

Cloud-Based Lightweight Hosting for Academic Use of Microsoft Dynamics AX

Frederick J. Riggins
College of Business
North Dakota State University
Fargo, ND 58108
(701) 231-5102
fred.riggins@ndsu.edu

Todd Schultz
Hull College of Business
Augusta University
Augusta, GA 30912
(706) 667-4534
tschultz@gru.edu

Ranida Harris
School of Business
Indiana University Southeast
New Albany, IN 47150
(812) 941-2324
rbharris@ius.edu

Abstract: Instructors find hosting Enterprise Resource Planning (ERP) software for hands-on activities a challenge. Several hosting models exist including services through academic alliance, third-party providers, and on-premise university hosts. Due to its complexity and modernity, instructors who integrate the increasingly popular Microsoft Dynamics AX into the classroom experience particular challenges. This paper presents a framework related to ERP hosting models, proposes a new cloud-based, lightweight model, and discusses the pros and cons of each hosting option. The paper also describes the cloud-based, lightweight hosting model for Microsoft Dynamics AX using Azure cloud space and provides suggestions for instructors who would like to adopt this approach for their classroom usage.

INTRODUCTION

Enterprise systems hosting can be a challenge for academic institutions seeking to integrate large Enterprise Resource Planning (ERP) systems into their curriculum (Davis and Comeau, 2004; Wimmer and Hall, 2016). Recent guidelines promoted by the Association for Computing Machinery (ACM) and the Association for Information Systems (AIS) suggest that a course focused on ERP systems would benefit from using the software to illustrate the concepts in the classroom. This approach would clearly show students how enterprise systems work and provide technical software skills for students through an integrative project (Topi, et al., 2010). The report states,

The course intentionally does not specify enterprise system software. Institutions have to make the decision of whether and how to provide students with experience with actual enterprise system software. It is preferable that the course includes exposure to and hands-on use of one of the many enterprise system vendors (SAP or Oracle, SSA Global, Microsoft (Axapta, Great Plains and Solomon), Intuit, or Minicom). The importance of actual use is clear. Enterprise systems software is in place in a majority of large organizations and increasing in use in small and medium-sized organizations. (Topi, et al., 2010, p 61).

The relevance for these curriculum suggestions has only increased in the ensuing years since the report was published. Organizations of all sizes from various industries, both non-profit and for-profit, continue to adopt enterprise systems

(Panorama, 2015). One market report suggests the market for ERP solutions will grow at a 7.2% Compound Annual Growth Rate (CAGR) during the period 2014 – 2020 (Choudhari and Ghone, 2015).

Research has shown that providing appropriate hands-on experience with enterprise systems increases learning outcomes. Davis and Comeau (2004) found that combining a hands-on learning lab environment with management-oriented conceptual learning materials in an ERP-based e-business course was a powerful combination for student learning. McDowall and Jackling (2006) showed that positive student perceptions of the usefulness of computer-assisted learning packages in learning accounting concepts significantly influenced classroom performance. Alshare and Lane (2011) studied student satisfaction in an ERP course and found that providing clear directions for the hands-on usage of the system increased student satisfaction and ultimately improved learning outcomes. Boulianne (2012) showed that students learned concepts related to the accounting cycle best by completing a manual written business case exercise followed by use of an accounting software tool, and that those who completed only the software exercise experienced better knowledge acquisition than those who only did the manual exercise.

Despite tangible benefits of including exposure to ERP in a wide variety of courses, adoption by faculty in courses can be problematic. This is especially true where the department or college has not yet established processes for hosting ERP. Unlike end-user software where students typically receive and install individual versions of a product (or the software is installed on lab workstations), ERPs are group-oriented, collaborative software customized to an enterprise environment rather than an individual user. The breadth and scope of infrastructure requirements for most ERP systems places an enormous burden on teaching faculty, typically stretching beyond the skill, capabilities, monetary, and time resources available for many faculty seeking to use ERP software for effective teaching in the classroom. In several small tests at a variety of universities, the light-weight hosting model described in this paper has helped overcome many of these hurdles.

THE ACADEMIC HOSTING PLATFORM FRAMEWORK

There are many factors that impact the platform hosting decisions for academic institutions seeking to implement ERP software into their curriculum (Hepner and Dickson, 2013; Hawking, et al., 2004; Bradford, et al., 2003). These factors (see Table 1 below) may be categorized in two broad dimensions: resources and scope, providing a meaningful approach to consider the different platform hosting options.

Resources refer to the availability of technical and financial resources required by the instructors, students, and other involved parties in order to enable an ERP system for instructional usage. Examples of resources include, but are not limited to those needed to acquire hardware, install ERP and other related software, maintain the ERP system, manage student accounts, subscribe to academic alliance memberships, and others.

Scope refers to the technical and academic requirements by instructors and curriculum in order to effectively conduct classroom instruction following the learning objectives. Examples of scope include, but are not limited to, the breadth and depth of ERP modules, the functionalities covered in ERP courses and curriculum, the number of classes utilizing the ERP system, the number of students in each class, and the breadth and depth of ERP related assignments.

In addition, academic units and faculty must consider the *depth* and *breadth* of their ERP curriculum offerings when choosing the appropriate hosting platform. Generally speaking, depth refers to the extent to which the ERP software will be used in a given class which may be measured by the level of knowledge required to complete the assignments, the number of ERP modules covered, and the number of assignments. Breadth refers to the extent to which the ERP software will be used across multiple courses in the curriculum, which may be measured by the number of courses utilizing the ERP software within the academic program.

Table 1: Factors impacting the platform hosting decision

Category	Factors impacting ERP platform hosting decision for academic institutions
Resources	The financial resources available for curriculum innovation
	The financial burden to be placed on the students
	The level of technical support available from the university IT support staff

	The experience and familiarity of the instructor with the particular ERP system
	Server hardware availability for the course, either through university IT services or within the college or department offering the coursework
	Security policies impacting options for hosting and student access
Scope	The technical capability of the instructor
	The availability of student-centered learning materials that match the ERP system configuration to be used by the students
	The breadth of ERP curriculum needs in terms of the extent to which the ERP software will permeate throughout multiple courses across the curriculum
	The depth of ERP curriculum needs in terms of the extent to which the ERP software will be used within a given course for the number of assignments and modules examined.

The current ERP hosting platform for teaching ERP in academic institutions usually falls into one of the three popular models: On-premise, third-party, and academic alliance hosting models. Each model is described in more detail below.

On-premise hosting requires universities to provide hardware server infrastructure, either through university computing services or through those administered within a department or individual faculty. This model typically requires specialized skills in server setup and maintenance, proper system configuration to ensure reliable and responsive system service, appropriate security software, and the ERP software installed on the server(s). In addition, the instructor or university personnel must setup and maintain student login accounts across multiple courses and semesters that utilize the ERP software. Universities and departments with a deep commitment to the ERP teaching program along with financial resources are able to provide this level of on-premise hosting if the size of the program and the number of students is large enough to justify the needed resources.

Unlike on-premise deployment, hosted software, also called Software-as-a-Service (SaaS), is a cloud-based software delivering model where the software is installed, hosted, and accessed entirely from a remote third-party location. Many universities have adopted this model due to limited capabilities and availability of technology infrastructure on campus. Hosting a cloud-based ERP software package by a third-party service provider involves establishing an appropriate server infrastructure, installing and configuring ERP and supporting software, ensuring secured connections, and providing means for managing student and instructor access. In many cases, hosting can be time consuming, requires specialized skills, and can be expensive. However, if the third-party service provider can achieve economies of scale by providing services to multiple universities, this solution can be less costly than on-premise installation. Many faculty teaching ERP rely on this type of third-part hosting.

The third hosting model also utilizes SaaS. However, instead of a third-party provider, the service is provided by the academic alliance institutes, such as the SAP University Alliance. By charging each university an annual fee, SAP uses these funds to operate University Competence Centers (UCC) to provide hosting services from the University of Wisconsin – Milwaukee and the University of California – Chico. Faculty of member institutions receive full hosting and support, both technical and pedagogical, from their assigned UCC for classroom instruction. Universities with large breadth and depth ERP curriculum offerings may be willing to pay the fee to receive the academic alliance-provided hosting solution. This hosting model is arguably the most expensive of the three, especially when the UCC charges a flat fee regardless of the amount of ERP content and modules utilized in the curriculum, the number or classes utilizing ERP system, or the number of students enrolled in each class.

Upon further evaluation of the three primary ERP hosting models, there are several consistent characteristics that the three models share, thus, influencing the decision on which ERP hosting model best suits the amount of *resources* available as well as the technical and pedagogical *scope* required to meet student learning outcomes. Specifically, with sufficient resources, academic institutions may choose on-premise or academic alliance ERP hosting models. With the emphasis on breadth and depth of ERP curriculum, i.e., scope, academic institutions may choose either third-party or academic alliance ERP hosting models. In other words, the academic alliance hosting model is the best option technically (e.g., SaaS) and pedagogically (i.e., strong UCC curriculum support). However, for institutions with fewer resources (i.e., cannot afford the academic alliance membership fee or implement ERP on campus), the third-party hosting model would be the preferred option.

In addition to the three ERP hosting models presented above, this paper suggests the fourth model, a cloud-based lightweight hosting model, for Microsoft Dynamics. Specifically, when examining the ERP hosting models from resource and scope requirements, this fourth model may be used to fill the void left by the on-premise, third-party, and academic alliance hosting models. Figure 1 presents the four different ERP hosting models relative to the resources and scope requirements.

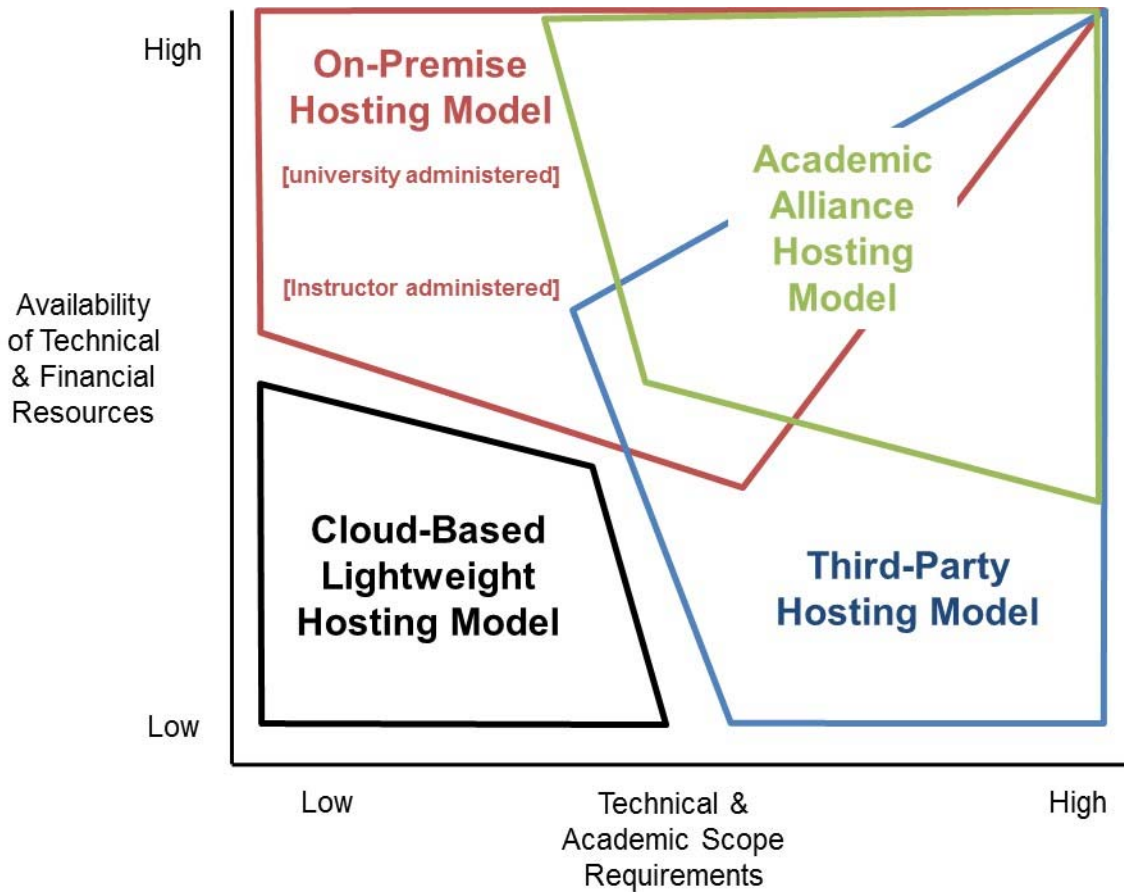


Figure 1: An Academic Platform Hosting Framework for ERP Systems in the Classroom

The vertical axis in Figure 1 represents the *Resource* dimension. The “high” end indicates the amount of financial and technical resources available for investment by universities in order to utilize ERP software in the classroom. Examples of such activities include joining the SAP University Alliance, utilizing “market rate” hosting providers, or investing in IT support capabilities for on-premise hosting and security management. On the other extreme, the “low” end represents the limited financial and technical resources available for investing in hosting ERP software. This situation is often the case when a limited number of instructors seek to offer curriculum innovation on their own, typically are part of smaller units with limited financial resources, have limited resources from IT support, and/or are constrained by university security policy that make on-premise hosting difficult.

The horizontal axis in Figure 1 represents the *Scope* dimension. The “high” end represents universities that seek to integrate ERP software into a number of courses across the curriculum (scope breadth) and/or go deep in the capabilities of ERP software, for example, by examining a number of different modules through a sequence of several assignments and projects (scope depth). On the other extreme, the “low” end is indicative of some instructors who would like to introduce students to what ERP systems are like by providing one assignment or even simply doing an in-class demonstration for students of what a popular ERP system looks like in terms of basic functionality and “look and feel” of an ERP system. Another example of this scenario would be an instructor who would like to introduce students to ERP capabilities by using the ERPsim SAP simulation made possible through HEC Montreal, but who otherwise would not make use of SAP (Charland, et al. 2016).

THE ACADEMIC HOSTING PLATFORM FOR MICROSOFT DYNAMICS AX

The purposed academic ERP hosting platform framework may be applied to the hosting platform for Microsoft Dynamics AX. Specifically, the two dimensions, i.e., resources and scope, suggest four different platform hosting models which we will describe in the following section.

Academic Alliance Hosting Model

In situations where both available resources and the need for curriculum scope are high, the academic alliance hosting model may be the right solution, especially if financial resources outpace internal technical resource availability. In this model, the benefits of paid membership include full ERP hosting, technical support for teaching and learning, and access to the instructional community where instructors and ERP professionals develop and share teaching and training materials. This model is currently available to academic units joining the SAP University Alliance program where the membership fee is used to fund two University Competence Centers, providing complete hosting solutions. However, a similar version of the hosting platform for members of the Microsoft Dynamics Academic Alliance is not currently available. In summary, the hosting infrastructure in this model is funded by the annual alliance membership fees.

On-Premise Hosting Model

Members of the Microsoft Dynamics Academic Alliance are able to make use of the Microsoft DreamSpark program to install Microsoft Dynamics AX and other Microsoft software tools on-premise at the university's facilities. In addition to the required hardware and software, technical expertise and support are needed to install and maintain the system, either by the university technical support staff, where available, or by the instructor with technical capability and hardware availability. This model is funded through DreamSpark software availability and university-provided hardware and technical support.

Third-Party Hosting Model

Where curriculum scope requirements are high, but available resources are low, a third-party hosting service such as DynamicsCloud that provides a full-service hosting solution for Microsoft Dynamics AX for classroom use, may be the best option. This model is typically funded through student fees that pay for online access or purchases of course materials.

Cloud-Based Lightweight Hosting Model

When resources are limited and the need for curriculum scope is relatively low, the proposed cloud-based lightweight hosting model might be the best option. In this model, a lightweight instance of Microsoft Dynamics AX, i.e., Dynamics AX with Contoso demo data, is installed on the Microsoft Azure cloud space. This option is mostly funded through the Microsoft Educator Grant Program that provides Azure cloud space for specific course needs in the form of a per-course grant. The faculty who enroll in this program receive a 12-month \$250/month account and students receive a 6-month \$100/month account. This option provides a good solution for instructors who would like to experiment with curriculum innovation and provide students some exposure to ERP software.

Table 2 summarizes the advantages and disadvantages of the four academic platform hosting options for Microsoft Dynamics AX.

Table 2: Four Academic Platform Hosting Options

Model	Advantages	Disadvantages
Academic Alliance Hosting	<ul style="list-style-type: none"> • Extensive instructor training and course materials available • Turn-key solutions with fully staffed support available 	<ul style="list-style-type: none"> • Off-site solutions • Relatively expensive annual university alliance fee • Currently only available for SAP

	<ul style="list-style-type: none"> • Moderate instructor technical knowledge required • Scalable for high breadth and depth curriculum needs 	<ul style="list-style-type: none"> • Moderate to limited instructor training required • Moderate to limited course materials development and customization required
On-Premise Hosting	<ul style="list-style-type: none"> • Customized solutions based on specific curriculum needs • On-site, controlled solutions • Microsoft software readily available • Scalable with adequate resources • Source of student internship opportunities 	<ul style="list-style-type: none"> • Extensive hardware capabilities and configuration expertise required • Security management required following the university policies • Extensive to moderate instructor training required • Extensive to moderate course materials development and customization required
Third-Party Hosting	<ul style="list-style-type: none"> • Relatively reliable system • Turn-key solutions provided with fully staffed support • Moderate instructor technical knowledge required • Scalable for high breadth and depth curriculum needs 	<ul style="list-style-type: none"> • Off-site solutions • Limited to providing students with supported software options • Moderate to limited instructor training required • Extensive to moderate course materials development and customization required • Students typically expected to pay for access, materials, or both
Cloud-Based Lightweight Hosting	<ul style="list-style-type: none"> • No or minimal costs required by university • No or minimal costs required by students • Moderately customizable based on curriculum needs • Moderate-to-high level of control over the virtual machines • Some instructor technical knowledge required • Attractive as learning “sandbox” for instructor to experiment and innovate • Students may have their own hosted instance • Technical support through Azure cloud service 	<ul style="list-style-type: none"> • Dependent upon Microsoft Azure Grant program • Instructor setup instructions required • Instructor knowledge of basic virtual machine management required (using easy-to-use dashboard) • Moderate instructor training required • Extensive to moderate course materials development and customization required • Moderate scalability for higher breadth and depth curriculum needs • Careful planning of cloud resources required

ACHIEVING SUCCESS WITH LIGHTWEIGHT HOSTING

In a proof-of-concept trial, the lightweight hosting was successfully implemented by six universities in the Spring 2016 term. Three universities applied for the Microsoft Educator Grants and received access to the Azure cloud space for academic usage at no monetary cost. All six universities are current members of the Microsoft Dynamics Academic Alliance (DynAA) where they have access to the ERP software, e.g., Microsoft Dynamics AX. Technically, the Azure cloud space is used to create a virtual machine (VM) running Microsoft Dynamics. Students and faculty then use the Remote Desktop Connection to access the VM and the ERP software from the computers in the classroom for instruction or from home to complete course assignments.

In the Spring of 2016, three universities created the VMs for instructional usage following this model. The three other universities, did not create their own VMs, but received access to the ERP system through the VMs hosted by a sister institution. In each case, the ERP software was utilized in a course similar to the junior level management information systems principles common to business curriculums, or in an enterprise systems class as suggested by the ACM/AIS MIS curriculum guidelines (Topi, et al., 2010). The usage in the enterprise system class represented a curriculum scope of greater depth as this hosting model was successfully utilized to support many different assignments, encompassing several ERP system modules.

All six universities implementing this hosting model reported successful implementation following the course goals and student learning objectives. Specifically, the ERP system was functional, providing an effective teaching and learning tool in the classroom. Students and faculty were able to access the Microsoft Dynamics AX ERP system through remote login to facilitate class discussion and complete hands-on activities. To reinforce the concepts, students were required to complete several assignments using the software outside the classroom. Based on the class performance, students accurately described the ERP functionalities and successfully completed essential tasks in the ERP system following the business processes related to accounting, supply chain, sales, and human resource modules.

The cloud-based lightweight hosting model can be scaled and configured to support many types of courses and assignments. Compared to other hosting models, it requires the least amount of financial resource to implement. The technical support is available from Azure, and from our experience, once the system is up and running, there was little trouble with the platform. However, it does require the instructor to have a certain level of technical knowledge related to cloud computing, VM, and remote desktop connections, in addition to the ERP knowledge. Furthermore, this approach relies on the availability of the Microsoft Educator Grant Program.

The cloud-based lightweight hosting model is a viable approach to use ERP software in the classroom, especially for institutions with limited resources. Faculty interested in adopting this model may want to consider the following suggestions before implementing this approach in order to provide effective classroom instruction related to ERP concepts.

Collaborate with a Mentor

At the very beginning, faculty who would like to implement the cloud-based, lightweight ERP hosting model could benefit from close collaboration with those who have previously adopted this approach. A mentoring program could be provided to incoming faculty by sharing instructions on how to create a VM, set up user accounts, and manage remote desktop access. Depending upon the instructor's technical knowledge and capabilities, getting started can be quite intimidating and time consuming. A close mentoring or an apprenticeship could ease their anxiety and provide significant benefit to help adopters pursuing this model.

Shared Experiences with Internal Colleagues

Through our observation, adoption of Microsoft Dynamics in a classroom usually occurs through an instructor's initiative and, therefore, the usage is limited to a single course or a few courses within the curriculum. In contrast, SAP adoption often occurs at the department, college, or even the institutional level due to higher level of resources and commitment of all involved parties. In addition to seeking a contact as a potential mentor and troubleshooter, the instructor should look for opportunities for peer collaboration within the same institution for sharing ideas and using the resources.

Be Realistic with Curriculum Scope Expectations

Adopters should keep in mind that lightweight hosting may not be suitable to support detailed, complex ERP scenarios, or a large number of students, both of which would constitute increased curriculum breadth or depth scope (location on the y-axis of Figure 1). Especially at the beginning, instructors should plan to work within the range of previously configured applications and existing curricular materials. Over time, once the instructor gains more understanding and expertise with the system setup and the program usage, the ERP program may be configured to support the increasing breadth and depth of pedagogical scope.

Start Small and Build Capabilities over Time

A hosting solution is something of an initial high-fixed cost and relatively low variable cost proposition in terms of faculty time and effort commitment. Once a solution has been adopted, the instructors should keep their eyes open for broadening curriculum scope either in terms of courses (breadth) or activities (depth) within the established Microsoft DynAA footprint. This can leverage the effort of getting started and growing involvement over time. Together with the previous suggestions, collaborating with colleagues would provide richer content and improve the overall student experience.

Upfront Planning Pays Off Later in the Semester

Particularly for instructors who would like to take advantage of the Azure space through the Microsoft Educator Grant program, upfront planning is important to carefully manage the usage of the resource allocation over the semester. As stated earlier, Microsoft currently provides \$250/month of Azure cloud space for instructor use which resets at a particular date of the month. Therefore, the resource availability will reset up to five times during the semester. Planning usage of class lab dates in advance will help alleviate the problem of having a major assignment due, but having only \$10 of usage available for the next eight days. In addition, learning to manage cloud-based VMs in terms of ramping up server capacity for intensive class-time activities and ramping down capacity for less intensive outside-of-class usage helps stretch the value of the grant.

CONCLUSION

Hosting for enterprise resource planning systems in the classroom is a hurdle for adoption of the software in many academic institutions where the software would be appropriate. This article describes an ERP hosting framework and proposes a cloud-based, lightweight model using Azure cloud space as a viable alternative, especially for institutions with limited financial and technical support. This framework might be useful for potential adopters in identifying the critical dimensions for intended use of ERP and also classifying the hosting solutions relevant to their case.

For the particular framework quadrant where lightweight hosting is appropriate, we describe how success was achieved by several schools in the first term of pilot study. Lightweight hosting can bring a distinct alternative to the more established academic alliance hosting offered, primarily, via SAP University Alliance. We are in the process of finalizing documentation for both students and instructors to make available to the DynAA community and others who may be interested. We are confident that widening adoption of lightweight hosting will help a number of institutions and courses adopt ERP in the classroom or for research projects currently facing significant hurdles which preclude software adoption.

REFERENCES

- Alshare, K. A. and Lane, P. L. (2011). Predicting student-perceived learning outcomes and satisfaction in ERP courses: An empirical investigation, *Communications of the Association for Information Systems*, 28(34).
- Boulianne, E. (2012). Examining the role of information technology in support of business students' knowledge acquisition, *Journal of Integrated Enterprise Systems*, 1(1), 9-17.
- Bradford, M., Vijayaraman, B. S., & Chandra, A. (2003). The status of ERP integration in business school curricula: results of a survey of business schools. *Communications of the Association for Information Systems*, 12(1), 26.
- Charland, P. Leger, P. M., Cronan, T. P., and Robert, J. (2016). Developing and assessing ERP competencies: Basic and complex knowledge, *Journal of Computer Information Systems*, 56(1), 31-39.
- Choudhari, S. and Ghone, A. (2015). *World ERP software market – opportunities and forecasts, 2013-2020*, report from Allied Market Research.
- Davis, C.H. and Comeau, J. (2004). Enterprise integration in business education: Design and outcomes of a capstone ERP-based undergraduate e-business management course, *Journal of Information Systems Education*, 15(3), 287-300.
- Hawking, P., McCarthy, B., & Stein, A. (2004). Second wave ERP education. *Journal of Information Systems Education*, 15(3), 327.

- Hepner, M., & Dickson, W. (2013). The value of ERP curriculum integration: perspectives from the research. *Journal of Information Systems Education*, 24(4), 309.
- McDowall, T. and Jackling, B. (2006). The impact of computer-assisted learning on academic grades: An assessment of students' perceptions, *Accounting Education: An International Journal*, 15(4), 377-389.
- Panorama Consulting Solutions (2015). *2015 ERP report*, report from Panorama Consulting Solutions, Denver, CO.
- Topi, H., Valacich, J.S., Wright, R.T., Kaiser, K.M., Nunamaker, J.F., Sipior, J.C., and de Vreede, G.J. (2010). The IS 2010 Curriculum Guidelines for Undergraduate Degree Programs in Information Systems," report issued by *Association for Computing Machinery and Association for Information Systems*.
- Wimmer, H. and Hall, K. (2016). A technical infrastructure to integrate Dynamics AX ERP and CRM into university curriculum, *Information Systems Education Journal*, 14(1), 48-61.

Biographical Notes

Frederick J. Riggins is an associate professor of Management Information Systems at North Dakota State University. He earned his Ph.D. from Carnegie Mellon University where he was awarded the William W. Cooper Doctoral Dissertation Award in Management. He has served on the faculty at Arizona State University, Minnesota, Georgia Tech, and the University of Alberta. In a ranking of IS researcher productivity, he was ranked #9 on the list of top IS researchers for the period 2003-2007. According to Google Scholar his research papers have over 3,350 citations. He is a member of the Microsoft Dynamics Academic Alliance Advisory Council.

Todd Schultz is a professor and director of Computer & Information Sciences at Augusta University in the Hull College of Business. His academic background includes a doctorate in operations research -- or analytics in today's vernacular -- but his research interests and practical experience of over 30 years are in quantitative programming, enterprise software, database, and business intelligence as an independent consultant and with firms such as American Management Systems and Ernst & Young Management Consulting Services. He currently serves on the advisory board of Microsoft Dynamics Academic Alliance.

Ranida Harris is an Associate Professor of Management Information Systems at Indiana University Southeast. She received her Ph.D. in Management Information Systems from Florida State University. Her research interests include the effects of computer technologies on communication, performance, and decision making. Her publications appear in *Journal of Applied Social Psychology*, *Journal of Social Psychology*, *Journal of Organizational and End User Computing*, *Information Systems Education Journal*, and other journals. Dr. Harris's teaching interests include business computer applications, data management and analytics, Enterprise Resource Planning (ERP) systems, systems analysis and design, and database management systems.