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Invited Paper
Survey of Technology and Skills in Demand: The 2024 Update

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ABSTRACT

Information Systems (IS) and Information Technology (IT) fields face a unique challenge because of the constant changes in the underlying technologies that need to be taught. The rapid overturn of content leads us to need a variety of strategies to maintain an up-to-date curriculum for our programs. This research continues a seventeen-year data collection project that aims to help IS and IT faculty identify trends in employer needs regarding the skills they expect from new hires upon graduation. This research marks the seventh deployment of a survey to IS/IT workers. We provide a summary of over 350 responses from IS/IT professionals. This iteration of the survey includes additional questions and insights about salaries and certifications. Noteworthy findings from this round of data collection include the surge of Artificial Intelligence (AI) as the most important platform for the near future. There is a need for educators to evaluate how to incorporate AI into our courses while still ensuring that students are gaining knowledge about the various topics AI is touching.

Keywords: IT skills, Technologies, Curriculum, Employment, IT certifications

1. INTRODUCTION

The one constant in the Information Systems (IS) and Information Technology (IT) field is change. This presents a unique challenge for instructors to stay abreast of the latest technologies impacting the field. The good news for both instructors and students is that demand for IS/IT graduates remains strong. The U.S. Bureau of Labor Statistics projects an average of 356,700 openings each year for the next 10 years, much faster than the average growth for other occupations. More specifically, the ten-year projection by occupation finds an increase in most areas including Information Security Analyst (+33%), Software Developers (+17%), Computer Network Architects (+13%), System Analyst (+11%), Data Base Administrators (+9%), and Web Developers (+8%). The median wage for these occupations is $104, 420 (as of May 2023) which is significantly higher than the median of all occupations at $48,060 (U.S. Bureau of Labor Statistics, 2024). However, there are occupations such as Programmers which are expected to see a 10% decline in the next 10 years. This further emphasizes the need for faculty (and universities) to adapt to changes in the field to meet the need.

An approach many universities employ to maintain relevancy in curriculum is to follow the recommendations from the ACM/AIS IS Model Curriculum (Leidig & Salmela, 2022). The limitation of such recommendations is these are updated only periodically and may not reflect current trends in the technology field. This has been a known issue in the IS/IT field with Legier et al. (2013), reporting several areas that universities and administrators should follow as industry needs change. Specifically, they outline the following challenge areas:

- How to meet employer needs in the changing IS and IT professions,
- How to determine what knowledge should be included in basic Information Systems courses,
- How to balance training and certification desires of students with providing a foundational knowledge of a topic area, and
- How to incorporate frequent advances in technology into the same total number of courses.

This research is part of a continuing effort over 17 years to survey and understand the industry's needs. The goal is to not only understand how specific technologies are being utilized by organizations, but also the business skills that will enhance their employment possibilities. This will help college students acquire a working knowledge prior to graduation concerning the various occupations based on their degree. It also attempts to provide guidance to students in these disciplines on the skills they should attempt to acquire to be desirable to employers. Our goal is to provide updated input to curriculum development to

cover the gap associated with the ACM/AIS Model Curriculum which is only done on a periodic basis.

2. LITERATURE REVIEW

Table 1 provides a summary of a sample of studies that investigate job skills and requirements in a variety of ways. Typically, these studies can be categorized based on their methodology. These include a) surveying employers, recent graduates, or seasoned employees, b) searching and analyzing job posts, or c) investigating current course offerings. If an approach includes secondary analysis such as reviewing course offerings at various universities, the approaches are combined with other qualitative or quantitative methods (e.g., Goulart et al., 2022; Zaheer et al., 2021). Oftentimes, the goal of these papers is to also identify gaps where curriculum from programs does not cover the needs of the industry. These gaps have been described by prior researchers as a need for self-management (Rhew et al., 2019), security and project management (Leonard et al., 2019), and a variety of soft skills (Burns et al., 2018; Goulart et al., 2022; Patacsil & Acosta, 2021).

Authors	Approach
Burns et al. (2018)	Collected and analyzed entry-level tech job posts over a four-month period
Dong and Triche (2020)	Used text mining on entry-level data analysts job posts over a five-year period
Goulart et al. (2022)	Pursued a mixed method approach involving IT program curricula, interviews with employers, and focus groups of students
Leonard et al. (2019)	Compared skills in job posts from skills described in course descriptions of AACSB programs
Patacsil and Acosta (2021)	Used text mining on job posts from various vacancy sites
Rhew et al. (2019)	Compared AACSB standards to collected and analyzed entry-level management job posts across 10 large cities
Sahin and Celikkan (2020)	Surveyed companies, faculty, and IT workers across 24 countries
Zaheer et al. (2021)	Pursued a mixed method approach involving interviews with employers and surveys of employees

Table 1. IS/IT Skill and Technology Related Research

Generally, these studies are cross-sectional and do not provide a longitudinal component. While there are exceptions, the time frames are typically short (e.g., four months in Burns et al., 2018) or just long enough to show initial trends (e.g., five years in Dong and Triche, 2020). The current research is part of a continuing project that surveys IS/IT professionals biennially, with the last survey completed in 2022. Our continued findings help identify trends within the field regarding what knowledge and technical skills are desired for various positions. The findings that we present can be coupled with the other important research to better inform the administration and faculty of universities regarding curriculum and course offerings for IS/IT-related programs.

3. METHODOLOGY

Using input from industry professionals and the prior iterations of the survey, the instrument was developed to give insights into the specific technical skills and technologies that IS/IT professionals currently use and foresee continuing to use in the next 2 years. This is the seventh version of our ongoing study to understand how these skills and technologies are perceived by IS/IT professionals. The results from this year's iteration will be compared to the prior study conducted in 2022 (Cummings et al., 2023). Our continued research questions include:

- What organizational technologies are currently in use and projected to be used in the future?
- What IT and non-IT knowledge and skills are required/needed by all IS/IT professionals?
- What is the importance of certifications in the field of technology and which ones are most prevalent?
- How have these changed from the prior survey?

The survey was developed using a multi-phase process involving an advisory board of IS/IT professionals and faculty. As this is a biennial survey and the process remains consistent with prior surveys, we have included more details concerning the survey development process in Appendix A.

As noted in the survey development process, an initial step was to assess any potential changes needed to the study. During an advisory board meeting with industry professionals, members participated in a roundtable discussion about possible changes to the survey for this cycle. There were some suggestions concerning changes to specific questions for various roles, but it was decided that the roles from the previous survey will remain the same:

- Analytics
- Business/Systems Analyst
- Database Admin
- Networking
- Project Manager
- Security
- Software Developer

Consistent with prior studies, a pilot test was conducted to make sure any new survey questions were clear to participants. Thirty participants participated in the pilot study and only minor changes were made based on feedback (e.g., clarity of question). The survey was then distributed nationally to participants through a survey company during the 2nd quarter of 2024. A total of 385 participants responded. In the subsequent section, an analysis of this year's survey will be conducted followed by a comparison with the previous results from the 2022 survey.

4. SUMMARY STATISTICS

For 2024, 385 IS/IT professionals completed the survey across various organizational types (Table 2) and sizes (Table 3). Corporations remained the primary organizational type

responding with 53% (down slightly from 56% in the previous survey). The only other organization type to see a drop in participation was LLC at 5% this year compared to 10% in 2022. All other types remained consistent or increased slightly.

Organization Type	2024	2022
Corporation	53%	56%
LLC	5%	10%
Education	6%	6%
Healthcare	7%	4%
Government	9%	6%
Non or Not for Profit	7%	7%
Sole Proprietor or Partnership	13%	12%

Table 2. Organization Type

However, we did see changes in the organization size with over 90% of respondents working at an organization consisting of less than 1000 employees (previously, 41% of respondents worked at organizations with 1000 or more employees). Additionally, responses came from across the United States with California (11%), New York (9%), Florida (9%) and Texas (9%) representing the largest number of responses.

Number of Employees	2024	2022
< 20	11%	3%
21-100	18%	8%
101-499	32%	18%
500-999	30%	29%
1000-9999	9%	34%
10000+	0%	7%

Table 3. Organization Size

Gender of participants remained consistent with females accounting for 24% of respondents and males at 76%. The educational background of participants was similar to previous studies with the majority of participants holding a post-secondary degree including an Associate's degree (9%), Bachelor's degree (IT related at 30% and non-IT related at 9%), Master's degree (IT related at 33% and non-IT related at 11%), and Ph.D. (3%). The average tenure of the participant in their given field (11 years) and the average years at their current employer (9 years) was unchanged from the previous study.

One change seen during this year's survey was the representation of participant roles at their organization (see Table 4 for a comparison with the previous survey). The role seeing the largest decline in participants was Software Developer which fell from 46% in 2022 to 34% in 2024. The largest increase in participants was seen in Analytics moving from 3% in 2022 to 10% in 2024. The remaining roles had variable changes of 3 to 5% increases or decreases.

Organizational Role	2024	2022
Business/Systems Analysis	12%	7%
Analytics	10%	3%
Database Admin	6%	9%
Networking	9%	8%
Security	6%	5%
Project Manager	18%	20%
Software Developer	34%	46%
Other IT	5%	2%

Table 4. Organizational Role

In the 2022 survey, salary was added to compare average salary from year to year. Table 5 summarizes the earnings of participants in both 2022 and 2024. The changes observed in this year's results suggest that there was equal representation based on respondent salary starting in the $50,000 range up to $150,000 or more.

Salary Range	2024	2022
Less than $10,000	1%	1%
$10,000 to $29,999	5%	3%
$30,000 to $49,999	7%	7%
$50,000 to $69,999	15%	8%
$70,000 to $89,999	15%	15%
$90,000 to $109,999	15%	19%
$110,000 to $129,999	12%	11%
$130,000 to $149,999	14%	13%
$150,000 or more	16%	21%

Table 5. Salary Range

5. RESULTS

The following sections are organized by first examining the current and future importance of technologies. Next, we evaluate specific skills within a specific field based on professionals currently working within that field. Lastly, we examine overall skills for all those entering the IS/IT profession.

5.1 Current and Future Technology Importance

Like prior surveys, we asked each participant questions about technologies they are currently using as well as the expected importance of those technologies within their field over the next two years. In addition to technologies specific to their field, all participants were asked about platform and cloud technologies. These will be discussed first followed by the responses to specific roles. As with past surveys, a comparison of the 2022 results is included. All technology importance questions were evaluated on a Likert 4-point scale which was calculated as follows: 4 - more important, 3 - same importance, 2 - less important, and 1 - not at all important.

5.1.1 Operating System (OS) Platform Expectations. All survey participants responded to the questions concerning OS platforms including the suggested addition of Artificial Intelligence (AI) to the 2024 survey (based on the suggestion of the advisory board). At a 95% rating of same/more importance

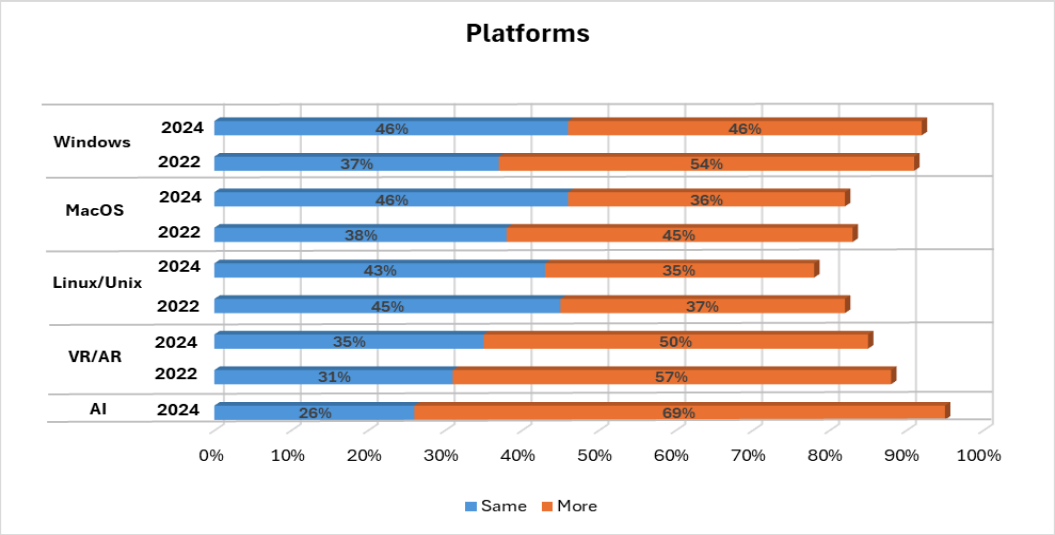

Figure 1. Platform Expected Importance

going forward, unsurprisingly, AI had the highest expected importance moving forward. This was followed by Windows and AR/VR (which was recently added in the 2022 survey) having the next highest importance moving forward. AI also had the highest rating for increased or more importance moving forward. Clearly, the shift to AI in the organizational environment is going to have significant impacts to the workforce in the future. Interestingly, there was a slight decline in overall importance (same and more) for both MacOS and Linux/Unix. While MacOS only dropped by one percentage point, the overall importance of Linux/Unix dropped by 4% (see Figure 1 for a complete summary).

Additionally, mobile operating platforms were evaluated for future importance as well. Both Android and iOS remained consistent with only a slight decline of 1% and 2% respectively. For a comparison of mobile operating systems' expected importance over the next 2 years, see Figure 2.

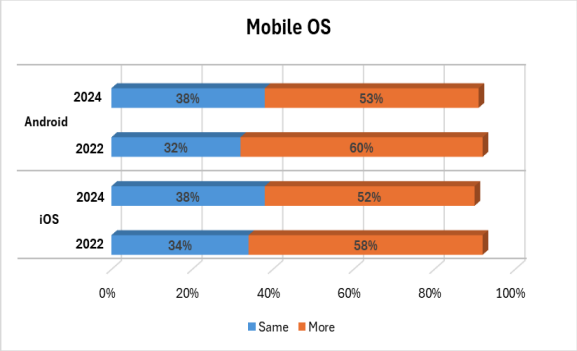

Figure 2. iOS and Android Expected Importance

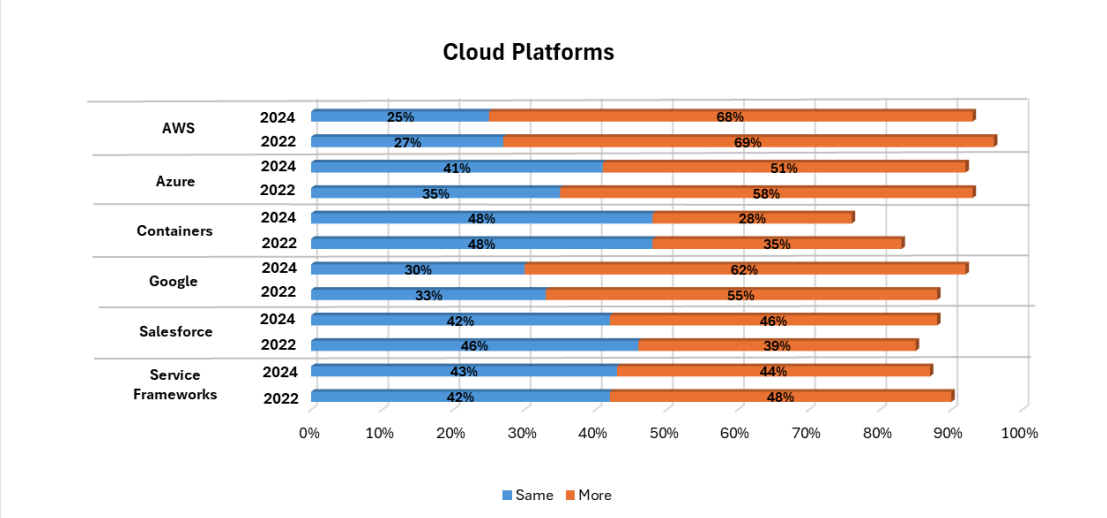

Figure 3. Cloud Platform Expected Importance

The final analysis of operating systems examines the average importance rating across all operating systems compared to the prior survey (see Table 6). The impact of AI is clear as artificial intelligence received the highest average rating of importance at 3.62. The remaining platforms saw modest declines but were still consistent with prior studies as far as importance is concerned (i.e., the rank order remained the same as in 2022). For mobile platforms, Android fell by 3% while iOS fell more at 11% down from 2022.

Platform	2024	2022
Artificial Intelligence	3.62	-
Windows	3.37	3.44
VR/AR	3.27	3.44
Mac OS	3.10	3.24
Linux/Unix	3.07	3.17
Mobile		
Android	3.38	3.49
iOS	3.10	3.48

Table 6. Summary of Platform Expectations

5.1.2 Cloud Platform Expectations. All survey participants also responded to the importance of cloud platforms with the results in Figure 3. While AWS was still ranked the highest importance going forward at 93%, it did fall 3% from the 2022 results. A similar decline was seen for Azure which tied for second highest importance at 92%, falling 1% from 2022. However, Google, which tied for second most important this year saw an overall increase from 2022 of 4% up to 92% for 2024. Finally, Salesforce came in at 3rd, increasing from 85% in 2022 to 89% in 2024. Finally, the two technologies that were added in 2022 both fell in 2024 with Service Frameworks at 87% Importance (down 3%) and Containers at 76% (down 7%).

When evaluating the average scores across platforms (see Table 7), all cloud platforms that were surveyed saw a decrease in average expectations of importance moving forward. AWS, Azure, and Google still lead with expectation of importance within cloud platforms. An open response question asking participants about technologies not captured in the survey suggests that many participants see IBM and Oracle as being a leader in the cloud platform arena. IBM Cloud was mentioned previously by a few participants but this year multiple participants included this as being significant moving forward. In the future, both IBM and Oracle will be included in the survey.

Cloud Platform	2024	2022
AWS	3.57	3.64
Azure	3.39	3.50
Google	3.39	3.51
Service Frameworks (e.g., SaaS, IaaS, etc.)	3.26	3.37
Salesforce	3.19	3.30
Containers	2.94	3.12

Table 7. Summary of Cloud Platform Expectations

5.1.3 Networking Technology Expectations. Starting with this section and subsequent section, participants self-selected into a specific role and were given questions concerning this role. The Networking and Technology role asked participants to report their expected importance of both software (e.g., Windows networking) and hardware (e.g., Cisco) technologies. A total of 35 participants responded as working in the networking role at their organization.

The 2024 included new technologies/software suggested by the advisory board. These include Software-Defined WAN, VMWare, HP Aruba and Palo Alto. Windows and Virtualization Technology remained the most important technologies moving forward which is consistent with the 2022. The largest change in this role was the importance of Cisco moving forward. In 2024, Cisco rated 88% which is down 12% from 2022. Palo Alto received the lowest rating of importance moving forward at 63% for 2024. Remote Technologies remained significant from 2022 suggesting many companies still rely on a remote workforce. See Figure 4 for results.

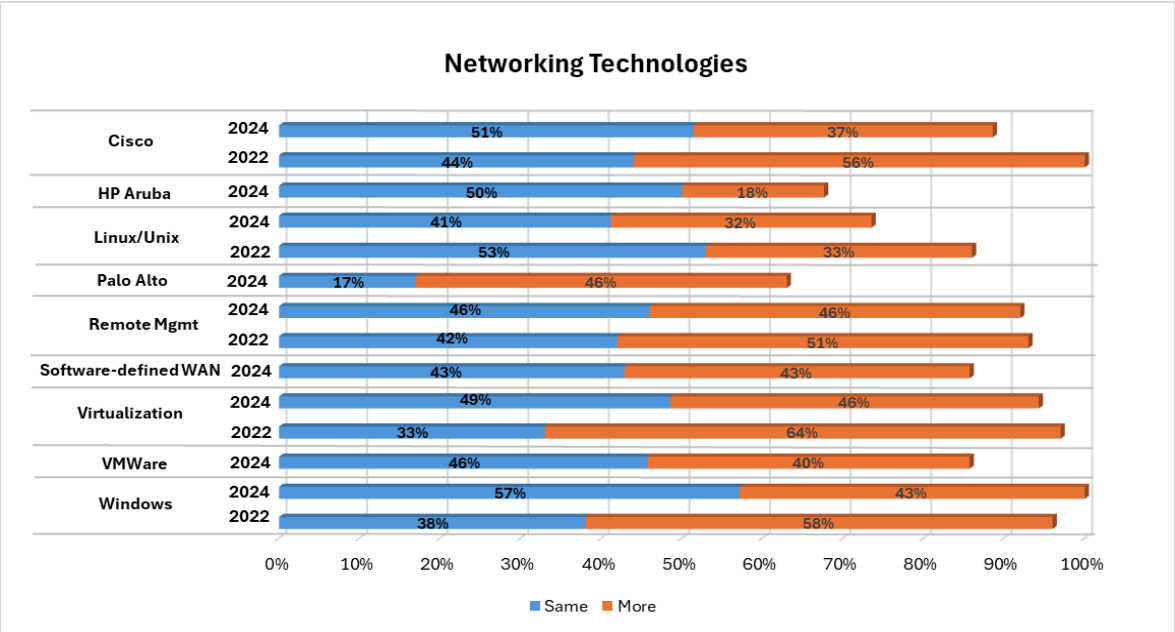

Figure 4. Networking Technologies Expected Importance

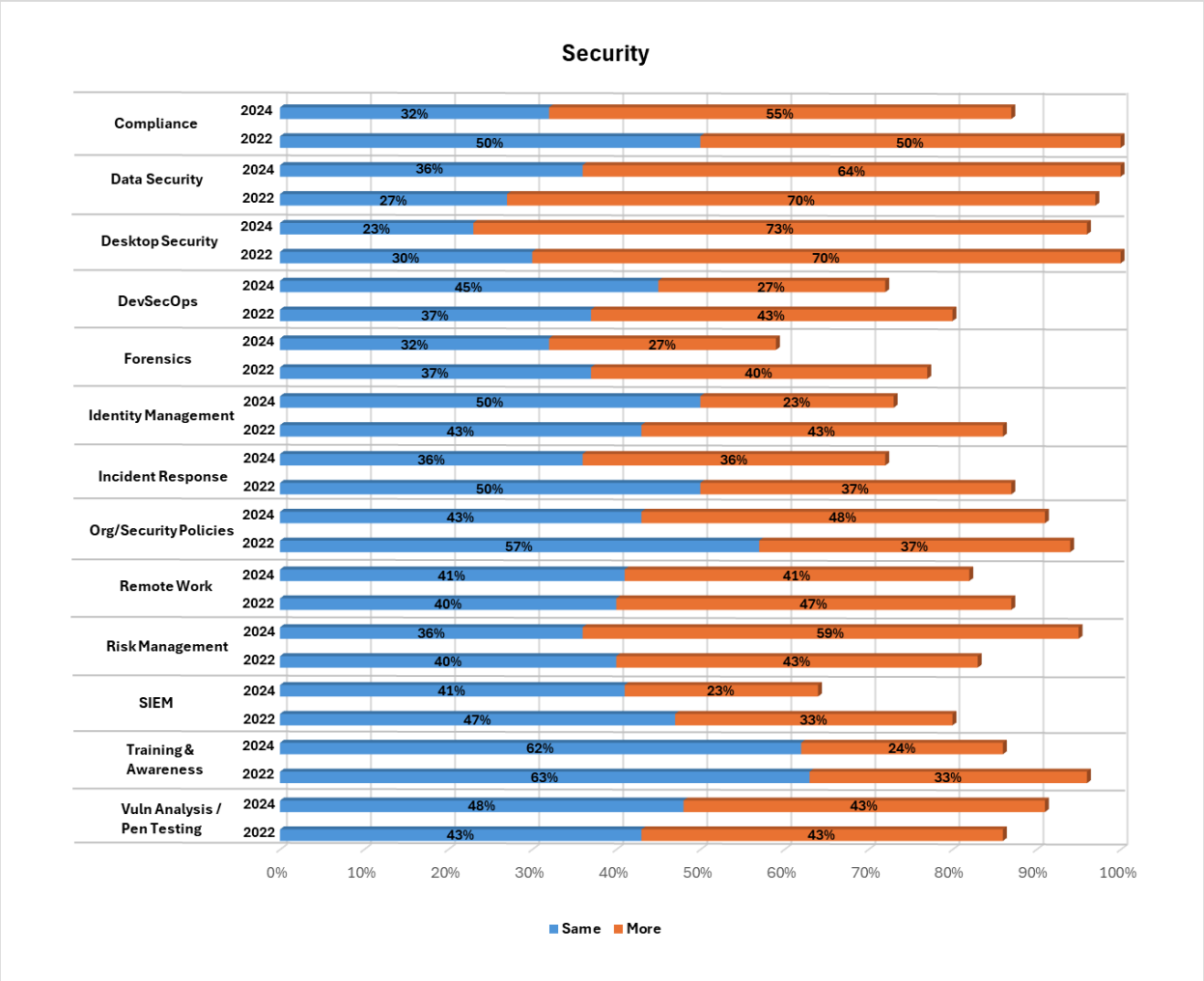

Figure 5. Security Expected Importance

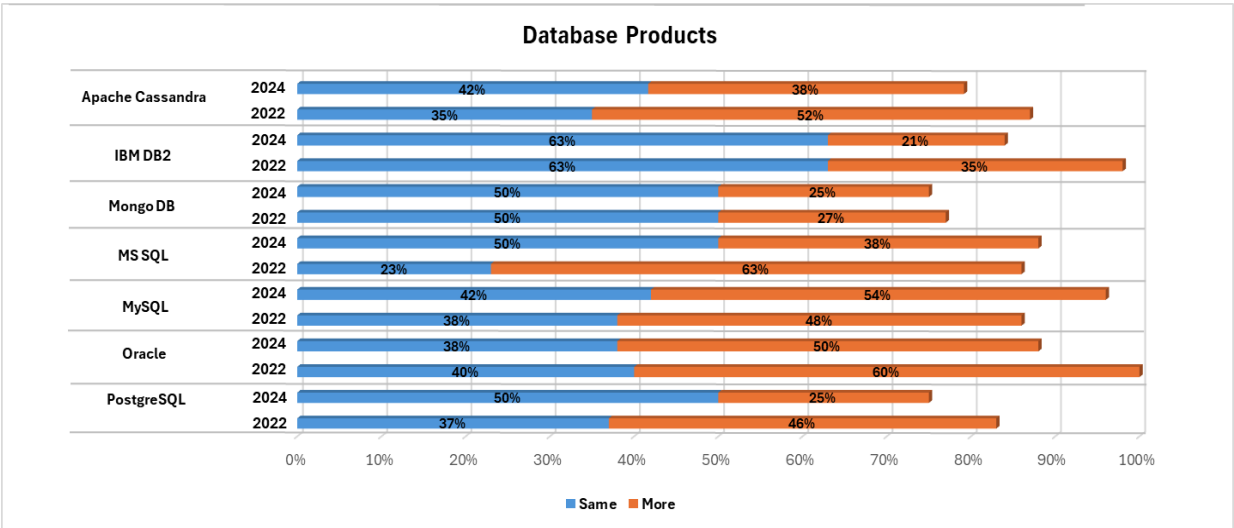

Figure 6. Database Products Expected Importance

The average ratings for networking can be found in Table 8. As mentioned in the previous paragraph, the largest change was with Cisco falling from 3.56 importance in 2022 to 3.14 in 2024. The newly added categories of Software-Defined WAN and VMWare were rated higher than Cisco. However, the additions of HP Aruba and Palo Alto saw the lowest importance in the future, suggesting this may need to be re-evaluated for inclusion in future surveys.

Networking Technologies	2024	2022
Windows	3.43	3.51
Virtualization Tech	3.37	3.62
Remote Management	3.34	3.44
Software-Defined WAN	3.23	-
VMWare	3.20	-
Cisco	3.14	3.56
Linux/Unix	2.94	3.18
HP Aruba	2.71	-
Palo Alto	2.63	-

Table 8. Summary of Networking Expectations

As with other categories, participants had the opportunity to include additional technologies of importance for this category. Most participants responded with no additional technologies. However, a few participants responded with AI to be included and there are some questions in the latter part of the paper that covers this topic.

5.1.4 Security Expectations. While most other categories focused on specific technologies and software, the security role included broader questions that focus on capturing the concepts/skills expected for those in the role. For 2024, 22 participants selected the security role.

Security	2024	2022
Desktop Security	3.68	3.70
Data Security	3.64	3.67
Risk Management	3.55	3.23
Compliance	3.36	3.50
Organization / Security Policies	3.33	3.27
Vulnerability Analysis / Pen Testing	3.33	3.27
Remote Work	3.18	3.33
Training and Awareness	3.05	3.30
Incident Response	3.05	3.20
DevSecOps	2.95	3.23
Identity Management	2.91	3.27
Forensics	2.82	3.13
SIEM	2.73	3.10

Table 9. Summary of Security Expectations

The results (see Figure 5) showed some movement in importance from the 2022 survey. While Compliance was the highest rated in 2022, Data Security (100%), Desktop Security (96%) and Vulnerability Analysis / Pen Testing (91%) were the highest rated categories of expected importance moving forward. While these categories focused primarily on the technical aspects of security, both Risk Management and Org/Security Policies were the fourth and fifth rated areas of importance, suggesting most organizations are taking a balanced approach to security.

The average ratings for security are listed in Table 9. While Desktop Security and Data Security remained the top 2 areas of focus, risk management jumped up to the third most important technology/skill for those in security. This could indicate an increased importance in identifying and mitigating risks within organizations as the number of data breaches in 2023 increased by 78% compared to 2022 (ITRC, 2024). The remaining areas ranked similarly to 2022 results with the exceptions of remote work and identity management which fell the most this year. This could also be the result of many companies now requiring employees to return to work (Hirsch, 2024).

5.1.5 Database Expectations. For 2024, there were 24 participants that selected the role of database. Like 2022, Oracle remained at the top of importance going forward at 88% (down from 100% in 2022) but this year, mySQL was the same at 88% (up from 2022). This was followed by MS SQL (88%), IBM DB2 (84%), and Apache Cassandra (79%). Both MongoDB and PostgreSQL were the last 2 products, ranking both at 75% importance going forward (see Figure 6).

Interestingly, the results compared to previous surveys showed declines in all products aside from MySQL which saw an overall increase in the average importance of 0.17 (see Table 10). The overall ranking by average remained the same except for MySQL moving from being 4th in 2022 to 1st in 2024.

Database Product	2024	2022
MySQL	3.46	3.29
Oracle	3.29	3.60
MS SQL	3.17	3.44
Apache Cassadra	3.08	3.31
IBM DB2	2.96	3.33
PostgreSQL	2.92	3.25
Mongo DB	2.92	3.02

Table 10. Summary of Database Expectations

5.1.6 Analytics Tools Expectations. The participant in the analytics role doubled in 2024 with 40 participants selecting this role (compared to 19 in 2022). Based on recommendations from previous surveys and the advisory board, two additional technologies (i.e., Azure Synapse and Snowflake) were evaluated in 2024. The results suggest that Azure Synapse has the highest importance moving forward with 93% of participants stating it will be the same or more important in the next 2 years. SAS had an increase in importance in 2024 following Azure with Apache Spark seeing similar importance as 2022. However, PowerBI, R/Rstudio and Tableau all decreased in 2024. See Figure 7 for full results.

When evaluated the overall averages of analytics tools in 2024, there is a significant shift in the importance of tools in the next 2 years (see Table 11). While SQL and Excel remained as some of the top tools, Tableau and R/RStudio fell dramatically in importance from 2022 to be at the bottom of importance for 2024. This may suggest Python is becoming the more popular open-source software as well as companies choosing alternative software to Tableau. While Azure Synapse was not included in 2022, it was one of the top tools for 2024 with an average

importance of 3.20. The additional question asked about other tools not listed in the survey resulted in similar results from other categories. Suggestions included AI, Machine Learning, and cloud tools. With the increase of importance on Azure, future surveys may include other data warehousing tools (e.g., AWS Redshift).

Analytics Tools	2024	2022
SQL	3.30	3.26
Excel	3.23	3.42
Azure Synapse	3.20	-
Python	3.18	3.21
SAS	3.13	3.21
Snowflake	3.10	-
PowerBI	3.08	3.05
Apache Spark	3.08	3.16
Tableau	3.03	3.47
R / RStudio	2.98	3.21

Table 11. Summary of Analytics Tools Expectations

5.1.7 Development Languages. The software developer role again represented the largest number of participants (n = 133, 34.5%) in this year's survey. Software developers were asked to rate the level of knowledge needed by IS/IT professionals across 13 different products (see Table 12).

For 2024, no additional development languages were added based on recommendations from both the advisory board and prior surveys. The top development language for 2024 was again JavaScript which also took the top spot in 2020 and 2022. In fact, almost all of the languages ranked similarly to previous surveys with only HTML5/CSS3 and Python moving up a spot each to 3rd and 4th respectively. C++ fell two spots to be rated 5th.

Development Language	Rating	2024 Rank	2022 Rank
JavaScript	3.36	1	1
Java	3.28	2	2
HTML5 / CSS3	3.27	3	4
Python	3.14	4	5
C++	3.06	5	3
C#	3.01	6	6
PHP	2.98	7	7
XML	2.93	8	8
jQuery	2.85	9	9
JSP	2.84	10	13
ASP.NET (Including MVC)	2.80	11	10
Angular	2.76	12	11
React	2.68	13	12

*Scale: 1-no experience, 2-fundamental, 3-working knowledge & 4-expert

Table 12. Development Language Level of Knowledge Desired

In addition to the languages surveyed, participants were able to suggest other important languages or skills that were not included in the list. Similar to the other roles, AI/Machine Learning knowledge was suggested as well as good communication and customer relationship skills.

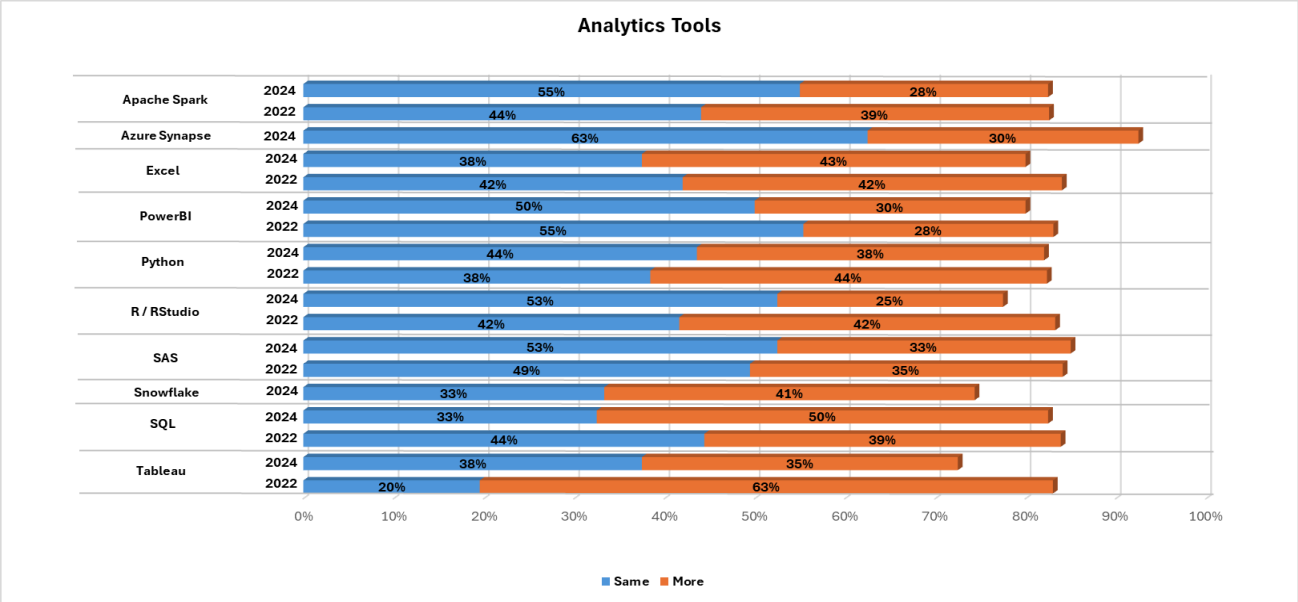

Figure 7. Analytics Tools Expected Importance

5.2 Skills by Role

In addition to evaluating technologies by role, the survey also captured specific skills needed within the role. The number of respondents per category will vary based on a participant's job role selection at the beginning of the survey. This ensured that only those working in the field responded to the questions regarding knowledge areas in their role.

5.2.1 Business/Systems Analyst. Previously listed at number four in 2022, Project Management knowledge was rated as the top skill for business/system analysts in 2024. Requirement Analysis was the only other skill that remained from the 2022 survey with a ranking of second in 2024. Quality Assurance, Software as a Service, and Web Services were the remaining knowledge areas participants suggested for the business/systems analyst role (Table 13 lists the top 5 knowledge areas in 2024 and 2022). The other skills from the 2022 survey did remain important but were not listed in the top knowledge areas for 2024.

Job Category	Knowledge Area*	
	2024	2022
Business/ Systems Analyst (n = 45)	Project Management	Requirement Analysis
	Requirement Analysis	System Design
	Quality Assurance	Process Analytics / Modeling
	Software as a Service (SaaS)	Project Management
	Web Services	Data Modeling
Project Mgmt. (n = 68)	Team Management	Team Management
	Planning and Scheduling	Planning and Scheduling
	Risk Management	Resource Scheduling
	Contract/Vendor Management	Risk Management
	Resource Scheduling	Contract/Vendor Mgmt
Software Dev. (n = 133)	API / Web Service Utilization	Cloud / Virtualization Concepts
	Cloud / Virtualization Concepts	API/Web Service Utilization
	Data Structures	Data Structures
	Object Oriented Programming	Mobile Device Development
	Version Control Mgt	OO Programming & Version Control Mgt (tied for 5th)

* in order of importance

Table 13. Knowledge Skills by Job Role

5.2.2 Project Management. Team Management and Planning/Scheduling remained the first and second knowledge areas of importance in 2024. In fact, all the top 5 skills for project management remained consistent from the 2022 survey. The only change that occurred was Resource Scheduling fell from third most important skill to fifth while Risk Management and Contract/Vendor Management each moved up one spot (see Table 13 for an ordered list of the top skills).

5.2.3 Software Development. While the previous section examined specific development languages, we also were interested in understanding specific skills developers need beyond a specific language. The average of the top three skills (i.e., API/Web Service Utilization, Cloud/Virtualization Concepts, and Data Structures) were only separated by 0.01, which suggests these three skills are necessary for all developers (see Table 13). Interestingly, API/Web Service Utilization was originally added in the 2022 survey and now takes the top spot in skills. Additionally, based on suggestions, a Low Code / No Code skill was added in the 2022 survey as this is a popular approach used at universities. For this year's survey, this skill was listed last suggesting that this is not a popular skill among software developers.

5.2.4 Analytics. Skills related to Analytics changed significantly from 2022 to 2024. Previously, the participants focused on the use of data through general statistics, predictive and prescriptive as being the top skills in 2022. In 2024, there appears to be more emphasis on working with the data as data visualization, machine learning, and data cleansing were selected as the top skills for analysts. The last two skills suggested by participants included Business Intelligence/Reporting and Data Warehousing (see Table 14).

Job Category	Knowledge Area*	
	2024 Results	2022 Results
Analytics (n = 40)	Data Visualization	General Statistics (e.g., Regression, ANOVA)
	Machine Learning	Big Data
	Data Cleansing	Predictive (e.g., Forecasting)
	Business Intelligence/Reporting	Prescriptive
	Data Warehouse	Descriptive & Data Visualization (tied)
Database Admin. (n = 24)	Analytic Tools (SSIA/SSAS/SSRS)	Virtualization
	DB Security / Access Control	Big Data Storage / Warehousing Concepts
	Big Data Storage/Warehousing Virtualization DB Design and Modeling (All Tied)	Raw Unstructured Data
	SQL Query / Reporting	DB Programming
	DB Programming (including ETL)	Analytic Tools (SSIA/SSAS/SSRS)

* in order of importance

Table 14. Analytics/Database Skills by Job Role

5.2.5 Database Admin. While Analytical Tools was selected as the fifth most important skill in 2022, this year's participants selected analytical tools as the most important skill in 2024. Additionally, there appears to be a focus on security not seen in previous years with DB Security and Access Control being selected as the second most important. There was a tie for third most important skills which included Big Data Storage/Warehousing, Virtualization, and DB Design and Modeling. SQL Query/Reporting and DB Programming were found to be the fourth and fifth most important skills, respectively (see Table 14).

5.2.6 Networking. The results for 2024 in the networking knowledge area remained the same from 2022 with only a change in ranking. The results only shifted the importance of Network Admin to the top spot (in 2022 listed as third) followed by Windows Admin and Firewall Admin/Security. Network Design/Programming and Cloud Services tied for fourth while Virtualization was listed as the fifth most important skill (see Table 15).

Job Category	Knowledge Area*	
	2024 Results	2022 Results
Networking (n = 35)	Network Admin	Windows Admin
	Windows Admin	Network Design / Programming
	Firewall Admin / Security	Network Admin
	Network Design / Programming Cloud Service (Tied)	Firewall Admin / Security
	Virtualization	Virtualization
Security (n = 22)	Desktop Security	Desktop Security
	Data Security	Data Security
	Risk Management	Compliance
	Compliance	Remote Work
	Org/Security Policies Vulnerability Analysis / Pen Testing (Tied)	Training and Awareness

* in order of importance

Table 15. Networking/Security Skills by Job Role

5.2.7 Security. Like 2022, Desktop Security and Data Security remained the top two most important skills for 2024. The third most important skill was risk management which did not appear in the top five skills in 2022. Compliance fell from third to fourth in 2024, while organization security polices, vulnerability analysis, and pen testing were all tied for fifth most important skills in security. Interestingly, remote work which was listed as fourth most important in 2022 did not make the top five skills in 2024. Following the high in remote work post pandemic, companies have started requiring employees to come back to the office which may explain the decline in remote work security importance.

5.3 Professional Certifications

The bi-annual survey continues to examine the proliferation of certifications within the field. The participants were asked if they had at least one certification with 83% indicating they held at least one professional certification (down from 95% in 2022).

Beginning this year, the survey was changed based on suggestions from the advisory board to ask participants to select certification by certifying body (AWS, Cisco, CompTIA, etc.). While it is not possible to do an exact comparison to the previous study (i.e., 2022 results), we can do some comparisons based on the actual certification listed in 2022 to the certifying body in 2024. Previously, the PMP was ranked 11th in certifications for 2022, however PMI (the certification organization for PMP) jumped to the 1st ranking in 2024. AWS Cloud Practitioner and Solutions Architect were ranked 2nd and 3rd, respectively, in 2022 and remained at the top of the list with AWS certifications ranking 2nd in 2024. The remaining results mirrored similar results from 2022, with Microsoft, Cisco, and CompTIA all ranking high in 2024. The only other significant change with 2024 was Scrum Alliance ranking 6th above ISACA, ISC^2, and EC-Council. Previously, in 2022, Scrum Master was ranked last behind these other certification bodies. Table 16 presented below lists the full results.

Certification Body	2024 Rank
Professional Management Institute (e.g., PMP)	1
AWS (e.g., Solutions Architect)	2
Microsoft (e.g., CSE)	3
CISCO (e.g., CCNA)	4
CompTIA (e.g., A+, Security+)	5
Scrum Alliance (e.g., Scrum Master)	6
ISACA (e.g., CISM, CISRP)	7
ISC^2 (e.g., CISSP)	8
EC-Council (e.g., CEH, CPENT)	9

Table 16. Professional Certifications Held by Participants

In addition to examining certifications currently held by IS/IT professionals, the survey also asked about certifications earned prior to graduating from their respective program (college, high school, etc.). Out of the 385 total participants, 129 (34%) reported having a certification upon graduation. These included certifications such as CompTIA A+, CAPM, Microsoft, and CCNA. Some participants reported more general certificates including Master's Certificates.

6. IMPLICATIONS FOR EDUCATORS

From the results of this year's survey, several implications for educators should be considered especially while developing curriculum. First and foremost, the theme throughout the various roles has been the impact of AI on their individual fields. As educators, we should evaluate how to incorporate AI into our courses while still ensuring they are gaining knowledge in the course. This is evident by Artificial Intelligence being ranked first among platforms organizations are going to be utilizing over the next 2 years. Within the mobile platform environment, Android appears to be more important in the next 2 years compared to iOS (this was not the case in 2022, where they were virtually tied).

Networking technology importance suggests that virtualization, Windows environments, and remote management continue to remain important for students to learn. For telecommunication courses, faculty should place an emphasis on student understanding of virtualized environments as well as including additional topics around the benefits of remote management. While some universities may not have a dedicated security course in their core curriculum, these topics need to be included based on our results, specifically with a focus on desktop security, data security, and risk management.

As with previous surveys, the importance of databases seems to be very similar with MySQL, Oracle, and MS SQL being the top listed database products which suggests that faculty should consider the most appropriate technology for the university's environment among the products listed above. If a university is to choose among the database products without any constraints, MySQL gained the most importance while MS SQL fell to third place behind Oracle. This may be due to the open-source nature of MySQL.

Development languages remained consistent with JavaScript and Java remaining the number 1 and 2 languages in both 2022 and 2024. If they are not already incorporating these technologies into curriculum, faculty should consider including these languages as they have been consistently at the top of the rankings for numerous years.

Thus far, we have focused on specific technologies used across various professional roles. The survey also captured more general IT Knowledge they would expect an individual to have when entering the field (see Table 17). There were significant changes from 2022 in this year's results. Specifically, there appears to be a focus on Data Analytics and Project Management compared to previous years. This may imply that we are moving away from traditional software development to the application and management of these areas. Additionally, while cloud/virtualization concepts remained high in the list, security jumped from 8th in 2022 to 4th in 2024, suggesting all graduates need to have a basic understanding of security concepts.

IT Knowledge	Rank of Importance	
	2024	2022
Data Analytics	1	3
Project Management	2	5
Cloud / Virtualization Concepts	3	2
Security	4	8
Networks	5	6
Database Skills	6	4
Business / Systems Analysis	7	7
Software Development	8	1
Artificial Intelligence / Machine Learning	9	9
Blockchain	10	10
Middleware	11(tie)	-
ERP	11(tie)	-

Table 17. IT Knowledge Importance

Business Knowledge	Rank of Importance	
	2024	2022
Soft Skills (e.g. Communication Oral/Written)	1	3
Management	2	1
Data Analytics	3	2
Statistics	4	4
Supply Chain / Logistics	5	5
Finance	6 (tie)	6
Marketing	6 (tie)	7
Economics	8	8
Accounting	9	9

Table 18. Business Knowledge Importance

The survey also asked about general Business Knowledge (see Table 18). While Soft Skills dropped in 2022 to be ranked 3rd, the results from this year's survey have these skills ranked number one again. The top three business knowledge areas changed slightly but the remaining areas were the same ranking as previously studied in 2022.

Finally, as educators, we are often asked by students whether they should get a certificate or not before graduating. While the results from the survey show many participants (83%) did have certifications, many of these certifications require experience. This year participants were also asked if they had any certifications before graduating. These results suggest that many do have certifications, but these are limited to those not requiring experience (e.g., CompTIA Security +). These results do not definitively answer the questions about certifications before graduation, but it does present a starting point for discussions with students on the pros and cons of certifications and how many current IS/IT professionals currently hold some type of certification.

7. CONCLUSIONS

The 2024 survey results provided further insights into the shifting landscape of the IS/IT field. Clearly, many companies are focusing on Artificial Intelligence with it being the most important platform moving forward. There also appears to be a shift in general skills away from software development to more management and analyzing data. Organizations continue to rely heavily on cloud services (e.g., AWS) and open-source software (e.g., MySQL) with newer services such as Azure Synapse leading cloud service importance in the upcoming years. Consistent with prior surveys, professionals in the field agree that soft skills, management, and analytical skills are all important areas students should be taught outside the technical skills and knowledge.

8. FUTURE RESEARCH AND REMARKS

With every iteration of this survey, changes are made based on the recommendation from the prior surveys (Cummings et al., 2023; Cummings & Janicki, 2021, 2020) as well as feedback from an IS/IT advisory board. This year's survey added additional technologies to some of the job roles as well as a change to the collection approach for certifications. While some

additions provided further insight, others may not have yielded any potential insights.

As with any research, there were limitations with data collection. We chose to use a third-party research company to target the specific fields as well as collect results from throughout the country. However, this limited our participants to those contacts of the survey company. Additionally, while there are a variety of technologies emerging within the field, we are not able to capture all those technologies within a single survey. This is why the technologies and skills surveyed have been limited to those identified by the advisory board and suggestions from previous surveys. As always, these will be re-evaluated for the next iteration of the survey in 2026.

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APPENDIX

Survey Development Process

Initial Survey Development

During survey development, a roundtable discussion was conducted with a corporate advisory board at the university. The advisory board consisted of 25 members that represent regional and national organizations of varying sizes (10 employees to over 1,000 employees). These members are primarily employees from their respective organization's IT department and interact with many of the technologies included in the survey. Additionally, IT management who manage and hire entry-level IT professionals were also members of the board and participated in the discussions. The roundtable goals were to understand what areas were important to IT professionals while identifying major technology areas. Faculty from the Information Systems and Information Technology department at a large, regional university led the roundtable discussions.

During the first roundtable discussions, a faculty representative worked with advisory board members to identify major trends or changes in technology in their respective fields. This included any suggestions from participants in the prior survey. Following this discussion, the group walked through previous surveys from the prior studies to evaluate relevancy in the current market as well as suggesting new areas to evaluate that were not covered in prior studies. Additionally, roundtable discussion included an evaluation of potential job categories that would fall under the technological areas identified.

Once the job categories were identified, the roundtable further discussed specific knowledge/skills needed for each of the jobs. This was done to provide a clear picture for educators of future IT professionals to incorporate specific skills into their courses that directly relate to the needs within industry. For example, under the Business/Systems Analyst job categories, the skills needed to perform effectively within the role were identified which included topics such as requirements analysis/gathering, process analysis, structured design, and system design.

Final Survey Development

Adjustments were made based upon the suggestions from the advisory board as well as suggestions from prior survey participants during the initial survey development and additional research was done to ensure all technologies and job categories were represented in the survey. The next step was to take the broad categories from the survey development phase and develop sub-categories of the technological areas. This discussion occurred during the following advisory board meeting in which specific technologies (including brand names) were identified within each category. The groups went through several iterations to make sure all possible sub-categories were captured and there was consistency across areas. The list of technologies/software was finalized based on the advisory board's experience and thoughts as well as ongoing importance. For example, professionals evaluated the networking category and specific technologies/brands (Cisco, Linux/Unix, etc.) were included as a subcategory.

In addition to the subcategories, questions centered on technologies used and future importance were developed to understand what industry professionals currently use now. Due to the evolving nature of the IT field, future importance was based on a two-year time horizon. After the subcategory selection was complete, the survey instrument was finalized and included general questions such as company size, organization type, employee functional area and general demographics (age, gender, location, company size, industry, job title).

Pilot Test

Once the survey was developed and finalized within the advisory board, a pilot test was conducted to ensure that the survey questions were clear to participants, all areas were appropriately covered, and average completion time was 10 minutes or less. A preliminary survey was emailed to industry professionals, which directed them to complete the online survey and provide feedback. The average completion time was below 10 minutes and based upon feedback, minor changes were made to the survey instrument, and it was deemed ready for distribution.

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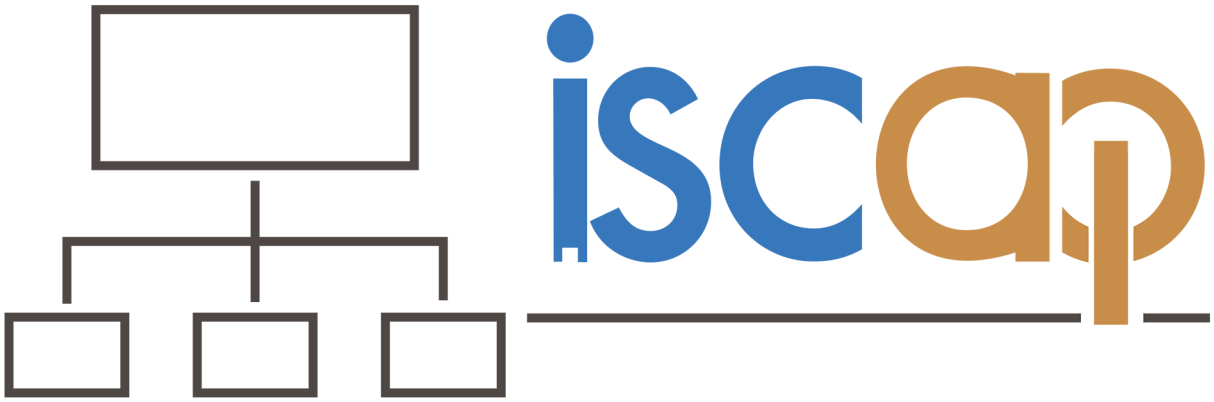

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