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ABSTRACT

Logistics organizations' training programs face many challenges. These challenges, such as cost and consistency in training, are magnified if the organization is geographically dispersed and a training program must be implemented globally. To address these issues, a training model was developed and tested in a classroom environment during spring 2013 in three university logistics courses. Delivered via both a traditional and a distance learning format, the training model used VMware View® clients configured to run the popular SAP® Enterprise Resource Planning (ERP) system and SAP's Datango® software. Testing revealed that students were able to grasp the skills necessary to use the training model with very little direction from the instructor. There were no differences in difficulties noted during the semester between traditional and distance education students. The model's initial success suggests the potential for ease in adaptation in geographically dispersed logistics environments.

Keywords

Virtualization, Computer Based Training, SAP, ERP, Logistics Training

INTRODUCTION

Global optimization of supply chains requires trained workers able to adapt to changes in both their internal and external environments. Therefore, members of supply chains need to find ways to ensure their workers are trained not only on logistics processes. They also need to find ways to efficiently train workers on the use of logistics software packages they utilize, since information technology is often a driver of change organizations employ to provide for efficient and effective supply chain operations. Furthermore, supply chain organizations need to ensure training costs are minimized, because research has shown that globally optimized supply chains provide effective use of limited resources, while costs are minimized (Arayapan and Warunyuwong, 2010).

Just as there are many logistics processes workers need to understand, there are many logistics software packages they need to be able to master as well. These software packages include yard management software, procurement and vendor management software, warehouse management software, and many other specialized software packages. While organizations within supply chains employ a variety of software to ensure effective supply chain operations, they often employ Enterprise Resource Planning (ERP) since it provides significant benefits, such as increased supply chain visibility and integration of organizations' information resources. The most widely utilized ERP software package employed by members of supply chains is SAP® ERP.

Although SAP® is widely used, it remains one of the most difficult software packages to learn (Klaus, Rosemann and Gable, 2000). A full SAP® implementation covers the majority of an organization's information system needs. Each SAP® module is vast in its processing capabilities where various screens, processing features, and capabilities are designed on what SAP® emphasizes are "best practices". Although the SAP® client user interface can operate on various platforms, such as Windows, it does not follow common Windows design standards. For example, the "Enter" key in SAP® is a check mark icon. In Windows, a check mark is usually associated with the selection of an object. Users that are accustomed to using Windows-based graphical user interfaces may find it difficult to adjust to the differences in design.

Further complicating the learning of SAP® is its adaptability to various organizations. SAP® is customizable to meet the organization's needs. Graphical user interfaces can be developed using SAP's programing language, ABAP, or Java. In addition, there are many software development tools that are available from SAP® that allow organizations to develop customized user interfaces permitting workers and customers to interact with SAP®. This ease of customization further complicates the training process, since workers that may have mastered a graphical user interface at one organization may not fully understand the graphical user interface at another organization. Due to the complexity of SAP® and its differences in customization, organizations are forced to spend countless hours and financial resources ensuring their employees are trained on the use of SAP®. In many instances, training is accomplished through on the job training with one-on-one instruction or provided in a classroom setting within the organization or at external training centers. Each of these approaches interferes with daily operations while workers undergo training. Therefore, supply chain organizations need to utilize training methods that allow them to train workers on logistics processes and software that don't impact daily operations and keep training cost to a minimum.

BACKGROUND

The rapid expansion of organization's implementing SAP® worldwide has led to a shortage of skilled SAP® users and technicians (Khoury, Jenab and Staub, 2012). Academic institutions understand the need to ensure that logistics / supply chain management or information systems graduates possess hands-on skills in ERP that integrate common business and logistics process. Studies have pointed out that students that have been exposed to common business and logistics processes within an ERP framework are more equipped to handle similar situations they are likely to encounter on the job (Sarfaraz, D'Souzab and Jenab, 2012). Exposure to these large scale ERP systems is more effective than traditional textbook exposure (Fedorowicz et al., 2004), since students are exposed to a real software environment. In order to address the need for trained SAP® users and technicians, SAP® implemented the SAP® University Alliance (SAP® UA) program at a number of colleges and universities. Each UA is assisted by a regional SAP® UA center tasked with providing support to universities with things such as the setup of SAP® software implementation and training of faculty within each university. Training is offered free of charge to authorized SAP® UA faculty through both face-to-face classes and webinars. SAP® UA faculty members are responsible for their own travel and other expenses.

To meet SAP's objectives, trained SAP® UA faculty members provide a variety of courses that are often integrated within logistics and supply chain management programs of study. Each integrated course utilizes a live SAP® system housed by the assigned SAP® UA regional center. Since each instance of SAP® utilization in a course must be setup by the assigned regional center in advance, requests for SAP® training modules and student user IDs must be submitted in advance to allow for sufficient time for setup. Once an account is created and users established by the regional center, faculty provide students with the login data and the SAP® client software needed to access the ERP system. Although the download and setup of the SAP® client is time consuming, it is a necessary task that enables students to access the ERP software. Both the SAP® client and the ERP software are available free of charge. The only cost SAP® UAs are faced with is the annual membership fee and travel expenses for faculty attending training at the regional centers.

Although the SAP® UA program is helping address the shortage of skilled SAP® users and technicians, it cannot meet organizations' continued training needs (Williams, 2011). Since SAP® is vast and difficult to master in a few short university logistics and supply chain management classes, organizations must continue to offer on the job training on the use and management of SAP® and the logistics processes it affects. This need for continued training has led to some difficulties for organizations, such as finding available time to send workers to training centers (Kumar, Maheshwari and Kumar, 2003). Another problem they face is how to conduct training on live ERP systems without adding undue risk to organizational processes. It is undeniable that such risk should be avoided when possible, since a simple input error can create significant problems for the organization and can lead to customers establishing negative perceptions of the organization.

Since these apparent difficulties in implementing ERP and logistics process training on live systems within organizations exist, an approach is needed that allows workers to learn on their own free time using an ERP system that is separate from the organization's ERP system, preventing users from being able to interfere with the organization's actual system or its stored data. This approach would need to be flexible enough to allow organizations to be able to add additional training materials and software beyond those offered by SAP®, since organizations often employ software from multiple vendors and perform logistics tasks that may not be integrated in the organizations' ERP system. It must also be available at any time and from anywhere an Internet connection is available. One approach was developed and tested at a university in the United States in the spring of 2013 in three logistics courses. The "ERP Systems for Distributors" and the "Transportation for Logistics" courses were on online sections. The third course, "Transportation for Logistics", was on campus section. Students in all three courses were undergraduate logistics students that completed an introduction to logistics course as a prerequisite to these courses. In all three courses students had little to no experience with ERPs or SAP®. They all had a basic

understanding of logistics processes and were competent in the use of a personal computer. None of the students had any experience with the new training model or the virtualization software used to develop the model. The same selected SAP® content and logistics related labs were covered in all three courses, since "Transportation for Logistics" related labs parallel some of the SAP® ERP labs that are normally taught in the "ERP for Distributors" course. This paper will describe the training model's design, its initial success and difficulties in implementation, and its potential for application in organizations that utilize SAP® and other common supply chain software.

TRAINING MODEL

The training model developed and tested within the three logistics course utilized VMware View® client software. A VMware® server was setup and students were instructed on how to download and setup the VMware View® client. Since the VMware View® client is the only software students were required to install on their laptops, the students' initial setup of the new training model was accomplished within a 50 minute class session. The only issue noted during this initial setup process was the difference in the steps required to install the VMware View® client on non-Windows® based machines. Students that had Apple® computers were provided with a different set of instructions on how to install VMware View®.

The VMware® server allowed the VMware View® client to connect through the students' standard login and password used to access other information technology services at the university. After the installation of the VMware View® client, students were given the connection path that allowed them to connect to the VMware® server. Once the web-based connection is made, students are prompted to enter their standard login ID and password they use for other information technology services, unless they selected the option to automatically login using their credentials when launching VMware View®.

Once a student has been authenticated and given access to the VMware® server, a windows operating system is automatically provided to them with all of the software they need to complete SAP® and other assigned labs in one self-contained system. Since each image that is provided to a student is an exact replica of the others, students are all using identical screens, labs and tools. Since each self-contained image is a separate virtual machine, students cannot negatively affect others' images by accidently installing viruses or making changes to their Windows environment. Should student completely render their image of the virtual machine useless, the image can easily be retrieved with the help of the instructor and the department's technology support personnel. Replacing the corrupted image is quickly accomplished without student effort. This allows the student to concentrate on learning the actual software a faculty member wants them to learn given the student doesn't have to spend time trying to install and troubleshoot a variety of software used in a course. An additional benefit is that conflicts between software already installed on a student's personal computer and software required for a course is avoided, as all of the software used in the class is housed in the virtual machine that was setup and tested by the instructor and the department's technical support personnel.

This virtual machine approach to providing software to students provides several additional benefits. One of these benefits is that students only need one small VMware View® client application to gain access to a large variety of software and tools. This reduces the time and effort spent preparing for the use of software within a classroom environment and other training environments that may be used within organizations, since this approach can easily be implemented in various types of organizations. Another benefit of this approach to software training is its ability to reach students worldwide, as long as a reliable high speed Internet connection exists between the student and the virtual machine. Also, this approach is useful for conducting other types of computer-based training besides SAP® software training, since each virtual machine is self-contained with the software and tools the instructor and technology support personnel provide to the student. Therefore, this approach provides many potential training benefits to various organizations, besides those organizations that employ SAP® software.

This new approach to SAP® training within academic programs ensures each VMware® connection provides students access to a computer image that contains the SAP® client software, along with other tools the instructor feels are necessary for the course. To gain access to the SAP® ERP server that contains the ERP's core data, users were issued an additional SAP® login ID and temporary password that must be changed during the initial login. Other additional SAP® parameters were provided to students that allowed them to connect to the correct SAP® system at the regional center. All of the data within the ERP system was housed and backed-up at the UA regional center.

Students were also provided a copy of the SAP® Supply Chain Management training module in PDF format, developed by SAP® UA faculty and provided free of charge. The Supply Chain Management training module consists of a series of SAP® labs that utilize core data within a live ERP system housed at the SAP® UA regional center. Each of the individual labs contained step-by-step instructions on how to complete a task with many screenshots of the tasks as they are performed. Furthermore, each lab provided an explanation of the steps and tasks that must be completed. Students were also asked to complete review questions to ensure they understood the concepts and tasks within each lab.

Since the Supply Chain Management training module is large and takes many weeks to complete in a classroom setting, certain labs related to logistics tasks that were normally taught in the courses were selected, assigned, and completed over a 14-week semester. The SAP® labs allowed students to navigate SAP® ERP and to perform a variety of SAP® transactions such as placing orders, making payments, and analyzing logistics documents and processes often performed in organizations. Each of the individual labs could be completed within a 50 minute class session. Furthermore, in most cases, the labs build on one another.

In addition to the SAP® client, users were provided access to the Datango® software via the VMware View® client. The Datango® software is a screen capture and authoring software that allows an organization to record the steps performed on a computer, which can later be played back in interactive web pages created by the software. Users can first watch the steps being performed and then complete the same steps in a practice mode or in a test mode feature within the Datango® software. Since students' use of the software is not recorded in the system, they can complete the test mode versions of the labs without fear of failing or the pressure usually associated with standard hands-on exams. Furthermore, the Datango® software also allows students to get help on a step if they get stuck, by simply clicking on a help option when they perform a wrong step. Since each step can be performed over and over without being graded, students can utilize the Datango® software for additional practice on the steps performed within the SAP® labs.

The SAP® UA provided three separate Datango® developed series of SAP® training labs as part of the Supply Chain Management training module. Each of the series contained small individual labs that mirror the labs in the Supply Chain Management training module. Students were instructed to complete both the assigned Supply Chain Management SAP® labs and the assigned Datango® recorded labs. Since the SAP® labs utilized a live system, students were instructed to complete the Datango® labs first since user errors will not prevent them from continuing with the remainder of the labs, because a Datango® recorded lab can be repeated many times without affecting other Datango® labs. This flexibility is not possible in the SAP® labs, since most SAP® labs depend on previous labs. Furthermore, input errors in the SAP® labs that are not detected can lead to errors in future labs and result in the inability to complete some labs. Therefore, students must exercise extreme care when working on each SAP® lab within the live SAP® ERP system.

FINDINGS

Step up and deployment of the training model did not result in any notable difficulties for the instructor or the information support staff tasked with setting up the virtual machines. Student lab and exam scores revealed that students were able to grasp the skills necessary to use the training model with very little direction from the instructor in both the online and on campus classes. Moreover, there were no differences in lab difficulties that were noted during the semester between the traditional and distance education students. On campus students and distance education students were both able to solve difficult labs and recover from errors with little to no help from the instructor.

A review of test and lab scores used to assess the learning outcomes in both the online and campus courses revealed that students in both groups performed well on the assigned SAP® and the Datango® labs. In both groups, as whole, students scored as expected on their exams and labs. The majority of the students performed well regardless of the mode of delivery, despite the instructor's expectation that online students would score slightly lower than on campus students since on campus students would be able to get more assistance from their instructor and other students.

Both mid-course and end-of-course anonymous feedback from students resulted in numerous positive comments about the training model. Students in both on campus and distance education formats noted they were pleased with the lab setup and take down and were also pleased with the constant lab availability throughout the semester, since labs could be accessed through any high speed Internet connection. Additional student comments about the training model included comments such as "I learned a lot from the labs in this course because I was able to take the Datango® labs as many times as I wanted to and not have it affect my grade", "it was nice not having to worry about having to go to the lab to get my labs done", "I liked how we didn't have to install a lot of software on our computers", "it only took one class period to setup all the software we used for the whole semester", and "I wish all of my classes had computer labs that were setup like this".

The instructor determined that initial setup of the labs was significantly faster than the previous semester. In the previous semester, students installed SAP® client software on their laptops. The previous method resulted in more difficulties for students, due to the reasons noted above. Lab setup using the new approach was completed before their courses started. Students were only required to install the VMware View® client that took approximately 30 minutes of class time. The previous approach required between two to three class sessions, since students were required to install additional software on their personal computers. Further complicating the process was the variety of software conflicts that were encountered during the previous process. None of these issues occurred during the study period.

CONCLUSION

As noted in the findings above, the model produced better than expected student exam and lab scores in the distance education courses, despite the instructor's expectation that online students would score slightly lower for the reasons mentioned above. Since the same materials, labs, and training model were used by both groups of students and no notable difference in student performance was noted between the two groups, this finding suggests that when it comes to software training the training model was able to neutralize the differences in learning ability between both groups. Further studies that utilize the training model on larger populations and other software would help validate this theory.

The significant class time savings noted in this study indicates that the training model can reduce initial lab setup time by as much two-thirds. Since class time is often limited, the ability to reduce wasted time spent setting up labs during normal class time is a welcome characteristic of this model. Although the SAP® client software is large and requires time to install and setup, instructors or organizations who adopt this training model may have a variety of software they may want to conduct training on, which could easily exceed the time it takes to setup the SAP® client and Datango® software used in this study. This model's ability to allow instructors and logistics firms that adopt it to be able to setup the training software outside of the class is an added benefit, since it saves critical classroom time.

Also, problems encountered during labs were often quickly solved by students in both groups. This is a significant finding, because students in distance education courses will need to be able to resolve problems often without the help of their instructor. The model's initial success suggests the potential for ease in adaptation in geographically dispersed logistics environments, since one of the most popular software packages used by logistics organizations was successfully used in three university courses during this study. Therefore, logistics organizations that implement this model or similar training models for their training needs can create virtual machines with all of the software they want their employees to learn without interfering with their production PCs and servers, since the virtual machines operate independently in their own enclosed environment. Although SAP® is popular among logistics firms, it is not the only logistics related software that can be taught using this model. Other logistics related software, such as those mentioned above, can be taught using this training model because it allows any software that can be installed on a computer to be installed in a virtual machine and made available anywhere in the world as long as an Internet connection is available.

The mobility of this approach creates an additional benefit for global organizations and mobile workers that need access to training materials and software. Although these findings appear promising, additional studies are needed to determine the viability of other types of computer-based training using this model. Other studies should also test the effectiveness of the model outside of the classroom. Lastly, other studies should attempt to determine the long-term retention of concepts and skills taught using the model and compare those findings to traditional classroom software-based training models.

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