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Nesrin Bakir, Leslie Ramos Salazar, and Jeffry Babb

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Foundations of Practical Analytic Skills: An Examination of Undergraduate Business Students' Self-Efficacy Using Excel

Nesrin Bakir
College of Business
Illinois State University
Normal, IL 61790, USA
nbakir@ilstu.edu

Leslie Ramos Salazar
Jeffry Babb
Paul and Virginia Engler College of Business
West Texas A&M University
Canyon, TX 79016, USA
lsalazar@wtamu.edu, jbabb@wtamu.edu

ABSTRACT

Microsoft Excel remains the primary spreadsheet software for numerical processing, computation, data analytics, and reporting in business schools across the United States. Given that Excel proficiency is a critical competency for business graduates, it also remains imperative that Excel skills are addressed as an essential component of the undergraduate business curriculum. Furthermore, Excel skills are also a critical issue in Information Systems education due to Excel's widespread use in end-user computing for business analytics and reporting. This study applies Bandura's self-efficacy theory to investigate how students' self-assessment of their Excel skills influences their confidence in solving business problems with Excel. A total of 113 undergraduate business students completed surveys which measured perceived Excel skills and self-efficacy. The study employed both qualitative and quantitative methods to analyze the findings. T-tests results revealed significant gender differences in Excel usage. Furthermore, differences in Excel proficiency were found among students in face-to-face and online courses. Multiple regression analysis showed a positive correlation between higher self-rated Excel skills, job-related Excel performance, and overall self-efficacy in using Excel. The findings offer implications for educators to further understand and enhance students' Excel self-efficacy within the business curriculum as a principal tool for quantitative and analytical reasoning.

Keywords: Business data analytics, IS education, Job skills, Spreadsheets

1. INTRODUCTION

The demand for business graduates to readily use data analytics knowledge and skills to solve business problems has increased substantially in recent years (Cainas et al., 2021). Among the available tools for these solutions, Microsoft Excel (Excel) continues to be the most popular, ubiquitous, and effective data analytics tool since its introduction 40 years ago. Additionally, there is a high certainty that Excel will remain primary among the tools available in contemporary business analytics toolkits. The persistence and prevalence of Excel is a testament and reflection of the lasting importance of end user computing, and Excel continues to serve as a "go-to" data management and analytical tool within many functional (non-IT) enterprise units (Rebman et al., 2023). Being a broad category of quantitative activities, data analytics takes many forms; however, data analytics commonly begins and ends with end-user-focused desktop solutions such as Excel. Thus, Excel skills remain an essential personal competency for many quantitative and analytics functions within an organization. For this study, data analytics is defined as "...the extensive and systematic use of data, statistical and quantitative analysis, exploratory and predictive analysis, and fact-based management to drive business decisions and actions" (Davenport & Kim, 2013, p. 3). Building on both a business and Information Systems (IS) context, the Association to Advance Collegiate Schools of Business (AACSB), the premiere accreditor of business programs worldwide, emphasizes the importance of proficiency in current technologies for both faculty and students in College of Business (COB) programs (AACSB, 2021). Under those auspices, Excel can be argued as an essential foundational skill and a key component of technical currency from a business perspective. This study proposes that Excel skills are essential for both entry and advancement in business data analytics, as Excel skills lay the foundation for data analytics practice (e.g., data discovery, preparation, cleaning, and standardization commonly begin with Excel). Among Excel's analytical advantages is its spreadsheet design: multidimensional tabular structure and presentation allows for a familiar approach to the organization and segmentation of data. Furthermore, this tabular structure is replicated in more advanced data analytics tools like Pandas and Numpy (using the Python programming language). Additionally, Excel's ability to transform operations and/or reduce broad sets of multidimensional data prepares users for common challenges in data analytics. Ultimately, Excel remains an indispensable and accessible toolset for analysts and managers for data realization, cleaning, and presentation.

The widespread use of Excel makes it essential for business students to develop both functional and practical Excel skills. While it is often assumed that contemporary students, for the purposes of this study, Generation "Z" (Gen Z) students, enter the business curriculum with advanced digital readiness, this is not always the case. In fact, there is an increasing "skills gap" among Gen Z students where extensive communication and information access skills do not always translate to computational and analytical skills (Marr, 2022). This skills gap may impact related work effectiveness and all-around work performance (Agarwal & Vaghela, 2018). Therefore, those responsible for designing and maintaining business curricula should be cautious in assuming students are digitally ready (Lyytinen et al., 2023) and also remain cognizant of students' awareness and evaluation of their actual skills. Students who overestimate their proficiency with Excel may actually possess only a basic skill set, which can lead to disconnect between their perceived and actual abilities. Because students' motivation levels differ in learning and using Excel, positive learning experiences may be the key to motivating different generations of students such that they may reach their full potential and achieve their academic and career goals (Schunk, 1989).

Most COBs incorporate Excel in their curricula to equip students with Excel skills and address workplace demands. However, undergraduate students' self-efficacy and prior exposure to Excel vary based on their educational backgrounds, including the extent of Excel instruction in their high school curriculum (Kelly et al., 2023). This study seeks to assess students' perceived self-efficacy as they enter their undergraduate business studies. The central interest of this study is in alignment with prior IS research on the development of Excel skills for IS and business students. For example, McCarron and Frydenberg (2023) examined the digital skills and competencies of 440 first-year students enrolled in an introductory IT course. The study found that while participants identified spreadsheets (Excel) as the most crucial skill to develop, most participants classified themselves as beginners or intermediates in their Excel skills. However, the student participants in that study struggled with basic functions like creating charts and summing a range of values. The observed disconnect between Gen Z students' assumptions about their proficiency and their actual Excel abilities calls for further exploration. With advancements in AI, Robotic Process Automation, and GPT/LLM tools, all of which promise to reduce Excel's technical complexities, a valid question can be raised: Are skills in Excel still valuable?

Bandura's (1986) self-efficacy theory may provide valuable insight and serve as a framework to understand students' confidence in their ability to perform specific tasks or activities. Self-efficacy is defined as "people's beliefs in their capabilities to produce given attainments" (Bandura, 2006, p. 307). This approach positions belief in one's capabilities as a key determinant of effective use and skills. Using Bandura's (1986) self-efficacy theory, this study examined student self-efficacy in Excel with a focus on improving student skills such as business analytics computations and data visualization. Given that Excel instruction is a common and prevalent component of business curricula, identifying the different confidence levels students have with Excel remains important. Insights from this study should extend instructors' understanding of how Excel skills can be best integrated into the curriculum. Additionally, results from surveys administered for this study may contribute to existing literature as the surveys explored ancillary dimensions such as gender differences in Excel skills, the differences in class modality (i.e., online vs. face-to-face, hereafter, F2F) in students' Excel skills, the positive relationship between Excel skill rate, Excel use self-efficacy, and job-related Excel skills.

2. LITERATURE REVIEW

2.1 Excel in Business Disciplines

Numerous studies have investigated how Excel can be applied across business disciplines. For example, in finance, Zhang (2014) used Excel's scenario manager, goal seek, solver, data table, and chart features to solve financial problems. Similarly, in accounting and information systems, Willis (2016) described an instructional project where peer teaching allowed students to learn Excel functions and communicate their understanding of Excel. Chen (2007) illustrated how Excel's pivot table feature could summarize business data into financial reports. The integration of Excel with other analytical tools has also been explored. Cainas et al. (2021) examined financial and managerial accounting cases using Excel, Power BI, and Tableau to determine the business analytical advantages that contributed to students' learning outcomes. When comparing these tools, Excel was deemed to be advantageous because of its accessibility on both PC or macOS and its relevance in students' future careers (Cainas et al., 2021). Additionally, Schuele and Felski (2021) examined how undergraduate accounting students developed a data analytical mindset in using Excel or Tableau in their *PwC Pixystems Toys* case. Their findings revealed that students appreciated learning data analytics as preparation for professional careers. Expanding on Excel's unique functionalities, Mangiero et al. (2021) found that Excel's "spinners" feature was crucial for helping students understand data analytics and business problem-solving relationships.

Within the management discipline, Excel has proven to be a valuable pedagogical tool. For example, Hanna (2010) used Excel's RANDBETWEEN function to explore system variation through Deming's funnel experiment, which improved the class discussions and helped students retain key concepts. Reinforcing Excel's significance in management education, Palocsay and Markham (2014) surveyed management science courses and found that 87% of respondents used Excel. The top four Excel features used included solver (94%), data tables (44%), data analysis-regression (39%), and goal seek (39%). Excel's analytical capabilities have been leveraged in marketing courses as well. Grenci (2015) studied how Excel's pivot table feature can facilitate the quintessential analytical processing analyses that form the backbone of more extensive business intelligence techniques. Similarly, Ganesh and Paswan (2010) demonstrated how Excel can be used in how-to-modules covering topics like channel mark-ups, contribution analysis, the breakeven point, and decision-making to teach the financial aspects of marketing. In economics, Excel has played a crucial role in simplifying complex theories. Cahill and Kosicki (2000) discussed how the implementation of Excel made more complicated topics accessible to students to learn consumer theory concepts. Salas-Velasco (2021) used Excel to solve price discrimination problems by implementing microeconomic theory and spreadsheet modeling. Excel's applicability extends to statistics courses as well. For example, Bell (2000) discussed how Excel could be implemented in an introductory statistics course to solve real-life business problems. Mangiero et al. (2021) argued that the implementation of the spinners feature saved class time, which allowed more time for discussions. Larson and Hsu (2010) described a learning activity in which students applied Excel to solve a single-factor analysis of variance to input the summary statistics using ANOVA. Overall, Excel remains an integral tool across the business disciplines and merits further inquiry into how Excel skills can enhance business and IS students' overall analytical competencies. Excel's widespread adoption across disciplines underscores its ongoing relevance and value in business education.

2.2 Excel as Foundational to Business Analytics

IS researchers may question whether new empirical inquiry into Excel skills and usage remains relevant. Having been in the IS practitioner's toolkit for the last 40 years, the instinctive answer is "yes" as Excel continues to serve as a "Swiss Army Knife" among available analytic and reporting tools. This fact remains poignant in the realm of data science and business analytics (Blayney & Sun, 2019). Furthermore, curricula in business, business analytics, and IS continue to incorporate Excel (Bakir et al., 2019; Formby et al., 2017), as does research on teaching Excel skills (Frydenberg, 2013). As the IS discipline evolves, data analytics and data science have become essential skills for undergraduate students (Glassdoor, 2021). de Vreede et al. (2019) stated that "big data and data science provide the foundation for an analytics perspective in IS, consisting of computational methods and technologies to perform quantitative and text-based semantic analyses to support evidence-based decision-making" (p. 8). Dewu and Barghathi (2019) defined the 21st century as the "information age" due to its reliance on data. Businesses use data for decision-making (Woodside et al., 2020), trend analysis (Madamanchi & Sreekrishna, 2020), and data management (Deniswara et al., 2020). For example, previous studies highlighted the importance of Excel skills in the business world. Mahadar (2011) found that 77% of the COB alumni considered Excel skills crucial for workplace success. Formby et al. (2017) found that advisory boards, students, recruiters, and employers acknowledged that Excel proficiency increased a graduate's marketability and success in the job market. A national survey indicated that 68% of employers from companies and small businesses in the U.S. use Excel spreadsheets on a daily basis to perform their job tasks (Patrizio, 2018).

More recent studies reaffirm the significance of having Excel knowledge and skills. As of February 2024, Excel remains as the most widely used data analytics tool, adopted by over 1.3 million small to medium-sized companies in the U.S. for its accuracy, usability, versatility, affordability, and longevity (Agnese, 2025). Additionally, Suarta et al. (2024) found that 47.1% of entry-level accounting job advertisements required proficiency in MS-Office including Excel. These studies highlight Excel's importance in the undergraduate business curriculum where Excel skills often lead to positive employment outcomes for business program graduates.

2.3 Gender Differences in Excel/Software Use

Additional variables such as gender may moderate and/or mediate students' self-efficacy in Excel skills. The inclusion of gender may reveal attitudinal differences that may advance the understanding of students' success in developing Excel skills. Gender differences in computer self-efficacy have been studied in the past. These studies reveal some basis for gender differences in attitudes, coping strategies, and intrinsic motivations for developing Excel skills. Studies have shown that females report lower computer self-efficacy than males (Appel et al., 2011; Beyer, 2008; Huffman et al., 2013). For example, Master et al. (2021) explored societal stereotypes suggesting that girls are less interested in computer science and engineering than boys. They found that these stereotypes often emerge as early as age six across diverse groups and discouraged girls from participating in activities marked by gendered interest biases. This perpetuates gender disparities in computational fields by diminishing girls' sense of belonging and interest in these areas. Vainionpää et al. (2021) further emphasized how societal norms, stereotypes, and educational systems inadvertently exclude girls from IT careers. Similarly, Barrett et al. (2024) examined factors influencing students' choice of major and their sense of belonging. They found that traditional gender roles and limited early exposure to computational fields negatively impacted women's sense of inclusion while men reported more frequent and positive early exposure, which fostered their confidence and interest in these fields.

Classroom experiences also shape career choices. Kindsiko et al. (2020) explored the impact of Information Communication Technology (ICT) education in five Estonian high schools. They found that teaching basic skills such as MS Word and Excel deterred female students from pursuing ICT careers. They emphasized that classroom experiences play a vital role in shaping young women's career choices. The study also highlighted that advanced ICT courses and interactive extracurricular activities markedly could increase interest among female students. Similarly, Rajala et al. (2022) surveyed first-year students at a Finnish university and observed that ICT students often shared similar perceptions of the field with their peers about career choices. The study suggested that highlighting the field's creative and people-oriented aspects could help attract more women to IS.

Additionally, studies have found that females demonstrate more anxiety when using a computer compared to males (Beyer, 2008; He & Freeman, 2010; Igbaria & Chakrabarti, 1990). He and Freeman (2010) administered two computer self-efficacy surveys to understand the role gender played on college-level business students and found that female students had less computer knowledge and experience than male students. Further, research by Grant et al. (2009) examined 235 undergraduate business students across 12 introductory computer application courses. Their findings revealed a discrepancy between what students perceived of their computer skills and the actual assessed computer skills for word processing and spreadsheet software. Similarly, Lahore (2008) found that over 75% of the students did not assess their own computer skills with accuracy. In addition, these findings were supported by another study that examined the business employers' expectations for technological proficiencies of business school graduates. The findings revealed a significant gap between students' perceptions of their skill levels and their actual proficiencies (Bingi et al., 2013).

In many of these prior studies, some gender differences could be said to be both attitudinal and perceptual. Davis (1989) found that a user's attitude toward technology is influenced by that technology's usefulness and ease of use. Usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance," and the ease of use as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Further to these concepts, "…expectations of personal efficacy determine whether coping behavior will be initiated, how much effort will be expended, and how long it will be sustained in the face of obstacles and aversive experiences" (Bandura, 1977, p. 191). In general, computer self-efficacy is critical in students' learning in computer-based learning environments, and positive attitudes, curiosity, and intrinsic motivation are positively linked to computer self-efficacy (Moos & Azevedo, 2009).

2.4 Course Modality and Excel Skills

This study considers course modality as an important factor relating to self-efficacy. Research has reported mixed findings on the effects of course modality and efficacy of developing spreadsheet competencies among college students. For example, in comparing online and F2F self-evaluations of technology ability of the same course during the post-test, online students increased from 66.7% to 83.3% while F2F students decreased from 31.4% to 26.5% (Kuo et al., 2007). Despite these differences, Kuo et al. (2007) reported no differences in technology use and technological application skills across course modalities. In another study, course modality had no effect on Excel test scores because the instructor provided the same amount of feedback (Logue & Maushak, 2008). Alrushiedat and Olfman (2013) examined asynchronous online discussions, which showed that those that were anchored with annotated computer learning activities had increased student participation and engagement than those who had traditional asynchronous discussions. In a follow-up study, Alrushiedat and Olfman (2014) found that anchored asynchronous online discussions had a positive effect on students' computer self-efficacy in comparison to standard online discussions.

Frantzen (2014) compared students' performances after completing a technology-intensive curriculum with a technological component that included spreadsheets and found a significant improvement in the GPA performance of online learners, but not among F2F learners. Additionally, Mays (2015) found that F2F and online business math students learned the most from problem demonstrations using spreadsheets and business applications in F2F courses. Yet, online students preferred business Excel applications and a final project using Excel functions such as the MIN and MAX, and calculating formulas such as AVERAGE (Mean) and STDEV (Standard Deviation).

Previous studies found that women often exhibit lower confidence and greater anxiety when using Excel spreadsheets compared to men (Appel et al., 2011; Beyer, 2008; He & Freeman, 2010; Huffman et al., 2013). However, it is not clear whether course modality affects gender differences as this was not an additional consideration of these studies. As such, this study fills this gap in the literature by exploring the course modality by gender differences in using Excel-specific functions and calculations skills at school or work.

2.5 Self-Efficacy Theory and Software Self-Efficacy

Bandura (1986, 1997) originally coined the term *self-efficacy* as a component of social cognitive theory. Self-efficacy is the perceived confidence in one's ability to perform a task (Bandura, 1997). Self-efficacy theory has been used to examine students' confidence in performing academic tasks to predict higher education performance outcomes (Gore, 2006; Yokoyama, 2019). When examining computer applications, task-specific computer self-efficacy is defined as "perceptions of ability to perform specific computer-related tasks" (Agarwal et al., 2000, p. 419). This study defines software self-efficacy as the degree of confidence in using a software application such as Microsoft Excel (Agarwal et al., 2000). While most researchers have used the term computer self-efficacy to understand the confidence in using a computer to perform general tasks, this construct is broad and does not include performing software-specific tasks (Compeau & Higgins, 1995). Previous studies on self-efficacy have found that higher self-efficacy is indicative of a higher amount of effort and self-control that is devoted to performing a given task effectively. However, in cases of lower self-efficacy, the complications of self-doubt and thoughts that interfere with confidence in performing tasks are often more prevalent (Bandura, 1997).

Studies have examined the role of software training in enhancing software self-efficacy. For instance, cross-sectional researchers have found that both training and prior computer experience positively relate to computer self-efficacy (Agarwal et al., 2000; Wang et al., 2015) and perceived usefulness (Wang et al., 2015). Further, Slayter and Higgins (2018) found evidence that taking a data literacy course enhanced students' Microsoft Excel skills in using basic functions such as SUM, AVERAGE, and IF. Longitudinal studies have found additional evidence of the development of students' Microsoft Excel Skills in completing software-related assignments (Bell, 2000; Frownfelter-Lohrke, 2017), Excel tutorial exercises in organizing data and creating charts and graphs (Rubin & Abrams, 2015), and training systems such as SMINET that develop Microsoft Office Software skills (e.g., Teach Me, Show Me) (Hardin et al., 2013). These studies demonstrate that students' computer and software self-efficacy in using Microsoft Excel can increase with the proper training such as using spreadsheets to understand numerical information, writing simple formulas, and displaying graphs. The present study extends prior findings in contributing to the understanding of software self-efficacy in relation to the workplace in using specific Excel features such as creating Excel charts and calculating numerical values relevant to IS and business statistics courses.

Past researchers have examined gender in relation to ICT acceptance using a variety of theoretical perspectives as well. For instance, Ali et al. (2021) adopted media dependency theory, which explains that college students rely on the media to obtain education and information on how to use technology. Their findings showed that males were more likely to learn through the adoption of technology in comparison to females because they have a higher learner acceptance of media, which ultimately affected their academic performance. Other researchers used self-determination theory to explain the role of gender on students' ICT needs, competence, and autonomy in relation to their achievement, such that females had lower ICT competence, ICT autonomy, and ICT interest levels in comparison to males, which demonstrate a gender gap in ICT (Li et al., 2022). Another theory that has been used to examine gender gaps in the ICT field is critical information systems theory, which explains that the reason that gaps occur in the IS field because of individuals' unique perceptions of power dimensions and dominant discourses in using ICT in workplace and educational contexts (Trauth & Howcroft, 2006). In terms of self-efficacy theory, studies have found that male college students have higher levels of ICT and technology self-efficacy than females, in part because their high self-confidence and self-motivation enable them to work and learn through technological software even when facing learning challenges (Al-Nuami, 2023; Huffman et al., 2013).

3. FOUNDATIONS OF THE STUDY

Given these foundations and theoretical background, this study seeks to contribute to self-efficacy research and the IS discipline by examining the implication of gender, modality, and attitudes on Excel skills self-efficacy and examining potential effects of gender and modality for Gen Z students at the time of the study. Furthermore, given the timing of the empirical work, it was hoped that this inquiry would provide insights on whether gaps related to gender or course modality had changed in a post-COVID-19 context.

Furthermore, Gen Z's unique context – acculturation to computing, the tools of computing and the ubiquity of information – were of interest. Beyond being digital natives, Gen Z students are uniquely characterized by life where ubiquitous and pervasive computing and information have been omnipresent for these students. Thus, differences in Gen Z students' measured Excel skills as compared to their Excel self-efficacy is of interest given that other researchers have discovered skills gaps with Gen Z. In this case, extensive availability of ICTs has not necessarily materialized into effective outcomes in tools use such as those found in Excel. Further, given Excel's extended tenure as a commonplace tool of computing, Gen Z is the latest of what are arguably three or four generations that have been expected to learn and leverage Excel. Concomitantly, the IS discipline itself has also experienced at least as many paradigmatic shifts and yet the ubiquity of Excel as a first-choice and frontline tool remains.

This study took place in an AACSB-accredited College of Business at a public university in the southwestern USA. The data came from two Bachelor of Business Administration required core curriculum courses: Management Information Systems, and Statistics for Business Economics. Students in these courses learned how to use Excel to conduct business analytics computations and develop graphic presentations of data such as charts and graphs.

The study poses the following research questions and developed hypotheses:

(RQ1) What are the factors that contribute to students' Excel skill development?

- (RQ1a): What are the gender differences in Excel skills?
- (RQ1b): What are the modality differences in Excel skills?
- (RQ1c): What are students' perceptions of their own Excel skill familiarity?

- (H1): Students' Excel skill rate positively relates to their self-efficacy in creating charts with Excel.
- (H2): Students' Excel skill rate positively relates to their self-efficacy in calculating functions with Excel.
- (H3): Students' Excel skill rate positively relates to their Excel job skills.

4. METHODOLOGY

4.1 Participants

Participants included students from two Management of Information Systems courses (F2F, $N = 35$; Online, $N = 29$) and two Statistics for Business and Economics courses (F2F, $N = 26$; Online, $N = 23$). A total of 188 students were invited to complete the survey across courses; however, only 113 fully completed the questionnaire, resulting in a response rate of 60%. There were 60.2% females and 39.8% males. Participants' ages ranged between 19 and 57 ($M = 25.94$, $Md = 23.00$, $SD = 7.39$). The study included 21 sophomores, 67 juniors, and 25 seniors. Students came from various majors: 14.2% pre-business, 10.6% marketing, 25.7% management, 18.6% finance, 11.5% accounting, 8.8% CIS, 0.9% small business/enterprise and international business, 7.1% economics, and 1.8% other. The average GPA was 3.19.

4.2 Procedures and Measures

After obtaining the Institutional Review Board's approval, the researchers recruited the participants. Participants completed two online surveys using Google Forms, approximating 10-15 minutes, prior to formal Excel training at the beginning of the semester (see Appendix for the survey). The first part of the questionnaire asked for demographic information such as gender, age, class standing, and GPA. The second part of the questionnaire asked students' prior Excel training and rating of their Excel skills based on a 5-point Likert-scale from 1 (Strongly disagree) to 5 (Strongly agree). Participants read the following statement, "I feel confident in my ability to ..." and rated their perceived Excel self-efficacy to create charts, calculate values, and perform functions and explained why they rated their skill in that way. Sample items included, "I feel confident that I can create a column chart in Excel" and "I feel confident that I can use the AVERAGE function in Excel." All of the self-efficacy and Excel measures from this study were adapted from validated self-efficacy measures from Bandura (2006).

4.3 Data Analysis

This study used a mixed methods research design that allowed researchers to collect and analyze qualitative and quantitative data to provide insights (Creswell & Creswell, 2018; Creswell & Plano Clark, 2018) and understand and answer the research questions in-depth (Creswell, 2012). The quantitative data analysis was conducted using SPSS 22.0. Independent sample t-tests and two-way ANOVA were conducted to examine gender differences and Excel skills (RQ1a). A two-way ANOVA (gender by course modality) was used to examine RQ1a and RQ1b. Hierarchical multiple regressions were employed to examine H1-H3. Given that variables correlated, a multicollinearity test was performed, and from the VIF (1.0-1.33) and tolerance values (.75-.98), multicollinearity was not a concern in the analytical results of this study. A post-hoc power analysis was conducted using G*Power 3.1.9.4 using the final sample size of 113 with an alpha coefficient of .05, and the data had a power of .97 with an effect size of d = .35.

After participants quantitatively evaluated their confidence in using different skills in Excel, they were then asked to reflect on and discuss their perceived confidence levels regarding their Excel skills. This qualitative data was analyzed using the six-phase guide for inductive thematic analysis outlined by Braun and Clarke (2006). These included "(a) familiarizing with the data; (b) generating initial codes; (c) searching for themes; (d) reviewing themes; (e) defining and naming themes; and (f) producing the report" (p. 87). Two researchers utilized these steps to analyze the qualitative data. First, the researchers read the qualitative inputs from the students. During the second reading of the data, initial codes were developed (e.g., know, understand, job, experience, prior knowledge). In the third reading, these codes were grouped into potential themes. Then, the researchers discussed the codes and identified any discrepancies. There were a few minor discrepancies identified during the coding process (e.g., the difference between "understanding" a process and "knowing" how to perform it). These differences were addressed through regular discussions among the researchers to ensure clarity and consistency in the application of codes. By examining differences and similarities in how the data were identified and coded resulted in better inter-rater reliability measures (Garrison et al., 2006). After resolving discrepancies and refining the coding, two themes emerged: familiarity and unfamiliarity. These themes were not altered throughout the process but evolved as the data were reviewed and grouped according to their relevance.

5. RESULTS

5.1 Quantitative Results

5.1.1 Gender and Course Modality Differences in Excel Skill. Mixed-gender difference findings were found in relation to Excel skills. Independent t-results showed that males (M = 2.82, SD = 0.83) performed better than females (M = 2.43, SD = 0.97) in perceived Excel skills, t(111) = -2.25, p = .02. However, no gender differences were found in obtaining Excel training or job-related Excel skills. Therefore, the findings show mixed support for RQ1a. Independent t-tests were conducted to determine differences in Excel skills across course modalities (RQ1b). Online students (M = 0.57, SD = 0.50) indicated having more Excel training than F2F students (M = 0.21, SD = 0.42), t(47) = -2.57, p < 0.01. Online students (M = 2.77, SD = 1.04) also reported higher levels of Excel job skills than F2F students (M = 1.79, SD = 1.03), t(47) = -3.22, p = .002.

This study found that course modality was an important factor in explaining Excel training differences; however, there were no interaction effects on Excel skill rate. A two-way ANOVA (gender by course modality) was used to further examine RQ1a and RQ1b. The ANOVA model found a main effect on course modality and Excel training, F(1,45) = 6.04, p = .018, ηp^2 = .12). Online students (M = 0.57) indicated higher levels of Excel training than F2F students (M = 0.22). However, there was no main effect on gender and Excel training, F(1,45) = 0.04, *ns*. Additionally, the model revealed no interaction effects between gender and course modality on Excel training, F(1,45) = 0.07, *ns*. Another two-way ANOVA (gender by course modality) on Excel skill rate was performed. Results showed no main effects for gender, F(1,45) = 1.80, *ns*, or course modality, F(1,45) = 2.88, *ns*, on Excel skill rate. No interaction effect was found among gender and modality on Excel skill rate, F(1,45) = 2.46, *ns*.

A final two-way ANOVA (gender by course modality) on Excel job skill was conducted. The study found gender and course modality differences in Excel job skill. Results showed no main effect of gender on Excel job skill, F(1,45) = 0.70, *ns*. The model found a main effect on course modality on Excel job skill, F(1,45) = 13.42, p < .001, ηp^2 = .23. Additionally, an interaction effect between gender and course modality was found on Excel job skill, F(1,45) = 12.06, p < .001, ηp^2 = .21. In particular, online students (M = 2.73) indicated having more Excel job skills than F2F students (M = 1.73). Online females (M = 2.14) indicated having higher Excel job-related skills than F2F females (M = 2.09). Online males (M = 3.31) also indicated having much higher Excel job-related skills than F2F males (M = 1.38). When examining similar modality and gender differences, online males (M = 3.31) reported higher job-related Excel skills than online female students (M = 2.14). However, F2F female students (M = 2.09) reported higher levels of job-related Excel skills than F2F male students (M = 1.38).

Additionally, a series of hierarchical multiple regressions were conducted to assess hypotheses 1 through 3 using SPSS 22.0. In the first block of each of the models included the control variables: course modality, gender, and age. In the second block, Excel skill rate served as the independent variable on each dependent variable. The preliminary zero-ordered correlation analysis of the variables included in the regressions can be seen in Table 1.

5.1.2 Excel Skill Rate and Self-Efficacy of Creating Charts With Excel. This study found that Excel skill rate had a positive relationship to the self-efficacy of creating a column chart, a stacked chart, and a pie chart. The first regression model examined the self-efficacy of doing a column chart on Excel skill rate, while controlling for the control variables. This model was significant R^2 = .74, ΔR^2 = .50, F(4,44) = 12.93, p < .001. In the first block, course modality had a positive relationship to the self-efficacy of doing a column chart via Excel (β = .47, p < .01). However, gender and age were not related to doing a chart via Excel. In the second block, there was a positive and moderate relationship between Excel skill rate and the self-efficacy of doing a column chart with Excel (β = .64, p < .001).

Another regression model examined Excel skill rate in relation to the self-efficacy of doing a stacked chart, and this model was significant, R^2 = .40, ΔR^2 = .35, F(1,44) = 7.43, p < .001. In the first block, control variables were not related to the self-efficacy of creating a stacked chart. In the second block, Excel skill rate had a positive and moderate relationship to the self-efficacy of creating a stacked chart via Excel (β = .52, p < .01).

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Modality	1										
2. Gender	.11	1									
3. Age	.49**	-.07	1								
4. SE Column Chart	.41**	-.02	.04	1							
5. SE Stacked Chart	.35*	-.02	.19*	.61**	1						
6. SE Pie Chart	.35*	-.03	.13	.64**	.62**	1					
7. SE Sum Function	.51**	-.04	.20*	.63**	.47**	.71**	1				
8. SE Average Function	.43**	-.02	.18	.55**	.55**	.71**	.83**	1			
9. SE Standard Deviation	.37**	-.01	.25**	.37**	.51**	.50**	.49**	.58**	1		
10. SE Excel Job Skills	.43**	-.12	.19*	.51**	.49**	.32**	.45**	.41**	.43**	1	
11. SE Excel Skill Rate	.25	.21*	.18	.46**	.50**	.40**	.47**	.49**	.44**	.82**	1
Note. SE = self-efficacy. *p<.05,**p<.01,***p<.001											

Table 1. Zero-Ordered Intercorrelations, Means, and Standard Deviations for Variables in Regression Analyses

The next regression model examining Excel skill rate on the self-efficacy of doing a pie chart while controlling for control variables was significant, $R^2 = .29$, $\Delta R^2 = .23$, $F(1,44) = 4.50$, $p < .01$. In the first block, no control variables related to the self-efficacy of creating a pie chart. In the second block, Excel skill rate had a positive and weak relationship to the self-efficacy of creating a pie chart with Excel, ($\beta = .17$, $p < .01$). Overall, the models provided support for the first hypothesis. Table 2 summarizes the regression findings of Excel skill rate on the self-efficacy of creating charts.

The next regression model examined the relation between Excel skill rate on the self-efficacy of calculating the AVERAGE function via Excel (H2), while controlling for demographic variables, and this model was significant, $R^2 = .40$, $\Delta R^2 = .35$, $F(1,44) = 7.59$, $p < .01$. In the first block, course modality had a positive relationship to the self-efficacy of calculating the AVERAGE function ($\beta = .40$, $p < .05$). However, other variables were not significant. In the second block, there was a positive and moderate relationship between Excel skill rate and the self-efficacy of calculating the AVERAGE function via Excel, ($\beta = .48$, $p < .01$).

The final model examined the relation between Excel skill rate on the self-efficacy of calculating the STANDARD DEVIATION via Excel (H2), while controlling for demographic variables, and this model was significant, $R^2 = .40$, $\Delta R^2 = .34$, $F(1,44) = 7.22$, $p < .01$. In the first block, no control variables were significant. However, in the second block after controlling for control variables, Excel skill rate had a positive and moderate relationship to the self-efficacy of calculating the STANDARD DEVIATION via Excel, ($\beta = .49$, $p < .01$). Overall, the models provided support for the second hypothesis. Table 3 displays summaries of the regressions on Excel skill rate on the self-efficacy of calculating in Excel.

	Column Chart				Stacked Chart				Pie Chart			
	B	95% CI for B	SE B	β	B	95% CI for B	SE B	β	B	95% CI for B	SE B	β
Block 1		(ΔR² = .13)				(ΔR² = .11)				(ΔR² = .07)		
Modality	1.03	[.34,1.72]	.34	.47**	.76	[-.05,1.56]	.80	.30	.69	[-.21,1.40]	.35	.31
Gender	-.05	[-.63,.54]	.29	-.02	.54	[-.15,1.22]	.40	.22	.13	[-.48,.74]	.30	.06
Age	-.01	[-.05, .03]	.02	-.11	.01	[-.04,.05]	.34	.05	.01	[-.03,.05]	.02	.07
Block 2		(ΔR² = .50)				(ΔR² = .35)				(ΔR² = .23)		
Modality	.80	[.27,1.32]	.26	.36**	.54	[-.16,1.23]	.35	.21	.54	[-.12,1.19]	.33	.24
Gender	-.39	[-.84,.07]	.23	-.18	.22	[-.39,.82]	.3	.09	-.10	[-.67,.48]	.29	-.05
Age	-.02	[-.05,.01]	.02	-1.18	-.01	[-.04,.04]	.02	-.01	.01	[-.04,.04]	.02	.02
Excel Skill Rate	.78	[.51,1.05]	.13	.64***	.73	[.38,1.08]	.18	.52**	.52	[.19,.85]	.17	.43**

Table 2. Results of Multiple Regression Analyses Between the Demographic and Excel Skill Rate Variable and Dependent Variables

	Sum				Average				Standard Deviation			
	B	95% CI for B	SE B	β	B	95% CI for B	SE B	β	B	95% CI for B	SE B	β
Block 1		(ΔR² = .21)				(ΔR² = .15)				(ΔR² = .14)		
Modality	1.42	[.60,2.23]	.40	.52***	.97	[.21,1.73]	.38	.40*	.72	[-.17,1.6]	.44	.25
Gender	-.03	[-.73,.66]	.35	-.01	.34	[-.30,.99]	.32	.14	.35	[-.40,1.10]	.37	.13
Age	-.01	[-.05,.04]	.02	-.02	.01	[-.04,.05]	.02	.04	.04	[-.02,.09]	.03	.22
Block 2		(ΔR² = .41)				(ΔR² = .35)				(ΔR² = .34)		
Modality	1.20	[.48,1.91]	.35	.44***	.78	[.11,1.45]	.33	.32*	.49	[-.29,1.27]	.39	.17
Gender	-.36	[-.97,.26]	.31	-.13	.06	[-.53,.64]	.29	.02	.02	[-.67,.70]	.34	.01
Age	-.01	[-.05,.03]	.02	-.08	-.01	[-.04,.04]	.02	-.01	.03	[-.02,.07]	.02	.17
Excel Skill Rate	.73	[.37,1.09]	.20	.49***	.65	[.31,.99]	.17	.48***	.76	[.37,1.16]	.20	.49***

Note. CI = confidence interval; LL = lower limit; UL = upper limit. Sum = Sum Function, Average = Average Function, Standard Deviation = Standard Deviation Function. *p < .05. ** p < .01, *** p < .001. β = standardized beta coefficients.

Table 3. Results of Multiple Regression Analyses Between the Demographic and Excel Skill Rate Variable and Dependent Variables

5.1.4 Excel Skill Rate on Excel Job Skill. In this study, Excel skill rate was found to have a positive relationship to Excel job skill, such that the higher the skill rate the higher the job skill. The regression model examining (H3) Excel skill rate on Excel job skill was significant, while controlling for course modality, gender, and age, $R^2 = .86$, $\Delta R^2 = .74$, $F(4, 48) = 30.54$, $p < .001$. In the first block, course modality had a positive relationship to Excel job skill (β = .40, $p < .05$). However, gender and age were not related to Excel job skills. After controlling for control variables, Excel skill rate had a positive and strong relationship to Excel job skill (β = .77, $p < .001$), which supported the third hypothesis.

5.2 Qualitative Results

To address RQ1c, an analysis of the qualitative data revealed participants' perspectives on their familiarity and unfamiliarity with Excel skills with pie charts, AVERAGE function, SUM function, column charts, STANDARD DEVIATION, and stacked columns (see Figure 1). The majority of students were highly familiar with basic tools such as the Pie Chart (90%), AVERAGE function (87%), and SUM function (86%). Familiarity decreased slightly with more advanced tools, such as the Column Chart (77%) and STANDARD DEVIATION (61%), while the Stacked Column Chart showed the lowest familiarity at 56%. Stacked Column Chart (44%) and STANDARD DEVIATION (39%) had the highest unfamiliarity. When participants were asked to discuss their current confidence levels using specific Excel skills, their familiarity, either due to prior work experience or coursework, were key contributors to their confidence levels.

Research Questions and Hypotheses	Result
RQ1a: What are the gender differences in Excel skills?	Partially supported
RQ1b: What are the modality differences in Excel skills?	Not supported
RQ1c: What are students' perceptions of their own Excel skill familiarity?	Supported
H1: Students' Excel skill rate positively relates to their self-efficacy in creating charts with Excel.	Supported
H2: Students' Excel skill rate positively relates to their self-efficacy of calculating functions with Excel.	Supported
H3: Students' Excel skill rate positively relates to their Excel job skills.	Supported

Table 4. Research Questions and Hypotheses

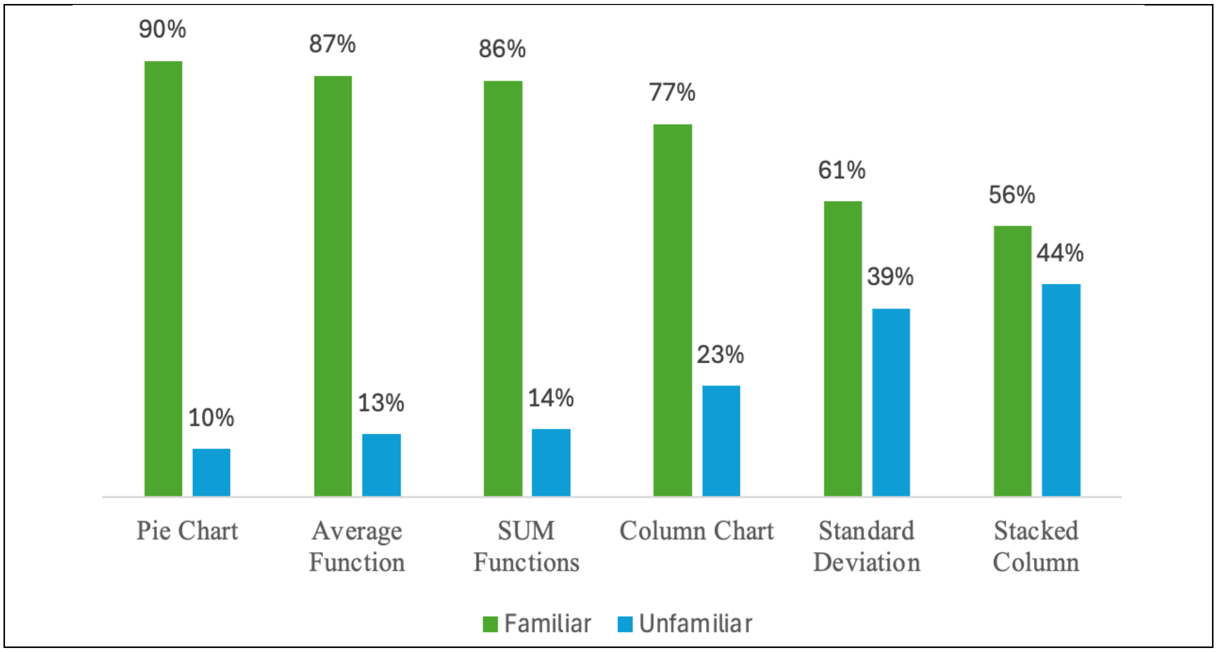

Figure 1. Levels of Students' Familiarity and Unfamiliarity

5.2.1 Familiarity With Creating Charts With Excel. Seventy-seven percent indicated familiarity with using Column Charts. Sample participant comments included:

- "I definitely know the process that goes into creating a column chart out of data in Excel."
- "I understand how to insert the graphic and change the numbers, modify legends, etc."

These participants noted their previous experiences as the reason for their familiarity with the skill. Participants shared the following quotes:

- "I feel very comfortable being able to create columns in Excel due to my previous experience."
- "I build charts almost every day in my current job."
- "I am very confident, I have learned how to do this awhile back."

Even though the majority of participants were familiar with using Column Charts, several indicated a need for more training. Twenty-three percent of the participants were not familiar with this Excel skill. When asked about their confidence level with using Stacked Column Charts, 56% of the participants indicated their familiarity. Participant comments included:

- "I have had experience with creating various charts in Excel, including a stacked chart."
- "I definitely know the process that goes into creating a stacked chart in Excel."

Often students' familiarity with these more advanced techniques was mainly due to being exposed to this skill at their current job or in coursework. A few participants shared that they still needed a refresher despite their familiarity. Forty-four percent were unfamiliar with the skill. Sample comments included:

- "The word "stacked" doesn't ring a bell too much, so I'd have to look into it probably."
- "Unsure what a stacked chart is, I would need to look at my notes to identify this and create it in Excel."

Of those, 34% indicated their willingness to learn this skill (i.e., "I don't know what a stacked chart is but I'm sure with the right tools I could figure it out," and "I am unsure how to do that, but I can learn.").

When asked about their confidence level with using Pie Charts, 90% of the participants indicated their familiarity with the function because they have used it at work or in coursework. Sample student comments included:

- "I create these weekly for my job."
- "I have created many pie charts in the past for previous classes."

Still, some of the participants needed training even though they felt confident in using this skill. Only 10% of the participants were unfamiliar with using Pie Charts.

5.2.2 Familiarity With Calculating With Excel. Responses also indicated students' familiarity with calculating the AVERAGE, SUM, and STANDARD DEVIATION functions in Excel. Concerning using the AVERAGE function, 87% indicated familiarity with the function, while 13% indicated unfamiliarity. Participants' familiarity with the function came mostly from using it previously at work or coursework. Participant comments included:

- "This is a simple function that I use in my daily job."

- "I have used this function in previous class assignments, and understand how to utilize it."

Some students indicated that they still needed a refresher or training despite their familiarity. The majority of the participants who indicated unfamiliarity stated their willingness to look for resources to learn. Importantly, the comments indicated that participants were familiar with the function and were willing to learn about it.

When participants were asked about their confidence level using the SUM function, 86% indicated familiarity. The remaining 14% were unfamiliar with the function. Only one participant indicated a willingness to learn about this function. Participants cited prior experience (work and coursework) as the reasons. Sample comments included:

- "I do this daily at work for spreadsheets related to construction & biz expenses."
- "It's a function we use for accounting, so I use it quite often."
- "I have done this a couple of times for classes."

When asked about their confidence level with using STANDARD DEVIATION, 61% confirmed their familiarity with the function because they either used it at work or in coursework. Thirty-nine percent of the participants indicated unfamiliarity. Of those, 26% were willing to learn this function. Responses highlighted that exposure to these advanced techniques was often limited to specific job roles or academic experiences, with many expressing the need for a refresher.

These findings show both strengths and gaps in business students' Excel skills. While basic functions are well understood, advanced charting and statistical functions require additional training. Given that prior work experience significantly influences familiarity, integrating practical Excel training into coursework could enhance students' confidence and competence in these skills.

6. DISCUSSION

6.1 Gender Differences in Excel Skills

This study found mixed outcomes regarding the gender differences in Excel use. In examining perceived Excel skills, males outperformed female students, which confirmed prior research findings that males have higher computer self-efficacy than females (Appel et al., 2011; Beyer, 2008; Huffman et al., 2013). One possible reason for this gender difference is that females have reported higher levels of anxiety toward computers compared to males (Beyer, 2008; He & Freeman, 2010). This study contributes to prior literature in reporting a post-pandemic gender gap in ICT education (Kindsiko et al., 2020), which shows that there is still work to be done in addressing gender disparities in Excel use. However, no gender differences were found in obtaining Excel training or job-related Excel skills. Business students, regardless of gender, may receive equal Excel training before taking core business courses. Additionally, students are able to obtain similar job-related Excel skills, which contribute new insights to the equity in prior Excel skill experience when it comes to the workplace.

However, this is in contrast to Vainionpää et al.'s (2021) prior finding that IT careers tend to exclude women. This may well be an equitable abundance of digital support in the current information environment where it has become common knowledge that help and support are available to those who seek it. This creates "I can learn it" or "I can look that up" assumptions and attitudes that were prevalent among the responders in this study. One implication is the need to continue emphasizing the availability of resources to support learning. A further implication, to increase overall computer self-efficacy as it relates to Excel, is for educators to devote more training resources that provide immediate feedback on progress. While this would benefit all students, female students may benefit from Excel exercises that develop their self-efficacy through implicit and explicit praise based on improved performance, and by assigning reflection exercises to improve self-efficacy.

6.2 Modality Differences in Excel Skills

This study's findings revealed course modality differences that impact Excel pedagogy. Overall, online students indicated having more Excel training compared to F2F students. This finding complements Kuo et al.'s (2007) results in that online students are more likely to have technological abilities. Students who enroll in online courses may already possess preliminary computer self-efficacy and Excel training compared to those in F2F courses. Further, online learners are more likely to be independent learners and are more self-motivated to learn about technology than F2F students both within and outside of the classroom (Ma, 2022). Additionally, some F2F students may have had more familiarity with Google Sheets from using it in in-person during their K-12 education, and for this reason, these students may not have received any Excel training (Bell, 2023). Additionally, online students had higher Excel job skills than F2F students. One reason for this may be that online students might have an advantage in technological abilities compared to F2F students, which may enable them to easily develop software skills such as Excel (Kuo et al., 2007). Another explanation is that some online students may be non-traditional, older working individuals, who may have developed job-related Excel skills in full-time jobs (Miller & Lu, 2003). There is evidence that online learners are more likely to take personal responsibility and develop better time management skills, which make them perform better in using technologies in an online learning environment over F2F learners across academic disciplines (Xu & Jaggars, 2014).

An implication for educators is to address the F2F students' unique learning needs by challenging students to complete additional Excel activities, form study groups, and encourage the attendance of out-of-class tutoring services. Furthermore, it is commonly the case that those who pursue online modalities are older and/or have more work experience. Those who select online modalities often do so due to convenience and flexibility.

6.3 Gender and Modality in Excel Skills

This study found no evidence of gender effect on course modality in Excel training and skills. This finding suggests that there are no gender differences when accounting for course modality in Excel training nor on perceived Excel skills, which is inconsistent with prior research that found gender differences in software training (e.g., Appel et al., 2011; Beyer, 2008). However, when examining Excel job-related skills, this study found an interaction effect between gender and course modality. This suggests that gender differences may be magnified depending on course modality, but only in developing Excel job-related skills. Males, in particular, performed better than females in online courses in job-related

Excel skills. One explanation may be that males may perceive themselves to be more technologically savvy than females. Theoretically speaking, from a critical IS framework (Trauth & Howcroft, 2006), there may be perceived power dynamics occurring in online environments in relation to Excel job-related skills, which enable males to outperform women.

Interestingly, a new contribution from this study is that in F2F courses, females outperform males in job-related Excel skills, which contrasts with prior ICT and IT literature looking at technology adoption (Ali et al., 2021; Li et al., 2022). In F2F courses, females might learn more from "hands-on" Excel exercises in comparison to males. Gender differences could also be explained by their use of Excel in their employment in part-time IT and analytical jobs. Regardless, understanding from these results could be extended with further study designed to identify and highlight gender differences and modalities apart from Excel knowledge and self-efficacy thereof.

6.4 Excel Skill Rate and Self-Efficacy With Excel

This study found that students' self-evaluation of skills positively related to their self-efficacy in creating various charts including column, stacked, and pie charts using Excel. These findings extend prior data analytics work that has examined undergraduate students' skills in Excel spreadsheets by examining their confidence in applying visualization skills using Excel. Business students who perceive themselves to have proficiency in Excel report having self-efficacy in creating various charts. The qualitative findings revealed that students had prior experience with these visualization skills because they used various charts at work and/or were exposed to them in their previous coursework. This finding confirms Bandura's (1977) self-efficacy theory's assumption that prior training experiences in performing software-related tasks such as Excel visualizations may relate to their self-efficacy (Agarwal et al., 2000).

However, students who expressed self-doubt in using Excel had lower levels of self-efficacy in creating Excel charts as well. The study revealed that students' Excel skill rate was positively related to their self-efficacy in calculating basic functions such as SUM, AVERAGE, and STANDARD DEVIATION. Prior research has examined students' spreadsheet use with Excel (Hardin et al., 2013; Rubin & Abrams, 2015; Slayter & Higgins, 2018); however, this study contributes new information to prior research by providing evidence that Excel skill rate positively relates to students' self-efficacy in calculating specific functions via Excel (e.g., averages, standard deviations, and sums) in undergraduate business courses. Based on the qualitative responses, this could be due to students' prior exposure to these functions at work and/or coursework.

Finally, this study contributes to past IS education research in that students' Excel skill rate was positively and strongly related to their Excel job skills. Additionally, those with more proficiency in Excel also reported having high self-efficacy in performing job-related Excel skills. Because many employers expect students to use Excel (Bingi et al., 2013), students with Excel skills will feel more self-efficacious in using Excel in the workplace, which may be advantageous to their professional careers beyond the boundaries of the classroom. However, students who had low perceived Excel skills suffered from low self-efficacy in Excel job skills.

6.5 Implications

While these findings are deceptively simplistic – students with more prior experience have higher self-efficacy – there are still opportunities to respond as educators. The success model of early and coached exposure to Excel provides a basis for grounded self-efficacy with continued practice and exposure. Repeated exposure through practice is often associated with mastery (or competency-based) learning that is designed to increase students' positive feedback loop (Slavin, 1987; Winget & Persky, 2022). As the elements of Excel learning are relatively discrete, this examination of Excel self-efficacy provides insights into how Excel skills can be made more accessible. As such, one important implication of this study is that educators need to continue to assign relevant Excel assignments that mirror the job market's expectations in using Excel. Doing so will place students at an advantage in positive job and career outcomes at graduation. While the literature on mastery learning may have its limitations (Slavin, 1987; Winget & Persky, 2022), repeated exposure and activity in the realm of tool and technique application accrues the benefit of analytic familiarity. Further, as a pervasive and foundational skill, the symbiosis of skill utilization and self-efficacy matters. As the workplace contemplates how training in business skills complements workforce preparedness, foundations and confidence in ubiquitous analytic tooling is paramount and welcomes deeper and more extensive investments in skills such as those gained with competence in Excel (Westfall, 2025).

Another approach would be to incorporate applied and experiential learning throughout the curriculum to reinforce the interdisciplinary importance of Excel skills in fostering self-efficacy. For instance, to further facilitate students' self-efficacy and motivation, faculty can provide automated support and feedback when using Excel assignments (Frost et al., 2021). Moreover, facilitating more opportunities for practice via internships and other experiential learning opportunities can increase students' confidence with learning data analytics with Excel. Simply sharing with students that there is a valid need for these skills in "in reality" should have some positive impact on their willingness to cope with early difficulties.

Overall, an important takeaway in examining experience and self-efficacy is a realization that tools such as Excel have remained perennially suited to purpose, and Excel skills serve as a basis for leadership, business, and analytical competencies. Excel has persisted and remains a common aspect of the business curriculum as a key analytic tool. This suggests that continued study on how and why students may excel with Excel is relevant.

7. LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

This study presents several limitations. First, this study used a cross-sectional approach. Whether students' self-efficacy in Excel improves over time in creating specific charts, performing calculations, and developing job-related skills remains uncertain. Future research may adopt a pre-test/post-test approach to examine the longitudinal effect on students' self-efficacy in performing functions and calculations with Excel. Second, this study had a small sample size and only used courses in one COB. Future studies may compare the findings of multiple COBs to strengthen the results. Third, the generalizability of the study is limited to U.S. students. Future studies may consider using international COB students to increase the generalizability of this study using more than one institution. Fourth, the reliability of the study is a limitation as well. Future researchers may consider using longitudinal methods design to determine pre-test and post-test measures of items using student and non-student populations to enhance the reliability of the findings. Fifth, the qualitative methodology relied on survey textual responses. Future researchers may perform more rigorous qualitative research by conducting interviews or focus groups to obtain in-depth narratives of participants' experiences in performing data analytics using Excel in the classroom and their careers.

Regardless of these limitations, this study suggests that the contemporary learning environment, regardless of modality, provides ample opportunity for students to improve their self-efficacy in many computing and analytical tools. In general, the contemporary computing, information and technology environment is appreciably different as compared to when many of the foundational studies from which the main body of knowledge on self-efficacy was established. In general, information technologies that are supportive, assistive, and accessible are now more common. Whether this abundance of support will lead to increased self-efficacy will likely depend on how this environment is introduced and utilized in a pedagogical sense.

The qualitative responses in this study would suggest that prior use and familiarity matter. One approach to this is to make Excel skills so ubiquitous and synonymous with business that the pervasiveness of Excel within the business curriculum is unassailable. This can be complemented by extensive use of two additional resources: applied and experiential learning, and assistive technologies such as generative pre-trained transformational models (GPT). Large language models can supplement and accelerate instruction by underscoring how basic concepts can be extended in application by quickly arriving at answers and artifacts. An additional benefit is that using artificial intelligence, such as GPTs, as a component of student learning is likely to accelerate the actual context of use moving forward.

Should self-efficacy be a matter of exposure, familiarity, perceived usefulness, and ease of use, as presaged by both the literature review and qualitative analysis of results, then the current technology landscape of assistive, supportive, and accessible resources should be helpful. Future research should investigate how the contemporary learning environment can be best defined and, within that definition, re-examine Excel self-efficacy as it relates to both gender and course modality. An ability to define and explicate this contemporary information and computing environment would be a contribution to the literature on self-efficacy, computing self-efficacy, and Excel skills and knowledge.

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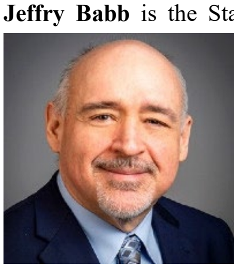
AUTHOR BIOGRAPHIES

Nesrin Bakir is an assistant professor of business education in the College of Business at Illinois State University in Normal, IL. She teaches courses in personal finance, technology, business education, and online course design. Her research focuses on business education, online teaching and learning, and pre-service teacher education. With a strong emphasis on integration of technology in education, she explores innovative strategies to design, develop, and evaluate teaching and learning experiences.

Leslie Ramos Salazar is a professor of business communication and decision management and the Abdullat Professor of Business at the Paul and Virginia Engler College of Business at West Texas A&M University. She has taught courses for 17 years and has published over 50 peer-reviewed journal articles. Her teaching areas include business statistics and business communication courses. Her publications appear in *Business and Professional Communication Quarterly*, *Computers in Human Behavior*, *Communication Quarterly*, *Journal of Business and Technical Communication*, and *Decision Sciences Journal of Innovative Education*.



Jeffry Babb is the Stan Sigman Professor of Business and professor of computer information systems at West Texas A&M University. His teaching interests include software and systems development and software process methodologies and improvement. His research interests include computing curricula, software systems design, cybersecurity, and privacy.

APPENDIX

Self-Efficacy Survey

1. Gender:
   - Female
   - Male
2. Age:
3. Class standing:
   - Freshman
   - Sophomore
   - Junior
   - Senior
4. Major:
   - Accounting
   - Economics
   - Finance
   - Computer Information Systems
   - Management
   - Marketing
   - Pre-Business/General Business
   - Small Business/Entrepreneurship
   - International Business
   - Other
5. GPA:
6. Have you received any formal Excel training before this class?
   - Yes
   - No

   If Yes, please explain what kind of training you received (Where?):

7. Rate your Excel skills:
   - Beginner
   - Below average
   - Average
   - Above average
   - Expert

8. Rate your Excel skills to complete job-related tasks:
   - Beginner
   - Below average
   - Average
   - Above average
   - Expert
   - Not applicable

9. I feel confident that I can create a column chart in Excel
   - Strongly disagree
   - Disagree
   - Neutral
   - Agree
   - Strongly Agree

   Discuss your current confidence level with creating a column chart in Excel.

10. I feel confident that I can create a stacked chart in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with creating a stacked chart in Excel.

11. I feel confident that I can create a pie chart in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with creating a pie chart in Excel.

12. I feel confident that I can create a line chart in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with creating a line chart in Excel.

13. I feel confident that I can use the SUM function in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with using the SUM function in Excel.

14. I feel confident that I can use the COUNT function in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with using the COUNT function in Excel.

15. I feel confident that I can use the COUNTA function in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with using the COUNTA function in Excel.

16. I feel confident that I can use the AVERAGE function in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

    Discuss your current confidence level with using the AVERAGE function in Excel.

17. I feel confident that I can use the MAX function in Excel.
    Strongly disagree
    Disagree
    Neutral
    Agree
    Strongly Agree

Discuss your current confidence level with using the MAX function in Excel.

18. I feel confident that I can use the MIN function in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with using the MIN function in Excel.

19. I feel confident that I can use the SUMIF function in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with using the SUMIF function in Excel.

20. I feel confident that I can use the COUNTIF function in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with using the COUNTIF function in Excel.

21. I feel confident that I can use the AVERAGEIF function in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with using the AVERAGEIF function in Excel.

22. I feel confident that I can use the STANDARD DEVIATION function in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with using the STANDARD DEVIATION function in Excel. *

23. I feel confident that I can create PIVOT TABLES in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

    Discuss your current confidence level with creating PIVOT TABLES in Excel.

24. I feel confident that I can identify the differences between the SUM and SUMIF functions in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree

Strongly Agree

Discuss your current confidence level with identifying the differences between the SUM and SUMIF functions in Excel.

25. I feel confident that I can identify the differences between the COUNT and COUNTIF functions in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

Discuss your current confidence level with identifying the differences between the COUNT and COUNTIF functions in Excel.

26. I feel confident that I can identify the differences between the AVERAGE and AVERAGEIF functions in Excel.
    - Strongly disagree
    - Disagree
    - Neutral
    - Agree
    - Strongly Agree

Discuss your current confidence level with identifying the differences between the AVERAGE and AVERAGEIF functions in Excel.

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