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ABSTRACT: The accounting profession is rapidly evolving due to technological innovations. There have been calls for universities to ensure that their programs equip accounting students with the relevant technology skills that will prepare them for the workplace of the future. This article introduces an accounting analytics capstone course that was delivered in an experiential-learning approach. Through the student consultancy project in the capstone course, students learn how to solve complex business problems with guidance from the faculty and industry project sponsor mentors, from problem definition to final client presentation. This close collaboration between faculty and project sponsors facilitates the exchange of ideas and knowledge, which integrates theory and practice.

Keywords: accounting analytics capstone course; experiential learning; industry partner; student consultancy project

An Experiential-Learning Approach

for Delivering an Accounting Analytics Capstone Course

I. Introduction

The accounting profession is rapidly evolving due to technological innovations (AICPA, 2019). Over the next decade, it is predicted that information technology (IT) will significantly transform the accounting industry (Janvrin and Watson, 2017). IT is expected to enhance transparency, accuracy and communication of financial information, offering opportunities for accountants to create value, to perform more in-depth analysis, and to provide timely financial advice (Dai and Vasarhelyi, 2017). The role of accountants will need to rapidly evolve and adapt as technology continues to drive changing business models (Vitale, 2020). In order to be able to leverage technology, accountants will have to develop new mindsets and skills (McKinney Jr. et al., 2017).

In this respect, there have been calls for universities to ensure that their programs equip accounting students with the relevant technology skills that will prepare them for the workplace of the future (Andiola, 2020; Greg et al., 2017). In particular, the Association to Advance Collegiate Schools of Business (AACSB), under the new Standard A5, recommends that accounting degree programs should include learning experiences that develop skills and knowledge related to the integration of IT in accounting and business. This includes the ability of both faculty and students to adapt to emerging technologies as well as the mastery of current technology (AACSB, 2018). Further, the International Federation of

Accountants (IFAC) has highlighted that relevant skillsets, including 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 Big 4 accounting firms, has also shared their view that to better prepare students for the opportunities and challenges that lie ahead, universities should infuse analytical exercises into existing curricula in order to help students develop data and analytics proficiency, in addition to core accounting skills (PwC, 2015).

Consistent with these views, the Pathways Commission on Accounting Higher Education highlights the need for universities to "develop curriculum models, engaging learning resources and mechanisms for easily sharing them (Behn et al., 2012, p. 598)." 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, p. 598)."

This article introduces an accounting analytics capstone course that was delivered in an experiential-learning approach. There has been much push for experiential-learning approaches, transforming accounting education from a teacher-centric to a student-centric learning model (Butler et al., 2019). Through the student consultancy project in the capstone course, students learn how to solve complex business problems with guidance from the faculty and industry project sponsor mentors, from problem definition to final client presentation. This close collaboration between faculty and project sponsors facilitates the exchange of ideas and knowledge, which integrates theory and practice.

II. Accounting Data and Analytics Second Major Program

In 2018, a university launched a second major program in Accounting Data and Analytics that students can pursue to complement their Bachelor of Accountancy degree program. This second major program aims to provide students with the relevant skillsets in data and analytics that can be readily applied in the accounting context. As such, students who complete both the Bachelor of Accountancy degree and the second major in accounting data and analytics would be well placed to fill the "skills gap" that has developed in the accounting industry, thus improving their career prospects upon entering the accounting profession.

Curriculum Structure

The curriculum is designed on three pillars (see Figure 1): (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. Under the second pillar, students will learn to apply these basic data and analytics skillsets in specific accounting contexts by taking three accounting application electives.

A key pedagogical innovation of this second major is the compulsory capstone course under the final pillar that employs the 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 organizations - a paradigm shift focusing on learning as opposed to teaching. Students need to deliver solutions

for real-world projects. The deliverables are the tangible demonstration of students' competencies.

Experiential Learning Pedagogy

The experiential learning pedagogy, which has been adopted across the university, is an experiential-learning framework where students tackle real-world opportunities by taking on real-world projects from companies and community organizations (Seow et al., 2019). The pedagogy encompasses four principles:

1. Project-based learning: Students are exposed to substantive in-class knowledge for contribution to the real-world problem in the form of a project that the industry partner brings to class.
2. Inter-disciplinary approach: Students from various disciplines form diverse teams to examine the challenges from multiple angles and expose students to different viewpoints. Real-world problems are also multi-faceted which require an inter-disciplinary approach to solving them. The focus is on real-world issues with high industry relevance, instead of hypothetical and simulated topics.
3. Close collaboration between faculty and external partners: Faculty learn how real world adapts theory and deepen their own learning. This further inculcates the value of continuous learning.
4. Active mentoring: Industry partners from different sectors and faculty actively mentor the students so that students could benefit more out of the mentoring relationship and better appreciate the context of the challenges.

Course Evolution

(i) Phase 1 – Year One (2015)

The accounting analytics capstone course was first introduced in 2015 with course title: Intelligent Accounting Function. With complexity and data proliferation, the CEO and the board turn to accountants to help make sense of all the data, to help cut through complexity, and to provide more informed analysis on the business and its operation. The objective of the course aimed to examine how an intelligent accounting function may run its operation, leverage technology to reduce finance operating costs, and strengthen stewardship and control, to establish a solid foundation to support growth. While the course showed a lot of potential, the first offering of the course, was, in retrospect, ambitious.

The course covers four key topics: finance strategy and transformation, business intelligence and analytics, enterprise performance management, and lean finance and finance shared services. The 12-week course was split into two halves, with four weeks focusing on course work on the four topics, and eight weeks to work on an industry project sponsored by companies. A term test consisting 25% of the course marks, was conducted at the end of Week 4 to assess students' knowledge from the course work. The student project, on the other hand, aimed to bring real-world into classroom by tacking real-world issues and problems faced by project sponsors. Each student project was handled by groups of five to six students, consisted of difference disciplines, such as accountancy, business, economics and information systems. Each project team was allocated a faculty adviser and an industry mentor from the project sponsor.

The student project kicked off in Week 5 of the semester. The project kickoff involved the project sponsors conducting project briefings to students. At this meeting, students clarified and finalised the project scope with project sponsors. In Week 6, students had to attend a workshop on a data visualization tool as the project requirements include building a financial dashboard. From this point, student groups began to work on their respective projects. This is followed by a series of weekly meetings with faculty advisor and industry mentor between Week 7 and Week 11. The project process involved having students to research on new knowledge, apply knowledge learnt from relevant disciplines, in the idea inquiry phase. The students also shared their initial ideas and interim solutions with the advisors and mentors to seek feedback before they refined their solutions. The course ended with a final project presentation to the faculty and project sponsor. During the final presentation, students had to present their recommended solutions and performed a demonstration of their financial dashboards.

Looking back, this first offering of the course had unrealistic expectations. Without much knowledge and skills in data analytics, students were asked to undertake a data analytics project by building a financial analytics dashboard. Some of the dashboards did not quite meet the satisfaction of the project sponsors. Students complaint about the short-time frame of six weeks to complete the industry project and an additional week was given to complete the projects. Furthermore, the projects sponsored by real-world companies tend to be complex and multi-faceted, with unclear expectation from project sponsors. The uncertainty of the project was also caused by changing project scope by the project sponsors during the semester. Another complaint from students was the relevance of the course work and the project. It was not obvious to students how the knowledge learnt in the course work

could be applied in the student project. From a course design perspective, by involving students in an industry project to address real-world issue and problem, the major takeaway was to create a real consulting experience for the students. Nevertheless, it appeared that in this case, students were not equipped with enough knowledge to build financial analytics dashboards. These issues were addressed in the Phase 2 of the course.

(ii) Phase 2 (2016-2017) – Year Two to Three

With the challenges from the first offering clearly in mind, the design of the course was changed in three ways. First, the project launch was brought forward a week earlier to Week 4 so that students would have seven weeks to complete the project. Specific dates (or milestones) were identified for the three main phases of the project: 1) project proposal confirmation with project sponsor and faculty (Week 5 of the semester); 2) the project progress presentation to project sponsor and faculty (Week 9 of the semester); and 3) another project progress presentation to project sponsor and faculty (Week 11 of the semester). This time, extensions would not be given, and grades of zero would be assigned for work not submitted by the required date. Timely feedback on each of the three milestones would be provided to students, with suggestions expected to be incorporated into the subsequent submission.

Second, it was communicated clearly to project sponsor that the project scope should not change after the project proposal meeting in Week 5. Even if minor changes were allowed, the project scope would not change after the first progress presentation in Week 9 as there would be too little time for the student group to add on additional project requirements. In addition, with two project progress meetings set aside with project sponsor,

students had the opportunity to update their project sponsor on the project progress, which allowed them to confirm if they had met project sponsor's expectation. This gave them time to address any shortfall before project completion deadline.

Third, instead of learning the four key topics on finance strategy and transformation, business intelligence and analytics, enterprise performance management, and lean finance and finance shared services, students spent the first four weeks mastering financial data analytics and dashboard building. With the switch of content focus, students could better relate and apply what they had learnt in the first four weeks of the semester into the project itself.

The new design essentially eliminated the following issues: risk of student incompletion, changing project scope in the middle of the project, unmet project expectation from project sponsor and students who lacked enough knowledge and skills to complete project. In response to the change of course focus, the course title was subsequently changed to Accounting Analytics Practicum to better reflect the new focus of the course. Despite the change, academic rigor was still expected in the project. The students were also exposed to a variety of different financial dashboard designs to enhance their design capability in the course. The project experience in the new course design was meeting its objective of providing students an appreciation for, and understanding of, accounting analytics. At the same time, the course was still facing two major challenges.

First, project sponsors were increasingly expanding their project requirements. Besides building financial analytics dashboard, they also requested students to develop predictive analytics modeling. A few even asked for machine learning driven algorithms in

the predictive models. This posed a new challenge, as students who signed up for the course did not have any machine learning predictive modeling knowledge and skills.

Second, with additional project requirement, both project sponsor and students requested more time to complete the projects. The existing arrangement of seven weeks did not seem adequate as apparently, building predictive models required a lot of time to gather and derive relevant variables. Also, students spent significant amount of time to perform 'extract, transform, load' procedure for data. With machine learning technique, more raw data were required to train the model and consequently, more time would have to be given to complete the project. These two new changes led to another rethink of the course delivery ensued.

(iii) Phase 3 (2018-2020) – Year Four to Six

Given the time intensive nature of the existing mode of delivery and keeping the two challenges identified in Phase 2, there was a need to envision a "new" approach for teaching the course. This "new" approach, with only minor variations, is still being used in the current offering of the course.

The course is grounded in the following guiding principles. First and foremost was the need to remain true to the overall course objective of providing students with an understanding and appreciation for accounting data and analytics and student consulting project experience. Second, was the importance of exposing students to the different types of accounting data and analytics needs and tools required and used in companies. Third, and perhaps most importantly, was a desire for the students to gain identify and address real-world issues and problems through a rigorous student project to gain some real-world experiences. As the course was made a compulsory finale course for students in the second

major in accounting data and analytics, the course title was changed to Accounting Analytics Capstone.

To address the challenges identified in Phase 2, the course made three major changes. First, more stringent course prerequisites were set up for admitting students into the course. For instance, prerequisites were expanded to include a data analytics foundation course either Data Modeling and Visualisation or Statistical Programming. This suggests students would have been equipped with enough data visualization and predictive modeling knowledge to complete the project in the capstone course.

Second, with the new prerequisites, it was decided that the course work portion was no longer required as students had already equipped themselves with necessary knowledge and skills to develop financial analytics dashboard and predictive analytics modeling techniques. The free up time allowed students to embark on their project in the first week instead of Week 4 of the semester. Altogether, students were given 11 weeks to complete the project, which addressed students' concern of insufficient time to complete their project.

Third, several guest speakers from the industry, were invited to the class at various junctures of the semester, to share some insights to what data analytics dashboards and predictive modeling techniques companies were using. These insights exposed students to what companies looked for and allowed them to be more innovative in designing their dashboards and models.

The resulting course, described in the outline below, was offered since 2018.

III. Accounting Analytics Capstone Course

This capstone course offers an experiential-learning opportunity that allows students to translate classroom knowledge and theory into practical solutions for real organizations. Students are exposed to valuable industry experience. In the process, students are equipped with broad skill sets beyond the classroom, which enhances their employability in the global marketplace and their ability to deal with a demanding volatile, uncertain, complex and ambiguous environment. Industry partners who work with students over an extended period have a better assessment of students who could be their future hires.

Each project group comprises five to six students. Project sponsors will collaborate with project teams, and in consultations with the instructors, to define the project scope, develop project plans, and determine the deliverables that project teams will create. There is a dual-mentor approach. Students are provided with faculty mentors (provide content expertise and advice on team dynamics) and an industry project sponsor mentor (provides industry expertise); such an approach is important in guiding and supporting students facing unfamiliar business problems. Project teams are expected to work remotely from campus with project sponsors, doing research on the issue or problem. Students are expected to meet their faculty and project sponsor mentors on a weekly basis.

Assessment Components

The assessment components consist of (i) Group Project Proposal (5%); (ii) Group Project Progress Presentation (10%); (iii) Group Project Presentation and Demo (50%); (iv) Group Project Final Report (20%); and (v) Individual Reflection Essay (15%).

(i) Group Project Proposal (5%)

Project groups are expected to meet instructors and project sponsors to develop their project proposals by Week 3 of the course. The project proposal should include:

- Executive Summary: A one-paragraph outline of the proposal
- Background: Tell us about the problem or issue in ways that demonstrate an understanding of existing problem or issue, as well as the context and intents of the organization involved in the project
- Project Statement: A paragraph on the problem or issue at hand, and what your team intends to deliver at the end of the project.
- Approach/Framework: How do you intend to tackle the problem or issue? What informs your approach?
- Timeline: A breakdown of your team's project schedule

(ii) Group Project Progress Presentation (10%)

Project teams are expected to conduct a project progress presentation during the semester. Each presentation should include a progress update on the project that details aspects of project management and solution development.

(iii) Group Project Presentation and Demo (50%)

Project teams are expected to deliver a formal presentation and provide a demonstration of their technical solution (if any) to senior executives of project sponsors and instructors in class. Project sponsors' feedback on students' performance during the project will be sought. Student peer-evaluations will also be conducted.

(iv) Group Project Final Report (20%)

Project teams are expected to submit a final report. The report much include:

- Write-up of company background
- Problem(s)/Issue(s)
- Recommendations and Justifications
- Walkthrough of demonstration using screen captures (if any)
- Bibliography Citations of research papers, books and periodicals referenced

(v) Individual Reflection Essay (15%)

Each student is expected to submit an individual reflection essay. The reflection essay should include:

- Were the goals and objectives of the experiential activity accomplished? Describe your experiential activity relating it to its goals and objectives
- What are the most important learning moments you take with you from this experience?
- What type(s) of a role did you fulfill during the experiential activity? Examples include leader, collaborator, challenger, creator, team-builder, innovator, etc.
- Were you effective within this/these roles?
- What did you do that seemed to be effective? What were your personal contributions to the experiential activity?
- What have you done in this experiential activity to make a difference? What impact do you think you have had?

A Sample Capstone Project

The Head of Group Finance at a snack small-and-medium enterprise commissioned a project for the capstone course in order to introduce data analytics to the company. His problem statement for the students was to build a financial forecasting model with both analytical and predictive capabilities, in order to help the company make key strategic decisions. As a traditional family business, the company previously relied on ballpark estimates. Supply of products for the current year was generated based on past demand; what had worked in the previous year would be repeated in the following year, and that practice had continued throughout the years. One of the key challenges for the company was the lack of accurate demand forecasting on a periodic basis. He commented that "*If you don't have the correct tool to help you understand where you are going and what you will need to get to it, you will never succeed.*".

The aim of this capstone project was to support the company in its decision-making process towards strategy planning, drive brand awareness for new products as well as maintain customer loyalty for existing ones. Based on the insights generated by the financial forecasting model created by the student team, the Head of Group Finance was more confident about conquering new foreign markets, as demand could now be predicted with some degree of accuracy. He also shared the new-found insights with his sales and marketing team, and the other group functions including HR and operations. With the newly acquired data analytical capabilities, he commented that it would no longer be business-as-usual for the company.

This data analytics project allowed me to understand my business much better. I guess it's all about changing the business and getting it to the next level. The data analytics tool helped me to predict how long it takes to achieve my targets.

IV. Conclusion

This article introduces an experiential-learning approach to deliver an accounting analytics capstone course. Completing a capstone course helps students integrate and apply the knowledge, skills and abilities. Furthermore, the experiential-learning approach provides students with opportunities for active and collaborative learning, interactive experiences, access to subject-matter experts from academia and industry, and a deepened understanding of diversity and interconnectedness. Increasingly, higher education has been called upon to train students to be capable of dealing with complex issues and systems at work. Therefore, there is a need for educational experiences rooted in content knowledge where students are provided with hands-on learning that mirrors real-world problems, coupled with interdisciplinary work opportunities.

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FIGURE 1

Curriculum Structure for the Second Major Program

in Accounting Data and Analytics

Data Technology **COMPULSORY: Four Courses**	**Accounting Application** **ELECTIVES: Any Three Courses**
▪ Accounting Information Systems ▪ Data Management ▪ Data Modelling and Visualisation ▪ Statistical Programming	▪ Financial Forecasting and Analytics ▪ Analytics for Value Investing ▪ Analytics for Financial Instruments ▪ Audit Analytics ▪ Auditing Information Systems
COMPULSORY: Accounting Analytics Capstone **(experiential learning)**	