An Interdisciplinary Approach to Big Data Analytics

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Analyzing real-time "Big Data" is an essential skill for many College of Business Administration students. As such, business students require an inter-disciplinary, multi-course approach to analyzing and interpreting Big-Data generated across the enterprise. This study suggests that the implementation of technologies across the business school curriculum and not just one single business discipline might provide business students with a competitive advantage in their job preferences by having an integrated view of technology across business disciplines. This academic approach and perspective offer insights into analytics education by using a qualitative research method.

Keywords: SAP, Big Data, ERP, analytics, data visualization, qualitative research

INTRODUCTION

Knowledge of Enterprise Resource Planning (ERP) Systems and Customer Relationship Management (CRM) systems and their shared data should be a required skill of all business students as the implementation of ERP and CRM systems becomes more commonplace. These systems, built upon digital information, have profoundly reshaped how organizations do business and the workforces with them over the last quarter-century. As with so many other employment sectors, a digital transformation has crept into the academic business discipline and, with it, the need for our business students to better understand the inter-connectedness of organizations and the use of big-data applications (Brooke, 2017). In recent years, there has been a subtle shift in competitive and market intelligence where organizations who rely solely on operators, working within silos, are moving towards an organizational structure that relies on collaboration with and between organizations (Fleisher & Hursky, 2016). Hauser (2007) suggested that marketing analysts mine, analyze, interpret, and be able to present relevant information at every touchpoint through the life cycle of the business (Hauser, 2007). There is substantial and notable evidence to suggest that doing collaborative market intelligence work is accomplished by taking advantage of emerging technologies, adapting best practices from adjacent fields, and benefiting from academic and scholarly research (Fleisher & Hursky, 2016). We believe business students require an inter-disciplinary, multi-course approach to analyzing and interpreting Big-Data generated across the

enterprise. Business leaders also recognize a need for cross-disciplinary expertise and the role in visualizing and presenting complex data in visually impactful ways that lead to better decision-making. They are mindful and appreciative of how data interconnects across business units. As such, the primary purpose of this study is to examine the inter-disciplinary approach to teaching Big Data analytics across the business curriculum.

Business education has long recognized the importance of developing integrative business programs in response to such external factors such as the emergence of "Big Data" and "Data Analytics." At issue is the need for business education to address the current and future needs of business students who will need the ability to analyze, critically evaluate, and recommend effective business solutions to complex problems. For students to accurately gather, analyze, interpret, and report Big Data in its intended context, they need to have an integrated understanding of the business life cycle. What is problematic about the totality of our business courses, as well as courses in business-specific disciplines, is that by some necessity, the existence of silo courses focused on a single aspect of the business life cycle.

The underlying issue is a general realization that information systems share common data across traditional business silos. That business education, in general, has not effectively communicated these relationships in our regular (silo) approach to business education and the overall business curriculum. As such, we suggest the introduction of analytics training systems into the whole business curriculum, across associated multidisciplinary business courses that would allow all business students to see an integrated business life cycle. This study emphasizes the importance of making business decisions in the context of the entire business, the impact of data analysis, the interpretation of relevant data, and reporting of that same relevant information within a collaboration business organization as an essential skill set for students to develop.

BIG DATA AND BUSINESS ANALYTICS

In 2011, the MIT Sloan Review Management Review and the IBM Institute for Business Value reported that 58% of organizations that apply analytics to create a competitive advantage within those same organizations are twice as likely to outperform their peers (Kiron, Shockley, Kruschwitz, Finch, & Haydock, 2012). The marketing literature has addressed the use of technology in higher education due to its connection to the marketplace (Lamont & Friedman, 1997; Peterson, 2001) and considered the impact of marking data in the context of the overall profitability of the firm. Accounting acknowledges the importance of stakeholder participation and the influence of information systems, decision-making, and organizational justice in the budgeting process (Dow, Watson, Greenberg, & Greenberg, 2012). Business curriculums increasingly include courses such as E-commerce, Internet marketing, electronic marketing, and using the internet for marketing research. In essence, the integration of technology in business education in the literature is both inevitable and beneficial (Lamont & Friedman, 1997). In one example, a traditional marketing research course which usually focused upon "design and conduct of a research study," was broadened to teach the application of technology (Lamont & Friedman, 1997). Topics such as database retrieval, software for data analysis, and visual graphics are part of most basic research marketing courses (Atwong, Lange, Doak, & Aijo, 1996).

Marketing analytics is a technology-enabled, model supported approach, needed to harness customer and market data to enhance marketing decision making (Lilien, 2011). Two types of applications are those that involve the users in a decision support framework and those that do not (i.e., automated marketing analytics). During the last half-century, the marketing literature has documented numerous benefits of the use of marketing analytics (Zoltners & Sinha, 2005). Kannan, Pope, and Jian (2009) reported that marketing analytics led to a better understanding of customers and better methods of reaching customers (Kannan, Pope, & Jain, 2009). For example, through analytics, the National Academies Press (NAP) built a pricing model that helped to launch its entire range of digital products with a variable pricing scheme. Netflix analyzed millions of real-time data points that its viewers create, thus improving the firm to determine if a pilot will become a thriving new show. Rhenania, a German Mail order company, used a dynamic, multilevel response modeling system to increase its profitability by

analyzing catalog distribution. Marriot used conjoint analysis to identify new locations and launch new product categories. The deployment of marketing analytics allows firms to develop and offer products and services that better align with customer needs and wants, which in turn leads to better performance (Germann, Lilien, & Rangaswamy, 2013). Data-driven firms can achieve favorable sustainable performance, especially in a more competitive environment (Germann et al., 2013). Analytical solutions within Customer Relationship Management (CRM) systems are more successful, the more innovative, technologically advanced, and process-oriented a firm is when they introduce CRM into their business systems (Sebjan, Bobek, & Tominc, 2016).

Traditional marketing research relies on analytics dealing with small data sets with limited analytic platforms and implementation capacity (Xu, Frankwick, & Ramirez, 2016). However, recent changes in marketing and information technologies feature high magnitude, mobility, and versatile solutions for strategic activities. The literature refers to the changes in Big Data analytics (Xu et al., 2016). Big Data is a term that describes data sets that are large, unstructured, and complex (Chen, Chiang, & Storey, 2012). A useful definition of Big Data Analytics is "building new analytic applications based on new types of data, to better serve your customers and initiate a better competitive advantage" (Bertolucci, 2013) (De Prato & Simon, 2015b) (Bertolucci, 2013; De Prato & Simon, 2015a). Further, Forrester Research (2011) defined Big Data as "techniques and technologies that make handling data at extreme scales affordable' (Hopkins et al., 2011). Big Data analysis (BDA) in marketing differs from Target Marketing Analysis (TMA), mainly in the revolution rather than an evolution of communication channels (Sathi, 2014). Firms use Big Data analysis techniques to follow the flow of information and analyze massive volumes of data in real-time. In contrast, TMA focuses on providing better insights regarding advertising, pricing, customer relationship management, and product development (Sathi, 2014).

Similarly, healthcare is retooling its IT education to overcome its lack of technical and organizational infrastructure by developing the skilled workforce needed to implement enterprise-level systems (Holman, 2014). Business Intelligence (BI) and healthcare analytics are emerging technologies required to improve service quality, reduce costs, and better manage healthcare risks (Zheng, Zhang, & Li, 2014). There is a great need for skilled individuals who can develop, understand, and manage medical information to transform the delivery of healthcare to improve public health (Holman, 2014).

The traditional business view of Big Data is not the conventional 3V Model – high volume, high velocity, and a wide variety of data. Organizations use a more business-like definition that reflects the integrated nature of the data found in ERP and CRM systems commonly found in today's business environment. Understanding, analyzing, interpreting, and presenting these types of data requires skill sets from across the business disciplines because of "actionable" data that impact the business decisions across the supply chain and influence decisions made in the finance, accounting, information system, etc. decision-making aspects of an organization.

BUSINESS AS AN INTER-DISCIPLINARY EDUCATION

In today's business environment, digital business roles and functions align with a company's activities, culture, and structure along with organizational goals (Kiron, Kane, Palmer, Phillips, & Buckley, 2016). Barber et al. (2001) suggest three general models of integration as ways to address rapid and effective responses to industry needs: (1) integration across disciplines (e.g., the inclusion of engineering and business), (2) integration of functional areas within a business (e.g., integration of marketing, management information systems, and finance), and (3) integration with a functional area (e.g., integration of financial reporting issues with tax and auditing issues in an accounting program) (Barber, Borin, Cerf, & Swartz, 2001). We suggest business education integrate across disciplines to reflect the digital alignment of business roles and functions to achieve similar organizational goals. Further, curriculums should mirror the digital linkages found in business to teach our students the importance of cross-disciplinary understanding of business information within the business cycle so they can be more effective in their real-world job roles.

Scholars have viewed marketing as an interdisciplinary field, due to its roots in economics, psychology, sociology, and anthropology roots (Alden, Laxton, Patzer, & Howard, 1991; Ramocki, 1993). As a result, marketing educators have called for cross-functional links with other business disciplines (Lamont & Friedman, 1997). The implication is that all business educators need to move beyond narrow, multiple course majors and begin to design curricula that require students to integrate business disciplines. Business educators will need to forge stronger links between marketing, finance, accounting, management, information systems, and other business areas, through team teaching, collaborative courses, and the development of cross-functional teaching materials (Lamont & Friedman, 1997). Within this context, an interdisciplinary approach to teach data analytics and data visualization are proposed, developed, and implemented.

Change is possible. Many disciplines have defined and shaped business education (Ferrell, A., & Ferrell, 2015). As an example, the marketing discipline evolved from economics and behavior science (Ferrell et al., 2015). Historically, Ralph Starr was one of the first scholars to conceive the definition of marketing, and he believed that marketing went well beyond distribution and selling (Bartels, 1976). Over time, consumer behavior disrupted the idea of the "rational man" taught in economics courses (Ferrell et al., 2015). Because motivation often occurs in the unconscious as well as conscious, the idea that consumers make a choice based upon rational thoughts was questioned (R. Fullerton, 2015; R. A. Fullerton, 2011). This recognition leads to changes in how we teach so that today's marketing education includes various topics such as transportation/logistics, financing, risk analysis, and assembling, management, etc. (Shaw & Carson, 1995). Healthcare is also questioning its traditional approach to technology education as healthcare organizations increasingly rely on the information technology systems to manage patients from initial admission records, through procedures, out-processing, and then final billing (Holman, 2014).

The Association to Advance Collegiate Schools of Business (AACSB) has also encouraged integration across programs to keep up with the rapidly changing business environment (Elam & Spotts, 2004). In this context, our program recently took advantage of newly created SAP learning initiatives and the opportunities provided through the SAP Academic Alliance. The business college formed an academic cross-disciplinary team to integrate all business perspectives by using SAP as an analytical platform to show students how business data integrates across an enterprise. The intent was to incorporate analytical skills across disciplines as opposed to a focus on a new course (s) or coordinating efforts around a typical project or case (Pharr & Morris, 1997).

Kreir (2011) suggested teaching core business skills specific to a single ERP course designed to cover critical competencies while learning about the data that supported business processes (Jennifer Kreie, James Shannon, & Carlo A. Mora-Monge, 2011). Many Information Systems (IS) programs use this approach. However, IT-specific ERP courses result in a tendency to teach ERP and CRM solely in these programs or as part of an elective Information Technology (IT) course that business students may or may not be required to take. The weakness of this approach is that many business students may never experience the importance of the interoperability of the data they produce and its effect upon the entirety of the organization.

Thus, Table 1, using an example from a marketing curriculum, alters the single course perspective. Technical business skills, often only taught, in an ERP only course, might be planned across multiple classes with the benefit of reinforcing data sharing across various disciplines. By removing the expectation that students will integrate an application of business skill competencies from the IS/IT silo, there is an expectation that all disciplines use ERP and CRM technologies. Business students using a familiar ERP interface in different functional area class would see their specific business skillset applied in the context of other business silos, reinforcing the importance of shared data impacting organizational decisions across the enterprise. A business student analyzes data in all of their SAP content courses and uses that information along with their understanding of the business cycle to make operational and tactical decisions requiring a grounding in the business disciplines of finance, marketing, accounting and finance (Jennifer Kreie, James Shannon, & Carlo A Mora-Monge, 2011).

AN INTEGRATED CURRICULUM DESIGN

Our integrated curriculum design starts with introducing SAP software (i.e., HANA, ERP, CRM, LUMIRA) and the SAP interface (the core platform for Big Data analytics) to students within courses taught by instructors familiar with and trained in the use of SAP software. This approach includes faculty from Marketing, Finance, Accounting, Management, and Healthcare Administration who attended summer training courses sponsored by the SAP Academic Alliance. This integrated approach creates opportunities for students to understand the inter-connectedness of data analytics and how big data is essential to business. Further, students who participate in three SAP courses, that have at least 30% of SAP content earn an SAP student recognition award. The student recognition award is a significant draw for students as well as administrators looking for ways to stand out and grow programs.

TABLE 1
MARKETING ANALYTICS ACROSS DISCIPLINES (ADAPTED FROM KREIE 2011)

Business Skill Competencies	Coverage in ERP Content Assigned Course	Functional Discipline Areas Involved
Technical Skills	Extensive Experiencer using SAP Locate Data Export data	IT
Statistical and Analytical Skills	Analyze and Interpret financial data Forecast and plan	Accounting Finance Statistics
Knowledge of Data	Learn about Master Data used in Business Processes Learn about Transactional data generated in business processes	Accounting IT Management Marketing
Know the Business	Learn Common needs addressed by the enterprise system Learn the specific characteristics of a business and its competitors (ERPsim simulation)	Accounting Finance Management Marketing
Communication & Partnering Skills	Work with management teams coordinating responsibilities and actions (ERPsim Simulation) Weigh alternatives and make decisions	IT Management

The SAP University Alliance is a global program with more than 3,100 member institutions in over 106 countries that aim to shape the future of higher education and expose business students to the latest SAP technologies (Anonymous, 2009). Central to our decision to join the SAP Academic Alliance was access to and training for Enterprise Resource Planning (ERP) and Lumira (data visualization), as well as access to instructor notes and experiences from other academics around the world. Further, we sought opportunities for all business students to make and understand data-driven decisions not only in their silo

context but, to see and experience the impact of data-driven choices in the context of other functional business disciplines.

Enterprise Resource Planning (ERP) is essential for business students to understand how different business components integrate. Everwijn et al. (1993) suggested that a business school's mission is how to make ensure that student knowledge acquired in the classroom gets transformed into the ability to apply to real-world situations (Everwijin, Boomers, & Knubben, 1993). As such, Competency-Based Training (CBT) suggests a better way for students to manage their cognitive and social resources in actions that result in a certain level of performance. Thus, as part of the SAP Academic Initiative, the ERP Simulation (ERPsim) is a validated active learning method and is an accepted instructional approach effectively used for many years (Conroy, 2012; Cronan, Léger, Robert, Babin, & Charland, 2012; Léger, 2006; Leger et al., 2011; Loos et al., 2010). For instance, a recent study indicated that training for analytical abilities benefited from the mentoring, team-based practice, and self-study (Writer, 2013). Importantly, the key to a strong analytical ability includes a proper mindset and understanding of methods rather than any specific software or mathematical skill. The SAP ERP Simulation used in many of our courses is a standard tool that shows how data is shared across the enterprise, introduces the concept of shared decision-making, and the importance of analyzing cross-disciplinary data to make better decisions. Lumira is an industry data visualization tool needed to complement MS Excel to not only make better decisions but, convey the data to decision-makers in useful ways that support the decision-making process.

In this regard, Enterprise Resource Planning (ERP) deals with the fundamental business processes found in every enterprise. They include but, are not limited to, Customer Resource Management (CRM), Supply Chaim Management (SCM), Supplier Relationship Management (SRM), Financials, Operations, Human Capital Management (HCM), Corporate Services, and Analytics (Missbach & Anderson, 2016). From our perspective, we sought a closer alignment between industry needs and classroom teaching. As a simple example, marketing, finance, and healthcare students exposed to the SAP ERP system and the SAP Lumira (data visualization platform) analytical tool will understand the impact of pricing decisions on logistics delivery schedules and the ultimate impact on an organization's bottom-line. To this end, while a marketing research course might focus on Lumira as a predictive analysis tool, other designated SAP courses in management, healthcare, and finance use the ERP simulation (ERPsim) to track learning objectives found in other classes. Student teams within the ERP simulation make pricing, advertising, logistics, and manufacturing decisions that affect the company's bottom line. Evaluation of various finance, accounting, pricing, supply reports, etc. are available for review, download, and analysis.

The emphasis on analytics training is SAP Lumira using data from an ERPsim, existing SAP Academic Alliance databases, or additional data available for download from the Teradata University of Arkansas website. The first step to learn data analytics is understanding big data are often unstructured. Business students can explore data by creating queries that discover critical business information, which can help with decision making. Students see real-world data (Tyson and Sam's Club data from Teradata) and data generated from ERP simulations. Lumira captures patterns within multi-dimensional data generated by business information systems. When the row and column dimensions are small, Lumira can use standard graphing techniques for visualization, such as bar charts and scatter plots. When the number of aspects becomes large, there are novel techniques such as geometric projection and pixel orientated techniques. In the analysis, many non-marketing related variables (e.g., cost, overhead) and marketing associated variables (e.g., advertising cost, product, and customer) come from the database, which requires knowledge acquired from accounting, finance and management courses. Also, students are required to learn predictive analysis techniques that identify the most significant variables that contribute to any dependent variable of choice. The platform also allows students to apply different models to predict consumers' behavior, such as the likelihood to make an insurance claim. Students must use learned analytical skills across disciplines to understand better-integrated business knowledge and realize a transference of skills from one subject to the other can take place.

The total training duration for the three techniques above is about six weeks to introduce essential SAP analytical tools. During training, each student receives a user ID and password to access data. The

instructor *also p*rovided hands-on experience to facilitate the learning process. Many sample data exist for students to practice each type of analysis. During the last two weeks of training, the students were assigned to a group with four other students to finish the final project. Each group creates its query from Info Cube and then perform predictive analysis with Lumira. They write down the objectives of a strategic plan after completing the report. Students are encouraged to include variables from marketing, finance, and accounting. The project is graded based upon the richness of the data (depth and breadth) sets expressed, the use of Lumira, predictive analytics results, and strategic discussion.

FACULTY EXPERIENCE WITH THE ERPSIM

The SAP ERPsim creates data that must be analyzed to support decision making in a simulated enterprise. As the simulation progresses through multiple rounds, students can use MS Excel or Lumira to analyze data. What faculty discover is that students don't understand the business cycle as an integrated, seamless exchange of data across functional areas but single silos of unique data unrelated to each other. Students typically do read and pay attention to the SAP lectures, how-to videos, and instructions from the pulpit, but tend to interpret that information from the perspective of their major. There is also a sense that there is no need to understand the technology and that technology should automatically provide the recommended decision. Once in the game, students become very competitive and want to quickly change everything at once to improve their rapidly deteriorating bottom-line. Instructors must get students to stop and recognize that changing everything at once does not allow for predictive behavior and that they must be more cautious and fix some variables as they alter others to see the impact of decisions. Once again, we emphasize that students, at least initially, do not understand how the different functional areas of business are interconnected. While we as faculty do understand, using SAP ERPsim may require a review of marketing concepts in a healthcare class or the meaning of accounts receivable in an IT/IS/MIS course.

Faculty have a steep learning curve to master SAP ERPsim, Lumira, and other SAP applications. While there is considerable support in the form of sandboxes, instructor notes, training videos, training conferences, industry books, textbooks, etc., faculty must still invest significant time and effort to master what may seem like an over-abundance of teaching materials. Further faculty must regularly attend conferences and training seminars (in-person or online) to stay current with SAP tools. SAP is now updating software 3-4 times a year, not including minor upgrades. The pace of industry development is inconsistent with an instructor who only teaches SAP once a year. Individual faculty should anticipate using SAP in as many courses as they can (in person or online) to keep their skills and knowledge base current.

Maintaining an effective program requires a substantial commitment of resources both in the short and long-term. The technologies are based on industry standards and best practices approaches and may not always conform to what we would like to experience or do in the classroom. Exposure to industry-level software is a definite advantage of ERPsim. ERPsim uses current production software to input data that creates reports that students use to make typical business decisions in a controlled but realistic environment. While faculty may offer suggestions on how a team might proceed, the complexity of the simulation requires students to analyze their data in real-time.

STUDENTS' EXPERIENCE

A total of 89 senior college students from three SAP classes (Marketing, Finance, and Healthcare) participated in the voluntary study. All students were American nationals registered as full-time students, taking at least one SAP course at a comprehensive university in the southeast region of the United States. A qualitative survey examined the students' learning experience in data analytics. Questions such as "please describe your learning experience with SAP" were asked in the qualitative study. The students were given adequate time and were encouraged to write their responses as thoroughly as possible. The average time to complete the questions was 30 to 40 minutes using Qualtrics software.

Three experienced researchers discussed the data analysis process, findings, and reached a common consensus concerning the meaning of the student questions. Transcripts were scrutinized for common themes and categories and compared for consistency across the entire data set (Arnould & Wallendorf, 1994). Much analysis coincided with data collection and helped to determine the direction of the study. As new data were collected, review for points of similarity and contrast occurred. The analysis was an iterative process of coding, categorization, and abstracting the data (McCracken, 1988). Data of thematic similarity identified keywords or phrases. Coded data yielded a few broad categories which, through sorting and clustering, were reduced to the more fundamental patterns that constitute the emergent themes. This approach is consistent with grounded theory procedures (Strauss & Corbin, 1994).

To further validate and confirm our understanding of the positive effects of a multidisciplinary approach to teaching SAP ERP. We analyzed students' responses, using Provalis QDA Miner WordStat 6 software. WordStat is a text analysis module specifically designed to study textual information such as responses to open-ended questions using automated categorical text mining methods, including 2D multidimensional scaling (http://www.provalis.com).

A REAL-TIME TRANSFORMATION

At a high level, the data resulted in three major themes, including initial experience and obstacles, learning transformation, and future expectations. Our interpretation of the student involvement with SAP suggested that students experienced a process of change from initial doubts to the ability to overcome the obstacles of using the SAP technologies. For instance, many students have expressed their frustration at the beginning of the survey.

> "We began with Lumira and followed basic exercises to become familiar with the interface and its different functions. At first, I had a minimal idea of how to use the system without instructions. The interface is not very user-friendly, and creating some of the more advanced visualizations can be difficult."

> "At first, I was bewildered and frustrated ---I found it to be a very complicated, complex, and confusing system."

> "My initial experience was a little overwhelming at first. There are many steps to complete to get your data. Using new software that most people do not know how to use can be intimidating."

> "It can initially be frustrating and confusing. There was little explanation of what the SAP system was, the goal of the simulation, how it related to healthcare, or what we were to do."

As the data uncovered, students found that learning marketing analytics to be confusing and frustrating. Most participants expressed negative feelings about the learning experience. However, many also stated their positive experience after understanding grew. For example,

> "I think the best part and most exciting part about the SAP system is that we have started to learn how to use it. We are now able to use and compare data using the SAP system. I think another thing that excites me about SAP is that there is still so much we can learn and do with it. We have started to use it, but there is still a lot that we do not know, and we can learn from it."

> "I loved how it gives me an advantage over people. I have a certification showing how I have experience with Microsoft, Excel, and Word documents. When I go into a job, I am adequately trained with the understandings of analytics software. "

> "What excites me most about it is how my understanding of it has grown from semester to semester. I am also thrilled by the fact that companies use this software, and it's something that we will be able to get certified in if we meet the 3-class requirement. I think it is a great idea that our university was able to incorporate something into the curriculum that would be applicable in the real world."

> "It is exciting because I know it could potentially be a handy tool in the future of business process efficiency. It is nice to have a database system that can consistently track all of the transactions going on within a supply chain and give you real-time updates that could help you to make more knowledgeable business decisions."

As the students expressed in their comments, students saw a positive aspect through the reality of using standard industry SAP software. Many repeatedly stated that real-time training is the key to improved learning outcomes.

> "Throughout this journey, I have developed several skills, or I have improved on the ones I already possess. My communication skills have gotten a lot stronger; my time management skills have developed, being able to make financial guesses have gotten better as well. My group had to communicate for us to excel in our group. My time management skills came in when we realized the timing of each cycle, and a new cycle would automatically continue once that cycle ended! These skills will set me apart from the rest because some potential hires don't have interpersonal skills I have and are less effective in the business world because of it."

> "There are two skills that I have acquired from this game, which are marketing skills and logistics management. With the marketing part, I have learned how to come up with marketing budget for each product, and each region, the impact of marketing in one region depended on the share of all marketing expenses in that region. That allowed me to make our products more desirable to our customers. The budget could be changed at any time, depending on how much revenue and sales we were inputting and outputting. For the logistics portion, I was able to manage how products became distributed, when they were coming in and when they were shipped out."

> "These days, the reality is that larger businesses have multiple facets of an operation, all of which must communicate with each other to keep things moving in the right direction."

Based on these sorts of student comments, we dug deeper into the available data using WORDSTAT to understand the student experience further. The results shown in Figure 1 reflect standard settings to display relationships between words and the removal of non-key words to improve understanding of relationships. The proximity distance between bubbles graphically represents word relationships. The size of the bubbles in Figure 1 depicts the relative frequency of the word, while the lines suggest an underlying connection.

As shown in Figure 1, student responses resulted in 6 main groupings with lines connecting words with stronger associations. The first group (marketing and group), found in the top left corner, reflects students' experiences with Lumira in the marketing research class and student experiences using the ERPsim Distribution simulation, which heavily emphasizes pricing and advertising decisions. Further,

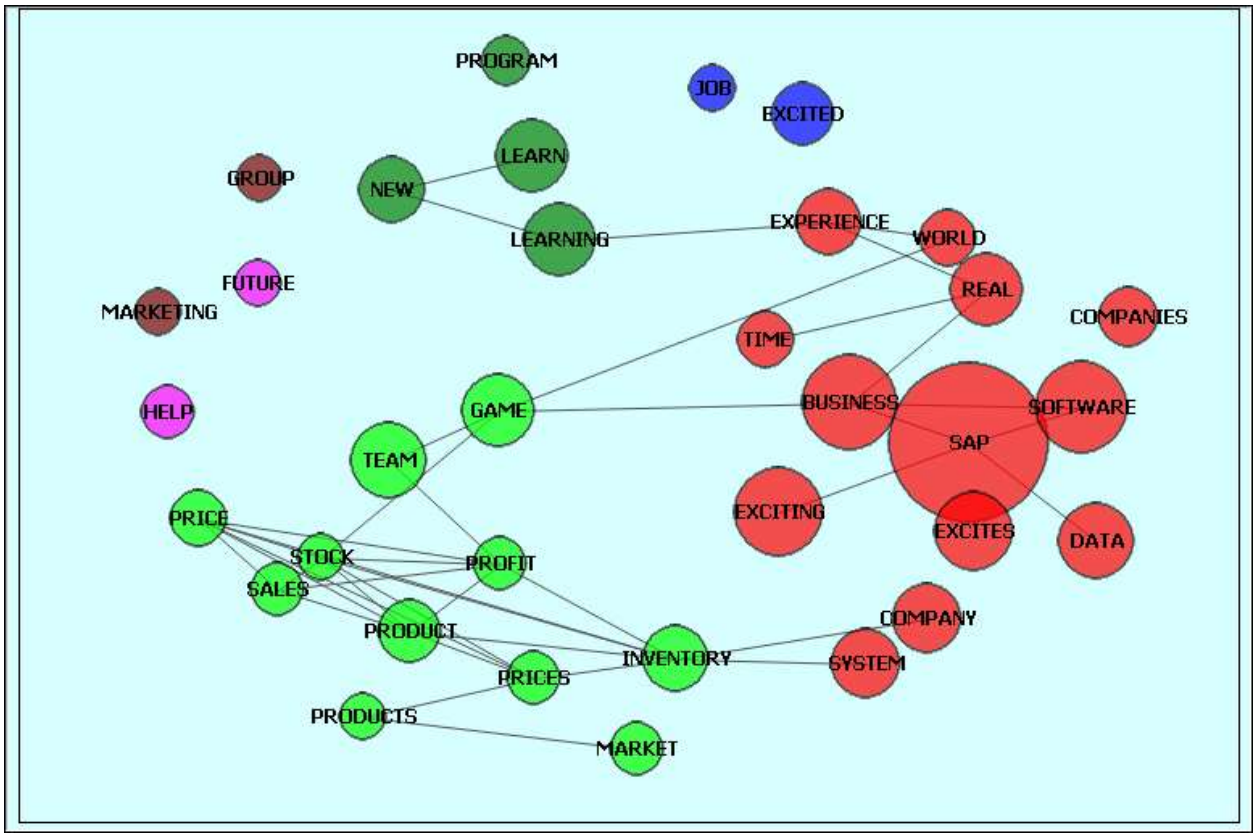
students were required to work in teams that emphasized cross-disciplinary decision-making using data across functional business lines in the marketing context.

The second group (Future and Help) suggests that students saw SAP as a "help" in their "future" careers. Course instructors emphasized to students the importance of having technical skills and understanding how SAP ERP worked to have a competitive advantage over students who had not acquired the same skills. Students must perceive their introduction to SAP technologies as a set of business skills needed in the future as opposed to make-work exercises in the present.

The third group found at the top of Figure 1 (Program, Learning, Learn, New) suggests that students knew they were part of a new program introduced into the curriculum. This point was emphasized to students frequently in the context of expecting problems and issues with the technology in that SAP technologies were constantly updating, that changes in technologies were a constant and that even in industry, one had to deal with changes in technology regularly. Group Four (Job and Excited) is an understanding by students that learning SAP was preparing them for competitive positions in industry and that they should be excited by exposure to industry-level software and skillsets desired by future employers.

Group Five, just below Group 4, is centered around the giant bubble "SAP." Students correctly saw SAP as a business experience related to the real world. In all courses, students benefited from exposure to the history, complexity, and wide-spread use of SAP. Group Six centered on the word "Profit." Profit was, in turn, related to the functional business areas. Students understood that substantive decisions impacted profit and that achieving an advantage was the primary purpose/outcome of the ERPsim game. We are less sure they know the business cycle and the interrelationship of functional decision-making to profit. It seemed that student word choice in answering open-ended SAP questions tended toward the politically correct, what they thought the faculty wanted to hear, as opposed to articulating what they knew and felt. That they listened to the message and will have the opportunity to expose themselves to SAP content in other courses will hopefully build confidence in their understanding of SAP and overcome detractors affecting the learning of new technologies.

FIGURE 1
STUDENT LEARNING EXPERIENCE



The lines connecting Groups Five and Six suggest that students understood the ERPsim and Lumira exercises related to SAP software. Further, they saw, at least on some level, that company data was available to all. We were disappointed that words like "Process," "Lumira," "Reports," and "Financial Statements" did not display. As instructors, the student-aids, video lectures, and classroom discussions emphasized the importance of business processes and SAP reporting. Despite this emphasis, it may be that students need more time to assimilate SAP in their thinking and the underlying significance of introducing inter-related business processes across the curriculum.

LIMITATIONS AND FUTURE DIRECTIONS

The initial implementation of SAP ERP was a success in each of the individual courses that included 30% SAP content but laid bare the lack of coordination, collaboration, and cooperation needed to more effectively integrate SAP ERP across the curriculum. Students at first exposure get the importance of SAP ERP in their future careers and the need to build an analytical skillset but still lack an intuitive understanding of business processes and the integrated nature of the business cycle. Addressing these limitations will lead to improved curriculum, student outcomes, and better measurements of starting salaries and job opportunities as our students search for internships and the high paying jobs they want.

CONCLUSION

Technical and analytical skills are necessary for a successful business career. The addition of SAP ERP and analytical software in the business school curriculum gave students the ability to look beyond

the data per se and analyze trends/patterns that lead to successful decision-making efforts (Levine, 2015; Mars, 2016). We found that students and faculty were excited about the introduction of SAP into the curriculum. Anecdotal comments from local industry leaders were optimistic and more responsive to hiring our students, and administrative support for faculty SAP training is in place based on positive reviews from students and industry interest in our program. One SAP course is not enough for students to understand the sharing of enterprise data underscoring the importance of multiple classes across disciplines. Students quickly master the input of relevant business information but then struggle to unify what they have learned from other business disciplines/courses to make effective marketing, pricing, transportation, fees, etc. decisions that impact the operational bottom-line. Being able to analyze actionable marketing data for business decisions within a cross-disciplinary context is where the actual value of inclusion of SAP ERP technology exists within the business school curriculum and not just one course in a business major.

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