

# An Industry Survey of Analytics Spreadsheet Tools Adoption: Microsoft Excel vs Google Sheets

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## Abstract

Spreadsheets have long played a key role in business decisions and operations. The use and adoption of data analytics has substantially increased over the last few years and amplified this role. Spreadsheets are often a first tool for data analytics as such applications provide ease of calculation with basic statistics and chart development. For much of the last two decades universities have provided training in Microsoft Excel because that was what companies used and demanded. Since mid-2020, there has been an increase in use of Google Sheets causing some faculty to believe that MS Excel should be replaced. Faculty should always be aware of current and future employer demands and ensure programs meet the expectations of both employers and recent graduates. This study reviews business job postings seeking employees with two or fewer years of work experience between 2019 and 2021 and examines demand for spreadsheet application experience. Results overwhelmingly indicate that Microsoft Excel still is the most required spreadsheet application by employers. Faculty should pause before changing MS Excel training or removing certifications.

Keywords: Curriculum, Spreadsheets, Skills, Position Analysis, Business Education, MS Excel, Google Sheets

### 1. INTRODUCTION

Graduate employability is a concern for all academic programs as graduate employability has become a measure of program health for program investment at many colleges (AACU, 2021). For business, tools knowledge and expertise are prominent in job descriptions. One such tool that is popular in job descriptions is spreadsheet and concomitant skills such as data analysis and visualization. With an increase in remote work, collaboration is also becoming a more common skill.

Lawson et al. (2009) reported electronic spreadsheet usage in business had been around 25 years. Since their study was published in 2009, it is feasible to extend the time to almost 38 years. According to Melissa James from GreyCampus (2015), spreadsheets are important to business as financial accounting tools, tracing product sales, accessing customer data, analyzing return on investment, and work scheduling. According to Rahman et al. (2020) and Mack et al. (2018) "spreadsheets are everywhere." In addition to business applications, they are used for a wide range of activities such as, but not limited to, managing diets, scientific experiments, real estate inventory, managing grades, managing financial portfolios, and managing real estate inventory. Thus, having good spreadsheet skills is beneficial beyond just knowing how to use them for their business applications.

Higher education business programs play a role in developing students' spreadsheet skills. A recurring question when performing curriculum review is whether faculty are teaching the right skills and tools for employability. To help shape curriculum, it is not uncommon for faculty to

review recent position descriptions, survey employers and recent graduates, and review other external sources to ensure that the curriculum provided meets the current and future expectations for both students and employers.

Spreadsheet tools and concomitant skills are an area of interest, especially since spreadsheet dominance has changed through the years. For example, Lotus 1-2-3 replaced VisiCalc, Microsoft Excel replaced Lotus 1-2-3, and now Google Sheets is emerging as a potential tool to replace Microsoft Excel. Understanding how spreadsheet interest is changing in the marketplace helps faculty know when or if a switch in tool emphasis in the curriculum is necessary to ensure graduate employability.

This study examines position descriptions posted on indeed.com, a popular online job posting site. The positions examined were posted between January 1, 2019, through December 31, 2021. The descriptions were limited to business program titles **requiring a bachelor's degree, and** two years or less of work experience. The position analysis focuses on requirements for spreadsheet knowledge, skills, and abilities such as data analysis and visualization, and on collaboration, a popular skill requirement for remote workers. The remainder of this paper is structured as follows:

The literature review includes a discussion and comparison of Excel and Google Sheets. It also includes information regarding using position descriptions to examine knowledge, skills, and abilities. The literature review is followed by the research methodology and study, results, and then conclusions and next steps.

## 2. LITERATURE REVIEW

Spreadsheets have existed for several decades. Many years before the first electronic spreadsheet program, LANPAR (LANguage for Programming Arrays at Random, Wikipedia, 2022), businesses used paper-based ledger systems to manage their financial operations. According to Dan Power of DSS Resources.com (2004), "in the realm of accounting jargon, a 'spread sheet' or spreadsheet was and is a large sheet of paper with columns and rows that organizes data about transactions for a businessperson to examine, it shows all the costs, income, and taxes for a **manager to examine when making a decision.**" Accountants primarily used these ledgers to handle budgeting, accounts receivables, and payroll. Accountants found spreadsheets were important as they allowed for better organization of data which enhanced decision making.

### Spreadsheets

Since 1969 there have been many spreadsheet applications. Some programs got their start as in-house programs such as Autoplot (General Electric), APLDOT (US Railway Association), while others obtained more commercial success and adoption such as VisiCalc, SuperCalc, Lotus 1-2-3, Microsoft Excel, and Google Sheets. It seemed as if the spreadsheet software world was like that of worldwide boxing champions with each newcomer knocking off the reigning king.

Research and practice have demonstrated that spreadsheet software can be robust and versatile. For example, Grossman et al. (2007) investigated 18 different cases in the areas of application software development, executive information systems, financial risk management, sales and marketing business processes, business operations, and complex analytics. They found that spreadsheets could be more strongly protected as Excel contains tools to keep the **developer's** source code protected. Large complex spreadsheets can require programming skills similar to a Fourth Generation and Rapid Development Language operating in an Integrated Development Environment.

Reschenhofer and Matthes (2015) discussed how spreadsheets have capabilities like formulae and macros to support complex calculations or automate processes, and spreadsheets have become an indispensable as a comprehensive medium for data management and analysis. Frownfelter-Lohrke (2017) reported that if companies did not create good spreadsheets or conduct thorough spreadsheet analysis then their

businesses could suffer from loss of profit or market share.

### Microsoft Excel vs Google Sheets

The exact current number of spreadsheet users is debatable and still by all counts considered to be large. Statista (2019) did a study in Finland in 2019 and found that a little under 50% of their population used spreadsheet software and it was relatively evenly spread over different age demographics (Figure 1).

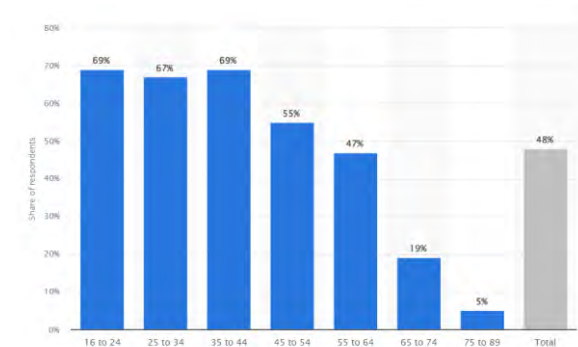


Figure 1: Share of people who use spreadsheet software in Finland, 2019

A few others have tried to determine the actual number of users for spreadsheet software programs. For example, in 2017 Simon Cocking from Irish Tech News wrote about seven reasons that a half a billion people still used Excel. Joseph (2021) estimates that there are 750 million to 1.2 billion Microsoft Excel users and over 2 billion Google Suite users world-wide. Elizabeth Gratton (2022) reported that 1 in 8 people use Microsoft although her numbered quote included the entire Office Suite.

In fact, one of the challenges with determining actual Excel and Google Sheets numbers stems from difficulties determining which exact product in the Microsoft Office Suite or Google Suite is being used. Hjalmar Gislason (2018) discusses how it is hard to differentiate between paying and free accounts as well as the inclusion of GMAIL in the Google Suite. To address this, Gislason applied a 2/3 estimate reduction in numbers when comparing MS Excel (800 million) and Google Sheets (160 million).

Gilsson (2018) provides an enlightening description of Microsoft Excel and Google Sheets users and is visually summarized in Figure 2. He talks about how more young people and young companies use Google Sheets while older and more mature companies use Microsoft Excel. He reports that Excel is more sophisticated and

preferred by 'pros' where Google sheets is more sluggish but good for quick and simple items. He also did note that Google sheets works better for collaboration and that even the pros were found to 'sneak' using Google sheets from time to time. Nina Semczuk (2020) provides support for Gilasson's claims by confirming the benefits of collaboration in Google Sheets as well as pointing out how frequently Google Sheets gets updated and works well with real time data.

### Excel vs. Google Sheets



Figure 2: Comparison between Excel and Google Sheets (Source: <https://grid.is/>)

Perhaps examining the technical differences between the two programs might shed some light on use and adoption. Appendix 1 presents a comparison of the technical differences taken from three sources: Simplilearn, EDUCBA, and WallStreetMojo.com.

All three sources provide the same pros and cons of the two programs. Their analysis reinforces previous research that Excel is more robust by being able to handle more cells and data. Conversely, Google Sheets is better for sharing, collaboration, multi-user, and for updating data. Excel tends to be faster and much better at data visualization, especially with the newer versions of Excel that contain PowerBI integrations and connect to Tableau seamlessly. PowerBI and Tableau are products that allow for easier generations of complex data visualizations.

Newer versions of MS Excel, such as Office 365, contain the Microsoft One Drive feature which was designed to address collaboration and sharing issues. One Drive still has its limitations as it requires more setup than Google Sheets. By comparison, Google Sheets is considered simpler and is continuously updated in real-time as data is entered. For example, Google Sheets automatically updates and saves when users engage with the file, when the file is shared, and it always tracks changes.

Investintech.com (2022) conducted personal interviews with 27 spreadsheet experts and asked

them to predict the future of Excel in Business Intelligence. Appendix 2 presents a few of the quotes from the experts. 25 out of 27 felt that Excel would always be important, at the heart of data analytics and highly used and valued.

The main differences noted between Microsoft Excel and Google Sheets were cost, maximum cells per sheet, the robustness, automatic file saving, large datasets, the ability to collaborate effectively, and certification.

In addition to research studies on specific spreadsheet software skills required by employers, our literature review found that studies on spreadsheets focused on two other areas: how to 'teach' spreadsheet software to students in specific domains (e.g., economics, statistics), and the value of certification in spreadsheet skills. Most of the articles were focused on Microsoft Excel, although there were some older articles on VisiCalc and Lotus 1-2-3. Those articles were not included because the software is retired. Articles on Google Sheets are starting to appear and those have focused on how to use and introduce Google sheets either in general terms or towards a specific domain. There was little in term of direct comparison between MS Excel and Google Sheets

Formby et al. (2017) found that 94% agreed or strongly agreed that being able to create spreadsheets, charts and analyze data were especially important skills and that data analytics was also an important skill for students. They reviewed job postings for 5 different states and found that on average approximately 50% of employers had a strong spreadsheet knowledge requirement, specifically Microsoft Excel.

Treadwell et al. (2013) found that industry demands were strong for spreadsheet skills. Their study sought to determine important spreadsheet skills and then test students on Microsoft Excel. They felt the students' performance was declining and that could cause students to have difficulties finding jobs after graduation.

Coleman and Blankenship (2017) attempted to determine the linkage between academia and businesses. They surveyed faculty and area businesses and asked about 18 different MS Excel and MS Access attributes and found many synergies and alignments between what was taught and what was needed by employers. Their study reaffirmed that analytical skills and specifically spreadsheet skills are important to be taught, and to be mastered by students.

Raglan and Ramachandran (2014) investigated **student's perception of their MS Excel knowledge** and perceived readiness for accounting positions. Their study was helpful in aligning the skills perceived as necessary and important by new hires with those of current students. They also found that Excel is the most common analytical tool used by accountants, that public accounting firms are emphasizing an interest in recruiting accounting students with proficiency in Excel, and they want to hire new staff who know MS Excel.

Lee et al. (2018) reviewed job postings and surveyed accountants. They found that over 50 percent of postings required spreadsheet skills, specifically MS Excel. They found that most accountants felt that spreadsheet skills were very important. Their study even identified specific **skills in MS Excel such as 'Lookup and Pivot Table', 'Data entry, format, and calculations', and 'Logic' as necessary for new hires. Their results further indicated that "educational institutions should place emphasis on spreadsheet training for accounting students, if they have not already done so"** (Lee et al., 2018).

Many of the studies on how to teach spreadsheets to students are predominately focused on Microsoft Excel. Barreto (2015) provided an interesting review of Microsoft Excel pedagogical history in Economics. They found spreadsheets improve learning outcomes across the Economics curriculum and are increasingly being used. His article was relatively unique in that it did not focus on a specific application or example which is more common in the literature. Barreto (2022) also published a paper using Microsoft Excel to teach microeconomics.

In addition to Economics, studies were found for using Microsoft Excel to teach in other domains. For example, Divisi et al. (2017) presented a paper on statistics and how Microsoft Excel has functions to help with learning statistical processes. Chaamwe and Shumba (2016) wrote a paper using Excel to teach statistics in an e-learning environment. Khan (2007) wrote about using Excel to teach physics. Al Rawahi et al. (2006) demonstrated Excel in math. Munisamy (2009) showed how Excel could be of benefit to operations research. Willis (2016) implemented Excel in accounting information systems. Mangeiro et al. (2010) provided an example of using Excel in a financial management class. Conant and Chaille (2022) created an excel-based classroom exercise to demonstrate an asset depreciation method comparison.

From the certification perspective, Clairborne (2017) did a comprehensive review of employers and employer desired certifications in prospective employees. They discovered that spreadsheet skills were viewed very positively, and the Microsoft Office Specialist (MOS) Exam in Excel was considered the most valuable out of all the Microsoft Office suite products. Rebman et al. (2019) found that certifications help prepare students to compete in competitive job markets and showcase their marketability while they are still in school.

Most of the studies involving Google Sheets were focused on introducing a new alternative to Excel or how to apply Google Sheets to classroom instruction. For example, Parra et al. (2021) created a teaching case to teach cloud-based Google Sheets using Shippy Express. The goal of the teaching case was to have students use Google Sheets to develop summaries of their financial transactions to help them make decisions. Blair and Mahoney (2022) present a method for using Google Sheets to provide a step-by-step system for creating graphs for research designs and clinical applications. Ovezmyradov (2020) illustrated a way to use Google Sheets to teach the classic supply chain beer game.

There were a few studies that conducted comparison studies. Lawson et al. (2009) to 1600 subjects and put them into two groups of spreadsheet level and found that people with spreadsheet experiences and training did much better. They also found that corporate culture played a role and those who valued training had more advanced users. It was unclear if other companies relied on new hires to have spreadsheet experience. This was one of a few studies by the Spreadsheet Engineering Research Project (<http://mba.tuck.dartmouth.edu/spreadsheet/>) and focused on Microsoft Excel.

However, the lack of research on spreadsheet usage has not gone unnoticed. Grossman (2007) commented on the lack of spreadsheet research in comparison to research on other programming languages despite its wide use and impact on business. Today there are still gaps in spreadsheet research, specifically as it relates to a determination on the more preferred spreadsheet software of business, and trends in spreadsheet skills, knowledge, and abilities. There is a fair amount of Reddit chat boards or simple blog reviews and not so much in peer-reviewed research. This study seeks to address this gap in research.

### Position Description Analysis and Curriculum Development

Current literature has examined methodologies faculty can use to determine if their programs are adequately preparing students for their current workforce environment. Downey et al. (2008) mentioned that examining job postings was an excellent method to determine the in-demand industry skill and tools. This approach was supported in Harper (2012), McArthur et al. (2017), and Munmun et al. (2022), who similarly found that examining job postings can successfully enhance the understanding of the industry's expectation for particular skills and tools and as well as the employment environment. Harper (2012) and McArthur et al. (2017) discussed the importance of reviewing position announcements in a specific area where the industry demand is emerging. Overall, job advertisements can successfully show the hiring trends, labor demand analytics, and specific skill requirements, and can be the most effective and reliable resources to design curriculum within and across courses (Ahsan et al., 2013; Carnevale et al., 2014; Carnevale et al., 2014; Diamond et al., 2014; Frankenfeld, 2017; Hirudayaraj & Baker, 2018; Meyer, 2017; Reeves & Hahn, 2010; Rosén, 2014; Stanton, 2017; Templin and Hirsch, 2013, Wellman, 2010).

**Desai & Von Der Embse (2001) and Uğur & Hamit Turan (2019)** suggest strategies to develop effective curriculum based on practitioner surveys built on the existing curriculum literature and job postings, one of which focused on concentrations and the other on academic departments and industry to collaborations to understand current and future emerging needs. proposed a "synergistic approach" to employ both integrative and intensive strategies in higher education program development. The authors focus on "assessing industry trend for specific IT". This "assess industry trend" means to find out the promising tools and skills associated with them, then assessing how complex/difficult they are, alignment with student body, and local industry needs to determine what should be included in curriculum.

### 3. RESEARCH METHODOLOGY AND STUDY

This study seeks to understand the trends in employer perception and value of spreadsheet skills and preference using employer position analysis. Specifically, the study compares employer expectations between Microsoft Excel and Google Sheets. To provide a context, the study also sought to determine the significance of data analysis skills. Given the historical

displacement of spreadsheet applications and the emergence of Google Sheets as a competitor in the spreadsheet application market, it is important to study its demand in comparison to the demand for Microsoft Excel in position descriptions and understand how the changing work environment may be impacting employer expectations. Concomitantly, understanding the changing expectations of employers can help faculty in higher education respond to that change to maintain student preparation to perform in the workplace. This study uses position analysis to determine if faculty should consider updating courses to include Google Sheets as part of the future curriculum as well as measuring demand for particular analysis skills that can be performed using spreadsheets.

The literature review demonstrated the link between data analysis skills and spreadsheets. (Formby et al. (2017); Treadwell et al. (2013); Coleman and Blankenship (2017); Raglan and Ramachandran (2014); and Lee et al. (2018)). Specific skills considered in the literature included the ability to create spreadsheets, charts and data analysis. This led to the question of how important these skills are currently. The first research question and hypotheses are:

1. Do employers consider having the ability to create spreadsheets, charts, and analyze data to be an important skill for students and new hires in 2021 as compared to 2019?

*H1: The prevalence of general spreadsheets knowledge, skills and abilities for new hires is significantly higher in 2021 than in 2019.*

*H1a. The prevalence of data analysis knowledge, skills and abilities for new hires is significantly higher in 2021 than in 2019.*

*H1b. The prevalence of developing charts knowledge, skills and abilities for new hires is significantly higher in 2021 than in 2019.*

The literature review also discussed the strengths and weaknesses of Microsoft Excel and Google Sheets as tools (Simplilearn, EDUCBA, and WallStreetMojo.com). These strengths and weaknesses are important based on the expectations of the position.

While it is important to study the overall expectations of spreadsheets knowledge, skills and abilities, specific tool knowledge is also important. Given that Microsoft products have been on the market longer, it may be expected that Microsoft Excel would be listed as a required

or preferred knowledge, skill or ability more often than Google Sheets. Thus, the next research question and hypothesis are:

2. Do employers prefer Microsoft Excel skills over Google Sheets skills?

*H2: The prevalence of MS Excel knowledge, skills and analysis is significantly higher than Google Sheets in positions posted.*

Since Google Sheets was initially designed as a collaborative tool (Simplilearn, EDUCBA, and WallStreetMojo.com), it may be considered a stronger collaborative tool than Excel. Although collaboration is an expectation in the workplace in general, the increase in remote work during 2020 and 2021 may have created a demand for the ability to collaborate electronically including using tools such as Google Sheets.

Thus, it seems relevant to analyze if there is correlation between the spreadsheet tools and work environment expectations such as collaboration and working remotely. The next research questions and hypotheses studied were:

3. Do employers who list positions as remote prefer Microsoft Excel or Google Sheets?

*H3. There is no significant correlation between remote work environments and preference for Microsoft Excel or Google Sheets in posted job positions.*

4. Do employers who list collaboration as a required or preferred skill prefer either Microsoft Excel or Google Sheets?

*H4. There is a higher correlation between collaboration skills and Google Sheets than for collaboration skills and Microsoft Excel.*

Several statistical methods were used to address and provide a response to the four research questions. We analyzed job postings from Indeed.com for the years 2019 to 2021.

Indeed.com is a free service to job seekers, where employers post position openings and applicants can upload a resume, create job alert emails, search for jobs, save them and apply to them directly. (Indeed.com, 2022) Positions were extracted from the indeed.com data using the following requirements:

- Position Keywords: accounting, management, information systems, marketing, sales, operations, supply

chain, logistics, economics, human resources

- Degree restriction: Bachelor’s required or preferred
- Experience restriction: Two years or less

This extraction resulted in 21,398 non-duplicated position descriptions of which there were 5,970 positions for 2019, 7528 for 2020, and 7900 for 2021. There were 284 remote positions posted in 2019, 2160 in 2020 and 1794 in 2021. Table 1 shows the breakdown in position descriptions that requirements for general spreadsheet, data analytics and collaboration skills.

YEAR	COLLABORATION	DATA ANALYTICS	SPREADSHEETS
2019	4047 (43%)	1061 (11%)	4378 (46%)
2020	5502 (43%)	1426 (11%)	5777 (46%)
2021	5672 (41%)	1646 (12%)	6402 (47%)
TOTAL	15221	4133	16557

Table 1: General Skills Requirements 2019-2021

The positions were analyzed using text extraction to identify the keywords relevant to the study. The keywords used for the extraction tool were collabor\* for collaboration, remote to identify remote positions, Microsoft+Excel, Google+Sheets, data+analytics, visualization, charts and or graph for charts; pivot+tables, statistics and/or data+analysis for data analysis; and spreadsheets for spreadsheets-general. If a keyword was found in the position description, the observation was coded with a 1, and 0 otherwise. The final list of variables was YEAR, MS EXCEL, SHEETS, REMOTE, COLLABORATION, and DATA ANALYTICS.

All the variables except YEAR were coded as binary (0,1). The breakdown in positions that specific Microsoft Excel and/or Google is shown in Table 2. Figure 3 presents the most frequently occurring software requirements overall job postings over the years 2019-2022 and illustrates how Excel has held a steady rate while Google Sheets experienced an increase between 2020 and 2021. It is important to note that many people were forced to work remotely in parts of 2020 and 2021.



YEAR	MS EXCEL	GOOGLE SHEETS	BOTH
2019	3587 (61%)	1243 (21%)	957 (18%)
2020	4546 (57%)	2008 (25%)	1395 (18%)
2021	4724 (51%)	2899 (31%)	1715 (18%)
TOTAL	12857	6150	4067

Table 2: Positions mentioning MS Excel, Google Sheets and/or both.

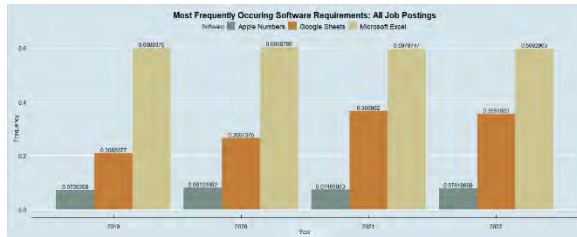


Figure 3: Most Frequently Occurring Software Requirements

The variables were analyzed using parts of the approach in Uğur, & Hamit Turan (2019). Since all the data is binary, the statistical analysis used t-tests for those hypotheses that compared pairs of data and correlation for the hypotheses that focuses on relationships between values.

#### 4. RESULTS

The data variables analyzed in the study were MS EXCEL, GOOGLE SHEETS, SPREADSHEET-GENERAL, REMOTE, CHARTS, COLLABORATION, and DATA ANALYTICS.

A correlation matrix was created for the variables to determine the strength of the relationship between remote work, collaboration and the two tools. The correlation between remote work and Google Sheets was .038 as compared to .014 for remote work and MS Excel indicating that Google Sheets was a slightly more preferred tool than Excel for those working remotely. Similarly, the correlation between collaboration and Google Sheets was .17 as compared to .16 for collaboration and MS Excel, indicating that Google Sheets was a more preferred tool than Excel for those positions stating collaboration as a required or preferred skill – but not by much.

However, when the correlations were performed by year, the correlation between remote work and Google Sheets increased from .002 in 2019 to .019 in 2021 as compared to .0024 in 2019 to .013 for Excel and remote work indicating that Google Sheets is growing faster as

a correlated skill for remote work than Excel. Similar results were found for collaboration. The correlation matrices can be found in Tables 3, 4 and 5.

Overall Correlation Matrix (2019, 2020 and 2021)		
Tool	Remote Work	Collaboration
Google Sheets	0.038	0.17
Microsoft Excel	0.014	0.16

Table 3: Overall Correlation Matrix

Correlation Matrix for 2019		
Tool	Remote Work	Collaboration
Google Sheets	0.002	0.12
Microsoft Excel	0.0024	0.11

Table 4: Correlation Matrix for 2019

Correlation Matrix for 2021		
Tool	Remote Work	Collaboration
Google Sheets	0.019	0.16
Microsoft Excel	0.013	0.13

Table 5: Correlation Matrix for 2020

The t-tests comparing Google Sheets demand to MS Excel demand had a p-value of .000 with means of .3 and .6, respectively. The t-test comparing Google Sheets demand, MS Excel demand, data analytics demand, and spreadsheet-general demand between 2019 and 2021 found all the comparisons to be significant with p-values of .000 with higher means for 2021 than for 2019.

The last t-test compared the 2019 and 2021 demands for general spreadsheet skills, data analysis and charts. The results indicate higher demand in 2021 than in 2019 for each as follows:

- Data analysis had p-value of .000 with means of .6 and .45, respectively
- Charts had p-value of .000 with means of .56 and .31, respectively
- Spreadsheet-general had a p-value of .000 with means of .7 and .56, respectively.

Based on the results, all hypotheses can be accepted. However, for the question of prevalence of MS Excel or Google Sheets, it should be noted that based on the trend analysis,



Google Sheets demand is growing slightly faster than MS Excel as a knowledge, skill or ability and that growth is correlated with growth in remote work.

Further, the results also suggest that faculty should be cognizant of the trends for increasing demand for data analysis skills and spreadsheets skills in general, as well as the increase in demand for collaboration skills and the number of positions that allow for remote work. There should be curriculum consideration of a balance between face-to-face and remote work in programs to ensure students become comfortable with both. Also, faculty should analyze and ensure sufficient collaborative projects that require online and face-to-face interactions to help students build collaboration skills in both environments. Lastly, faculty should examine the depths and applications of data analysis and spreadsheet skills throughout the curriculum to ensure that students are exposed to a variety of skills including but not limited to statistical analyses such as trend, descriptive statistics, and regression; pivot tables; and effective chart and graph techniques.

As to whether there should be an emphasis on Microsoft Excel or Google Sheets, though, the answer is less definitive. Although Microsoft Office 365 was introduced in 2011, it has increased its collaborative tools with Teams and OneDrive, and offers multiple ways to share documents. However, the ability to simultaneously edit documents in Google Suite is probably one of the reasons that demand for Google products is increasing. Further, this analysis was a national view rather than a regional view. Faculty are encouraged to analyze the position descriptions for their regions to determine if the national results hold true for their specific region.

#### 5. LIMITATIONS AND FUTURE RESEARCH

This study provided a US-based lens for specific skills for new university bachelor-level graduates. While a national view is helpful, individual campuses would benefit from an analysis based on the student population it serves. For example, if the student population is largely regional, then a regional perspective is needed. If the student population has a significant percentage of international students, then a global perspective should be considered. This is perhaps the highest limitation of the study. The data is also from one source. One of our next steps is to analyze the data by states or cities and compare regional expectations.

Further, 2020 and 2021 represent the two years with most companies asking workers to work remotely due to a pandemic. This may artificially impact positions' demand for remote work and collaboration. We also intend to examine the 2022 data to determine if the trends found for 2019 through 2021 continued in 2022.

Although the data was validated with three people reviewing a random selection of the observations for algorithm accuracy in extracting results, it is likely there are other keywords that were missed that might suggest a preference for specific data analytics or analysis skills.

Another limitation is the scope of this study. Examining job postings only partially answers the question of which software program should be taught. Companies have cultures to which have their own norms and behaviors and can influence decision making. Surveying employers on their software preference, value, and adoption could also help provide more answers as to what should be taught.

Lastly, previous studies (Bakir et al., 2019; Rebman et al., 2021; Tastle et al., 2017) have discussed Microsoft Excel certification curriculum programs and their impact on producing strong Excel knowledge workers. Future research would be helpful to determine if employers reported the having the same perception and value of MS Excel certified employees. It would be interesting to combine the results of employer preference to employer perceived value of certification and compare it with employer job postings. Such are questions we learned from this study that we plan to address in the future.

#### 6. CONCLUSION

This study was conducted as a response to questions regarding curriculum, specifically whether Microsoft Excel should be taught or replaced with Google Sheets. The results reinforce previous studies in that MS Excel is still preferred over Google Sheets, at least in terms of job postings. The increase of remote jobs indicates that Google sheets should not be disregarded. As companies determine their new normal, there may be increased demand for products that promote and support collaboration the way Google products do.

As technology changes, it is important that faculty analyze regional or local trends to determine if their respective curriculums adequately address knowledge, skills and abilities required by employers. However, there doesn't appear to be

an immediate need to remove MS Excel training and certifications from the curriculum or to replace course work with alternatives such as Google Sheets.














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Appendix 1. Microsoft Excel and Google Sheets Comparison

		 Excel	 Google Sheets
	<b>Software Developed By</b>	<b>MS Excel, 1987</b>	<b>Google Sheets, 2006</b>
	<b>Certification</b>	<b>YES, MOS</b>	<b>NO, discontinued</b>
	<b>Languages</b>	91 Languages	83 Languages
	<b>Price</b>	Expensive, Office 365 online \$8.25 a month	Cheap. Free. Business subscriptions is \$5 a month
	<b>Large Data Sets</b>	Ideal for large data sets	As data size increases, Google slows down. More suitable for small datasets.
	<b>Collaboration</b>	No default to share file users must set up connection	Google Sheet default set up for collaboration
	<b>Chatting</b>	Not Available	Available in sidebar
	<b>Tracking</b>	Available, but manual	Automatically available
	<b>Online/offline</b>	Can be used on & offline	Can be used on and offline
	<b>Cell Quantum</b>	Around 17 billion cells available	Maximum 2 million cells available
	<b>Number of Functions</b>	Supports 400 functions	supports limited functionality
	<b>Tool for Statistical Analysis &amp; Visualization</b>	Superior for data visualization since many formulas are built-in in Microsoft Excel.	Only simple chats, Gantt or a flow chart must be done manually
	<b>Seamless and easy to use</b>	Excel is easy to use, needs manual file save.	File automatically saved to Google Drive
	<b>Usage of macros</b>	Has built in macros, custom macros, VBA or find premade one	Google Sheets has just added macro functionality

			
	<b>Software Developed By</b>	<b>MS Excel, 1987</b>	<b>Google Sheets, 2006</b>
	<b>Certification</b>	<b>YES, MOS</b>	<b>NO, discontinued</b>
	<b>Linkage/sync with external data</b>	Data needs to be imported	Data can be imported directly from Internet

Appendix 2 Sample list of Experts on Predicting Spreadsheet software (I nvenstintech.com)

There is a running joke in BI communities.  
 "What is the most used feature in any business intelligence solution?"  
 It is the Export to Excel button.

*Excel continues to be the #1 platform when it comes to analyzing data, finding information, preparing charts and presenting them to decision makers. In that sense, I see Excel playing a strong role in BI workflows in future.*  
 /\* -Purna Duggirala \*/

*Excel will be right where it always has been – at the center, loved by its users, disliked by IT and the target of endless attempts to replace it by third party BI software vendors.*  
 /\*- Chris Webb\*/

*BI makers understand that Excel is here to stay, it is versatile and works excellently with the web and BI systems.*  
 /\* – Tom Urtis\*/

*The addition and integration of the new Power BI tools within Excel really opens up the possibilities for any type of analyst or everyday user to get involved in Business Intelligence.*  
 /\* – Jon Acampora\*/

*Not everyone works with millions of rows of data. What matters to everyone, anywhere, is what they can do with the data.*  
 /\* – Andrew Engwirda \*/

*The user will ultimately define how Excel fits into the BI workflows. It could happen at any point in the BI process.*  
 /\* – Jordan Goldmeier\*/