Enhancing Learning Outcomes through Experiential Learning: Using Open-Source Systems to Teach Enterprise Systems and Business Process Management

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ABSTRACT

Enterprise systems and business process management are the two key information technologies to integrate the functions of a modern business into a coherent and efficient system. While the benefits of these systems are easy to describe, students, especially those without business experience, have difficulty appreciating how these systems are used to improve the efficiency of business operations. This paper reports on a project to provide experiential learning to beginning business students. We focus on open-source enterprise and process management systems to investigate whether the benefits can be provided even by small institutions and without a large investment into commercial systems. The results of experimental studies are provided and suggest that hands-on learning on open-source systems can lead to improved learning outcomes. The main contribution is the demonstration that educators need not shy away from experiential learning when faced with the obstacles that large-scale commercial enterprise systems may present, but can instead choose a "bottom-up" approach of easily integrating enterprise systems into the curriculum to benefit student learning.

Keywords: Enterprise systems education, Enterprise resource planning (ERP), Business process management (BPM), Curriculum design and development, Experiential learning and education

1. INTRODUCTION

Enterprise systems, also called enterprise resource planning (ERP) systems, play a vital role in modern business. Consequently, ERP education has become an important aspect of general information systems business or management curriculum. Integration of ERP systems into graduate and undergraduate business courses has been widely reported (Bradford, Vijayaraman, and Chandra, 2003; Rosemann and Watson, 2002; Strong et al., 2006; Winkelmann and Leyh, 2010). While the business benefits of these systems are easy to describe, they are difficult for students, especially those at an early stage in the degree program, to fully appreciate without hands-on experience. This hands-on experience can be provided through the pedagogy of experiential learning.

Experiential learning is a "more effective and long-lasting form of learning" that "involves the learner by creating a meaningful learning experience," (Beard and Wilson, 2006, p. 1) and "learning from experience is one of the most fundamental and natural means of learning available," (Beard and Wilson, 2006, p. 15). The benefits of hands-on, experiential learning with ERP systems have been shown in many situations (Alavi, 1994; Kim, Hsu, and Stern, 2006; Sager et al., 2006), and advances in pedagogical approaches place emphasis on learning-by-doing (Bok, 1986; Auster and Wylie, 2006).

To our knowledge, few Canadian universities provide any experiential learning on ERP systems. Instead, these programs rely on passive learning where students are unable to experience fully the capabilities and organizational impacts that ERP systems provide. In fact, passive learning, such as through lectures, has been shown to be inferior to experiential learning (Kolb and Kolb, 2005).

This paper presents our experiences of providing experiential learning opportunities on an ERP system in the business undergraduate curriculum as part of a course improvement project in order to add to the existing knowledge of the learning outcomes of hands-on ERP system use in the classroom. We targeted two core business courses as part of this project - Information Systems (IS) and Business Process Management (BPM). In the IS course we demonstrated and provided hands-on opportunities with the ERP system, and in the BPM course we demonstrated how business process automation and ERP systems can be integrated to best support operational business processes.

While ERP education has been recognized as important, many academic institutions cannot afford commercial ERP systems, such as SAP, for teaching purposes. Even with educational discounts, the maintenance and training costs often put these systems out of reach for most academic institutions (Hawking and McCarthy, 2004; Watson and Schneider, 1999). The costs are even more difficult to justify when systems are only used in select courses as opposed to throughout the entire curriculum. In contrast to the realities in the teaching space, most of the 20 articles published between 2000 and 2011 in the Journal of Information Systems Education on ERP teaching methodology used an ERP system provided by the market-leader in the enterprise IT field, SAP, and none reported using an open-source system until 2011 when Ayyagari (2011) provided their experiences with using an open-source ERP system in the classroom.

This paper presents the findings of our study on learning outcomes resulting from the introduction of experiential learning opportunities with an open-source ERP system in the IS and the BPM undergraduate business courses. The authors are happy to provide specific advice on implementing the Odoo system in a classroom setting and many of the practical, hands-on "lessons learned" to the interested reader.

The active, experiential learning was expected to increase student understanding, engagement, learning, and interest in learning about enterprise systems in the IS course and workflow management systems (WMS) in the BPM course. If positive learning outcomes are demonstrated in our study, then the main entry barrier to integrating ERP systems into the curriculum can be diminished - that of cost. There is evidence that the conceptual knowledge that is gained is more important than the software package's specific skills (Strong et al., 2006). The experiences of five universities that have taught with commercially available ERP systems have demonstrated that "…recruiters have said that the particular package [ERP system] does not matter; it is the [enterprise system] concepts learned by students that are valuable to companies and that knowledge is transferable," (Strong et al., 2006, p. 747).

In the next section, we provide a background on experiential learning, and then the research setting is presented. This is followed by the research design and a discussion on how learning outcomes were assessed and analyzed. The paper concludes with a discussion and recommendations for future work.

2. EXPERIENTIAL LEARNING

Recently there has been much focus on experiential learning in higher education as a means to improve learning outcomes. According to Kolb and Kolb (2005), "experiential learning has been widely accepted as a useful framework for learning centered educational innovation, including instructional design, curriculum development, and life-long learning" (p. 196). It emphasizes reflection on experiences and defines learning as "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 41). Experiential learning theory describes the learning process as a four-stage cycle that includes: (1) concrete experience, (2) reflective observation, (3) abstract conceptualization, and (4) active experimentation (Kolb and Kolb, 2005). Incorporating a hands-on activity with an ERP system in the curriculum is one way of creating a new learning space that promotes the experiential learning cycle for students.

Watson and Schneider (1999) show that there are significant opportunities to enhance an IS program through experiential learning with ERP systems. However, they note that the benefits are not achieved without significant costs. While they participated in the ERP University Alliance program which provides a completely functional ERP system at reasonable or no cost, they noted that "significant time, effort and money resources [were] required to ensure success," (p. 39). They experienced start-up costs including hardware, software and training, and annual maintenance and support (i.e. upgrades and training). Therefore, in this study we set out to examine how a university can implement hands-on learning experiences, i.e. provide experimental learning opportunities, to students without significant costs of time, effort, or money.

3. RESEARCH SETTING

Our research context is the business faculty of a mid-tier Canadian university that offers two four-year undergraduate business degrees with approximately 1600 students across the two degree programs. Both degrees require a core course in IS and in BPM. These courses are typically taught in multiple sections of 40 to 50 students by different instructors and they are the only IS or BPM courses that most students will complete. As such, the range of topics is broad. The IS course includes both managerial as well as technical subjects; enterprise systems is only one of over a dozen different topics. The BPM course covers many aspects of BPM, including: strategic, managerial, operational, and technical. The course already includes a hands-on component with a WMS, which plays a prominent part in the course to illustrate the capabilities and benefits, but also the complexities of process automation. The business faculty is limited in its ability to fund a curriculum-wide introduction of ERP systems, faces significant hurdles in gaining the required support by the teaching faculty, and is not prepared to incur significant expenditures for the benefit of only one or two courses in a particular discipline. As a result, teaching staff in the IS and BPM courses found itself in a situation that required a bottom-up approach of integrating experiential learning with ERP systems. For this, the university funded a small course improvement project aimed at introducing hands-on ERP systems experience into the curriculum - the IS and the BPM courses. This paper discusses the effects of this project.

3.1 The Open Source ERP System

Using a commercial ERP system was ruled out based on cost and the organizational commitment that would be required. This meant that an open-source approach was required to develop a simple ERP system, sufficient for the intended use in the target courses. The system had to fulfill a number of criteria:

1. Cheap to procure;
2. Reasonably quickly installed and configured;
3. Include all required features;
4. Easy to configure and easy to understand for non-IS majors;
5. Stable with appealing user interface;
6. Web accessible allowing use with existing infrastructure; and
7. Well-documented and stable API (application programming interface) to access its data and functions from other software systems. This is a requirement as the ERP system was to be integrated with the existing WMS in the BPM course.

While there are a host of options for open source ERP systems, few satisfy all criteria. After a review of options and different system trials (installing, configuring, evaluating), the Odoo system (formerly OpenERP) was selected. Odoo satisfied all of our criteria. First, it is free to install and use (criterion 1). Furthermore, when compared to commercial systems the software is more easily configurable (criterion 2), easier to use (criterion 3), has faster out-of-the-box configuration (criterion 4), and provides more information visibility (criterion 5) (Delsart and Van Nieuwenhuysen, 2011). Also, Odoo uses a web-based interface with no client software requirements (criterion 6). Finally, Odoo allows access to its data and function from the WMS system that is used in the BPM course (criterion 7).

Odoo is backed by a large developer community providing a large number of business application modules on the Odoo Apps website. Users install the modules that are needed and can add more at any time. Since Odoo is free to download and use without registration, it is not possible to determine how many academic institutions are using this product. However, Odoo is also provided as a hosted version to educators with almost 100 institutions using this version (Odoo, n.d.).

When comparing Odoo to SAP, the most popular commercial system, based on the common business applications covered (e.g. sales management, purchase management, accounting and financial management), SAP was found to provide more of the standard features within these business applications; however Odoo provided over 75% of the features for all but two of the business applications - payroll management and manufacturing management (Delsart and Van Nieuwenhuysen, 2011). Therefore, Odoo appears to provide a suitable teaching alternative to SAP. However, a search for "Odoo" or its former name "OpenERP" in the academic literature only found one study that used OpenERP (Odoo) to teach ERP skills in an undergraduate IT course. In that study Ayyagari (2011) indicates that it is possible to configure and integrate this system in a classroom setting, but he does not measure or evaluate learning outcomes.

3.2 Positioning of Experiential Learning in the Courses

A 2003 survey of 94 colleges and universities found "no consensus on the best way to integrate ERP software into courses" (Bradford, Vijayaraman, and Chandra, 2003, p. 448). A review of the literature since 2003 found that a consensus still does not exist. Different approaches to integrating ERP systems into the curriculum have been proposed, for example, simulation games (Hopkins and Foster, 2011), creation of a foundation course through blended learning (Daun, Theling, and Loos, 2006; McCarthy and Hawking, 2004), or participating in arrangements with ERP vendors (Strong et al., 2006, p. 747).

Given that the courses into which the ERP was to be integrated are introductory courses in the first or second year of the business curriculum, we wanted to focus on demonstrating the operational support that ERP systems provide to a business, rather than focusing on accounting, finance, or strategic issues. Consequently, the Odoo system was configured for an example company manufacturing bicycles and selling bicycle parts. This product is easy to understand and the parts are familiar to students. The processes are sufficiently simple and understandable even without prior exposure to operations management or accounting courses.

Because the demonstration data available with the system was too complex for our purposes, key information, including chart of accounts, warehouses, pricelists, suppliers, customers, bill-of-materials, and automatic replenishment rules, was developed and configured in the system. The experiential learning exercises for students focused on the sales and procurement processes with selected elements of manufacturing presented as well to highlight the ability of ERP systems to integrate different aspects of a business.

3.2.1 IS course: To allow students to appreciate the range of integration that ERP systems allow, students were asked to process a sales order using the ERP system and identify how the information of the sales order affects other aspects of the company such as accounts receivables, inventory, shipping, sales person compensation, and commissions. During a 75 minute class, following an approximately 15 minute long instructor-led demonstration of the system, students were given a handout that consisted of the step-by-step process required to sell a product to a customer, with each step accompanied by a written description of the process and a screen shot (see Figure 1). The experiential learning was about one hour in duration.

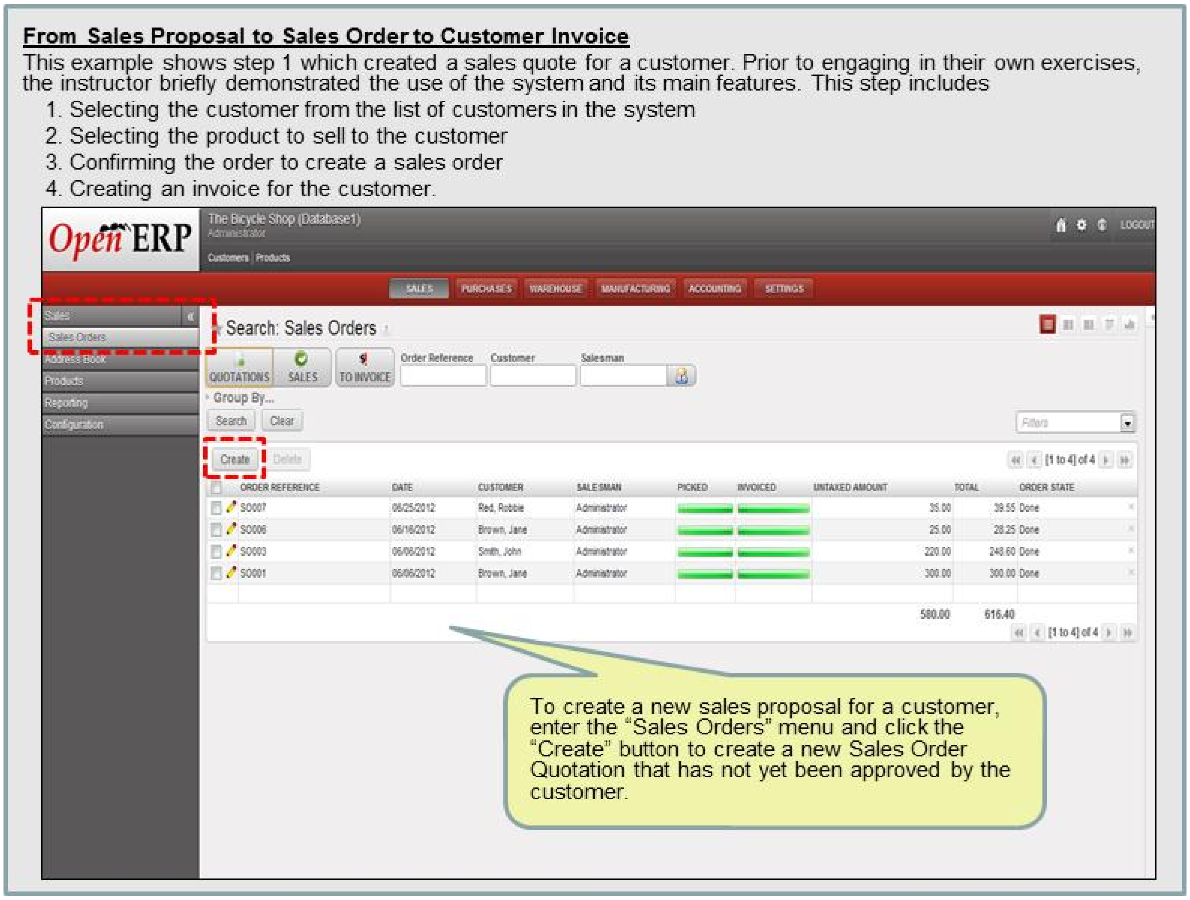

Figure 1. Excerpt from the Odoo Tutorial

3.2.2 BPM course: The BPM course uses the open-source YAWL WMS (http://www.yawlfoundation.org) throughout the semester. Experiential learning was already in place in this course with hands-on exercises and students being asked to reflect on their learning experiences. Our project included the integration of the YAWL WMS with the Odoo ERP system to demonstrate the importance of application integration for the support of operational business processes. From the BPM course perspective, integrating YAWL with the ERP system provides for a more realistic environment for students to experience and learn about workflow management and process automation. In contrast to the IS course, the authors did not have discretion with respect to the WMS system; the YAWL system had been a part of that course and could not be changed.

Odoo provides its own process model and workflow engine. However, the configuration language is XML based and there is no recognizable formal underpinning for the workflow description language. This suggested the need for the ability to develop an interface from YAWL to Odoo, so that Odoo functionality could be used in a YAWL workflow.

We developed a YAWL codelet that accepts input and provides output using pre-specified data types to interface with Odoo (Evermann, 2013). Figure 2 shows the YAWL workflow for creating and processing a sales order.

When the project was initiated, the intention was to allow students to create realistic workflow definitions for simple processes like sales order processing, as part of an assignment or course project. It was hoped that by using a realistic integration with business data in the ERP system, the usefulness of workflow management could be demonstrated to students and lead to better appreciation and understanding of the business value of process automation. However, as the codelet implementation was completed and an example process (Figure 2) implemented, we found that the level of YAWL, Odoo, and XML knowledge required to develop integrated workflows is beyond what can be taught in an introductory course that has no computer science or programming pre-requisites. Therefore, we were unable to give students hands-on experience with the YAWL-Odoo interface. Instead, the integration between YAWL and the ERP system was demonstrated in-class by the course instructor using the sales order management process in Figure 2. Students were shown the workflow definition, the Odoo data, and the running workflow.

4. RESEARCH DESIGN

The measures of learning outcomes included in this study are based upon Bostrom, Olfman, and Sein's (1990) model of evaluation, which proposes that there are two types of

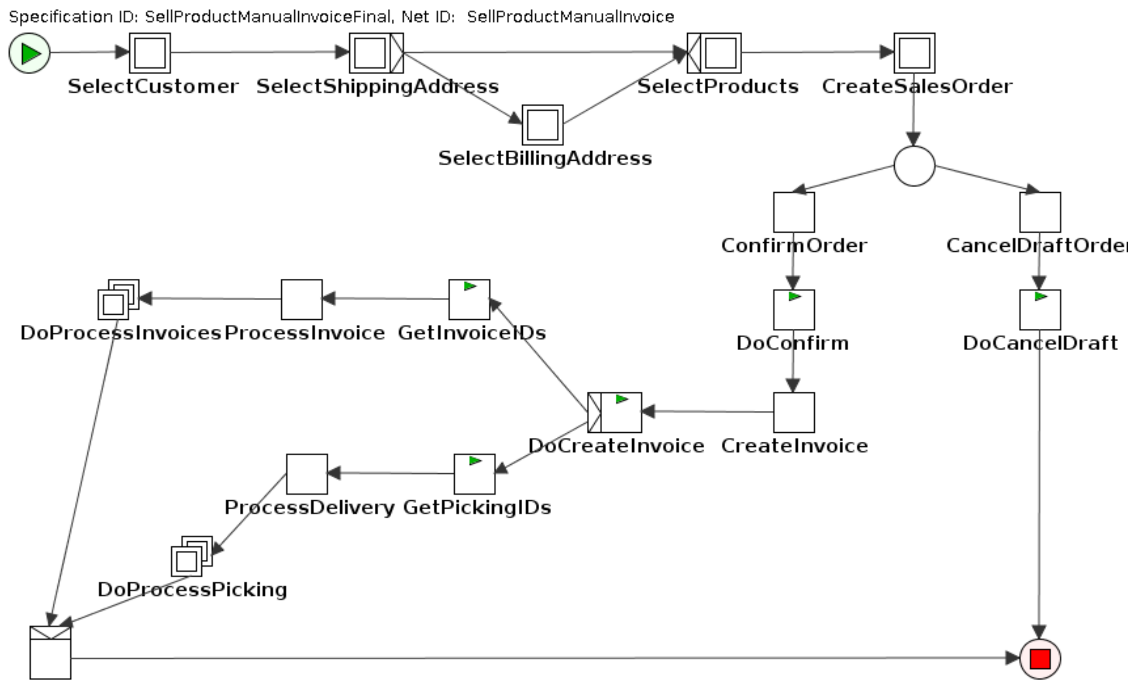

Figure 2. YAWL Workflow for Calling the Sales Order Process in Odoo

learning outcomes: understanding (measured through learning performance) and motivation to use the system (measured through attitudes toward the system). The intended learning outcome for the IS course is an improved understanding and appreciation of the capabilities and importance of an ERP system to business operations, with an emphasis on operating processes. The intended learning outcome for the BPM course is an improved understanding and appreciation of the capabilities and importance of workflow management principles and the role and capabilities of YAWL in process automation. More specifically, compared to the in-class lecture, the experiential learning exercise is hypothesized to:

H1. Increase student understanding (Nelson and Millet, 2001; Noguera and Watson, 1999; Wagner, Najdawi, and Otto, 2000)

H2. Increase student engagement (Webster and Ahuja, 2006; Webster and Ho, 1997)

H3. Increase student learning (Alavi, 1994; Hiltz, 1988), and

H4. Increase student interest in learning (Alavi, 1994; Hiltz, 1988).

We wanted to test the changes in learning outcomes; therefore to test these hypotheses, an experimental pre-test - post-test design was followed. This allowed us to measure learning outcomes not only through self-reported measures after exposure to the hands-on exercise, but also to measure outcomes directly by evaluating students' answers to questions on the systems to see if improvements in learning had occurred. In contrast to cross-sectional post-test only designs, or test group/control group designs, a pre-test/post-test design allows one to directly test for the effect of the intervention (the experiential learning), and can rule out the subject as confounding factor, a danger inherent in the test-control design especially for small sample sizes. The fact that both pre- and post-test occurred during the same class, rules out threats such as maturation and non-random drop-outs typically inherent in this design for longer treatments.

Subjects consisted of students enrolled in four sections of the IS course, and two sections of the BPM course.

In the IS course, the experiential exercise was scheduled to take place within a few weeks of students being introduced to enterprise systems through a lecture and assigned readings. The exercise session began by asking students to complete the pre-test questionnaire; students were then given an instructor-led demonstration of the features of Odoo and of a typical sales process (approximately 35 minutes). This was followed by students being given a handout of the steps of the sales process, which they were instructed to follow to sell a product to a customer. Students were given approximately 20 minutes to complete this sales process in Odoo. Finally, students were asked to complete the post-test questionnaire.

In the BPM course, the experiential exercise took place at the end of the semester and consisted of the pre-test questionnaire, an Instructor-led demonstration of the process management from the YAWL perspective, as well as how workflow activities are reflected in the underlying Odoo system (15 minutes), and the post-test questionnaire.

5. EVALUATING LEARNING OUTCOMES

To understand the impact of the experiential learning on students, we measured the learning outcomes. Some previous studies on ERP education in Information Systems have evaluated learning outcomes but no standard measures were found in the literature (Table 1).

Study	Design	Outcome Measures (self-reported unless noted)
Noguera and Watson (1999)	Pre-test post-test and control	Understanding (score on post-test) Self-efficacy User satisfaction
Wagner, Najdawi, and Otto (2000)	Test and Control	Understanding
Nelson and Milet (2001)	Pre-test post-test	Understanding
Davis and Comeau (2004)	Post-test only	Perceived learning
Rienzo and Han (2011)	Pre-test post-test	Knowledge (direct measure) Understanding (using measures from the Technology Assessment Model)
Alshare and Lane (2011)	Posttest only	Factors that influenced learning outcomes (measures from the Unified Theory of Acceptance and Use of Technology) Learning outcomes Knowledge Satisfaction
Tyran and Springer (2012)	Pre-test post-test	Knowledge Team Potency, Satisfaction and Role Clarify

Table 1. Prior work on evaluating learning outcomes for experiential ERP learning

The use of self-reported performance measures is common practice in educational research and such measures tend to be accurate (Benton, 1980; Cassady, 2001). However, self-reporting is a problematic approach to measurement (Collopy, 1996; Straub, Limayem, and Karahanna, 1995) and it is suggested that more direct instruments should be developed. In order to measure learning outcomes as comprehensively as possible we did not want to base our analysis solely on self-report measures; therefore, we included items to capture outcomes before and after the experiential learning activity, which we then evaluated for changes in outcomes. These instructor-evaluated items were categorized as part of student understanding. We then used self-reported items after the experiential learning activity to measure more of the student understanding outcome, and to measure engagement and learning outcomes. Where possible, we use instruments that have been tested and developed previously (Figure 3).

To measure student understanding, students were asked four questions before and after the exercise and we evaluated whether students' understanding had improved (Q1 – 4). We also asked students to self-report their level of understanding (Q5a-d).

Engagement was measured on the after-exercise questionnaire based on Webster and Ho (1997) and Webster and Ahuja's (2006) measures (Q6a – Q6g). "Engagement is the feeling that a system has caught, captured, and captivated user interest," (Webster and Ahuja, 2006, p. 662). Users are engaged in a system when it "holds their attention and they are attracted to it for intrinsic rewards" (Jacques, Precce, and Carey, 1995, p. 58). Engagement is appropriate for our study as this is critical to the 4-step process of experiential learning outlined above. It is both necessary for the process to work, as well as an outcome of the process. We also asked students whether they found the exercise useful (Q6h).

Students' own perception of their learning was measured based on self-reported learning items adapted from Hiltz (1988) and Alavi (1994). Hiltz (1988) originally developed these items for a post-course questionnaire to assess the relative effectiveness of an online course and was based on a thorough review of the literature on learning effectiveness. Alavi (1994) used three scales to measure self-reported collaborative learning: perceived skill development, self-reported learning, and learning interest. Since we are studying individual learning instead of collaborative learning, we excluded questions that were not applicable to individual learning outcomes (i.e. more confident in expressing ideas to a group, learning to value other points of view, etc.). We measured self-reported learning (Q6i-k), learning interest (Q7a-c), and we added two additional items to measure self-reported learning: helped me to interrelate important topics and ideas in ERP systems/WMS (Q6l), and helped me to learn basic concepts of ERP systems/WMS (Q6m).

As control variables we included questions about how many of the previous classes the respondent had attended (Q8), and whether students are fluent in English (binary, Q9).

5.1 Data Analysis and Results

5.1.1 IS course: From a total of 185 students enrolled in the IS course, 82 responses were received. While this is a response rate of approximately 45%, all students that participated in the experiential exercise responded to the questionnaires. Of these, 71 provided information on both the before and after questionnaire, 5 provided responses only on the before questionnaire, and 5 only on the after questionnaire, and one provided responses only to questions other than Q5a-Q5b.

Participants were instructed not to provide a response for Q1-Q4 if their after-demonstration response was no different than their before-demonstration response. All but 11 participants provided responses to questions Q1-Q4 for both the before and after questionnaire.

Quantitative Results:
Significant differences (ANOVA) between the four course sections were observed for some of the understanding questions (Q5a-Q5d) for the after questionnaire. No significant differences in the control variables were observed between the course sections. We conducted further analysis on the combined data set for two reasons. First, the differences were found on only two of four questions relating

Understanding (Q1 – Q5) Pre and Post-Test	▪ Please discuss your understanding of : – an ERP/YAWL system (Q1) – the place of an ERP/YAWL system in an organization (Q2) – how an ERP/YAWL system relates to other information systems in a company, and (Q3) – how an ERP/YAWL system can be useful to a company (Q4)	Open-Ended Question
	▪ Please rate the following : – I have a good understanding of enterprise resource planning/workflow management (Q5a) – I am able to explain ERP/workflow management to other students (Q5b) – I am able to use an ERP system/WMS (Q5c) – I am able to make a business case for an ERP system/WMS to a company (Q5d)	7-point agreement scales ranging from “strongly disagree” to “strongly agree”
Engagement (Q6) Post-Test	▪ Please rate the following. The demonstration of the OpenERP system/Sales Order Process in YAWL … – … Kept me absorbed in the demonstration (Q6a) – … Held my attention (Q6b) – … Excited my curiosity (Q6c) – … Aroused my imagination (Q6d) • … Was fun (Q6e) – … Was interesting (Q6f) – … Was engaging (Q6g) – … Was useful (Q6h)	7-point agreement scales ranging from “strongly disagree” to “strongly agree”
Learning (Q6) Post-Test	▪ Please rate the following. The demonstration of the OpenERP system/Sales Order Process in YAWL … – … Increased my understanding of basic concepts of ERP systems (Q6i) – … Helped me to learn factual information about ERP systems (Q6j) – … Helped me to identify central issues in ERP systems (Q6k) – … Helped me to interrelate important topics and ideas in ERP systems (Q6l) – … Helped me to learn basic concepts of ERP systems (Q6m)	7-point agreement scales ranging from “strongly disagree” to “strongly agree”
Learning Interest (Q7) Post-Test	▪ Please rate the following. – I will discuss related topics outside the class (Q7a), – I will do additional reading on related topics (Q7b), and – I will do some thinking for myself about related issues (Q7c).	7-point agreement scales ranging from “strongly disagree” to “strongly agree”
Control Variables (Q8, Q9) Pre-Test	▪ How many of the 24 previous classes have you attended? (Q8) ▪ Are you fluent in English (binary, Q9).	

Figure 3. Learning Outcome Measures

to the same underlying factor (“understanding”). Second, the sample size for the outlier section was only 15, which would severely limit the insight one could derive from separate analyses on this section.

Responses on the two control questions (Q8, Q9) showed too little variability to warrant further inclusion in the analysis: 95% of students responded as being fluent in English, and the median proportion of classes attended was 1 (all classes) (min=0, max=1, mean=0.85).

Principal components analysis for Q5a-Q5d (pretest) showed two distinct factors (Q5a and Q5b; Q5c and Q5d), which together explain 87% of the observed variance.

Principal components analysis for Q5a-Q5d (post-test) showed no such distinct factors, with a single factor explaining 81% of the observed variance. Given the conceptual difficulties in attempting a pre-post comparison with different numbers of factors, we decided to use two factors for both pre- and post-test. This may be justified by the question content, which, for Q5a and Q5b emphasizes the understanding or *comprehension* of the concept (“understand”, “explain”), whereas Q5c and Q5d emphasize the *application* of the concept (“use”, “making a business case”). Thus, we call the factor that consists of Q5a and Q5b “understanding” and the factor that consists of Q5c and Q5d “ability to apply.” In the subsequent analysis we use the means of the two questions within each factor. There was a significant difference (t-test, $p < 0.05$) between the pre- and post-test scores for understanding (pre-test mean 2.59, post-test mean 4.11) (Figure 4).

There was also a significant difference (t-test, alpha=0.05) between the pre- and post-test scores for ability to apply (pre-test mean 2.21, post-test mean 4.05) (Figure 5).

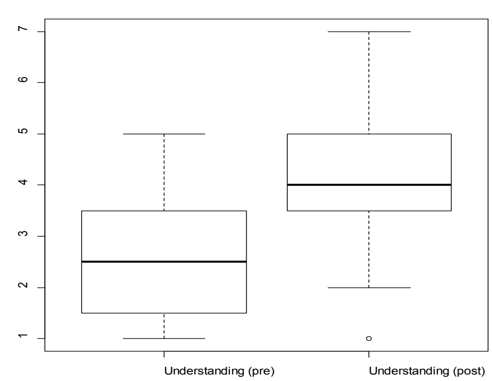

Figure 4. Difference Between Pre and Posttest Scores for “Understanding”

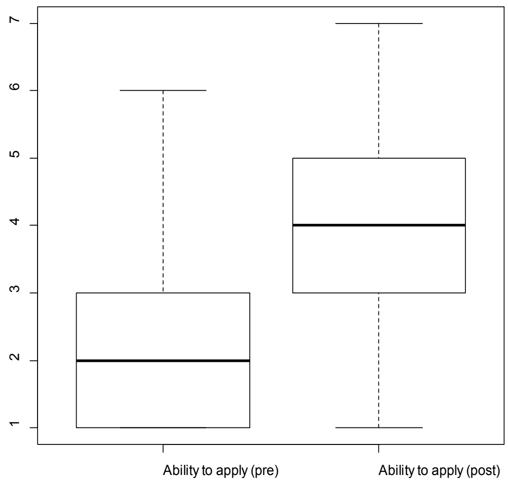

Figure 5. Difference Between Pre and Posttest Scores for "Ability to Apply"

Next, we examined the engagement (items Q6a-Q6g), perceived learning (items Q6i-Q6m) and perceived usefulness (single item Q6h). These items (Q6) were asked only on the after demonstration questionnaire. A principal components analysis on Q6a-Q6m suggested a two- or three-factor solution (five highest eigenvalues 3.936, 1.883, 1.240, 1.026, 0.965), which is also visually suggested by the scree plot of eigenvalues (Table 2). A two-factor solution explains 75.0% of the observed variance; a three-factor solution explains 81.0% of the observed variance.

The loadings of a maximum-likelihood solution with two factors suggest that the questionnaire items load as theoretically expected with loadings > 0.6 (and mostly > 0.7) with cross-loadings below 0.4 and mostly below 0.3. Question Q6h was a single item about the perceived usefulness of the demonstration.

	Factor 1	Factor 2
Q6a	.794	.294
Q6b	.857	.184
Q6c	.837	< .100
Q6d	.758	.242
Q6e	.804	.318
Q6f	.775	.429
Q6g	.797	.361
Q6i	.216	.882
Q6j	.168	.919
Q6k	.283	.654
Q6l	.318	.610
Q6m	.258	.735

Table 2. Factor Analysis for Self-Reported Engagement and Learning (Q6)

We used the mean of the items for each factor for further analysis. The descriptive information and a boxplot are shown in Table 3 and Figure 6.

	Mean	SD
Perceived Engagement	4.331	1.276
Perceived Learning	5.117	1.105
Perceived Usefulness	5.074	1.456

Table 3. Descriptive Statistics for Self-Reported Engagement, Learning and Perceived Usefulness (Q6)

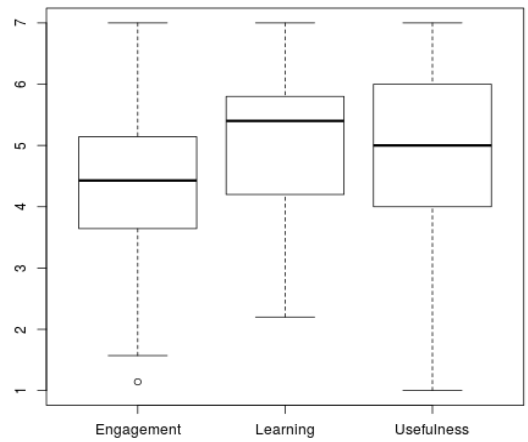

Figure 6. Boxplot for Self-Reported Engagement, Learning (SkillDev) and Perceived Usefulness (Q6)

The results indicate that the demonstration was engaging to students (mean significantly higher than scale mid-point, t-test, $p < 0.05$). Furthermore, the demonstration was perceived as improving learning (mean significantly above scale mid-point, t-test, $p < 0.05$) and useful (mean significantly above scale mid-point, t-test, alpha=0.05).

Like Q6, Q7a-Q7c were asked only on the after demonstration questionnaire. We report descriptive results in Table 4 and a boxplot in Figure 7.

Question	Mean	SD
Q7a ("discuss topics")	3.556	1.55
Q7b ("additional reading")	3.654	1.59
Q7c ("thinking about")	4.000	1.55

Table 4. Descriptive Statistics for Learning Interest (Q7a-c)

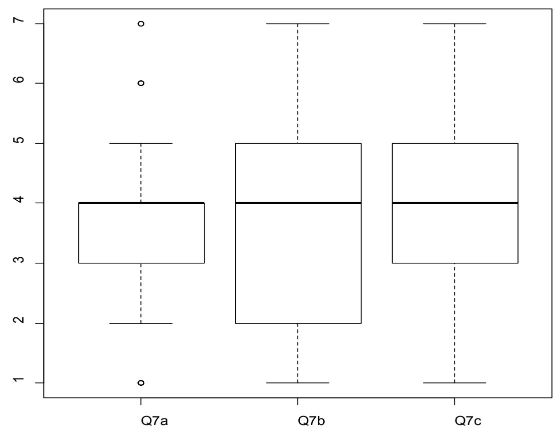

Figure 7. Boxplot for Learning Interest (Q7a-c)

These results indicate moderate learning interest (around the scale mid-point) for the first two questions, whereas the last question shows good motivation levels. T-tests show the differences between Q7a and Q7c and between Q7b and Q7c to be significant ($p < 0.01$) whereas the difference between Q7a and Q7b is not. The difference is not surprising, as the first two questions asked students whether they would take some action, whereas the last question only asked whether they would "think about" the topic.

Qualitative Results:
Questions Q1-Q4, which were used to measure improvements to understanding, were open-ended questions that required students to describe their understanding of an ERP system, its place in a company and how it can provide benefits to a company.

To analyze the responses to these questions, the improvement in understanding for each question between the pre- and post-intervention questionnaire was rated on a 3-point scale, where 0 indicated no improvement, 1 indicated some improvement, and 2 indicated significant improvement. The two investigators independently rated a set of 31 responses, which yielded a low agreement of 0.49 (Cohen's Kappa inter-rater agreement). Considering the lack of agreement, the raters discussed the rating scheme and their interpretation, and jointly rated all responses, discussing and reconciling any disagreement.

The following table presents some example instances that demonstrate improvements to understanding.

Question: "Please discuss your understanding of:"	Before	After
1: an ERP system.	It's a system that allows the organization to plan its resources.	It is a system that an organization would use for preparing, sales, billing customers, tracking inventory and ordering. Can also be used for the functions sales tracking and HR.
	An ERP system is a system the enterprises use for resource planning.	An ERP is a system used by businesses to track and record transactions along with inventory and customer information.
2: the place of an ERP system in an organization.	ERPs are very important to a company, not so much for day-to-day operations, but on a higher scale level.	ERP is essential for allowing companies to run smoothly. It ensures that companies don't sell products they don't have and allows management to see what products need to be ordered.
3: how an ERP system relates to other IS in a company.	And ERP relates to TPS systems in terms of reducing costs and creating more cost efficient systems.	An ERP system relates to most other information systems as it effects most aspects of a company in terms of efficiency of an organization.
	Don't know.	An ERP connects all other systems, connecting systems allows for business to run smoothly.
4: how an ERP system can be useful to a company.	ERP can be useful in many ways, specifically in managing risks.	ERP is useful to managers so they know when to make orders of inventory but also so that they can track customer buying. If they know the busiest buying time, management can be better prepared.
	It's a good management tool. It assists with strategic planning.	It can provide a central database that can be customized to meet the needs of the organization to perform and track tasks.

Table 5. Examples of Improvements in Understanding of an ERP System

A t-test on each question's responses showed a statistically significant improvement in understanding on all questions ($p < 0.001$). To identify a possible impact of the different sections from which students were drawn, ANOVA analyses were performed with each of Q1-Q4 as a dependent variable. The class section did not have a significant effect on the improvement in understanding for any of Q1-Q4 ($p>0.05$). The following table reports the mean and standard deviation of the improvements for each of the four aspects:

Question	Mean	SD
Q1	.5854	.6658
Q2	.4390	.6106
Q3	.2195	.5217
Q4	.3536	.5957

Table 6. Mean and SD for Increase in Understanding

5.1.2 BPM course: In the BPM course, from a total of 77 students in two course sections, 57 responses were received, for a response rate of 74%. Of these, 53 provided information on both the before and after questionnaire, 2 provided responses only on the before questionnaire, and 2 only on the after questionnaire. The same questionnaire was used as in the IS course (Figure 3) and, as in the IS course, participants were instructed not to provide a response for Q1-Q4 if their after-demonstration response was no different than their before-demonstration response. Only 18 participants provided responses to questions Q1-Q4 for both the before and after questionnaire.

Quantitative Results:
No significant differences (t-test) between the two course sections were observed for understanding (Q5a-Q5d) for either the before or after questionnaire. No significant differences in the control variables were observed between the two course sections. Thus, the subsequent analyses are conducted on the combined data set.

Questions Q5a-Q5d were averaged for analysis as all questions represent understanding of WMS. This is supported by the correlation matrix (correlations ranged from 0.63 to 0.82) and factor analysis (ML factor analysis single factor explained 69% of variance; principal component first component explained 76% of variance, only one eigenvalue > 1). Unlike with the IS course, there was no significant difference (t-test) between the sums for the before and after questionnaire (mean/before = 3.80, mean/after = 3.97) (Figure 8).

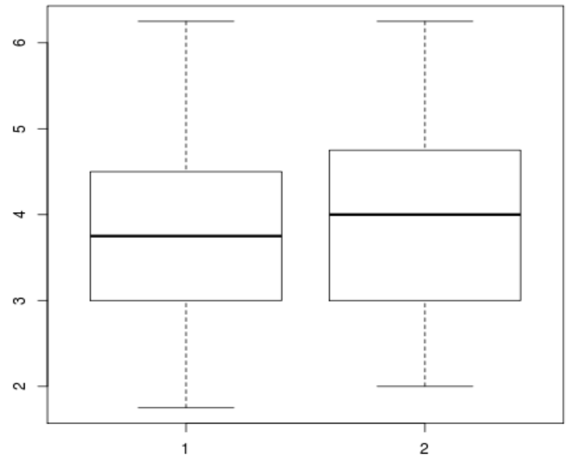

Figure 8. Pretest and Posttest results for "Understanding" of WMS (7 point scale)

Next, the engagement and perceived learning were examined (Q6a-m). These questions were asked only on the after demonstration questionnaire. An ML factor analysis confirmed the dimensionality of the instrument. A two factor solution explained 76.8% of variance in questions Q6a-Q6m; all items loaded on intended factors > 0.7 and cross-loaded generally < 0.5.

	Factor 1	Factor 2
Q6a	0.764	0.421
Q6b	0.795	0.450
Q6c	0.728	0.535
Q6d	0.736	0.506
Q6e	0.739	0.404
Q6f	0.918	0.185
Q6g	0.733	0.391
Q6i	0.359	0.744
Q6j	0.446	0.713
Q6k	0.303	0.852
Q6l	0.342	0.851
Q6m	0.336	0.753

Table 7. Factor Analysis for Self-Reported Engagement and Learning (Q6)

We therefore report mean scores of items for engagement and learning. Question Q6h was a single item about the perceived usefulness of the demonstration. The descriptive information and a boxplot are shown in Table 8 and Figure 9.

	Mean	SD
Perceived Engagement (Q6a-g)	3.33	1.39
Perceived Learning (Q6i-m)	4.04	1.29
Perceived Usefulness (Q6h)	4.26	1.58

Table 8. Descriptive Statistics for Self-Reported Engagement, Learning and Perceived Usefulness

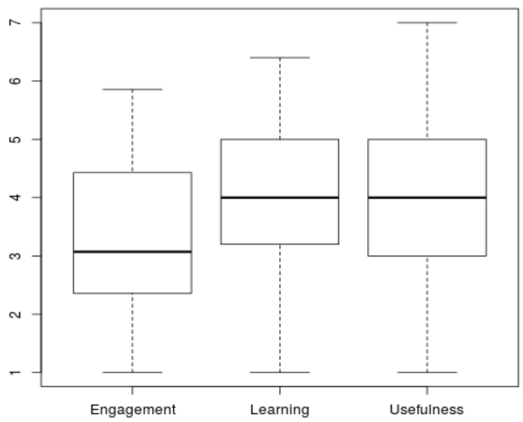

Figure 9. Boxplot for Self-Reported Engagement, Learning (SkillDev), and Perceived Usefulness

Contrary to the IS course, the results indicate that the demonstration was not engaging to students (mean less than scale mid-point, but not significant as per t-test). However, like the IS course, the demonstration was perceived as improving learning (mean significantly above scale mid-point, $p<0.01$) and useful (mean significantly above scale mid-point, $p<0.01$). The result with respect to engagement is not surprising as the demonstration required students to watch for 15 minutes rather than interacting with the system themselves in a true experiential way, as originally intended, and as with the IS course, the results with respect to learning and usefulness are encouraging, especially given the low level of student engagement. We believe that this can be significantly increased once true experiential interaction with the system is available.

The questions on learning interest (Q7a-Q7c) were only on the after demonstration questionnaire. The descriptive information and a boxplot are shown in Table 9 and Figure 10.

Question	Mean	SD
Q7a (“discuss topics”)	3.40	1.55
Q7b (“additional reading”)	3.28	1.77
Q7c (“thinking about”)	4.36	1.64

Table 9. Descriptive results for Learning Interest

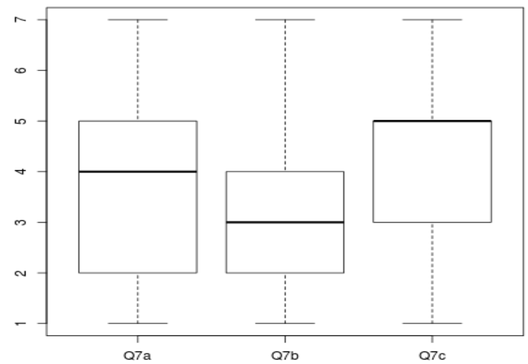

Figure 10. Boxplot for Learning Interest

As with the IS course, these results (Table 9) indicate moderate motivation levels (around the scale mid-point) for the first two questions, whereas the last questions shows good motivation levels. T-tests show the differences between Q7a and Q7c and between Q7b and Q7c to be significant ($p < 0.01$) whereas the difference between Q7a and Q7b is not. Again, this is not surprising as questions 7a and 7b require the students to discuss or do additional reading, whereas question 7c only requires the students to think about the topic.

Qualitative Results:
Only 18 responses were received with answers for understanding (Q1-Q4) differing between the before-demonstration and after-demonstration questionnaire. The answers were examined by one of the investigators to identify improvements in understanding and each question was rated on a 3-point scale, where 0 indicated no improvement, 1 indicated some improvement and 2 indicated significant improvement.

Of the 18 respondents, only 12 showed improvements in understanding and even fewer showed a marked improvement across all four questions. The following table presents some example instances that demonstrate improvements to understanding.

Question: “Please discuss your understanding of:”	Before	After
1: a YAWL system	YAWL is a useful system which can describe work processes of a company or an organization. It is consist of starting and ending point and the main process nods of the used system.	It is combined with organization management and data management to help the company to create a better resource management.
	The YAWL system	YAWL is a system,

	is one in which was designed to help users/organizations design and implement workflows into their businesses.	with the support of other IT systems that aims to help organizations create, improve, or effect workflows within a given organization.
2: the place of a YAWL system in an organization.	To help the company improve the overall system and processes and how they relate to each other.	The YAWL system helps to improve workflows within a company, with the info from other IT systems within the company.
	YAWL belongs to the R+D part of the company to improve the processes.	YAWL works alongside any process in a company can automate it.
3: how a YAWL system relates to other IS in a company.	Don't know	After the demo I could see how YAWL only manages the flow of work in a process and allows the users to interact with system. Other info system keeps track of the order whether it has been invoiced or not, or what are the customer details and warehouse locations. Basically the other info systems act as a database for YAWL.
	Sometimes in a company, data and resources come together in many different aspects to improve the overall efficiency of a given company.	YAWL uses information from other systems and resources within an organization in order to create the best potential workflow within a company.
4: how a YAWL system can be useful to a company.	YAWL can be useful in a company that wishes to model their current system of processes, improve them, or even create new ones.	It can help to improve overall efficiency of a company, with help from exogenous and exogenous information.
	The YAWL system can be used to improve processes efficiency by testing out different ways to complete a process and studying where there improvements could be made.	It can be used to bring information together and assign people to perform tasks for different departments.

Table 10. Examples of Improvements in Understanding of YAWL

5.2 Summary of Results

The results can be summarized as generally in support of our hypotheses and expectations as to the value of experiential learning for the Odoo system. Table 11 shows that, with the exception of student interest in further learning, significant learning outcomes have been achieved for the IS course. However, for the BPM course the results are a little different. There was a significant increase in student learning, but there was no significant increase in student engagement, student interest in learning, nor student understanding. However, student responses to the four qualitative understanding questions (Q1-4) did indicate improvements in understanding.

In addition to the data in Table 11, we note that students in both courses also perceive the experiential learning aspect as useful (Q6h). While we expected learning interest (Q7a to Q7c) to show the same results, only Q7c (think about the topic in the future) was significantly higher than the scale mean, so that we do not consider H4 as supported for either the IS or the BPM course.

Hypothesis		Support	
		IS Course	BPM Course
H1	Increase student understanding (pretest-posttest)	Yes (Q1-Q4), Yes (Q5a-Q5d)	Yes* (Q1-Q4), No (Q5a-Q5d)
H2	Increase student engagement (retrospective self-report)	Yes (Q6a-Q6g)	No (Q6a-Q6g)
H3	Increase student learning (retrospective self-report)	Yes (Q6i-Q6m)	Yes (Q6i-Q6m)
H4	Increase student interest in learning (retrospective self-report)	No (Q7a-Q7c)	No (Q7a-Q7c)

* No tests for statistical significance were performed. The before and after demonstration questions were examined by the researcher.

Table 11. Summary of Hypotheses

6. DISCUSSION

This study reports on the benefits of experiential learning to teach undergraduate business students about enterprise systems and business process automation. We measured changes in pedagogical outcomes resulting from an open-source ERP system, Odoo, using an experiential, hands-on exercise. We found increases in student understanding, engagement, and learning for the IS course. We found an increase in student learning for the BPM course; however, we did not find an increase in student understanding or engagement. This may be attributed to the lack of true experiential interaction with the Odoo-YAWL integration, and instead relying on an instructor-led demonstration of the integration between the Odoo and YAWL systems. Additionally, for both courses we did not find an increase in student interest in learning. Students showed a good level of interest in thinking about ERP systems in the future, but not in discussing or doing additional readings on the subject. Since students received limited hands-on experience with the ERP system in this study, perhaps more exposure to the system would help raise student interest in learning. Finally, students in both courses found the hands-on activities useful.

The results of this study suggest that the Odoo ERP system, and similar open-source systems, may be a suitable ERP systems for integration into the classroom. It is hoped that increased knowledge of such freely-available ERP systems will help to reduce one of the main entry barriers to integrating ERP systems into the curriculum, that of cost. Another benefit of using an open source enterprise system such as Odoo is that the configuration of the ERP system can be freely made available to other interested academic institutions. With almost 100 institutions currently using the online supported Odoo, but with only one academic study found in the literature discussing its use in the classroom, this paper makes a contribution by reporting on the learning outcomes associated with the integration of Odoo into an IS course.

The intended use of Odoo in our context is as a supplement to traditional lecture-based instruction, rather than as a replacement. This means that the learning does not take place solely based on the experiential component. While we acknowledge that approximately 1 hour of experiential learning is relatively short, given the extensive capabilities of enterprise systems, even this brief experience had a significant positive effect on learning. Moreover, given that typical courses provide only about 24 classes (30 hours) of instructional time for a semester, providing one class of experiential time to a single topic in a broad introductory course is often as much as is feasible.

Furthermore, the intended use as a supplement to traditional teaching methods that requires little up-front investment of money, time and other resources makes the Odoo system a better choice than commercial systems, which, while perhaps free of direct monetary cost, may require significant vendor-delivered training or setup time. On the other hand, we acknowledge that popular commercial system may generate more student interest, due to students being able to advertise this experience on their CV.

7. LIMITATIONS

Due to the nature of the introduction into the existing course, the experiential learning was limited in scope to a single exercise for the ERP system. While our results were significant and our overall assessment of the experiential learning introduction positive, we caution the reader that this limitation naturally limits the generalizability of the conclusions drawn from this study.

Because the motivation for this research is the inability, for various reasons, of using commercial ERP systems, we could not in this study make a direct comparison between the effects on learning outcomes of the Odoo system and, e.g. the SAP ERP system. However, our results indicate improved learning outcomes that make the inclusion of the Odoo system useful from a pedagogical perspective.

A limitation of the study, due to the short experiential time of approximately 1 hour, is the fact that we were unable to explore the long-term effects of experiential learning. Beard and Wilson (2006) suggest that experiential learning is a "more effective and long-lasting form of learning." Hence, longitudinal studies would be useful for investigating the long-term learning outcomes. This was not possible in our situation as we were not the course instructors and thus did not have the ability to follow up on the experiential component later in the semester.

The context of this research was, by necessity, an introductory IS course. Other courses, such as accounting information systems, or upper-level information systems courses, might benefit from experiential learning of ERP system concepts in different ways. However, the study was limited by the courses being offered at the faculty, and the access to courses to the authors for introducing the system.

8. CONTRIBUTIONS AND FUTURE RESEARCH

In summary, this study makes two contributions. First, we have demonstrated the benefits of experiential learning, even with a brief time period for the experiential aspect. Second, and more important to the practice of teaching enterprise systems, our study shows that open-source systems, while not as feature-rich as their commercial counterparts, can be used easily as a supplement to traditional pedagogy that requires neither an upfront commitment of resources, nor a top-down introduction to the wider faculty curriculum, but can be used by instructors on an ad-hoc and per course basis. In fact, Ask et al. (2008) call for more light-weight demonstration environments and our effort with Odoo can be seen as answering their call. Thus, our overall contribution is the demonstration that educators need not shy away from experiential learning when faced with the obstacles that large-scale commercial ERP systems may present, but can instead choose a "bottom-up" approach of easily integrating ERP systems into the curriculum to benefit student learning.

Future studies might consider extending the use of the freely-available Odoo system to a fully integrated blended approach throughout the course, based on conceptual learning in the classroom and hands-on learning in the lab. In addition, the Odoo system could be integrated into other courses, such as accounting or operations management.

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10. REFERENCES

Alavi, M. (1994). Computer-Mediated Collaborative Learning: An Empirical Evaluation. *MIS Quarterly,* 18(2), 159-174.

Alshare, K. & Lane, P. (2011). Predicting Student-Perceived Learning Outcomes and Satisfaction in ERP Courses: An Empirical Investigation. *Communications of the Association for Information Systems*, 28.

Auster, E. & Wylie, K. (2006). Creating Active Learning in the Classroom: A Systematic Approach. *Journal of Management Education,* 30(2), 333-353.

Ayyagari, R. (2011). Hands-on ERP Learning: Using OpenERP®, an Alternative to SAP®. *Journal of Information Systems Education,* 22(2), 123-133.

Ask, U., Juell-Skielse, G., Magnusson, J., Olsen, D., & Päivärinta, T. (2008). Enterprise Systems as Vehicles of Pedagogic Innovation – Enterprise System Inclusion in Higher Education. *Proceedings of the 5th International Conference on Enterprise Systems, Accounting and Logistics (ICESAL*), Crete Island, Greece.

Beard, C. & Wilson, J. (2006). *Experiential Learning: A Best Practice Handbook for Educators and Trainers, 2 ed*. Philadelphia: Kogan Page Limited.

Benton, S. (1980). The Use of Self-reported Grade Point Averages in Research Studies. *Southern Journal of Educational Research,* 14(2), 145-150.

Bok, D. (1986). *Higher Learning*. Boston: Harvard Business Press.

Bostrom, R., Olfman, L., & Sein, M. (1990). The Importance of Learning Style in End-user Training. *MIS Quarterly,* 14(1), 101-119.

Bradford, M., Vijayaraman, B., & 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.

Cassady, J. (2001). Self-Reported GPA and SAT: A Methodological Note. *Practical Assessment, Research & Evaluation*, 7(12).

Collopy, F. (1996). Biases in Retrospective Self-Reports of Time Use: An Empirical Study of Computer Users. *Management Science,* 42(5), 758-767.

Daun, C., Theling, T., & Loos, P. (2006). Teaching Enterprise Systems in a Blended Learning Environment. *Proceedings of the 12th Americas Conference on Information Systems*.

Davis, C. & 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.

Delsart, Y. & Van Nieuwenhuysen, C. (2011). *OpenERP Evaluation with SAP as Reference*. Belgium: Tiny SPRL.

Evermann, J. (2013). Developing a Realistic Workflow Management Environment for Teaching: An Interface from YAWL to OpenERP. *Proceedings of the YAWL User Group Symposium*, St. Augustin, Germany, June 7th. CEUR Workshop Proceedings, Vol. 982. Online at: http://ceur-ws.org/Vol-982/YAWL2013-Paper02.pdf

Hawking, P. & McCarthy, B. (2004). Integrating E-learning Content into Enterprise Resource Planning (ERP) Curriculum. *Issues in Information Science and Information,* 23(30).

Hiltz, S. (1988). *Learning in a Virtual Classroom. Volume 1 of A Virtual Classroom on EIES: Final Evaluation Report*, New Jersey Institute of Technology, Newark, NJ.

Hopkins, J. & Foster, S. (2011). Supply Chain ERP Simulation: A Unique Learning Experience. *Proceedings of the 17th Americas Conference on Information Systems*.

Jacques, R., Preece, J., & Carey, J. (1995). Engagement as a Design Concept for Hypermedia. *Canadian Journal of Educational Communications,* (Spring), 49-59.

Kim, Y., Hsu, J., & Stern, M. (2006). An Update on the IS/IT Skills Gap. *Journal of Information Systems Education*, 17(4), 395-402.

Kolb, D. (1984). *Experiential Learning*. Upper Saddle River: Prentice Hall.

Kolb, A. & Kolb, D. (2005). Learning Styles and Learning Spaces: Enhancing Experiential Learning in Higher Education. *Academy of Management Learning & Education*, 4(2), 193-212.

McCarthy, B. & Hawking, P. (2004). ERP E-Learning: If You Can't Take Mohammed to the Classroom, Take the Classroom to Mohammed. *Proceedings of the 10th Americas Conference on Information Systems*.

Nelson, R. & Millet, I. (2001). A Foundation Course in ERP and Business Processes: Rationale, Design, and Educational Outcomes. *Proceedings of the 10th Americas Conference on Information Systems*.

Noguera, J. & Watson, E. (1999). Effectiveness of Using Enterprise Systems to Teach Process-Centered Concepts in Business Education. *Proceedings of the 8th Americas Conference on Information Systems*.

Odoo (n.d.). *Educational Program*. Retrieved from https://www.odoo.com/page/education-program

Rienzo, T. & Han, B. (2011). Does ERP Hands-On Experience Help Students Learning Business Process Concepts?. *Decision Sciences Journal of Innovative Education,* 9(2), 177-207.

Rosemann, M & Watson, E. (2002). Special Issue on the AMCIS 2001 Workshops: Integrating Enterprise Systems in the University Curriculum. *Communications of the Association for Information Systems*, 8.

Sager, J., Mensching, J., Corbitt, G., & Connolly, J. (2006). Market Power of ERP Education - An Investigative Analysis. *Journal of Information Systems Education*, 17(2), 728-755.

Straub, D., Limayem, M., & Karahanna, E. (1995). Measuring System Usage: Implications for IS Theory Testing. *Management Science*, 41(8), 1328-1342.

Strong, D., Fedorowicz, J., Sager, J., Stewart, G., & Watson, E. (2006). Teaching with Enterprise Systems. *Communications of the Association for Information Systems*, 17, 728-755.

Tyran, C. & Springer, M. (2012). Learning and Team Attributes in an Enterprise Systems Simulation. *Proceedings of the 18th Americas Conference on Information Systems*.

Wagner, W., Najdawi, M., & Otto, J. (2000). An Empirical Investigation into the Impact of ERP Training on Cross-Functional Education. *Journal of the Academy of Business Education (Proceedings Issue)*.

Watson, E. & Schneider, H. (1999). Using ERP Systems in Education. *Communications of the Association for Information Systems*, 1.

Winkelmann, A. & Leyh, C. (2010). Teaching ERP Systems: A Multi-perspective View on the ERP System Market. *Journal of Information Systems Education*, 21(2), 233-240.

Webster, J. & Ahuja, J. (2006). Enhancing the Design of Web-navigation Systems: The Influence of User Disorientation on Engagement and Performance. *MIS Quarterly*, 30(3), 661-678.

Webster, J. & Ho, H. (1997). Audience Engagement in Multimedia Presentations. *The DATABASE on Advances in Information Systems*, 28(2), 63-77.

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