Preparing Accountants of the Future: Examining an Accounting Data and Analytics Undergraduate Program in Singapore

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ABSTRACT

Manuscript type: Research paper

Research aims: Due to technological innovations, there is a need for universities to produce accounting graduates who are proficient in data and analytics. A university in Singapore launched the accounting data and analytics (AD&A) second major program to provide students with skillsets in data and analytics. The aim of this study is to examine the efficacy of the AD&A program.

Design/Methodology/Approach: 100 participants were surveyed, involving 70 graduates of the program and 30 employers.

Research findings: The results show that both graduates and employers were satisfied with the program. The results also show that the program adequately equips graduates with relevant skills and competencies, reflecting current needs in the accounting profession.

Theoretical contribution/Originality: This study examines a new program in accounting data and analytics. Universities need to ensure that their accounting curricula remain relevant.

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Practitioner/Policy implications: This study is timely as the need for accountants to become more tech-savvy and conversant with data has been identified as an important way to help the accounting profession thrive amid digital transformation.
Research limitation: The results may not be generalised to other similar programs in other universities.

Keywords: Accounting Data and Analytics, Program Evaluation, Skills and Competencies
JEL Classification: M41, J24

1. Introduction

The accounting profession is rapidly evolving due to technological innovations (AICPA, 2019; Brink and Reichert, 2020; Blix et al., 2021; Damerji and Salimi, 2021; ISCA and ICAEW, 2017). It is predicted that, over the next decade, information technology (IT) will significantly transform the accounting profession (Janvrin and Watson, 2017; Pan et al., 2016; Seow et al., 2021). Although technological advances are set to transform the accounting profession in the coming years, there is a significant shortage of accounting professionals who possess the relevant skillsets to exploit these advances (ACCA, 2016; Daff, 2021; ISCA and ICAEW, 2017). This study is motivated by the need to ensure that young accountants entering the workforce possess the relevant skills and competencies as organisations increasingly seek to capitalise on the potential gains that can be achieved through the implementation of new technologies.

Accountants will need to develop new paradigms and skills to effectively leverage technology (McKinney Jr. et al., 2017; Pasewark, 2020). In this regard, there have been calls for university programs capable of equipping accounting students with technology skills that they will bring to the future workplace (Albring and Elder, 2020; Andiola, 2020; Dzuranin et al., 2018; Gamage, 2016; Sarkar et al., 2021). AACSB recommends that accounting degree programs should include learning experiences that develop skills and knowledge related to the integration of IT in accounting and business. As per AACSB's International Accounting Accreditation Standard A7 (Information Technology Skills and Knowledge for Accounting Graduates), these experiences include development of skills and knowledge related to data creation, data sharing, data analytics, data mining, data reporting, and storage within and across organisations (AACSB, 2021). Furthermore, the International

Federation of Accountants (IFAC) also highlights that the relevant skillsets, including those in IT, statistics, and data modelling, should be integrated in university programs for both current and future accountants (Sirois and Savovska, 2017). PwC, one of the global Big Four accounting firms, has also shared their view that to better prepare students for the opportunities and challenges ahead, universities should infuse analytical exercises into existing curricula in order to help students develop proficiency in data and analytics, in addition to core acounting skills (PwC, 2015).

Consistent with these views, the Pathways Commission on Accounting Higher Education of American Accounting Association highlights in its fourth recommendation the need for universities to "develop curriculum models, engaging learning resources and mechanisms for easily sharing them (Behn et al., 2012)". Further, the commission also notes that to achieve this, "vital programs, courses and approaches require systematic attention to curriculum, pedagogy, and opportunities for renewal (Behn et al., 2012)." Specific objectives articulated to accomplish this recommendation include engaging the accounting community to define the body of knowledge considered to be the foundation for accounting's future curricula (objective 4.1) and implementing curricula models for the future (objective 4.2).

In response to these demands and developments, a university in Singapore (UNIS) launched the Accounting Data and Analytics (AD&A) second major program in 2018. The AD&A program aims to provide students with skillsets in data and analytics that can be readily applied in the accounting context. This study aims to examine the efficacy of the AD&A program. Specifically, it examines the research question "To what extent does the AD&A second major program equip students with key skills and competencies expected in the future accounting workplace?"

This study employed the survey method to address the research question. Two online surveys consisting of quantitative and qualitative measures were developed for graduates of the program and employers. A total of 100 participants were surveyed, involving 70 graduates of the AD&A program, and 30 employers. The survey for graduates involved finding out their satisfaction level and perceptions of the AD&A program, perceived importance of skills and competencies gained from the program, and self-ratings on skills and competencies. The survey for employers involved finding out their perceptions of the AD&A program, perceived importance of skills and competencies taught, and their perceptions of graduates' skills and competences.

The results show that the graduates were satisfied with the AD&A program. They also indicated that the program supported their career needs. Similarly, the employers were positive about the AD&A program and indicated that the program adequately reflects current needs in the accounting profession. Increasingly, employers are expecting fresh graduates to be skilled in data analytics. Both graduates and employers rated positively about the importance of skills and competencies gained from the program to current work, indicating that the program equips graduates with relevant skills and competencies. While it is important to have technical skills, employers commented that graduates must not forget about having strong communication skills and being an effective team player. Among the generic skills, employers rated problem solving skills as the most important.

This study contributes to both existing literature and practice. In terms of contribution to education literature, this study examines a new program in accounting data and analytics. This study is timely as the need for accountants to become more tech-savvy and conversant with data has been identified as an important way to help the accounting profession thrive amid digital transformation. Universities need to ensure that their accounting curricula meet these needs. The findings of this study serve as useful feedback and inputs for UNIS to revamp its undergraduate accounting curriculum. It is important to review the program to not only understand whether the program's goals are met but also to identify potential problems and recommend possible improvements. It also serves as useful learning experience for other universities that may consider implementing similar accounting analytics program.

The remainder of the paper is organised as follows. The next section presents the AD&A program and discusses the principles of program evaluation. The subsequent sections describe the research method and discuss the results. The final section examines the limitations of the current study, and opportunities for future research.

2. Background and Literature Review

2.1 Accounting Data and Analytics (AD&A) Program

The accounting data and analytics (AD&A) second major program was launched in 2018. During the program development phase, focus group discussions were conducted with 23 representatives of major employers of accounting graduates in Singapore to gain insights into the relevance of a program in accounting data and analytics

for the accounting profession. They provided valuable insights and expressed strong support for the AD&A program.

Students need to complete eight courses to complete the AD&A second major to complement their Bachelor of Accountancy degree program at UNIS.[1] The curriculum is designed on three pillars: (1) data technology, (2) accounting application, and (3) a capstone course. Students will take four compulsory courses under the data technology pillar to equip themselves with basic data and analytics skillsets useful for accountants. These four courses include accounting information systems, business data management, data modelling and visualization, and statistical programming. Under the second pillar, students will learn to apply these basic data and analytics skill sets in specific accounting contexts by taking three electives. Electives available include forecasting & forensic analytics, analytics for value investing, audit analytics, and auditing information systems.

A key pedagogical innovation of the AD&A second major is the compulsory accounting analytics capstone course under the final pillar that employs a unique award-winning experiential learning pedagogy. Students are required to apply the skills learned under the first two pillars to work on real-world accounting analytics projects from companies and community organisations – a paradigm shift focusing on learning as opposed to teaching. The curriculum structure is illustrated in Figure 1.

Figure 1: Curriculum structure for the AD&A program

Data Technology (Compulsory) Four Courses	**Accounting Application (Electives) Any Three Courses**
• Accounting Information Systems	• Forecasting and Forensic Analytics
• Business Data Management	• Analytics for Value Investing
• Data Modelling and Visualisation	• Audit Analytics
• Statistical Programming	• Auditing Information Systems
	• Accounting Data and Analytics Work-Study Elective

COMPULSORY: Accounting Analytics Capstone (Experiential-learning format)

[1] The AD&A second major program is optional. Students can graduate with just the Bachelor of Accountancy degree program. Students can also pursue other second major program from other schools at UNIS such as marketing from the business school, legal studies from the law school, and psychology from the school of social sciences.

2.2 *Program Evaluation*

The Kirkpatrick's model is an established framework commonly used to examine the effectiveness of training programs (Kirkpatrick and Kirkpatrick, 2006). Although the model was first conceptualised with the intention to examine workplace training programs, in the recent years, it has been used to assess efficacy of university curriculum (Praslova, 2010). The Kirkpatrick's model consists of four levels: Reaction (Level 1), Learning (Level 2), Behavioral Change (Level 3) and Organization Performance (Level 4). The model helps to provide a structure for program evaluation, so one needs to adjust and adapt the model accordingly to the specific situation and intentions of the examined program, to ensure adequate and appropriate appraisal (Paull et al. 2016).

This paper focuses on the first two levels (reaction and learning) of the Kirkpatrick's model. The first level of the model is the reaction level. It measures students' perceptions and experience of the program and are usually examined using self-reported surveys. Alliger et al. (1997) suggested that the reaction level consists of two components – affective reactions and utility judgements. Affective reactions refer to students' level of satisfaction towards the program, while utility judgements consist of their perceptions of the usability of the skills and competencies learnt in the program (Alliger et al., 1997). This level provides insights into whether the program was well received by the students (Arthur et al. 2003). It is always preferable that the program was beneficial, engaging, and relevant for the students to facilitate better learning (Arthur et al. 2003).

The second level of the model is the learning level. Both reaction and learning levels are largely similar when referring to student reactions towards the program (Aryadoust, 2017). Capturing students' perceptions and experience towards the program is essential as negative experiences could have decreased their motivation and interest in the program and subsequently influencing their learning (Albashiry, et al. 2015). On the other hand, the learning level of the model assesses the level of skills and competencies that students have gained from the program. It is crucial to receive input and suggestions from students as they are the beneficiaries of the programs. Based on the students' perspectives, universities will be able to gain a better understanding on the learning process and improve on the quality of the programs (Medina et al., 2019). Students' feedback enables universities to make appropriate changes to their program to address the gaps and improve the quality of the curriculum (Kuznetsova, 2019).

A key goal for universities relates to the employability of graduates. When designing curriculum for university programs, it is important that the employers' needs are incorporated into the design of the programs (Mari et al., 2019). This is particularly evident in the accounting profession where accounting accreditation and professional bodies are calling for universities to integrate information technology and data analytics skill sets into their accounting programs to meet the current needs (AICPA, 2019; AACSB, 2021; ISCA & ICAEW, 2017). With the increasing use of technologies in the accounting profession, the demand for accounting graduates equipped with the relevant IT skills are growing. Paper qualifications alone would not be able to guarantee graduates' employment in the current competitive job economy. Universities will need to design their curriculum programs to bridge the gap between the graduates' competencies and the skills required by the industry or profession.

Based on Kirkpatrick's model, this study proposes an evaluation framework, consisting of six areas, to examine the efficacy of the AD&A program (see Figure 2).

Figure 2: Proposed Areas Based on Kirkpatrick's Model

Reaction Level	Learning Level
Affective Dimension	
1. Graduates' perceptions of the program	6. Graduates' self-rating of skills and competencies gained from the program
2. Graduates' satisfaction level of the program	
3. Employers' perceptions of the program	
Utility Dimension	
4. Graduates' perceived importance of the skills and competencies gained from the program	
5. Employers' perceived importance of the skills and competencies gained from the program	

3. Research Method

3.1 Skills and Competencies Framework

This study adapts the Singapore National Skill Framework for the accountancy sector[2] (SkillsFuture Singapore, 2020) to map and assess the relevant skills and competencies gained from the AD&A program. The framework is a guide for individuals who wish to understand how they can stay relevant and benefit from new opportunities in the accountancy sector. The framework emphasises on providing information about career choices to the individual to further support them in skill upgrading and career planning. The framework covers core accounting skills and competencies such as those related to the traditional areas of financial accounting, management accounting, audit and taxation. Besides the core accounting skills and competencies, the framework covers technical skills and competences related to data analytics and digitalisation. It also includes generic skills and competencies.

This study identified 14 technical skills and competencies related to data analytics and digitalisation that are applicable to the AD&A program. This study also identified 10 generic skills and competencies in communication, computational thinking, decision making, digital literacy, interpersonal skills, problem solving, sense making, teamwork, transdisciplinary thinking and virtual collaboration that were relevant to the AD&A program. Figure 3 illustrates the list of technical and generic skills and competencies that are applicable to the AD&A program.

[2] The framework was developed by the SkillsFuture Singapore, Workforce Singapore, the Singapore Accountancy Commission and the Institute of Singapore Chartered Accountants, together with employers, industry associations, and education and training institutions. The first version was launched in 2017, and the revised version was released in 2020.

Figure 3. Mapped Skills and Competencies from the Singapore National Skills Framework for the Accountancy Sector that are Applicable to the AD&A Program

Technical Skills and Competencies (Data Analytics)	Technical Skills and Competencies (Digitalisation)	Generic Skills and Competencies
1. Finance Business Partnering	9. Cyber Security	1. Communication
2. Information Gathering and Analysis	10. Data Governance	2. Computational Thinking
3. Data Analytics	11. Digital Technology Adoption and Innovation	3. Decision Making
4. Data Storytelling and Visualisation	12. Digital Technology Environment Scanning	4. Digital Literacy
5. Digital Forensics	13. Programming and Coding	5. Interpersonal Skills
6. Forensic Data Analytics	14. Infocomm Security and Data Privacy	6. Problem Solving
7. Business Process Analysis		7. Sense Making
8. Business Process Management		8. Teamwork
		9. Transdisciplinary Thinking
		10. Virtual Collaboration

3.2 Surveys

Two online surveys[3] consisting of mainly quantitative and a few qualitative questions were developed for graduates and employers (see appendix). Prior approval for the survey was obtained from our university's Institutional Review Board. Both surveys were created and conducted on Qualtrics. Participants were sent the survey link via email and were compensated with vouchers for their participation. For all quantitative questions, a 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).

The survey for graduates involved their satisfaction level and perceptions of the AD&A program, perceived importance of skills and competencies gained from the program, and self-ratings on skills and competencies. The first part consists of eight questions, adapted from prior studies, to assess the graduates' satisfaction level and perceptions of the program (Han et al., 2018; Wilkins et al., 2012).

[3] To ensure the face validity of our survey questions, we pre-tested the survey instrument with current students of the AD&A program and two faculty members from UNIS who have expertise in data analytics and who have participated in related projects with industry partners. Overall, they were satisfied with the clarity of the survey questions and that the questions appropriately measured the underlying constructs.

The second part consists of 24 questions, adapted from the Singapore National Skills Framework for the accountancy sector, to measure graduates' perceived importance of skills and competencies gained from the program to their current work. Under the third part, the same 24 skills and competencies were adapted into self-rating scales where graduates rated their proficiency levels for each skill and competency. Last, there were two open-ended questions for graduates to comment about how the program has aided them in their current job and any other feedback for the program.

The survey for employers involved finding out their perceptions of the AD&A program, perceived importance of the technical and generic skills and competencies taught in the program and, their perceptions of graduates' skills and competences. Their perceptions of the program were measured on a seven items instrument adapted from Mari et al. (2019). Similarly, to the survey for graduates, the same 24 items were used to measure employers' perceived importance of the skills and competencies taught in the program and was adapted accordingly for employers to rate graduates' proficiencies in each of the competency. Last, open-ended questions were included to find out what other skillsets and other emerging technologies that they would like the university to inculcate and any other feedback for the program.

3.3 Participants

A total of 100 participants were surveyed, involving 70 graduates of the AD&A program, and 30 employers.[4] The respondents consisted of 32 graduates (46 per cent) from the first batch who have graduated in 2020 and 36 graduates (51 per cent) from the second batch who have graduated in 2021.[5] There were 2 graduates (3 per cent) who managed to accelerate their progress and graduated in 2019, earlier than the intended first batch of graduates in 2020. Among the graduates, there were 43 females and 27 males. The respondents from employers consisted of 18 employers (60 per cent) from accounting firms, 3 employers (10 per cent) from banks and the remaining 9 employers (30 per cent) from various sectors such as consulting, manufacturing, retail, technology, telecommunications and media. Among the employers, there were 12 females and 18 males.

[4] The survey automatically closed when the number of respondents hits the target of 70 graduates of the AD&A program and 30 employers.

[5] There were 45 graduates from the first batch who have graduated in 2020 and 84 graduates from the second batch who have graduated in 2021.

4. Results and Discussion

4.1 Graduates' Perceptions of the AD&A Program

One-sample independent t-tests (test value = 0) were conducted to examine the data. Table 1 presents the graduates' perceptions of the AD&A program. Based on a 15-point Likert scale, ranging from "-7" (strongly disagree) to "7" (strongly agree), the mean rating for overall satisfaction level of the program was 5.23 (*SD* = 1.86). Graduates enjoyed the program (*M* = 5.71, *SD* = 1.47) and their expectations were met (*M* = 4.89, *SD* = 2.35). They believed that it was a wise decision to take on the program (*M* = 5.67, *SD* = 1.82) and would recommend the program to other students (*M* = 5.40, *SD* = 2.18). Overall, the graduates' ratings are significantly larger than zero for these questions (all $p < 0.001$), which we interpret as positive evaluations of the AD&A program.

Besides positive satisfaction level, graduates indicated that the program supported their career needs. They rated that the program prepared them adequately for their career (*M* = 4.33, *SD* = 2.21, $p < 0.001$), the level of data analytics skillsets was sufficient for their career needs (*M* = 3.79, *SD* = 3.04, $p < 0.001$), and helped them to attain employment upon graduation (*M* = 5.07, *SD* = 2.27, $p < 0.001$).

Table 1: Graduates' Perceptions of the AD&A Program

Satisfaction Items	*M*	*SD*	*t*(70)
(1) Overall, I am satisfied with this program.	5.23	1.86	23.54**
(2) Overall, I enjoyed myself while taking this program.	5.71	1.47	32.35[a] **
(3) I would recommend this program to other students.	5.40	2.18	20.76**
(4) My decision to take up this program was a wise one.	5.67	1.82	26.02**
(5) Overall, this program has met all my expectations.	4.89	2.35	17.39**
(6) This program has prepared me adequately for my career in accounting.	4.33	2.21	16.38**
(7) I believe that my level of data analytics skillsets is sufficient for my career needs.	3.79	3.04	10.43**
(8) I believe that this program has improved my chances to attain employment.	5.07	2.27	18.66**

A 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).
**p <.001
[a] n = 69

Besides the positive ratings, graduates shared encouraging takeaways from the program.

"The AD&A major exposed me to various programming languages and visualisation tools and incorporating accounting concepts in making data meaningful. This gave me an advantage in my work as I am tasked with work that require data analytics and I can draw insights using the skills acquired."

"Understand the concept of machine learning, the importance of collecting the right data and proper form of data in order to capitalise the data efficiently. Able to immediately plug-and-play into the organisation without much on-the-job training needed, with regards to basic coding, data manipulation, dash boarding and analytics related advice to clients."

"I was able to portray myself as a bridge between the business and tech function, a role that is becoming more and more important these days."

"This program has greatly influenced me to pursue the data analytics job which has helped me to find the job that I'm currently in. With the knowledge that I have gained from this program, it has helped me to deal with dashboards and analysing data which is crucial with the work that I'm currently doing."

"Yes. While my current role is not directly related to the major, it has equipped me with transferrable skills that help me approach and tackle complex challenges at the workplace in a methodical manner."

"It has exposed me to multiple analytical tools and to teach us a systematic manner to approaching a business problem. These lessons are valuable in the eyes of hirers and has helped me to adapt to work more quickly as I have used many of the tools that were taught previously under the ADA major."

Some graduates also suggested areas for improvement. They were hoping to have more applied learning opportunities during the program, besides the accounting analytics capstone course. Some were hoping to learn more advanced technical skills and competencies.

"For these analytics modules to have more hands-on approaches (such as working on real projects, not only limited to the capstone module) such as running research analysis, for students to learn and to be able to see its practicality in the working environment."

"I think it's better to focus the course on real business projects than written/coding exams. It seems to yield more benefits in terms of application, since often we can google even at work, when you don't know how to code something."

"Pretty well rounded and good basic knowledge to start off. However, I would personally appreciate more in-depth exposure to the mathematical concepts behind certain common models and algorithms (understand this is covered

at the post-graduate level), just a small section will be good. More technical knowledge taught during the ADA course will be beneficial."

"I felt the program could equip the students more in terms of statistical knowledge, in order to build (the) strong foundation on how to analyse data."

"The broad exposure is great for preparing us for data analyst roles, however the lack of in-depth knowledge creates a steep learning curve when entering a role that requires in-depth data science and data analytics skills."

4.2 Employers' Perceptions of the AD&A Program

Table 2 presents the employers' perceptions of the AD&A program. Similarly, the employers were positive about the AD&A program, with their ratings being positive and significantly different from zero. They highlighted the importance of data analytics (M = 6.37, SD = 1.33, $p < 0.001$) and indicated that the program adequately reflects current needs in the accounting profession (M = 5.07, SD = 1.36, $p < 0.001$). This shows that the AD&A program is timely and would help undergraduates to prepare themselves for the work of the future. The employers also believed that graduates of the program are more employable (M = 5.21, SD = 1.59, $p < 0.001$) and will have better career progression (M = 5.0, SD = 2.29, $p < 0.001$). They are more inclined to hire AD&A program graduates (M = 5.13, SD = 1.87, p <0.001) and offer better salary (M = 4.33, SD = 2.21, $p < 0.001$). The results suggest that data analytics skills are important skills that employers are looking for. Increasingly, employers are expecting fresh graduates to be skilled in data analytics. This also suggests that graduates who have data analytics skills may have an advantage over graduates who do not have data analytics skills.

Table 2: Employers' Perceptions of the AD&A Program

Satisfaction Items	***M***	***SD***	***t*(30)**
(1) I believe that this program adequately reflects current accounting needs.	5.07	1.36	20.36**
(2) I believe that in the future, data analytics in accounting will become essential.	6.37	1.33	26.30**
(3) I agree that graduates from this program are "work ready" upon graduation.	4.03	2.74	8.08**
(4) I believe that graduates with this program are more employable.	5.21	1.59	17.64[a] **
(5) I am more inclined to hire graduates with this program.	5.13	1.87	15.03**

Satisfaction Items	M	SD	t(30)
(6) I am willing to offer better salary for graduates with this program.	4.33	2.21	10.78**
(7) I believe that this program will allow graduates to have better career progression.	5.00	2.29	11.96**

A 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).
** p <.001
[a] n = 29

Besides the positive ratings, employers commented that graduates must learn to apply their technical skills to real-world problems and issues. This is precisely the motivation for the program to include a compulsory accounting analytics capstone course. The capstone course is delivered in an experiential-learning manner where students will get the opportunities to be mentored by industry practitioners and work together on projects involving real-world problems.

> *"The ability to adapt to the businesses and take into account the specifics of each organisation's processes and environment. Data analytics scenario and results are often not the standard but graduates often find it challenging to take into account the nuances in practical situations."*

> *"Having the adaptability and flexibility in applying their analytical skills across different business processes."*

> *"The application of data to translate into relevant business information is more applicable."*

> *"While it is good to have graduates who are work ready, it is also important to have graduates who are thinkers and problem solvers and not just workers."*

Employers also commented on emerging technologies that will be increasing important in the next few years such as cloud computing, blockchain, deep learning, robotic process automation and immersive technologies. The program should consider incorporating these emerging technology areas so that it will remain relevant for the accounting profession. While it is important to have technical skills, employers stressed that graduates must not forget about having strong communication skills and being an effective team player to solve problems. They also highlighted that graduates must be resilient and learn to work in a volatile, uncertain, complex and ambiguous business environment. Due to the fast-changing environment, graduates need to adapt a continuous-learning mindset and be active learners at work. These qualitative comments suggest

that it is important for the program to continue incorporating both technical and generic skills and competencies so that graduates will be developed holistically and be all-rounders.

4.3 Graduates' and Employers' Perceived Importance of Skills and Competencies Gained from the AD&A Program to Current Work

This study adapts the Singapore National Skill Framework for the accountancy sector to identify 14 technical skills and competencies related to data analytics and digitalisation that are applicable to the AD&A program. This study also identified 10 applicable generic skills and competencies. Figure 3 illustrates the list of technical and generic skills and competencies that are applicable to the AD&A program. Table 3 presents the graduates' and employers' perceived importance of skills and competencies gained from the program to current work.

Graduates rated the importance of all 24 skills and competencies positively and the results were statistically significant, indicating that the program equips graduates with relevant skills and competencies. Overall, both the graduates' and employers' ratings were positive and significantly different from zero (all $p \leq 0.001$). Under technical skills and competencies (Panel A), the highest rating for graduates was information gathering and analysis (M = 4.4, SD = 2.62), followed by data analytics (M = 4.09, SD = 2.8), and data storytelling and visualisation (M = 3.94, SD = 3.18). For employers, they rated both finance business partnering (M = 5.6, SD = 1.85) and data analytics (M = 5.6, SD = 1.74) as joint highest, followed by data storytelling and visualisation (M = 5.53, SD = 1.53). This suggests that employers highly value the ability to generate key business insights. While graduates learn the technologies and tools, they must be able to apply and help companies make sense of the data and support the business in a strategic manner. It is about helping companies generate actionable insights in order to achieve business advantages.

Table 3: Graduates' and Employers' Perceived Importance of Skills and Competencies Gained from the Program to Current Work

Panel A:	**Graduates**			**Employers**			**Difference (*a* – *b*)**	***t*-value**
Technical Skills and Competencies	***M*(a)**	***SD***	***t*(70)**	***M*(b)**	***SD***	***t*(30)**		
(1) Generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)	3.30	3.67	7.53**	5.60	1.85	16.58**	-2.30	-3.26*

Panel A:	Graduates			Employers			Difference	*t*-value
Technical Skills and Competencies	***M*(a)**	***SD***	***t*(70)**	***M*(b)**	***SD***	***t*(30)**	**(*a* – *b*)**	
(3) Apply data extraction and analyse methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)	4.09	2.80	12.20**	5.60	1.74	17.69**	-1.51	-2.74*
(4) Combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)	3.94	3.18	10.39**	5.53	1.53	19.87**	-1.59	-2.61*
(5) Use forensic technologies in the delivery of forensic services. (Digital Forensic)	1.04	4.07	2.15**	4.13	2.66	8.51**	-3.09	-3.82**
(6) Interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)	2.69	3.53	6.37**	4.79	2.54	10.16a**	-2.11	-2.92*
(7) Analyse business processes for improvement, optimisation, and efficiency. (Business Process Analysis)	3.50	3.40	8.62**	5.38	1.59	18.21a**	-1.88	-2.85#
(8) Manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)	3.37	3.42	8.24**	5.17	1.80	15.70**	-1.80	-2.71*
(9) Develop awareness of cyber security threats. (Cyber Security)	1.80	4.19	3.59**	4.07	2.91	7.65**	-2.27	-2.69*
(10) Develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)	2.11	3.85	4.60**	4.40	1.96	12.31**	-2.29	-3.08*

Panel A: Technical Skills and Competencies	Graduates			Employers			Difference ($a - b$)	t-value
	M(a)	SD	t(70)	M(b)	SD	t(30)		
(11) Develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)	2.66	4.41	5.04**	4.67	2.12	12.04**	-2.01	-2.37*
(12) Evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)	2.43	4.48	4.54**	4.48	2.28	10.60a**	-2.05	-2.34*
(13) Develop technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)	1.96	4.87	3.36*	4.20	3.16	7.29**	-2.24	-2.32*
(14) Develop awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)	3.21	3.88	6.93**	4.97	1.67	16.28**	-1.75	-2.38*
Panel B: Generic Skills and Competencies	**Graduates**			**Employers**			**Difference ($a - b$)**	***t*-value**
	***M*(a)**	***SD***	***t*(70)**	***M*(b)**	***SD***	***t*(30)**		
(1) Convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)	5.29	2.28	19.41**	5.43	1.85	16.08**	-.15	-.31
(2) Develop and use computational models, tools, and techniques to interpret and understand data, solve problems, and guide decision-making. (Computational Thinking)	3.91	3.32	9.87**	4.60	2.01	12.53**	-.69	-1.05
(3) Choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)	4.47	2.48	15.07**	4.70	2.32	11.09**	-.23	-.43
(4) Use ICT tools, equipment, and software to create, evaluate and share information digitally with others. (Digital Literacy)	3.93	3.54	9.27**	4.83	2.12	12.50**	-.91	-1.30

Panel B: Generic Skills and Competencies	Graduates			Employers			Difference ($a - b$)	*t*-value
	M(a)	*SD*	*t*(70)	*M*(b)	*SD*	*t*(30)		
(5) Manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)	4.96	2.48	16.75**	5.30	1.82	15.93**	-.34	-.68
(6) Generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)	4.31	3.20	11.28**	5.60	1.61	19.05**	-1.29	-2.09*
(7) Organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)	4.80	2.59	15.50**	5.03	1.83	15.08**	-.23	-.45
(8) Work collaboratively and effectively with others to contribute to group efforts to achieve identified objectives. (Teamwork)	5.54	1.89	24.59**	5.23	1.89	15.18**	.31	.75
(9) Understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)	4.77	2.68	14.88**	5.17	1.91	14.79**	-.40	-.73
(10) Use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)	5.30	2.15	20.63**	5.43	1.68	17.77**	-.13	-.30

A 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).
**p <.001, *p <.05, #p =.05
[a] n = 29

As for generic skills and competencies (Panel B), the highest rating for graduates was teamwork (M = 5.54, SD = 1.89), followed by virtual collaboration (M = 5.3, SD = 2.15), and communication (M = 5.29, SD = 2.28). For employers, the highest rating was problem solving (M = 5.6, SD = 1.61), followed by communication (M = 5.43, SD = 1.85) and virtual collaboration (M = 5.43, SD = 1.68). Employers rated problem solving as the highest, reinforcing the importance of the ability to generate insights in order to solve business problems.

Communication was rated second highest, which is consistent with some qualitative feedback from employers. The high rating of virtual collaboration could be due to the Covid-19 pandemic. Nowadays, it is important to learn how to work virtually with colleagues due to remote work-from-home arrangements.

For each of the 14 technical skills and competencies (Panel A), employers rated higher than graduates and the differences were statistically significant (all $p \leq 0.05$). This shows that employers perceived these technical skills and competencies as more important to current work than graduates. This could be due to the fact that graduates have just started their careers and may not be as aware as employers who have experienced the impact of IT on the accounting profession. Employers also rated higher than graduates for each of the 10 generic skills and competencies (Panel B), except for teamwork. However, only problem-solving skill is statistically significant ($p < 0.05$). This is consistent with the highest rating of problem-solving skills by employers. Graduates need to demonstrate their ability to solve problems in order to be highly valued by employers.

4.4 Graduates' Self-Ratings of their Skills and Competencies

Graduates were asked to self-rate their proficiencies for the 14 technical and 10 generic skills and competencies that are applicable to the AD&A program. Table 4 presents the graduates' self-ratings of their skills and competencies. For all 24 skills and competencies, graduates self-rated their proficiencies positively and the results were significantly different from zero (all $p \leq 0.001$), indicating that the graduates were confident about their skills and competencies gained from the program.

Table 4: Graduates' Self-Ratings of their Skills and Competencies

	Panel A: Technical Skills and Competencies	***M***	***SD***	***t*(70)**
(1)	I can generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)	4.31	2.76	13.06**
(2)	I can collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)	4.89	2.10	19.44**
(3)	I can apply data extraction and analyse methods to analyze and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)	4.74	2.28	17.39**

Panel A: Technical Skills and Competencies	*M*	*SD*	*t*(70)
(4) I can combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)	4.79	2.24	17.89**
(5) I can use forensic technologies in the delivery of forensic services. (Digital Forensics)	2.40	2.99	6.72**
(6) I can interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)	4.46	2.38	15.66**
(7) I am capable of analysing business processes for improvement, optimisation, and efficiency purposes. (Business Process Analysis)	4.37	2.32	15.74**
(8) I can manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)	4.19	2.57	13.64**
(9) I have awareness of cyber security threats. (Cyber Security)	3.29	3.77	7.29**
(10) I can develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)	3.11	3.33	7.84**
(11) I can develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)	3.43	2.73	9.32**
(12) I can evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)	3.71	2.73	11.41**
(13) I have the technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)	3.57	3.17	9.44**
(14) I have awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)	3.97	2.91	11.40**

	Panel B: Generic Skills and Competencies	*M*	*SD*	*t*(70)
(1)	I can convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)	5.11	1.59	26.86**
(2)	I can develop and use computational models, tools, and techniques to interpret and understand data, solve problems, and guide decision-making. (Computational Thinking)	4.63	2.35	16.45**
(3)	I can choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)	4.86	1.91	21.33**
(4)	I can use ICT tools, equipment, and software to create, evaluate and share information digitally with others. (Digital Literacy)	4.81	1.94	20.81**
(5)	I can manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)	5.03	1.92	21.93**
(6)	I can generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)	4.81	1.91	21.14**
(7)	I can organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)	5.17	1.82	23.81**
(8)	I can work collaboratively and effectively with others to contribute to group efforts to achieve identified objectives. (Teamwork)	5.33	1.74	25.59**
(9)	I have understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)	4.76	1.99	20.01**
(10)	I can use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)	5.47	1.51	30.31**

A 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).
**p < .001, *p = .001

Under technical skills and competencies (Panel A), graduates self-rated information gathering and analysis (M = 4.89, SD = 2.1) as the highest, followed by data storytelling and visualization (M = 4.79, SD = 2.24), and data analytics (M = 4.74, SD =2.28). These three

skills and competencies were perceived earlier under section 4.3 as the most important to their current work. The program has equipped them to be confident about relevant technical skills and competencies at work. Under generic skills and competencies (Panel B), the highest self-rating was virtual collaboration (M = 5.47, SD = 1.51), followed by teamwork (M = 5.33, SD = 1.74), and sense making (M = 5.17, SD = 1.82).

4.4 Comparisons Between Graduates with Analytics Jobs and Non-Analytics Jobs

Out of the 70 graduates surveyed, 27 graduates held analytics job positions while the remaining 43 graduates indicated that they were not working in analytics-related job positions. Additional tests were conducted to compare these two groups of graduates.

Graduates who are working in analytics jobs rated the eight questions relating to satisfaction level and perceptions of the program, as reported in section 4.1, higher than graduates who are not working in analytics jobs. The differences were statistically significant for all questions ($p < 0.05$), except for the question whether the program has adequately prepared them for their accounting careers. It is expected that some graduates may be disappointed when they could not secure analytics jobs and ended up in more traditional accounting roles. Therefore, they were less satisfied with the program and held less positive reactions towards the program than graduates who are working in analytics jobs.

Section 4.3 reported information gathering and analysis, data analytics, and data storytelling and visualisation as the top three technical skills and competencies that were perceived as important by the graduates for their current work. Graduates who are working in analytics jobs rated the perceived importance of these three technical skills significantly higher than graduates who are not working in analytics jobs. The perceived importance for information gathering and analysis (M = 5.22, SD = 2.03 vs. M = 3.88, SD = 2.84), data analytics (M = 4.93, SD = 2.4 vs. M = 3.56, SD = 2.93), and data storytelling and visualisation (M = 5.56, SD = 1.37 vs. M = 2.93, SD = 3.56) were significantly higher for graduates who are working in analytics jobs compared to graduates who were not working in analytics jobs ($p < 0.05$). Graduates who are working in analytics jobs are more exposed to analytics at work and thus they are expected to be more aware of the importance of technical skills and competencies at work.

Besides perceived importance, graduates who are working in analytics jobs self-rated their proficiencies of these three technical skills significantly higher than graduates who are not working in analytics jobs. The self-ratings proficiency level for information gathering and analysis (M = 5.67, SD = 1.11 vs. M = 4.4, SD = 2.42), data analytics (M = 5.44, SD = 2.03 vs. M = 4.3, SD = 2.35), and data storytelling and visualisation (M = 5.44, SD = 1.42 vs. M = 4.37, SD = 2.55) were significantly higher for graduates who are working in analytics jobs compared to graduates who were not working in analytics jobs ($p \leq 0.05$). Graduates who are working in analytics jobs continue to hone their technical skills and competencies at work. Thus, they are more confident with their proficiency levels and rated higher than graduates who are not working in analytics jobs.

Table 5: Comparisons Between Graduates with Analytics and Non-Analytics Jobs

Panel A:	**Analytics**			**Non-Analytics**			**Difference**	***t*-value**
Perceptions of the AD&A program	***M* (a)**	***SD***	***t*(27)**	***M*(b)**	***SD***	***t*(43)**	**(*a* – *b*)**	
(1) Overall, I am satisfied with this program.	5.89	1.16	26.5**	4.81	2.10	15.06**	1.08	2.44*
(2) Overall, I enjoyed myself while taking this program.	6.30	1.03	31.74**	5.33	1.59	21.77[a] **	.96	2.79[b] *
(3) I would recommend this program to other students.	6.15	1.38	23.18**	4.93	2.45	13.18**	1.22	2.35*
(4) My decision to take up this program was a wise one.	6.41	.84	39.45**	5.21	2.11	16.18**	1.20	2.81*
(5) This program has prepared me adequately for my career in accounting.	4.70	2.16	11.30**	4.09	2.23	12.01**	.61	1.13
(6) I believe that my level of data analytics skillsets is sufficient for my career needs.	4.74	2.82	8.73**	3.19	3.04	6.87**	1.56	2.14*
(7) I believe that this program has improved my chances to attain employment.	6.07	1.11	28.52**	4.44	2.59	11.27**	1.63	3.10*
(8) Overall, this program has met all my expectations.	5.70	1.14	26.06**	4.37	2.75	10.42**	1.33	2.39*

Panel B:	Analytics			Non-Analytics			Difference ($a - b$)	t-value
Perceived Importance of Technical Skills and Competencies	***M* (a)**	***SD***	***t*(27)**	***M*(b)**	***SD***	***t*(43)**		
(1) Generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)	3.67	3.90	4.88**	3.07	3.54	5.70**	.60	.66
(2) Collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)	5.22	2.03	13.40**	3.88	2.84	8.97**	1.34	2.13*
(3) Apply data extraction and analyse methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)	4.93	2.40	10.66**	3.56	2.93	7.96**	1.37	2.03*
(4) Combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)	5.56	1.37	21.1**	2.93	3.56	5.40**	2.63	3.66**
(5) Use forensic technologies in the delivery of forensic services. (Digital Forensic)	1.81	4.47	2.11*	.56	3.76	.97	1.26	1.26
(6) Interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)	3.41	3.49	5.07**	2.23	3.52	4.16**	1.18	1.36

Panel B: Perceived Importance of Technical Skills and Competencies	Analytics			Non-Analytics			Difference (*a* – *b*)	*t*-value
	M (a)	*SD*	*t*(27)	*M*(b)	*SD*	*t*(43)		
(7) Analyse business processes for improvement, optimisation, and efficiency. (Business Process Analysis)	4.19	3.44	6.32**	3.07	3.33	6.04**	1.12	1.35
(8) Manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)	4.52	2.46	9.56**	2.65	3.76	4.62**	1.87	2.29*
(9) Develop awareness of cyber security threats. (Cyber Security)	1.89	4.72	2.08*	1.74	3.89	2.94*	.15	.14
(10) Develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)	2.89	3.79	3.97**	1.63	3.85	2.77*	1.26	1.34
(11) Develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)	4.56	2.85	8.32**	1.47	4.82	1.99	3.09	3.02*
(12) Evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)	3.89	3.17	5.44**	1.51	4.71	2.11*	2.38	2.22*

Panel B:	Analytics			Non-Analytics			Difference	*t*-value
Perceived Importance of Technical Skills and Competencies	***M* (a)**	***SD***	***t*(27)**	***M*(b)**	***SD***	***t*(43)**	**(*a* – *b*)**	
(13) Develop technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)	3.78	4.14	4.75**	.81	4.99	1.07	2.96	2.58*
(14) Develop awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)	4.11	2.97	7.20**	2.65	4.30	4.05**	1.46	1.55
Panel C:	**Analytics**			**Non-Analytics**			**Difference**	***t*-value**
Self-Ratings of Technical Skills and Competencies	***M* (a)**	***SD***	***t*(27)**	***M*(b)**	***SD***	***t*(43)**	**(*a* – *b*)**	
(1) I can generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)	5.04	2.79	9.37**	3.86	2.68	9.45**	1.18	1.76
(2) I can collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)	5.67	1.11	26.54**	4.40	2.42	11.90**	1.27	2.56*
(3) I can apply data extraction and analyse methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)	5.44	2.03	13.97**	4.30	2.35	12.03**	1.14	2.09*
(4) I can combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)	5.44	1.42	19.88**	4.37	2.55	11.22**	1.07	1.99#

Panel C: Self-Ratings of Technical Skills and Competencies	Analytics			Non-Analytics			Difference (*a* – *b*)	*t*-value
	M (a)	*SD*	*t*(27)	*M*(b)	*SD*	*t*(43)		
(5) I can use forensic technologies in the delivery of forensic services. (Digital Forensics)	2.52	2.81	4.66**	2.33	3.13	4.87**	.19	.26
(6) I can interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)	4.89	1.95	13.04**	4.19	2.60	10.55**	.70	1.21
(7) I am capable of analysing business processes for improvement, optimisation, and efficiency purposes. (Business Process Analysis)	4.85	2.20	11.48**	4.07	2.37	11.24**	.78	1.38
(8) I can manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)	4.78	2.33	10.67**	3.81	2.67	9.38**	.96	1.55
(9) I have awareness of cyber security threats. (Cyber Security)	2.59	4.86	2.77*	3.72	2.87	8.52**	-1.13	-1.22
(10) I can develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)	3.04	3.57	4.42**	3.16	3.21	6.47**	-.13	-.15
(11) I can develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)	4.33	2.50	9.02**	2.86	3.29	5.70**	1.47	1.99#

Panel C: Self-Ratings of Technical Skills and Competencies	Analytics			Non-Analytics			Difference ($a - b$)	t-value
	M (a)	SD	t(27)	M(b)	SD	t(43)		
(12) I can evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)	4.48	2.21	10.55**	3.23	2.93	7.24**	1.25	1.90
(13) I have the technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)	4.78	1.63	15.28**	2.81	3.65	5.06**	1.96	2.63*
(14) I have awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)	4.04	2.68	7.82**	3.93	3.08	8.36**	.11	.15

A 15-point Likert scale was adopted, ranging from "-7" (strongly disagree) to "7" (strongly agree).
**p <.001, *p <.05, #p =.05
[a] n = 42, [b] n = 69

5. Conclusion

Technological innovations will transform the accounting profession. There have been calls for university programs to equip accounting students with technology skills that they will bring to the future workplace. UNIS launched the AD&A program to provide students with skillsets in data and analytics that can be readily applied in the accounting context. This study aims to examine the efficacy of the AD&A program. This study is motivated by the need to ensure that young accountants entering the workforce possess the relevant skills and competencies as organisations increasingly seek to capitalise on the potential gains that can be achieved through the implementation of new technologies.

The results show that the graduates were satisfied with the AD&A program and supported their career needs. The employers were also positive about the AD&A program and indicated that the program adequately reflects current needs in the accounting

profession. Both graduates and employers rated positively about the importance of skills and competencies gained from the program to current work, indicating that the program equips graduates with relevant skills and competencies.

Both employers and graduates highlighted the importance of applied learning. Employers valued problem solving skills highly and commented that graduates must be able to apply their technical skills to real-world problems and issues. This helps companies to make sense of the data and generate actionable insights in order to achieve business advantages. This provides validation for including a compulsory accounting analytics capstone course in the AD&A program, which is a key pedagogical innovation of the program. For the capstone course, students are required to apply the skills learned during the program to work on real-world projects. This close collaboration between students, faculty and industry practitioners facilitate the exchange of ideas and knowledge which integrates theory and practice. Increasingly, universities have been called upon to train students to be capable of dealing with complex issues and systems at work. Therefore, there is a need for an education where students are rooted in content knowledge and be provided with hands-on learning that mirrors real-world problems, coupled with interdisciplinary work opportunities.

Regarding limitations of this study, this study examines the efficacy of a specific analytics program at a university in Singapore. The results may not be generalised to other similar programs in other universities. Next, this paper focuses on the first two levels (reaction and learning) of Kirkpatrick's model and did not examine the next two levels (behavioral change and organisation performance). Graduates were asked to self-rate their skills and competencies. It may not be an accurate representation of their actual abilities. Another limitation relates to the relatively small sample size of 30 employers. Out of the 30 employers, only 12 employers stated that they have worked directly with the graduates. Due to the small sample size, this study could not make meaningful insights of employers' ratings of the graduates' skills and competencies.

Future research could consider measuring graduates' learning outcomes. This study is the first in a series of related work. Subsequent projects will adopt semi-structured interview and experimental research methods to examine the efficacy of the program. Following the Kirkpatrick's model, future studies could investigate graduates' on-the-job performance to examine actual work performance. Future research could examine analytics programs in

other disciplines. Besides accounting, new technologies has affected two other service-oriented professions, law, and finance. It is clear that practitioners and academics in accounting, law, finance and many other industries need to rethink about the future of their professions and to take active steps towards embracing digital transformation.

Endnote

[1] The AD&A second major program is optional. Students can graduate with just the Bachelor of Accountancy degree program. Students can also pursue other second major program from other schools at UNIS such as marketing from the business school, legal studies from the law school, and psychology from the school of social sciences.

[2] The framework was developed by the SkillsFuture Singapore, Workforce Singapore, the Singapore Accountancy Commission and the Institute of Singapore Chartered Accountants, together with employers, industry associations, and education and training institutions. The first version was launched in 2017, and the revised version was released in 2020.

[3] To ensure the face validity of our survey questions, we pre-tested the survey instrument with current students of the AD&A program and two faculty members from UNIS who have expertise in data analytics and who have participated in related projects with industry partners. Overall, they were satisfied with the clarity of the survey questions and that the questions appropriately measured the underlying constructs.

[4] The survey automatically closed when the number of respondents hits the target of 70 graduates of the AD&A program and 30 employers.

[5] There were 45 graduates from the first batch who have graduated in 2020 and 84 graduates from the second batch who have graduated in 2021.

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Appendix A: Survey Instrument

Survey Questions for Graduates

Part 1: Overall Experience

Please indicate to what extent you agree with the following statements about your experience with the Accounting Data and Analytics second major program.

1. Overall, I am satisfied with this program.
2. Overall, I enjoyed myself while taking this program.
3. I would recommend this program to other students.
4. My decision to take up this program was a wise one.
5. This program has prepared me adequately for my career in accounting.
6. I believe that my level of data analytics skillsets is sufficient for my career needs.
7. I believe that this program has improved my chances to attain employment.
8. Overall, this program has met all my expectations.

Part 2A: Importance of Technical Skills and Competencies to Your Work

Please indicate to what extent you agree that the following skills and competencies are important to your work currently.

1. Generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)
2. Collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)
3. Apply data extraction and analyse methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)
4. Combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)
5. Use forensic technologies in the delivery of forensic services. (Digital Forensic)
6. Interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)
7. Analyze business processes for improvement, optimisation, and efficiency. (Business Process Analysis)
8. Manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)
9. Develop awareness of cyber security threats. (Cyber Security)
10. Develop, implement, and practice guidelines, laws, and regulations across the organization for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)
11. Develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)
12. Evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)
13. Develop technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)
14. Develop awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)

Part 2B: Importance of Generic Skills and Competencies to Your Work

Please indicate to what extent you agree that the following skills and competencies are important to your work currently.

1. Convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)
2. Develop and use computational models, tools and techniques to interpret and understand data, solve problems and guide decision-making. (Computational Thinking)
3. Choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)
4. Use ICT tools, equipment and software to create, evaluate and share information digitally with others. (Digital Literacy)
5. Manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)
6. Generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)
7. Organize and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)
8. Work collaboratively and effective with others to contribute to group efforts to achieve identified objectives. (Teamwork)
9. Understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)
10. Use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)

Part 3A: Proficiencies of Technical Skills and Competencies Gained from the AD&A Program

Thinking about the skills and competencies that you have acquired during your course of study for the AD&A program, how would you rate yourself in the following scale?

1. I can generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)

2. I can collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)
3. I can apply data extraction and analyse methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)
4. I can combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)
5. I can use forensic technologies in the delivery of forensic services. (Digital Forensics)
6. I can interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)
7. I am capable of analysing business processes for improvement, optimisation, and efficiency purposes. (Business Process Analysis)
8. I can manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)
9. I have awareness of cyber security threats. (Cyber Security)
10. I can develop, implement, and practice guidelines, laws, and regulations across the organization for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)
11. I can develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)
12. I can evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)
13. I have the technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)
14. I have awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)

Part 3B: Proficiencies of Generic Skills and Competencies Gained from the AD&A Program

Thinking about the skills and competencies that you have acquired during your course of study for the AD&A program, how would you rate yourself in the following scale?

1. I can convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)
2. I can develop and use computational models, tools, and techniques to interpret and understand data, solve problems, and guide decision-making. (Computational Thinking)
3. I can choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)
4. I can use ICT tools, equipment, and software to create, evaluate and share information digitally with others. (Digital Literacy)
5. I can manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)
6. I can generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)
7. I can organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)
8. I can work collaboratively and effectively with others to contribute to group efforts to achieve identified objectives. (Teamwork)
9. I have understanding of concepts across multiple disciplines, with the capacity to synthesize the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)
10. I can use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)

Part 4: Open-ended Questions

1. How has this program prepared you for the work that you do/your job?
2. Any other feedback or comments regarding your experience or the major?

Survey Questions for Employers

Part 1: Overall Perception

Please indicate to what extent you agree with the following statements about UNIS's Accounting Data and Analytics second major program.

1. This program adequately reflects current accounting needs.
2. I believe that in the future, data analytics in accounting will become essential.
3. I agree that graduates from this program are "work ready" upon graduation.
4. I believe that graduates with this program are more employable.
5. I am more inclined to hire graduates with this program.
6. I am willing to offer better salary for graduates with this program.
7. I agree that having a major in Accounting Data and Analytics will allow graduates to have better career progression.

Part 2A: Importance of Technical Skills and Competencies to Your Work

Please indicate to what extent you agree that the following skills and competencies are important to the work that your team/organization/company does currently.

1. Generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)
2. Collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)
3. Apply data extraction and analytical methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)

4. Combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)
5. Use forensic technologies in the delivery of forensic services. (Digital Forensic)
6. Interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)
7. Analyse business processes for improvement, optimisation, and efficiency. (Business Process Analysis)
8. Manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)
9. Develop awareness of cyber security threats. (Cyber Security)
10. Develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)
11. Develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)
12. Evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)
13. Develop technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)
14. Develop awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)

Part 2B: Importance of Generic Skills and Competencies to Your Work

Please indicate to what extent you agree that the following skills and competencies are important to the work that your team/ organisation/company does currently.

1. Convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)
2. Develop and use computational models, tools and techniques to interpret and understand data, solve problems and guide decision-making. (Computational Thinking)
3. Choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)
4. Use ICT tools, equipment and software to create, evaluate and share information digitally with others. (Digital Literacy)
5. Manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)
6. Generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)
7. Organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)
8. Work collaboratively and effective with others to contribute to group efforts to achieve identified objectives. (Teamwork)
9. Understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)
10. Use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)

Part 3A: Your Perceptions of the Technical Skills and Competencies of Graduates from the AD&A Program

Please indicate to what extent you agree that the graduates of this program are adequately equipped with the following skills and competencies.

1. They can generate finance-related insights to support the business in a strategic manner. (Finance Business Partnering)
2. They can collect and analyse information and data to obtain business insights for business activities. (Information Gathering and Analysis)
3. They can apply data extraction and analytical methods to analyse and evaluate financial and non-financial information and provide business intelligence. (Data Analytics)

4. They can combine data insights, dynamic visual displays with illustrative and interactive graphics and narrative representative formats to present patterns, trends, meaning, messages and analytical insights from data or new concepts in a strategic manner. (Data Storytelling and Visualisation)
5. They can use forensic technologies in the delivery of forensic services. (Digital Forensics)
6. They can interpret and analyse data using statistical techniques to uncover trends and patterns in finance and accounting documentation which are indicative of fraudulent activities. (Forensic Data Analytics)
7. They are capable of analysing business processes for improvement, optimisation, and efficiency purposes. (Business Process Analysis)
8. They can manage and optimise an organisation's business processes for efficiency and effectiveness. (Business Process Management)
9. They have awareness of cyber security threats. (Cyber Security)
10. They can develop, implement, and practice guidelines, laws, and regulations across the organisation for the handling of data at various stages in its lifecycle as well as the provision of advice on proper data handling and resolution of data breaches. (Data Governance)
11. They can develop digital technology enhancement projects to support the organisational objectives. (Digital Technology Adoption and Innovation)
12. They can evaluate the digital technology environment and the impact of digital technology development. (Digital Technology Environment Scanning)
13. They have the technical capabilities to understand, design and write instructions to be processed by computers as software programs to achieve desired outcomes. (Programming and Coding)
14. They have awareness of various risks related to Infocomm Technology (IT), information security and data privacy. (Infocomm Security and Data Privacy)

Part 3B: Your Perceptions of the Generic Skills and Competencies of Graduates from the AD&A Program

Please indicate to what extent you agree that the graduates of this program are adequately equipped with the following skills and competencies.

1. They can convey and exchange thoughts, ideas, and information effectively through various mediums and approaches. (Communication)
2. They can develop and use computational models, tools, and techniques to interpret and understand data, solve problems, and guide decision-making. (Computational Thinking)
3. They can choose a course of action from various alternatives using a reasoned process to achieve intended goals. (Decision Making)
4. They can use ICT tools, equipment, and software to create, evaluate and share information digitally with others. (Digital Literacy)
5. They can manage relationships efficiently and communicate with others effectively to achieve mutual consensus and outcomes. (Interpersonal Skills)
6. They can generate feasible and efficient solutions to solve problems and capitalise on new opportunities. (Problem Solving)
7. They can organise and analyse data and information accurately to identify relationships and detect patterns and trends to gain insights for decision-making. (Sense Making)
8. They can work collaboratively and effectively with others to contribute to group efforts to achieve identified objectives. (Teamwork)
9. They have understanding of concepts across multiple disciplines, with the capacity to synthesise the knowledge and insights to guide decisions and foster cooperation. (Transdisciplinary Making)
10. They can use online collaborative communication tools to work as teams to accomplish tasks or projects. (Virtual Collaboration)

Part 4: Open-ended Questions

1. What other skills or competencies do you think is necessary that graduates should have when they enter the workforce?
2. What emerging technologies in your industry will arise in the next few years?
3. Any other feedback/comments.