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Revisiting an Introductory Computer Information Systems Course: An Update to Course Topics and Incorporation of Project-Based Learning

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Abstract

The field of computing continues to rapidly evolve, and university curricula in computer information systems must be periodically reviewed and updated to remain relevant and effective for students living in a digital age. This paper discusses a review process of an introductory computer information systems course at a mid-Atlantic university, including a review of both content and format for the course. Faculty from the CIS department created an INFS1020 Committee to review the topics. Also, 346 undergraduate students enrolled in the introductory course were surveyed to determine their perceptions of the importance of topics within the course. Findings indicated that the faculty believed only eight categories should be taught in the one-semester course. The faculty also believed that more time on less topics would increase student learning. Findings indicated that students want to see increased coverage of Internet security and the social Web, as well as an introduction to programming in the introductory course. Students also wanted increased coverage of spreadsheet concepts and hands-on skills with spreadsheet software. Students did not indicate that database concepts and hands-on skills were critical for the introductory course. A discussion of the revised course content and structure is presented.

Keywords: introductory computer course, CIS curriculum, IS education, curriculum review, teaching digital literacy

1. INTRODUCTION

An introductory computer information systems (CIS) course holds a critical role in university curriculum, for both majors and non-majors (Baugh, 2009; Mackin, Johnson, & Paranto, 2006). It must prepare students with the knowledge they need to use computer and information systems effectively in this digital age (Tsai, 2002), often referred to as digital literacy or information literacy (Bruce, 1999). Digital literacy involves the ability to use computer hardware and software to function and communicate effectively, and to understand information regardless of the way in which it is presented (Lankshear & Knobel, 2008). This includes both technical skills and cognitive and socio-emotional aspects of working in digital environments (Eshet-Alkalai, 2004).

Much research has been done in terms of analyzing the content that should be in an introductory CIS course (Baugh, 2009; Fichman, Dos Santos, & Zheng, 2014; Tsai, 2002). The

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content and format of the introductory course has seen many iterations since it was first introduced in the early 1970s, following the model curriculum work for Information Systems (IS) by the Association for Computing Machinery (ACM) (Topi et al., 2010).

In 2017, such a course is typically expected to teach digital literacy, including the basics of computer hardware and software, Internet access and browsing concepts, cloud computing services, and current issues including advanced technology uses and security topics. The course is often also required to provide a solid overview of the many and varied areas within CIS for majors, including but not limited to software development, project management, database management, and computer networking. In addition, such a course is often expected to teach students proficiency skills in Office productivity software such as spreadsheet and database software. The varied tasks of an introductory course serving both majors and non-majors can sometimes be overwhelming for students due to the volume of topics that must be covered.

This research addresses one such course at a mid-Atlantic university. The introductory course at this university is part of the core university curriculum and thus aimed at both computer information systems majors as well as non-majors. The course was originally intended to cover basic computer literacy concepts, but also provide software proficiency skills in the use of both spreadsheet and database software, utilizing Microsoft Excel and Microsoft Access. Due to the heavy focus on those two software packages, the course was named Introduction to Decision Support Systems. The course was delivered in a format utilizing both lecture and computer lab time. Lecture time would typically cover topics relating to fundamental computer and information systems topics, while lab time would focus on teaching Excel and Access skills.

Fundamental topics addressed in the course consisted of the basics of computer hardware and software, understanding how a computer functions, use of operating system functions, basics of computer networking, and database concepts.

Lab time was primarily comprised of hands-on learning via students completing tutorials in Excel or Access. These tutorials were step-by-step from a textbook or online resource so that students had clear, guided instruction for learning basic software functions. Projects in Excel or Access utilizing the skills learned from the tutorials were also assigned. Projects were intended to provide students with the opportunity to use the skills gained during their tutorial practice along with critical thinking to apply the learned concepts to a new situation or problem.

Over time, as the computing field continued to grow, more and more topics were required to be added to the course in order to ensure that students were being taught the fundamental skills needed to ensure digital literacy. In addition to the topics already covered in the course, new topics were continually added, such as computer and Internet security, advanced uses of technology (e.g. artificial intelligence, neural networks, bioinformatics), social media and the social Web, effective ways to search the Internet, data analytics, cloud computing, mobile devices, mobile apps, and more. While the field of computing continued to grow and evolve, the course tried to adapt by adding more and more content.

The sheer volume of topics covered in the course led some students to perceive the course as disjointed and tedious. In order to review and redesign the course in a way that would be effective for both majors and non-majors as well as engaging to students, the faculty took a two-fold approach. Updated curriculum standards (Topi et al., 2010) were reviewed and compared to the topic list for the course, and students were surveyed in order to determine their perceptions of the topics addressed in the course.

This research discusses the review process of this introductory CIS course, comparing topics covered in the course to new model IS curriculum standards as well as faculty and student perceptions of course topics.

The Role of Spreadsheets and Databases

One of the major questions considered when looking at the introductory course was whether or not to continue teaching software skills in spreadsheets (Microsoft Excel) and databases (Microsoft Access) within the course. One of the major concerns of faculty teaching the introductory course was that the time allocation needed to adequately teach skills in both Excel and Access was extremely high, and thus taking away time that could be spent teaching additional information systems topics.

The latest IS 2010 Model Curriculum recommends removing any courses focusing on personal productivity tools (such as word processing,

spreadsheets, databases, and presentation software) from IS programs. It notes that high schools now teach these skills and most institutions require students to be proficient in these software tools prior to enrolling (Topi et al., 2010). Because of this change in the IS Model Curriculum, a major consideration for this course revision was whether or not to continue coverage of basic skills in Excel and Access as part of the course.

2. PURPOSE

The purpose of this research was to examine both CIS faculty and students' perceptions of the importance of various possible course topics for the introductory course in computer information systems (CIS). The study addressed the following research questions:

RQ1: What topics do CIS faculty believe should be taught in an introductory CIS course at the university level?

RQ2: What topics do students taking the introductory course find to be important for their learning?

This data could be helpful and important input for designing an effective and engaging course.

3. METHOD

In order to review the current Introduction to Decision Support Systems course, the CIS faculty were asked to review the various topics. In October 2016, the CIS faculty were invited to rewrite/revamp the INFS1020 curriculum. The INFS1020 Committee was created. The committee consisted of four full-time faculty and one part-time faculty. Also, the five part-time instructors who were currently teaching the course were asked about their perceptions of the course.

The committee members were given a list of 21 topics for consideration in the course. The topics considered were the topics currently covered in the introductory course. Faculty were encouraged to add topics if they found the list lacking in a specific area. The committee members then narrowed down the list of topics into 8 categories that mirrored the IS Model Curriculum published by ACM: characteristics of the digital world, information systems in organizations, developing information systems, business intelligence for decision making, business intelligence and data analytics, internet and communication technologies, threats to information systems, and security and privacy of information systems.

The committee developed four goals for the course. The goals are to develop an understanding of information systems technology and how this technology can be applied to our business and personal lives; to develop an understanding of the processes for designing a user-based or technology-based system to meet desired needs; to learn to examine, analyze, and compare information from various sources in order to evaluate validity, accuracy, authority, timeliness, and point of view of biases; and to develop an ability to identify, formulate, and solve technology/ scientific problems.

The last part of the committee's role dealt with whether to teach Excel and/or Access. All of the faculty currently teaching or have taught INFS1020 were asked what, if any software, should be taught. Based on the faculty beliefs, only Excel would be included in the course. Excel would not be taught in the tutorial format, rather be project-based.

In addition, the INFS1020 Committee shared the goals of the course redesign with the Deans of each school within the University and solicited feedback from each school in regard to how the course would meet each goal. This was deemed important by the committee since the course is a "core" university course that serves students from a variety of majors.

Next, we wanted to gather data on student perceptions of the topics in the current course. We surveyed all of the sections of the course taught by five instructors at RMU. Four of the instructors taught three sections each and one taught one section for a total of 13 sections of the course delivered during the Spring 2017 semester. There were a total of 346 students enrolled in the 13 sections, and 251 (or 72%) of the students participated in the study by completing a questionnaire. Students were assured that the questionnaire was voluntary, responses were anonymous, and that responses would in no way impact their grade in the course. The survey was conducted with the approval of the university's Institutional Review Board.

The questionnaire that was distributed to students consisted of fifteen questions. Students were asked to note their major and what they liked most and least about the course. They were also asked to respond "yes" or "no" to a list of topics that they think should be included in the course. Students had just taken the course and

were familiar with the varied areas covered in each topic area. The topics included:

- History and evolution of computers
- Computer hardware components
- Application software
- System software (OS, file concepts and file organization)
- Internet and telecommunications
- Digital devices and media
- Computer security, cybercrime, and ethics
- Computer programming
- Hands-on exercises with spreadsheet software
- Database concepts and principles
- Hands-on exercises with database software

Students were asked if an understanding of spreadsheets and databases was important to their major. In addition, students were asked about any prior training they may have received in Office productivity software. They were asked if there were any topics not covered in the course that they felt were critical and should be addressed. In addition, students were asked to note anything they would do differently if they were to teach the course. Lastly, students were asked if they felt that the course prepared them to be literate in computing technologies for the digital age and if the course inspired them to learn more about information systems.

4. FINDINGS

Three hundred and forty-six undergraduate students enrolled in the introductory course responded to the questionnaire. The majors were Engineering, Accounting, Management, Marketing, Environmental Science, Economics, Actuarial Science, Finance, Biology, Psychology, Criminal Justice, Media Arts, Cyber Forensics, Communication, English, Organizational Leadership, Data Analytics, CIS, History, and TV/Video Production.

When asked what they liked most about the course, the top four responses were Excel (49 students), Technology (32 students), Teacher (25 students), and Excel and Access (22 students). Other things the students liked about the course were real-world scenarios and group projects.

When asked what they liked least about the course, the top four responses were Access (43 students), too many assignments (27 students), Excel (18 students), and lectures (18 students). Some of the other responses were that tests/quizzes and assignments were not clear.

When asked about the topics that should be included in the course, the students responded that the most important topics were:

- Security (211 students)
- Application software (207 students)
- Networking (203 students)
- Internet (195 students)
- Spreadsheets (194 students)

The only topic that students believed should be eliminated from the course was the history and evolution of computers.

When asked to list any topics not covered that they feel should be covered, students responded that they would like harder Excel assignments, programming, security, and social media.

The INFS1020 Committee reviewed the results of the student survey and used this information for insight into the topics that students perceived as valuable. While it may seem counterintuitive to survey current students about course topics, the INFS1020 Committee felt that these insights would be useful as one of the goals of the course redesign is to inspire students to want to learn more about information systems, and perhaps consider a major in the field. The purpose of the survey was certainly not to allow students to select the topics for the introductory course, but rather to gauge student perceptions of each topic's importance. If the committee found that a topic was not considered important by the students, yet agreed that the topic was of importance, then that topic could be identified as one needing additional emphasis or perhaps a different teaching method.

There several key findings from the survey that aided the committee. First, it was interesting that a high percentage of students found the Excel topics valuable, and requested more difficult and advanced Excel assignments. As previously mentioned, the decision to keep or remove the Excel and Access content in the course was a major issue for the course redesign. It was helpful to know that a majority of students perceived the Excel content to be useful to their chosen major(s). In addition to these results, the committee's feedback from the college Deans also found that Excel skills were considered to be a key component of the INFS1020 course in order to best serve majors in other schools. Though the committee had expected to remove Excel content from the course during the redesign due to the recommendation from the ACM IS Model

Curriculum, these insights from stakeholders influenced the faculty to keep Excel within the course curriculum. If the course were being designed to stand alone for IS majors, this decision would have been different. However, to best serve the needs of all students taking the course, it was decided that Excel would be kept within the course.

While Excel would be kept within the course, the committee determined to change the way Excel is taught within the course. Excel concepts were previously taught using a tutorials-based method and textbook. The same concepts will now be taught using a projects-based approach. Students will now purchase a reference style textbook for Excel (which they can hopefully utilize even after the course). Rather than following step-by-step types of assignments, students will be assigned projects that apply Excel concepts and will achieve a higher level of learning by researching the mechanics of the software a bit more on their own and learning to apply the features to achieve a specific goal.

A second finding from the survey was that a high percentage of students did not find Access content to be interesting or useful. In addition, the feedback from the college Deans also indicated that database coverage was not critical for this core course from their perspective. The database content was primarily used by students who major in information systems, and so the committee determined that Access could be eliminated from the course during the redesign. Basic database concepts would still be covered so that students would be exposed to the ideas of a database, but coverage of the mechanics of Access would be eliminated. This also eliminated the need for an Access textbook.

A final key finding from the survey was that many students asked for coverage of programming, security, and social media. All of these topics were included in the course, but were not emphasized. After further discussion, the committee decided to include projects covering each of these areas. Due to the relevance of each of the topics, these projects might spark more interest in information systems while keeping students' interest level high. A programming project, in particular, was an interesting consideration for the committee. Of course it is not feasible to fully cover any programming language, but it was determined that a variety of simpler types of programming project ideas would be explored. An initial idea is to include use of App Inventor (appinventor.org) to build a drag-and-drop mobile app.

The idea to incorporate a project-based learning approach in the course inspired the committee to develop a community learning site within Blackboard that will incorporate shared ideas and projects for all faculty teaching the INFS1020 course. This learning community is planned to provide resources for both full-time and part-time faculty. Providing more resources and project ideas for part-time faculty will hopefully also improve the consistency of the course overall.

Based on all of the findings, the committee revised the curriculum for the course. The newly revamped course includes an intro to computers, application software, file management, hardware, system software, digital devices and multimedia, the Internet, communicating and sharing, networks and communication, security and privacy, databases, and program development. These topics are organized in alignment with the IS Model Curriculum. The course also covers Excel basics, formulas, sorting and filtering, charts/graphs, What-if, and pivot tables. This is against the recommendation of the IS Model Curriculum, but meets the needs of our particular school, given that the course is a core course that services students from a variety of majors.

5. CONCLUSIONS

Based on what the findings revealed, the course content of the introductory course was changed. First, the name of the course was changed to Fundamentals of Information Technology. This title reflects more of what is actually covered in the course, taking the focus away from decision support and giving the course a broader scope.

The course format was adjusted to incorporate more project-based learning. Computing courses that use project-based learning have been shown to be effective (Hutchings & Wutzdorf, 1998).

The history of computers was removed from the course and topic coverage for the Internet, security, and the Social Web was increased. As part of this coverage, current world events are now used to stimulate discussion and projects surrounding these evolving topics. The students will be faced with ethical dilemmas and critical thinking. For example, in the weekly current/world events assignment, students will choose an article from a major news magazine, newspaper, or credible online source. They will complete a written response consisting of a

summary of the article, an explanation of how this article relates to what is being studied in class, and the development of two questions that can be used to guide a class discussion.

Coverage of programming was also added into the course. While learning a full programming language is outside the scope, a project was added that allows students to create an "app" using cloud computing and drag-and-drop functionality to build the business logic for the app. This gives students a chance to experience programming at a high level and see tangible results.

One of the major questions during the redesign was whether or not to continue to include coverage of basic skills in spreadsheet and database software. Findings indicated that the majority of students wanted continued coverage of spreadsheets and felt that this coverage was important to their major. In addition, 17 students responded that they wanted harder Excel assignments, which indicates that they are familiar with the basics of Excel and want to explore more advanced features and uses of the tool. This is consistent with findings of the IS Model Curriculum which indicate that most students now receive basic instruction for skills in spreadsheet software in high school (Topi et al., 2010).

However, it was determined that spreadsheet content would continue to be covered in the course, despite the recommendation of the IS Model Curriculum (Topi et al., 2010) to remove this content from the introductory course. This decision was made primarily because this course serves both majors and non-majors at the university. Non-majors in certain fields need a solid understanding of spreadsheet functionality (in particular, Business, Accounting, and Actuarial Science). Feedback from Deans of the colleges within the university strengthened the decision to keep spreadsheet coverage within the course. So, Excel coverage was continued in the course, but adjusted so that basic software functions will not be taught. Instead, the course was revised to change the coverage of Excel to more project-based learning. Rather than focusing on software basics and step-by-step tutorials, the course increases coverage of Excel by having students complete projects that showcase What-If analysis techniques. The tutorial-based textbook previously used in the course was replaced with a "quick guide" text that provides a reference for most of the basic functions of Excel as well as coverage of What-If analysis. This text will be used as a reference for all students. Those who are not as well versed in the basic skills of the software upon entering the course will be able to use this reference for guidance. Changing the text from a tutorial-based text to a reference text is an attempt to shift the focus of the coverage of Excel from a hand-holding approach to an approach where students are responsible to look up and review the techniques necessary to accomplish a task.

Coverage of relational database concepts was continued in the course, but hands-on tutorials and software skills in Microsoft Access were discontinued. Removal of this section of the course will allow more time for the additional topics that were added.

There are some obvious limitations to the study since it was conducted for one course at one university. Results may vary in different academic environments, depending upon the mission and overall core curriculum offered at the school and the characteristics of the student body. This study also addressed a course that serves both majors and non-majors. If a university offers separate introductory courses for majors and non-majors, results may differ significantly.

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