INTEGRATING ERP SYSTEMS FOR EXPERIENTIAL BUSINESS EDUCATION: A CROSS-DISCIPLINARY LEARNING FRAMEWORK

Wapee Manopiniwes[1] and Martin Tutko*

[1]Department of Industrial Engineering, Faculty of Engineering, Chiang Mai University
**International College of Digital Innovation, Chiang Mai University*

Abstract

Purpose: This objective of this project is to explore how a comprehensive learning environment, combining a practice enterprise model, an ERP system, and AI techniques, enhances learning outcomes and the reasons behind it, particularly for students in the field of industrial engineering.

Design/ methodology/ approach: In this research, we begin by examining related research on the lecture-based model and IT-focused industrial engineering learning environments using Bloom's taxonomy. Next, we present a case study that compares the lecture-based model with an ERP-based business and AI techniques learning environment. We then analyze the learning outcomes and discuss the underlying reasons. Finally, we conclude with a discussion of the limitations, contributions, and recommendations for future research.

Findings: We use Bloom, Taxonomy as a framework to validate our research questions as well as to guide the interpretation of our results, following the three domains of learning: cognitive domain, affective domain, and psychomotor domain.

Originality/value: Efforts to deliver practical learning experiences have been made for decades, but each approach has its shortcomings. The practice enterprise model, for instance, requires the tools and dynamism that can be provided by information technology (IT). Meanwhile, ERP systems and simulations lack a comprehensive perspective. The combination of IT and human-to-human interaction in this project produces more effective learning outcomes than either technology or face-to-face interaction alone.

Keywords: Enterprise Resource Planning, Teaching and Learning Development, Simulation-Scenario Based Learning

Introduction

Criticism has been levelled at Industrial Engineering education for its theoretical nature and perceived lack of connection to the realities of the engineering profession. It has become increasingly evident that business management involves a more complex set of skills, including both disciplinary expertise and soft skills such as communication, teamwork, ethics, and social responsibility.

However, traditional classroom settings may not provide the ideal environment for acquiring these skills. A collaborative learning approach, involving both teachers and students, is needed to foster imagination and natural experiences. To this end, there are several alternative methods that can provide students with practical learning experiences. For example, business skills laboratories and practice enterprise models simulate real workplaces, allowing students to participate in role-play scenarios and make day-to-day business decisions in a risk-free environment. Enterprise resource planning (ERP) systems can help students learn about business processes, while business simulations offer dynamic learning situations.

The aim of this research is to investigate the impact and underlying reasons behind the effectiveness of a comprehensive learning environment, which includes a practice enterprise model, an ERP system, and AI techniques, in enhancing learning outcomes. Generative and discriminative AI approaches are integrated into teaching and learning management for content creation, personalized learning, simulation-scenario based learning, performance assessment and feedback, and adaptive learning. We conducted a year-long case analysis, comparing the learning outcomes of the comprehensive learning environment with those of student groups who experienced the lecture-based model.

Efforts to deliver practical learning experiences have been made for decades, but each approach has its shortcomings. The practice enterprise model, for instance, requires the tools and dynamism that can be provided by information technology (IT). Meanwhile, ERP systems and simulations lack a comprehensive perspective. The combination of IT and human-to-human interaction produces more effective learning outcomes than either technology or face-to-face interaction alone. (Karoliina Nisula & Samuli Pekkola, 2019)

In this research, we begin by examining related research on the lecture-based model and IT-focused industrial engineering learning environments using Bloom's taxonomy. Next, we present a case study that compares the lecture-based model with an ERP-based business and AI techniques learning environment. We then analyse the learning outcomes and discuss the underlying reasons. Finally, we conclude with a discussion of the limitations, contributions, and recommendations for future research.

Our research endeavours to improve learning outcomes in various domains of Bloom's taxonomy. First, the approach in this project aims to enhance the cognitive learning of students who perform poorly and at an average level, an aspect that requires improvement in the lecture-based model. The improvements are due to the holistic learning environment acting as a boundary infrastructure where the practice enterprise model, the simulation and the ERP system are all different kinds of boundary objects. This aligns with previous studies suggesting that students with low performance benefit from a boundary infrastructure comprising multiple tangible boundary objects. (Monk and Lycett 2016; Pasin and Giroux 2011). This boundary infrastructure functions as a point of interaction and communication, and enables the students and teachers to cross social, cultural, and conceptual boundaries between different communities of practice, and importantly, between theory and practice.

For the affective learning, ERP simulation would be seen as motivation learning environments. The hands-on approach provided by ERP-based environment should be particularly valued by the students, indicating that real-life tools can enhance the sense of "learning by doing." This is a notable improvement compared to the lecture-based model, where this has been a challenging aspect to address. However, the measurement of psychomotor is limited to the ERP-based business learning environment, and therefore cannot be used to assess differences in learning between the groups. Nevertheless, analysis of the ERP log-file should indicate significant improvements in processing times, suggesting that learning has occurred.

Case Profile

The case in this research encompasses fourth-year students in the Department of Industrial Engineering, Faculty of Engineering, who have taken the course 'Industrial Engineering and Enterprise Resource Planning' from 2020 to present. The following are additional details:

(1) The control group

In the department of Industrial Engineering, the fourth-year students' batch of 2020 was taught by using an integrated curriculum approach, supported by the lecture-based model. However, the limitations of this approach became apparent over time, as it failed to capture the complexities of a real-world business environment. As a result, a project was launched to replace the lecture-based model with an ERP-based business environment from 2021 in the classroom. The primary objective of the project is to evaluate the learning outcomes resulting from this shift in the learning environment.

(2) The experimental group

Fourth-year students' batch from 2021 to present is our target for the experimental group while 2020 is the control group as mentioned earlier. The ERP-based business learning environment has been used in the classroom since 2021 instead of lectured-based approach. Both control and experimental groups followed identical curriculums. The program consisted of several modules, each focusing on a specific theme and incorporating various disciplines. Students were assigned to teams and received guidance from an appointed teacher-coach, who provided supervision and mentorship. The coaches collaborated to plan each module's implementation and held weekly meetings to discuss and prepare for upcoming activities. However, within this group, there exist subcategories outlined below.

- Batch 2021 and 2022

The students in this category were instructed using a business learning environment based on ERP. They were introduced to several modules on a selected ERP platform that were tailored only to the theme of industrial engineering. The specific core four modules included Sales and Distribution, Materials Management, Production Planning, and Warehouse Management.

• <u>Batch 2023 and 2024</u>

In the year 2023, we gained experience in facilitating joint learning between students of industrial engineering and the ICDI faculty through collaboration funded by Active & Integration Learning (Type C) from TLIC CMU. As part of this cooperation, we incorporated supplementary modules in Finance, Accounting, and Controlling for industrial engineering students, in addition to the four core modules specific to the theme of industrial engineering management. The collaboration with the ICDI faculty will also continue into the coming year of 2024 together with the integration of AI techniques in teaching and learning management. This expansion will give students in this category a broader perspective and practical experience in understanding and using finance modules within an ERP-based business environment.

Research Methodology

1. **Research Design**

   We use Bloom's Taxonomy as a framework to validate our research questions as well as to guide the interpretation of our results, following the three domains of learning: cognitive domain, affective domain, and psychomotor domain. In the meantime, generative and discriminative AI techniques are applied to teaching and learning management in the context of ERP subject in several ways as follows.

   (A) Generative AI for Content Creation:
   - Use generative AI models, like language models (e.g., GPT), to create interactive learning materials such as tutorials, quizzes, and case studies related to ERP concepts.
   - Employ generative models to generate synthetic ERP datasets for training purposes, allowing students to practice data analysis and decision-making within ERP systems without accessing real-world data.

   (B) Discriminative AI for Personalized Learning:
   - Utilize discriminative models to analyze student performance data and provide personalized recommendations for learning resources, study paths, and practice exercises tailored to individual learning styles and proficiency levels in ERP subjects.

   (C) Generative AI for Simulate and Scenario-based Learning:
   - Develop generative AI-driven simulations that mimic real-world ERP scenarios, allowing students to apply theoretical knowledge in practical contexts. For example, simulating inventory management processes, production planning, or supply chain optimization within ERP systems.
   - Create virtual ERP environments using generative AI techniques, where students can experiment with different configurations, workflows, and decision-making strategies without the risk of disrupting actual enterprise systems.

   (D) Discriminative AI for Performance Assessment and Feedback:
   - Employ discriminative AI models to automate and the grading and assessment process for ERP-related assignments, projects, and exams. These models can provide detailed feedback on correctness, completeness, and the application of ERP concepts.

2. **Sampling**

   The case in this research encompasses fourth-year students in the Department of Industrial Engineering, Faculty of Engineering, who have taken the course 'Industrial Engineering and Enterprise Resource Planning' from 2020 to present. Details have been stated in the earlier section.

3. **Data Collection and Analysis**

   According to Bloom's Taxonomy framework, data collection and analysis are described as follows.

   3.1 Learning outcomes in the cognitive domain: Both pre- and post-tests are used for experimental and control groups. The pre-test analysed the student's previous understanding and provided a basis to compare these two groups. Midterm and final examinations are considered as the post test. We use t-test analysis to check whether the differences in the results are significant.

3.2 Learning outcomes in the affective domain: The students are given a questionnaire on the learning environment halfway through the academic year. Our main goal is to collect feedback for immediate improvements in the learning environment. Questions in the survey are developed based on the curriculum objectives: integration between disciplines, overall business process understanding and teamwork. The survey aims to assess the impact of the learning environment project on students' motivation and their perception of versatility.

3.3 Learning outcomes in the psychomotor domain: Psychomotor learning outcomes are identified into 3 aspects: efficiency, accuracy, and response magnitude. Efficiency is measured by the time taken to finish a task, while accuracy is evaluated by counting the number of errors made during task completion. Response magnitude is determined by the complexity of the task accomplished. For example, the order-to-delivery process, the sales order process, and inventory management process, etc in ERP platform practice can be the indicators for an appropriate measurement to access psychomotor domain learning in this area.

4. **Ethical Considerations**
   We ensure that the study is conducted in an ethical manner, with informed consent obtained from all participants and their anonymity and confidentially maintained

Research Discussion and Expectations

The improvement in learning can be explained by the holistic learning environment acting as a boundary infrastructure. A comprehensive learning environment has been implemented through the combination of a practice enterprise model and an ERP-simulation. We believe the research evidence would show that this approach improves the cognitive learning of poor and average-performing students, an area that needs improvement in the lecture-based model.

The lecture-based model provides the abstract discourse, while the ERP system concretizes it through standardized forms, processes, and simulation constructs that tie the boundary objects together. The boundary infrastructure provides a common ground for students, coaches, and disciplinary teachers. The ERP-simulation provides momentum and a sense of reality that are lacking in the lecture-based model. The combination of these concrete boundary objects reinforces each other, facilitating mutual understanding and the crossing of the boundary from novice to expert.

Indications of affective domain areas could show that students appreciate the benefits of crossing boundaries, including joining theory to practice, integrating the learning environment into the curriculum, and intersecting the social worlds of other students.

References

- Monk, E., & Lycett, M. (2016). Measuring business process learning with enterprise resource planning systems to improve the value of education. Education and Information Technologies, 21(4), 747–768.
- Nisula, K., & Pekkola, S. (2019). ERP-based simulation as a learning environment for SME business. The International Journal of Management Education, 10(1), 39–49.
- Pasin, F., & Giroux, H. (2011). The impact of a simulation game on operations management education. Computers in Education, 57(1), 1240–1254.