Pedagogy and the PC: Trends in the AIS Curriculum

FRANK BADUA
McNEESE STATE UNIVERSITY
LAKE CHARLES, LOUISIANA

ABSTRACT. The author investigated the array of course topics in accounting information systems (AIS), as course syllabi embody. The author (a) used exploratory data analysis to determine the topics that AIS courses most frequently offered and (b) used descriptive statistics and econometric analysis to trace the diversity of course topics through time, complementing previous literature on the topic by providing an alternative research methodology. The results indicate an increase in topical diversity and an emphasis on data modeling and AIS design and development, evident in both the course topics offered and the choice of software in these AIS courses. These findings (a) provide a reference for faculty whom administrators have tasked with designing AIS curricula and (b) serve as a basis for considering the state of accounting education, the relevance of information systems, and the evolving role of the accountant.

Keywords: accounting information systems, diversity, exploratory data analysis, syllabi, topics

Since the late 20th century, computerized accounting information systems (AIS) have become significant in the accountant's workplace and accounting curriculum (Wu, 1983). Although many accountants associate AIS with the process of operating computers merely to input debits and credits and to generate financial statements, the present research will empirically show that the scope of AIS is greater and more profound than the technical operations of accounting software.

AIS are generally defined as a collection of functional components that work together to translate transaction data into useful information in financial statements and manager reports (Kieso, Weygandt, & Warfield, 2007). This definition embraces a wide variety of AIS, including the traditional, noncomputerized accounting cycle, whose processes begin with transaction analysis and culminate in financial statements (Kieso et al.). However, popular association of the term *information systems* with computers has made *AIS* synonymous with the combination of traditional accounting practices and information technology used for financial reporting and managerial resource planning and control (Mock, 1999).

Even within this narrow definition, there is a continuum of software types that ranges from the basic spreadsheet-based general ledgers to enterprise resource planning systems (ERPs) that use a database framework to record, analyze, and format both (a) data from dollar-denominated transactions traditionally maintained by accountants and (b) information such as the number of inventory parts in various stages of the supply chain and the number and duration of marketing contacts held with continuing or prospective clients. Furthermore, AIS encompass not only the operation of these systems by the user but also the design and development of these systems based on models of the user's data and information needs.

Research Objective and Prior Literature

This study contributes to a small body of research for determining what constitutes AIS by empirically investigating its curriculum. This research principally comprises studies by Wu (1983), Davis and Leitch (1988), Murthy and Groomer (1996), and Bain, Blankley, and Smith (2002). These researchers tried to characterize the AIS course and its content, availability, and pedagogy.

Wu (1983) outlined the history of AIS, beginning with the initial calls for the American Accounting Association to integrate information technology into the accounting curriculum in the 1950s, and surveyed accounting faculty to elicit rankings of AIS topics in order of

importance. Wu concluded with a recommended AIS curriculum integrating case studies, theory, and programming.

Davis and Leitch (1988) surveyed both faculty and practicing accountants to determine what changes these groups wished would be made to the existing AIS curriculum. Those researchers concluded with the finding that, because of the rapid change in information technology and its significant effect on business practice, there were enough topics for several specialized AIS courses within the accounting major, and they recommended the creation of a graduate-level AIS course.

Likewise, Murthy and Groomer (1996) used faculty surveys to describe the characteristics of the AIS course and the institutions and faculty teaching it. Although the scope of the study was much wider, it also concerned the topics offered in AIS courses, concluding that "advanced topics [such as] data bases and modeling received very little coverage" (p. 16).

Bain et al. (2002) used multiple research methods, including surveys of faculty and practitioners and content analysis of AIS texts and syllabi, to examine topical coverage in the AIS course. The researchers found a consensus was forming about the core content of the AIS course, comprising an introduction to information systems, transaction processing, and internal controls.

Some findings of previous research remain relevant. For example, prior researchers have found that a significant component of the AIS curriculum comprises controls and transaction processing (Murthy & Groomer, 1996), a finding that we further investigate. Furthermore, it seems that in more recent years, researchers enacted some previous recommendations, as may be seen from the increased topical diversity revealed in this article's analysis.

Nevertheless, changes in technology and the student body have generated curricular changes that make previous findings obsolete. For example, there are (a) a greater emphasis on software design and modeling that earlier research did not find (e.g., Murthy & Groomer, 1996) and (b) a migration away from programming, which was initially proposed as a major part of the curriculum (Wu, 1983). These and other new findings about the composition, diversity, and nature of AIS topics to this date compose a major portion of this article. We adopted a new research methodology, using a search engine and performing content analysis of actual course syllabi, to complement previous research.

METHOD

I conducted a keyword search with the search phrase "accounting information systems syllabus" on the Google search engine (http://www.google.com) on June 19, 2007. All items returned from that search were examined, and 65 different course syllabi from 56 different colleges and universities were identified and included to form the sample. Those institutions had offered those courses to students at different tertiary educational levels, from sophomores to graduate students. No courses were offered to freshmen, 6% of courses were offered to sophomores, 32% of courses were offered to juniors, 26% of courses were offered to seniors, 8% of courses were offered to postgraduates, and 28% of courses were not specified.

Similarly, the tertiary educational institutions in the population were of different sizes. However, 4-year universities predominated: 1.8% of institutions in the population were community or technical colleges (1 of 56), 3.6% were 4-year colleges (2 of 56), and 94.6% were 4-year universities (53 of 56). Thus, the findings and conclusions in this article are relevant to a variety of AIS courses in universities.

By using a popular search engine, I avoided problems inherent in other methods that researchers used previously, such as self-selection bias and nonresponse to questionnaires and surveys. Furthermore, Google returns results according to their relevance to the search terms and the frequency at which the particular search result item was accessed from the Internet. This method implies that the syllabi returned from this Web search were those most referenced by users, regardless of whether they were students in the courses or faculty using other syllabi to configure their own. Thus, the syllabi that this search returned are the most representative of what is being taught to students and the most influential in determining what other faculty include in their own courses.

Moreover, the use of syllabi as the unit of study provides a better proxy for what is actually taught in courses than do survey responses, because syllabi are deemed contracts between faculty and students (Millis, 1990; Parkes & Harris, 2002). Thus, whereas a survey respondent may claim to teach a topic but not actually include it in his or her course, an item on a course syllabus is subject to enforcement by administrative oversight and student expectation.

I inspected each syllabus to identify course topics from explicit content in various parts of the syllabi, including the course description, required texts and software, and the course schedule. A review of syllabi from 65 AIS courses offered between 2001 and 2007 identified 76 distinct topics.

RESULTS

I performed a box-plot analysis on the frequencies at which each topic appeared in course syllabi. The results are plotted in Figure 1. Box plots are a graphical form of explanatory data analysis (EDA) revealing characteristics of data distributions by plotting the data values and denoting the median, interquartile ranges, and extreme outliers among these values. This analysis is used when the objective is detection of unusually high or low values. Accordingly, I deployed box plots in this study to characterize the state of AIS education by identifying topics most frequently offered in AIS courses.

Most Frequent Topics

Box-plot analysis revealed nine topics so frequently offered in AIS courses that their frequencies appear as upper outlier values. Among these are dataflow diagrams (DFDs; $n = 12$), e-commerce ($n = 12$), Great Plains ($n = 14$), flowcharts ($n = 14$), database management systems (DBMS; $n = 15$), resource entity agent modeling (REA; $n = 18$), Microsoft Access or MDB ($n = 27$), controls ($n = 30$), and accounting cycles or processes ($n = 35$). Each of these topics was taught in at least 12 of the 65 courses in the sample, and that number is not only

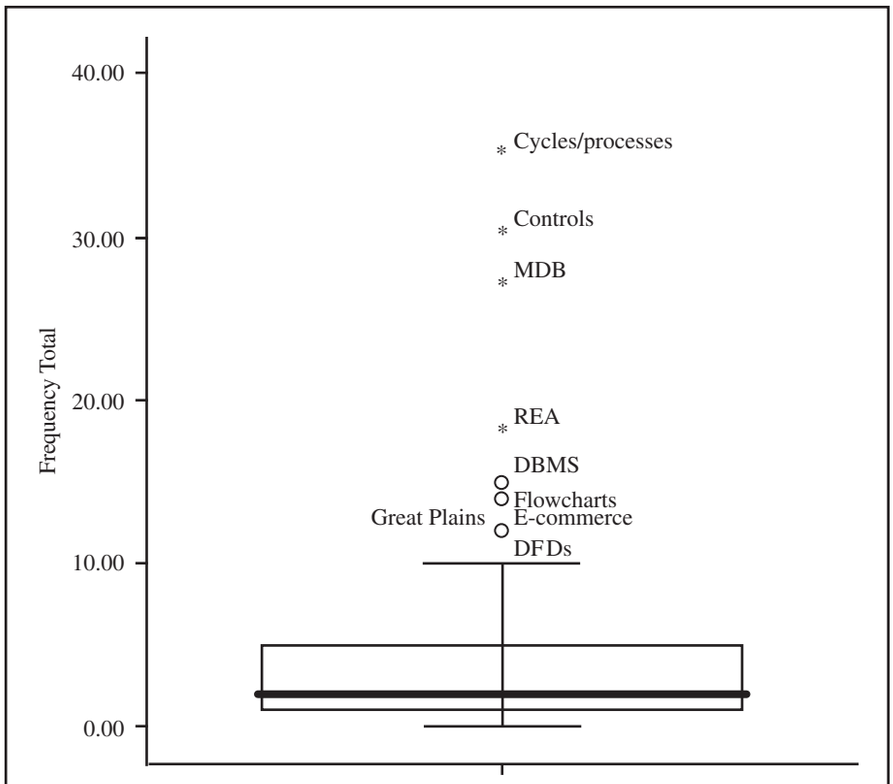

FIGURE 1. Box-plot analysis of accounting and information systems course topic frequency for all years in the sample. DBMS = database management systems; DFDs = dataflow diagrams; MDB = Microsoft Access; REA = resource entity agent modeling.

above the median number of courses in which a topic is taught (*Mdn* = 2) but also beyond the upper third quartile of the frequencies at which a topic appears in an AIS course (75th-percentile minimum value = 4.5). This finding indicates that AIS instructors have come to consider these topics the most important, perhaps composing the foundation of an AIS curriculum.

I also executed a longitudinal box-plot analysis of these topics, excluding some observations to provide a temporally contiguous sample of observations from 2001 to 2007. This analysis yielded the result that of nine topics identified by the aggregate box-plot analysis as the most frequently taught, four of them—accounting cycles or processes, controls, MDB, and REA—had extremely high frequencies of inclusion in course syllabi for at least 4 of the 6 years under consideration. Only one other topic, DBMS, ever had such extreme frequencies in more than 1 year, generating such values in 2 years.

This finding underscores the preeminence of analysis and conceptualization over computer operator dexterity and software competence. Only one of these topics, MDB, concerns a software program. Further, as discussed in detail later, MDB is included in AIS not to build data-entry and computer operator skills but to teach students how to implement dataflow conceptualizations in an actual computer program. MDB is taught so that students learn not only how to operate an information system but also how to design one. Of the remaining three topics, accounting cycles or processes and REA concern modeling frameworks that enable the user to analyze firm personnel, resources, and transactions and to translate them into dataflows, with the objective of designing information systems around them. Controls are included to avoid design flaws in developing an information system and to detect them in an implemented one.

Descriptions of Most Frequent Topics

Great Plains (also known as *Microsoft Dynamic GP*) is accounting software that accountants use to maintain financial records and prepare financial statements. Besides this basic financial reporting function, this software also facilitates inventory and revenue cycle operations by providing accounts payable and accounts receivable maintenance modules and assists in cash flow management through bank reconciliation and bank-reporting functions. As a Microsoft product, Great Plains integrates with other Microsoft software, providing a virtual enterprise resource control software, not only providing accounting functions such as generation of ledger entries and financial statements but also tracking non-dollar-denominated events ignored in the monetary-unit-oriented accounting cycle.

In traditional accounting courses, teachers usually discuss controls as asset (especially cash) custody protocols, or relative to audit planning, in which absence of controls over particular transactions implies increased need of substantive testing of account balances reflecting those transactions. In AIS courses, the discussion is broader, covering not only traditional accounting controls but also safeguards against the increased number and magnitude of risks that occur in a digital environment. Thus, the discussion covers—in addition to standard accounting control procedures—computer viruses, data encryption, and data storage and backup.

The discussion of e-commerce in the AIS curriculum usually includes many topics, dealing with the many facets of information technology and with local and wide-area network connectivity issues. Another e-commerce topic relevant to AIS is the emergence of new types of transactions and business organizations, such as business process disaggregation and e-hubs, because they necessitate adjustments to the design of AIS to capture the relevant information and correctly value the firms involved in these transactions.

I discuss the next six topics—transaction cycles, flowcharts, DFDs, REA, DBMS, and MDB—in sequence, because they compose the series of steps in designing and developing AIS. Many AIS designers and AIS courses will skip some steps, but because these actions represent a logical progression from

transactions to information systems implementation, they are often executed in one continuous methodology.

Transaction cycles, also known as *business process cycles*, outline and analyze the basic business functions underlying firm operations (Dunn, Cherrington, & Hollander, 2005). These typically include the purchasing, revenue, and payroll cycles, although firms with operations of greater complexity may have more. Each process or cycle is modeled as a series of procedures that require data input from various firm entities or outsiders. Once the procedure has processed the data, the procedure passes it along to the next step in the cycle until the system generates the desired information. Depending on the cycle, this information may take the form of purchase vouchers, bills of sale, or paychecks, which, although often thought of as requests for a specific action (e.g., product delivery or payment), are essentially preformatted statements with actionable information (referred to as *forms* in database theory). Hence, knowledge of the components and sequence of events in these various cycles is important to the development of AIS, and in many cases specific software modules are included in AIS to serve cycle functions.

Flowcharting is the graphical analysis of the flow of data through firms or information systems. There are several different flowcharting protocols, but among the most popular are *document flowcharts*, which trace the flow of paper reports through a firm, and *system flowcharts*, which trace the flow of digital data throughout the firm (Bagranoff, Simkin, & Strand Norman, 2005).

DFDs are similar to flowcharts but focus on the aforementioned business process or transaction cycles. DFDs model the dataflows, data sources, and processing involved in these cycles for designing AIS.

The REA model was first proposed for use in developing AIS in the early 1980s (McCarthy, 1982). As the name implies, REA modeling envisions the firm's transactions in terms of the resources (assets and data) used, the firm personnel and outsiders involved, and the interactions among these. Although it is possible to model firm processes directly in the REA framework, systems designers often use DFDs first to model the movement of data between REA entities. The REA model is typically the last step in AIS modeling, because the model structures are, by design, immediately transformable into database table schemata, which form the basis for implementation of the AIS by creating tables, forms, and queries in the DBMS of the designer's choosing.

The topic of DBMS encompasses the function, underlying theory, and implementation of database software systems, which record, update, and report data through prestructured forms or user-specified queries. Although the resemblance is not readily apparent, AIS are actually built on a DBMS platform, because the basic functions of the two software types are the same. Like a DBMS, an AIS will record data from transactions and other business events (in the form of debits and credits, dollars and cents, or other units of measurement), update these records (through periodic and adjusting entries), and generate information in either preformatted structures (standard financial statements) or nonstandardized user queries (informal internal managerial reports).

MDB is the database software program included in the Microsoft Office package. Like other database software, MDB's primary function is to record, update, and report data according to standard forms or specific user queries. However, as a standard component of the Microsoft Office system, which uses the familiar mouse/icon graphical user interface, MDB's ubiquity and user friendliness make it more popular than other database applications. Like other databases, it is included in AIS syllabi because accounting and enterprise resource information systems are essentially databases with certain specific financial reporting functions.

Software Topics

Although some AIS courses in the sample (9 of 65) did not specify a software program to be used in class, those courses that did do so revealed that 18 different software programs were used on 99 occasions (some courses concerned several software programs; see Table 1).

TABLE 1. Number and Percentage of Each Curricular Use of Software From 2001 to 2007

Software	Number	%
Baan	1	1.01
eEnterprise	1	1.01
Great Plains	15	15.15
HTML	2	2.02
MDB	27	27.27
MYOB	2	2.02
Oracle	1	1.01
Peachtree	9	9.09
Peoplesoft	1	1.01
Quickbooks	7	7.07
Sage Line	1	1.01
SAP R3	8	8.08
SQL	2	2.02
Visio	3	3.03
XBRL	6	6.06
XLS	10	10.10
XML	3	3.03
Total	99	100.00

The mean number of times any single software was offered was 5.5, the median was 2.5, and the 75th percentile was 7.75. Those software programs that were offered most often (in the 75th percentile of frequency) were SAP R3 (offered 8 times, and composed 8% of all software program offerings; SAP R3, 2008), Peachtree (n = 9, 9%; Peachtree, 2008), Microsoft Excel (n = 10, 10%; MDB, 2008), Great Plains (n = 14, 14%; Great Plains, 2008), and MDB (n = 27, 27%; MDB, 2008).

Of these programs, three (SAP R3, Peachtree, and Great Plains) are specialized accounting application software. These programs are specifically configured to support accounting functions, such as bookkeeping and financial statement and managerial report generation. The other two (Microsoft Excel and MDB) are general purpose software that can be used to support nonaccounting functions.

These findings indicate that AIS faculty recognize and are responding to the needs of employers for accounting staff who are familiar with either the actual software used in the workplace or software similar to it. Nevertheless, AIS curricula also reflect the need for training beyond knowing which icons to click and what to input in various

fields. The inclusion of Microsoft Excel in the curriculum equips students with the skills necessary to organize and manipulate quantitative information in a spreadsheet environment. More important, instruction in MDB is a means by which students are compelled to think in terms of the fundamental database concepts on which all specialized accounting software packages are based. As mentioned in the discussion of frequently offered topics, this database and dataflow orientation allows students to perceive business events and transactions through a framework that facilitates the design and development of appropriate information systems to capture the essential event and transaction information.

Evolution of Topic Coverage

I conducted longitudinal analysis of all course topics to determine the trends in their evolution. Observations of topics from undated course syllabi were excluded to have a temporally contiguous sample. Longitudinal analysis of the course topics shows that the number of topics offered through syllabi has increased steadily from 2001 to 2007, from 8 topics to 39 topics. Furthermore, the average percentage of the total population of topics that each topic comprised for each of those years decreased from 13% to 3% (see Table 2).

These findings indicate that the topical array that instructors presented to AIS students has become more diverse. To further test this result, I computed the Gini metric over the proportions at which the various AIS course topics were offered from 2001 to 2007. The Gini metric is typically computed as:

$$100 \times \text{SUMSQ}(x_1/N...x_n/N),$$

where $\sum x_1... x_n = N$.

That is, the Gini index equals 100 times the sum square of a distribution of proportions, which together make up one whole. It is named for the Italian economist and statistician, Corrado Gini, who developed it as an index of diversity. This metric generates a score on a 100-point scale that is lower (higher) for distributions that are more (less) equal and diverse (Stigler, 1994).

The Gini metric analysis confirms the finding that AIS course topics are becoming more diverse over time, as the decrease of the Gini metric score from 14 to 4.8 during the period from 2001 to 2007 shows.

DISCUSSION

The findings concerning frequently covered topics indicate that AIS courses have evolved to focus on training the student to model business processes and then to design AIS on the basis of these models. This evolution may be considered a positive development because it shows that accounting academe is increasingly producing a thinking professional, not just a skilled technician. Instead of merely being able to apply prescribed procedures to a set of standard transactions, the accounting professional is being trained to develop the ability to grasp the essential characteristics of business events and to design procedures to capture their inherent financial truths.

This analytical orientation is appropriate for educators to inculcate in accounting students, because changes in the business environment, with the development of new forms of business entities and transactions, mean that knowledge of technical procedures based on existing situations is no longer enough. The ability to develop new, more appropriate procedures to accurately capture firm value and decision-critical information in ever-changing business environments is paramount.

The types of software that AIS courses emphasize confirm this finding. These types include not only accounting software packages that familiarize students with computerized accounting procedures but also general application software that accountants use to analyze firms' information needs and to design information systems.

Our findings should be useful to faculty who have been charged with the task of designing and teaching AIS courses, by describing topics that are being taught by their colleagues. This research also contributes by providing a perspective on what direction the AIS curriculum has taken over the past several years and by analyzing what curricular changes mean to accounting educators, students, and professionals.

Although this study's findings on topical diversity indicate a gain in the breadth of knowledge to which an AIS course introduces a student, such a gain may be a mixed blessing. There exists the possibility of subjecting students to information overload, wherein the amount of data presented to them is greater than the amount they can meaningfully understand and indefinitely retain. Fortunately, the average number of distinct topics that educators offered per course for each of the years in the longitudinal sample (2001–2007) was relatively stable, at about six topics per course (see Table 2).

Another hazard is the possibility that AIS courses will be so different from one another that employers will no longer be sure what the newly graduated hires have learned from any particular AIS course. In response, AIS faculty and accounting academia may have to develop an authoritative, universally accepted AIS core curriculum. However, because of the speed at which technology and business practices change, this curriculum will need constant revisions. This challenge, among many others, will keep the task of the accounting academic interesting and engaging.

TABLE 2. Summary Metrics for Accounting Information Systems Course Topics From 2001 to 2007

Variable	2001	2002	2003	2004	2005	2006	2007
Average % topics[a]	13	10	5	8	5	4	3
No. of topics	8	10	20	11	21	28	39
Gini metric	14	10	5.9	12.5	6.79	5.46	4.8
Avg. no. of topics per course	6	5.5	5.2	6.25	5.86	6	6.79

[a]The average percentage of the total population of topics that each course topic comprised.

ACKNOWLEDGMENT

The author thanks Dr. Ann Watkins for her help with this article.

NOTES

Frank Badua, PhD, is an assistant professor of accounting and accounting information systems at McNeese State University in Louisiana. He received his PhD at Rutgers, the State University of New Jersey, and has taught at McNeese, Rutgers, and Case Western Reserve University in Ohio.

Correspondence concerning this article should be addressed to Dr. Frank Badua, McNeese State University, College of Business, 4205 Ryan Street, Lake Charles, LA 70609, USA.

E-mail: fbadua@mcneese.edu

REFERENCES

Bagranoff, N., Simkin, G., & Strand Norman, C. (2005). *Core concepts of accounting information systems* (9th ed.). New York: Wiley.

Bain, C., Blankley, A., & Smith, L. (2002). An examination of topical coverage for the first AIS course. *Journal of Information Systems, 16*(2), 143–164.

Davis, J., & Leitch, R. (1988). Accounting information systems courses and curricula: New perspectives. *Journal of Information Systems, 3*(1), 153–167.

Dunn, C., Cherrington, J., & Hollander, A. (2005). *Enterprise information systems: A pattern based approach*. Boston: McGraw-Hill-Irwin.

Great Plains. (2008). *Microsoft dynamics GP Web site*. Retrieved April 9, 2008, from http://www.microsoft.com/dynamics/gp/default.mspx

Kieso, D., Weygandt, J., & Warfield, T. (2007). *Intermediate accounting* (12th ed.). New York: Wiley.

McCarthy, W. (1982). The REA accounting model: A generalized framework for accounting systems in a shared data environment. *Accounting Review, 57*(3), 554–578.

MDB and Microsoft Excel. (2008). *Office products Web site*. Retrieved April 9, 2008, from http://office.microsoft.com/en-us/default.aspx

Millis, B. (1990). *Syllabus construction handbook.* College Park: University of Maryland, University College.

Mock, T. (1999). *Encyclopedia of business* (2nd ed.). Retrieved June 6, 2007, from http://findarticles.com/p/articles/mi_gx5209/is_/ai_n19125599

Murthy, U., & Groomer, S. (1996). An empirical analysis of the accounting information systems course. *Journal of Information Systems, 10*(2), 103–127.

Parkes, J., & Harris, M. B. (2002). The purposes of a syllabus. *College Teaching, 50*(2), 55–61.

Peachtree. (2008). *Peachtree accounting software Web site*. Retrieved April 9, 2008, from http://www.peachtree.com/peachtreeaccountingline/

SAP R3. (2008). *SAP business software solutions Web site.* Retrieved April 9, 2008, from http://www.sap.com/usa/index.epx

Stigler, S. M. (1994). Citation patterns in the Journal of Statistics and Probability. *Statistical Science, 9*(1), 94–108.

Wu, F. (1983). Teaching accounting information systems: A synthesis. *Issues in Accounting Education, 1*(1), 132–146.