Measuring the Integration of Data Analytics in the Computerized Accounting Curriculum

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ABSTRACT	Published Online: June 24, 2024
This study demonstrates a framework for integrating data analytics into an existing undergraduate accounting curriculum, that students are introduced to data analytics progressively while not requiring additional semester credit units. The Qasim model proposes course learning outcomes related to data analysis with specific course levels from lecturers and students of accounting study program. The findings showed that data analysis materials are identified as existing and impact changes in learning materials. Empirically, there are differences in the level of understanding and mastery of skills in data analysis tools between lecturers and students. The course that needed to develop the adoption of data analysis material is intermediate financial accounting expansively. This model can be a reference for lecturers and curriculum committees when updating the accounting curriculum to include data analytics integrating.	**KEYWORDS:** Data analytics, Integration curriculum, Course learning outcome, Qasim Model

1. INTRODUCTION

Data analytics is massively changing the nature of business operations today [1]. Significant data are being created and distributed as a direct result of the emergence of daily operations of businesses. Data analytics are applied in every company area, requiring education institution, specially accounting study programs must train undergraduate students to work successfully with data analytics in the contemporary business context [2].

Both the American Institute of Certified Public Accountants (AICPA) and the American Accounting Association (AAA) have recommended that academic institutions reconfigure their instructional methods to better prepare students for current and future technology and international business trends. Consistently, the accounting programs should contain learning experiences that focus on developing skills and knowledge related to data generation, data sharing, data analytics, data mining, data reporting, and storage inside and between companies [3].

According to the Indonesia National Higher Education Standards, the curriculum must be adaptive, reviewed, evaluated, and possibly can employ is integrating the latest trends in workplace competency needs into learning materials. The need to revitalize the accounting curriculum to reflect the current business utilization of new technologies is also found in profession-sponsored reports and practitioner-academician joint efforts [4]. Accountants with well-developed data analytics skills will be better prepared for professional success.

This research focused on integrating data analytics concepts within the existing accounting curriculum rather than requiring students to take a different course in data analytics. The advantage of this approach is that it introduces students to data analytics material in a progressive, sequential manner, allowing them to gradually understand the application of data analytics in different accounting courses[5]. In addition, implementing this strategy does not require adding appropriate credit hours to combine the emerging technologies currently intended in the accounting profession.

Illustration that using data in decision-making through data analytics is a must for the competency direction of the upcoming undergraduate graduates[6]. This fact remains low in the literacy and review of analytic data integration in the curriculum, so competency development in data analytics is still challenging[7], it learned from the pandemic in Indonesia, and the lack of analytic data studies in teaching make this research meaningful.

In response to this urgent need for transformation, this study provides a framework for integrating data analytics in the existing accounting curriculum. This paper makes several contributions. First, while there is a large body of literature on the growing importance of data analytics in accounting and the need for accountants to have IT skills, there's less research on how data analytics themes may be implemented into the accounting curriculum. Second, the article indicates using textbooks, case studies, and general readings related to data analytics for accounting. Third, the paper creates CLOs for various accounting courses and academic levels. Regarding updating accounting curricula to reflect modern technology practices in the field, this article will likely serve as a significant resource for educators and curriculum developers.

II. METHOD

The research respondents are lecturers and students who implement the undergraduate curriculum for the accounting and computerized accounting study program in accounting department at three state polytechnics (Semarang, Banjarmasin and Malang) as vocational institution that focuses on implementing competencies in practice. Respondents are 102 lecturers and 360 students who interact in the five main courses of financial accounting, managerial accounting, cost accounting, auditing, and accounting information systems in the academic year 2023.

Respondents were asked to answer nine questions using an instrument developed by [2]. Respondents answered in measures from no existence to existence and no impact (1) until existence and give in big impact (5). As respondents, lecturers were asked to give an example of the effects of learning, and students were asked to identify suitability learning with the material. Questions were differentiated for lecturers and students and adapted according to their scope of understanding and roles.

The integration model introduces data analytics into the undergraduate accounting program by incorporating course learning outcomes (CLOs) in Bloom's taxonomy. The following learning outcomes are expected for teaching a case study integrating data analytics in accounting: (1) gain how data analytics understanding can be used to answer critical business questions; (2) gain an understanding of data analytics software; and (3) develop skills and knowledge related to data analytics from an accountant's perspective. This analysis demonstrates how students' data analytics skills progress with the accounting content as they move from introductory to upper-level courses.

III. RESULTS

The analysis for each subject matter, where Introduction to Financial Accounting course was the first course in the undergraduate accounting curriculum. It is recommended that instructors require students to write an essay discussing the application of data analytics in the accounting profession, may be addressed by applying simple data analytics techniques using spreadsheet applications such as Microsoft Excel. Table 1 further illustrates how to introduce data analytics in this course.

Table 1. Introduction to Financial Accounting

No	What to teach/what to learn	Lecturers	Students
1	The Importance of data analytics in the accounting decision-making process	4,6	4,2
2	Identify the relevant data analytics tools used in the accounting profession	4,4	4,3
3	Learn about data pre-processing (extract, transform, learn)	4,2	4,3
4	Applying simple data analytics on the business transaction to cover the accounting cycle	4,6	4,5
5	Concluding basic data analytics	4,6	4,4
Possible Assignment			
1	Short essay assignment regarding the Importance of data analytics	4,5	4,3
2	Preparation of trial balance	4,6	4,3
3	Basic amortization, depletion, and depreciation analysis	4,7	4,2
4	Bank reconciliation	4,8	4,4
5	Bank analysis of PPE	4,6	4,6
Data analytics tools			
1	Spreadsheet software	4,5	4,3
	Average value	4,6	4,3

Sources: primary data processed, 2023

Table 1 showed that the average answer of lecturers and students is above 4, meaning that there tends to be an existence of analytical data material and an impact on the material. The result also showed that lecturers' reasoning on data analytics material differs regarding understanding content, strengthening tasks, and using tools.

In the Introduction to Managerial Accounting and Cost Accounting courses, students will move toward using data analytics tools to support the decision-making process. Using case studies will allow students to better comprehend data analytics in managerial and cost accounting.

Table 2. Introduction to Managerial and Cost Accounting

No	What to teach/what to learn	Lecturers	Students
1	Understand the Importance of data analytics in the field of managerial and cost accounting	4,3	3,8
2	Apply data analytics tools in the role of managerial and cost accountant	4,5	4,1
3	Learn how to generate key performance indicator	4,7	4,3
Possible Assignment			
1	Short essay assignment regarding the Importance of data analytics	4,3	4,2
2	Preparation of trial balance	4,5	4,4
3	Basic amortization, depletion, and depreciation analysis	4,7	4,5
4	Bank reconciliation	4,6	4,5
5	Bank analysis of PPE	4,5	4,3
Data analytics tools			
1	Spreadsheet software	4,6	4,4
	Average value	4,5	4,2

Sources: primary data processed, 2023

Table 2 shows that the average answer of lecturers and students is above 4, which means there tends to be an existence of analytical data and an impact on the material. With the average presence of analytic data material in the financial accounting course, the result also shows that lecturers' understanding is higher than that of students.

In the Intermediate Accounting course sequence, students are expected to gain a deeper understanding of data cleaning, data preparation, and applying data visualization in financial reporting and external decision-making.

Table 3. Introduction to Intermediate Accounting

No	What to teach/what to learn	Lecturers	Students
1	More profound knowledge of data cleaning and data preparation (ETL)	2,5	2,7
2	Demonstrate the ability to prepare and organize an accounting information system	4,6	4,1
3	Apply the general knowledge of data analytics tools to specialized areas of accounting	3,8	3,3

Table 3 (continued)

No	What to teach/what to learn	Lecturers	Students
4	Learn about presenting the data in a visual manner	4,5	3,7
Possible Assignment			
1	Applying data visualization in financial reporting	4,3	3,9
2	Comparison of various inventory valuation	4,8	4,3
3	Inventory valuation and estimation	4,4	4,3
4	Using data analytics in bonds valuation	4,7	4,5
5	Investment analysis	4,7	4,6
6	Lease valuation analysis	4,6	4,5
7	Decision-making related to sales and purchase discount analysis	4,7	4,5
Data analytics tools			
1	ETL software (e.g., Alteryx, Tableau Prep	2,0	2,8
2	Visualization software (e.g., Tableau, QlikView)	2,3	2,2
3	Spreadsheet software (e.g., MS Excel)	4,2	4,4
	Average value	4,0	3,8

Sources: primary data processed, 2023

The answers of lecturer and student respondents at table 3 showed the same results: higher-level lecturers showed better mastery of analytical data materials. The material in intermediate accounting experienced differences in data cleaning and preparation results through the extract, transform, and load (ETL) mechanism.

Table 4 shows that lecturers' identification of data analytics content is higher than that of students. The results of respondents' answers in the Accounting Information System lecture material clearly show the analytics data's content. Unfortunately, neither lecturers nor students can identify robotic process automation material.

Table 4. Introduction To Accounting Information System

No	What to teach/what to learn	Lecturers	Students
1	Predictive Modelling	4,6	4,6
2	Machine learning Concepts (AI)	4,7	4,6
3	Robotic Process Automation	3,4	3,5
	Possible Assignment		
1	SQL Queries	4,2	4,0
2	ETL	4,4	3,8
3	Joining tables	4,5	3,9
4	Use AI for prediction purposes	4,5	4,1

5	Automation of specific processes (RPA)	4,4	4,0
6	Project	4,7	4,7
	Data analytics tools		
1	MS Access	4,5	4,1
2	MS Excel	4,4	4,1
3	Tableau Prep/Alteryx	4,1	4,0
4	RPA software (UiPath, Automation Anywhere)	4,0	4,2
	Average value	4,3	4,1

Sources: primary data processed, 2023

Table 5 displays the answers to the Auditing course's identification of data analytics materials. There is the highest range of differences in lecturers' responses compared to students. Understanding the concept of analytics-based audits, such as analytical procedures, provides a good understanding of the content of analytical data and analytical and data-based predictive models.

Table 5. Introduction to Auditing

No	What To Teach/What to Learn	Lecturers	Students
1	Understanding the concepts of audit analytics	4,6	4,4
2	Understanding the concepts of continuous auditing	4,5	4,4
3	Advanced data analytics	4,6	4,1
4	Use analytics to identify fraud	4,7	4,3
5	Use data analytics to predict bankruptcy	4,8	4,4
6	Test of internal controls	4,8	4,0
7	AI in auditing (potentially)	4,3	4,2
	Possible Assignment		
1	Sampling technique	4,2	4,0
2	Outlier detection	4,3	4,0
3	Fraud detection using Benford's Law	4,5	4,2
4	Gap and sequence analysis	4,3	4,0
5	Use the rule-based system to identify internal control violation	4,6	3,9
	Data analytics tools		
1	Computer Assisted Audit Tools (e.g., IDEA, Case Ware, Galvanize)	4,6	4,1
2	Visualization software (Tableau, Click View)	4,4	4,0
3	Mind bridge AI/analytics AI (Case Ware)	4,3	4,0
	Average	4,5	4,1

Sources: primary data processed, 2023

The Accounting Information Systems course is widely considered to be the most reasonable option for implementing data analytics into an accounting program. However, accepting an AIS session is the perfect way to approach it if you want to acquire data analytics from a technical perspective. On the other hand, other classes in the curriculum (such as Introduction to Managerial Accounting and Cost Accounting, Auditing, and Financial Statement Analysis) may be more helpful in applying data analytics principles to various decisions. In this context, [8,9] recommended that AIS courses be updated to reflect the most recent technological developments. It has been pointed out that the goals of the information system include data analysis and reporting, which is in line with the demands currently placed on employees; the curriculum should introduce students to popular analytical and visualization tools.

IV. DISCUSSION

Currently, teaching materials related to data analytics in accounting are limited. The most cited textbook, Data Analytics for Accounting by [1], is generally the leading textbook in university-level accounting programs. However, this textbook is intended to be used in a stand-alone data analytics course rather than for use across an accounting curriculum.

Despite the limited availability of mainstream textbooks that integrate data analytics into accounting topics, numerous data analytics textbooks can be used as supplemental reading material in the courses. These textbooks are specialized but do not provide exercises, questions, or problems that are usually available in textbooks used in university teaching. For example, [10] can be used for subjects related to data analytics in internal auditing. In addition, authors and publishers are beginning to modify their textbooks to introduce data analytics exercises and problems.

Another component of data analytics materials is software applications. Students must be presented with the applications needed to run specific analytical tasks. Fortunately, several software companies offer students free (sometimes limited) educational licenses, high-quality tutorials, and training exercises. Moreover, these companies provide the instructors with additional educational materials that include but are not limited to academic appointments, recorded video tutorials, datasets for analysis, and case studies.

The existing academic studies in accounting could help teachers incorporate data analytics into their lessons. For instance, professors can assign educational case studies in their classes to give students real-world examples of using data analytics tools effectively in decision-making. Students can apply their knowledge from case studies to real-world scenarios, ultimately developing new skills.

Previous research cites some data analytics technologies that are suitable for educational purposes and can be used. According to [11], one of the first things to do

before beginning a data analytics project is to choose the program or programs that would be utilized in the endeavour. They suggested using Tableau, a data visualization software product extensively utilized by various industries [12]). Tableau is a free web-based program for students and teachers, and it features an intuitive user interface. In addition, Tableau may be downloaded from the internet at any time (www.tableau.com).

On the other side, [12,13] used a data analytics scenario provided by ACL, one of the most well-known businesses in the audit software market. They found that the procedure positively impacted the data quality (now Galvanize). The SAP ERP software was applied to discuss training scenarios that were resented, covering several internal control issues [14]. According to a study, lecturers in accounting classes selected IDEA CaseWare, Galvanize, and Tableau as the second, third-, and fourth-most essential data analytics tools for their students, respectively [15].

Accounting students found that statistical programming products like IBM SPSS and SAS were the most helpful tools for data analytics. These hypothetical situations are practical as a teaching instrument and a technique for assessing students' progress. The availability of software, datasets, and high-quality accounting and auditing cases enables the instructor to provide hands-on exercises and to use these examples to evaluate the student's progress throughout the course.

These case studies explicitly emphasized accounting and were our levels and courses. Introducing data analytics into accounting classes is one of the aims of this alliance, which aims to make this process easier. It is a joint effort by accounting firms, academics, companies that develop accounting software, and educators who teach accounting[16].

The accounting profession is placing a greater emphasis on graduates' data analytics skills. The study programs should emphasize comprehensive management and accounting expertise and include data analytics in their curricula. Instead of delivering a stand-alone course in data analytics, the concept advises incorporating data analytics subjects gradually into existing accounting courses and levels of study. The course learning outcomes (CLOs) for data analytics are directly proportional to the degree of study and course material [17].

Consequently, as students advance their education, their data analytics skills develop concurrently with their accounting knowledge. Utilizing case studies and data analytics tools, accounting educators can combine these applications. Producing practical IT exercises for students involves significant academic staff work, may have limited reusability due to the ever-changing nature of technology, and necessitates scarce technological resources. In addition, the emphasis on research as professors' leading recruitment, tenure, and promotion criterion may inhibit efforts to produce IT courses and resources.

V. CONCLUSION

The results showed that data analytics exists in the learning materials of the accounting study program. The understanding of lecturers is higher than that of students, but mastering assignments and utilizing tools can balance student mastery with lecturers. This fact suggests that data analytics content has been expansively included in the learning materials. The primary lecture material includes analytic data that is equally understood and can be identified by lecturers and students.

Understanding the necessity of incorporating data analytics into the accounting curriculum in Indonesia presents several obstacles, such as the claim of a pervasive lack of suitable preparation for teaching data analytics among accounting teachers and the pervasive belief that students are not receptive to studying analytics. Similarly, it was suggested that the shortage of skilled and enthusiastic lecturers in teaching IT impedes the incorporation of IT into the undergraduate accounting curriculum.

This study could be conducted by examining the perspectives of accounting professionals and academics to determine how the accounting curriculum should be modified to match contemporary accounting practices. In addition, instructional materials that incorporate data analytics into accounting subject areas are scarce. Existing accounting textbooks must be revised to include more challenging exercises, problems, and case studies involving data analytics. In addition, a more thorough overhaul of accounting courses is suggested. The redesign should involve practitioners and academics in designing an accounting curriculum integrating data analytics into course structure and CLOs.

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VII. DISCLOSURE

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