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Enhancing Experiential Learning in a Smart Flipped Classroom: A Case Study

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***Abstract*—**A flipped classroom which is a form of blended learning shifts the focus from a teacher-centered approach to a learner-centered approach. However, not all learners are ready to take the active role of knowledge and skill acquisition through a flipped classroom and they continue to delve in a passive mode of learning. This challenges educators in designing, scaffolding and facilitating in-class activities for students to have active learning experiences in a flipped classroom environment. Experiential learning theories have been employed by educators in the past in physical classrooms based on the principle that knowledge could be actively developed through direct experience. However, with more of online teaching witnessed recently, there are inherent limitations in designing and simulating an experiential learning activity for an online environment. In this paper, we explore enhancing experiential learning using smart digital tools that could be employed in a flipped classroom within a higher education setting. We present the use of smart collaborative tools online to enhance the experiential learning activity to teach higher-order cognitive concepts of business process modeling as a case study.

***Keywords*—**Experiential learning, flipped classroom, smart software tools, online learning higher-order learning attributes.

I. Introduction

FLIPPED classroom is known as inverted classroom that "flips" the traditional physical classroom-based learning and teaching to integrate online interactive activities [1]. Using information and communication technologies, students are allowed to access instructional material and other learning resources online before the scheduled classroom time (asynchronously), so that the deeper inquiries could be explored during the classroom time (synchronously). Agile methodologies are being employed to facilitate flipped classrooms in higher education [2], [3].

The pedagogical approach of flipped learning is a form of blended learning where the students are given opportunities to make use of their available time outside classrooms to access the lesson materials prior to attending their classes. This enables students to be prepared with the real-time classroom beforehand so that during the class activity, students can engage in a more meaningful and collaborative learning with both the teacher and other students [4]. It is therefore believed that flipped classroom fosters active learning rather than passive knowledge gathering and assimilation [5]. However, the students are required to take an active role in the process of acquiring new knowledge a priori. The student learning outcomes rely more on learner-centered approaches which poses a challenge to lecturers in designing and scaffolding active learning experiences for learners [6]. Further, many students face challenges in adapting to online teaching and engagement and are not ready yet for a student-centered role in learning [7], [8].

In flipped classroom, students and educators have need to consider dual mode of education that involves traditional classroom learning activities in a synchronous way along with at-home learning activities in an asynchronous way [9]. Certain computer-based learning resources such as videos and self-assessments can convey and self-assess the knowledge a priori and outside the classroom. This facilitates students to apply the knowledge gained for a deeper learning through classroom-based learning activities [10], [11]. Some studies have reported positive impact of flipped classroom in student learning and engagement [12]. However, recent changes in online teaching have posed other challenges in the development of a flipped classroom with online teaching requiring addition technical support and scaffolding for students [7], [13].

In this paper, we explore smart software tools to enhance the experiential learning in an online flipped classroom environment. We consider a higher education as a case study for demonstrating how experiential learning activities could be employed for teaching a subject called Business Analysis using smart tools online in a flipped classroom. The topics involving business process modeling requires our students to understand the higher-order cognitive concepts involved in this subject domain.

The rest of the paper is organized as follows. In Section II, we highlight the key experiential learning theories that have potential for adapting for our case study. We identify the challenges in experiential learning in Section III. We present the application of our proposed smart flipped classroom activities to enhance experiential learning in Section IV. Finally, Section V provides conclusions.

II. Experiential Learning Theories

Kolb's experiential learning theory is the "process whereby knowledge is created through the transformation of experience" [14] (Fig. 1) with each stage being mutually supportive of and feeding into the next stage [14]. Effective learning is seen when a person progresses through a cycle of four stages: (1) having a concrete experience followed by (2) observation of and reflection on that experience leading to (3) the formation of abstract concepts (analysis) and generalizations (conclusions) which are then (4) used to test a hypothesis in future situations, resulting in new experiences. However, effective learning only

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occurs when a learner can execute all four stages of the model. Therefore, no one stage of the cycle is effective as a learning procedure on its own. Iterative experimentation should be applied until competency is achieved.

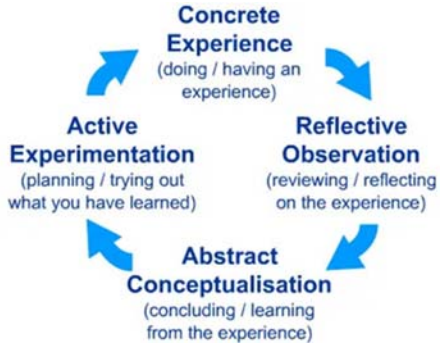

Fig. 1 Kolb's experiential learning model [14]

Recent studies using experiential learning for competency building in technology disciplines have been conducted in e-business [15]-[17]. Similarly, studies have been conducted in e-learning using experiential learning [18], [19]. Another study [20] reported that experiential learning was used to teach big data analytics and data-driven analytics to build competencies using MS-Excel. These studies have reported a positive increase in student engagement and student performance.

In particular, a recent study [21] reported an increase of 29% in students in the level of attainment of competencies in lean-thinking. While experiential learning is noteworthy in previous studies, information technologies are outpacing the higher education system [22]. Current and future students are grouped as generation Z (Gen Z) whom are born after 1996. As digital native users Gen Z are skim reading the web [8], as a result it is reducing the cognitive capacity of future students to read and analyze relevant content required in understanding, processing and reporting business solutions [23].

The mentioned experiential learning studies were formed in traditional face to face classroom teaching environment. In the next section, we address some challenges faced in a flipped classroom environment.

III. Challenges in Online Experiential Learning

As traditional classes have moved to more online teaching recently, educators have discovered challenges in adapting to a flipped classroom environment [2]. There are limitations in simulating experiential learning activities in an online environment. The challenges explored to date have mainly been with internet technology, student engagement and work life balance.

Our student cohort comprised of international students mostly living in Australia with a few students stuck in their homeland due to border restrictions. Results revealed that our students studying from their home countries did not have access to reliable internet connection, and had difficulty attending classes on line and keeping up with learning activities due to COVID-19 pandemic. For our students living on the mainland, disruptions from COVID-19 and transition to online learning, access to reliable internet connection and personal computers have affected the learning outcomes for students. Some students engage in online classes with their mobile phones while working, which prevents them from completing learning activities during online classes and collaborating with other students.

Our institution accommodated students with access to computer labs for students who had difficulty with internet technology access. However, due to long COVID-19 lock downs some students managed to share or borrow computers to complete their learning activities.

Our observations also indicated that most students had work-life balance issues, which affected their academic studies negatively and impacted their motivation. While our students had issues with internet technologies, class engagement had also declined due to their lack of motivation. We experimented with smart collaborative tools online to improve the flipped classroom environment by simulating learning activities online.

IV. Experiential Learning in Smart Flipped Classroom: Case Study

In this section, we present the use of smart collaborative tools online used to enhance the experiential learning activity to teach higher-order cognitive concepts of business process modeling.

We explored enhancing experiential learning using smart digital tools that could be employed in a flipped classroom to increase time spent on in simulating learning activities with students. The current activities in the business analysis subject are used to assess student performance with case studies and tutorials for developing higher order analysis and evaluation skills. Throughout the business analysis subject students are required to build business process modeling and process visualization skills. By using a variety of tools to students are enabled to analyze business object oriented modeling (BOOM) concepts and learn how to present process analysis through Unified modeling Language (UML) and business process management notation (BPMN) based visualization and modeling.

We present some examples of how introducing smart tools has improved student learning from enabling to enhancing of creating higher-order cognitive and practical skills. Table I summarizes the smart tools used to enhance the higher order thinking skills required to complete the learning activities.

TABLE I
Smart Tools Used to Enhance Higher Order Thinking Skills

Smart Tool Used	Higher Order Thinking Skill
Learning Activity 1 - SAS Studio	Enhance analysis, evaluation and conceptualization
Learning Activity 2 – draw.io	Enhance analysis, evaluation and conceptualization
Learning Activity 3 – Vizologi, draw.io	Enhance analysis, evaluation and conceptualization

Learning activity 1 (Fig. 2) is about enhancing business process modeling skills. To perform this learning activity 1, SAS, studio a business modelling application, was introduced to simulate the creation of a "Booking a TRIP" business

process. SAS studio was the software tool used to make learning process modeling easier to understand through visualization of business process creation. The tool being used in the activity helped the students enhance creating their higher-order cognitive skills. Networking major students struggled with all higher-order cognitive skills as this was their first business analytics assignment requiring higher-order cognitive skills. Table II provides the research methods used for collecting and analyzing data to assess the student learning experience using online smart classroom tools.

Learning activity 2 (Fig. 3) is an assessment using a case study involving a Car Rental Administration System (CRAS). This activity enables students to analyze BOOM concepts and learn how to present process analysis through UML and BPMN visualization and modeling. Students are expected to complete tutorials to demonstrate understanding of concepts and visualization of BOOM and UML in self-pace mode. To enhance student higher-order thinking skills, a different case study was used to simulate how the questions should be answered for the CRAS assessment. BOOM skills were demonstrated by students during online sessions to increase engagement. After the simulation, students were asked if the simulation improved their understanding of the assessment. 22 out of 23 students agreed that the case study simulation helped them improve understanding and answering the assignment questions. Learning activity shows that HOW TO simulations could be effective in building higher-order thinking skills for IT students and a future learning strategy.

TABLE II
RESEARCH METHODS USED FOR DATA COLLECTION AND ANALYSIS OF STUDENTS' LEARNING EXPERIENCE

Research method	Activity	Expected Outcomes
Free Observation	During the whole teaching period in the business analysis class	Management and communication information among student groups and between students and teacher
Interviews	Four interviews carried out in four sessions. Each interview last for 10 – 15 minutes	Specific aspects of each target group in the research process: students
Survey (before and after)	A set of six questions to be answered anonymously	To obtain qualitative data based on the experience of the students in the experiential learning class

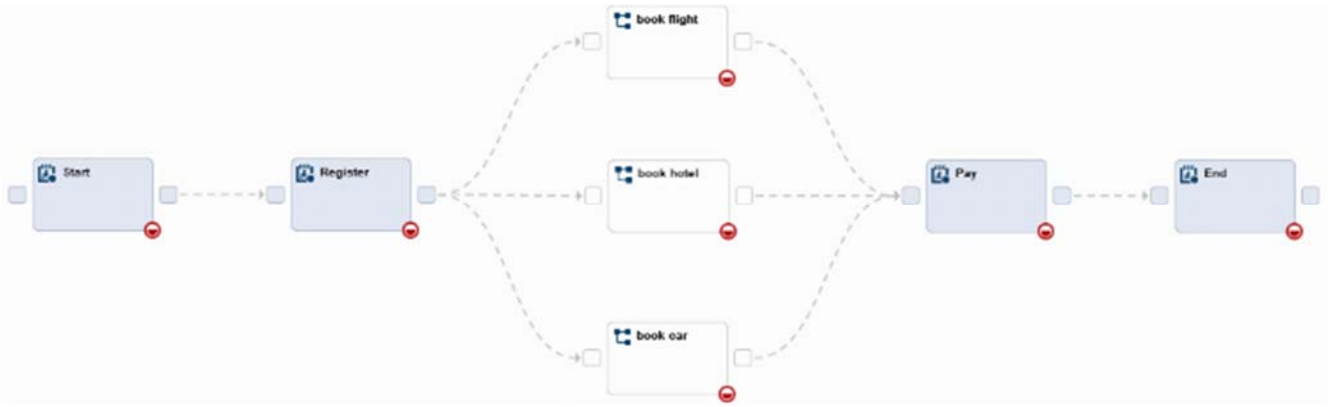

Fig. 2 Trip business process created in SAS Studio

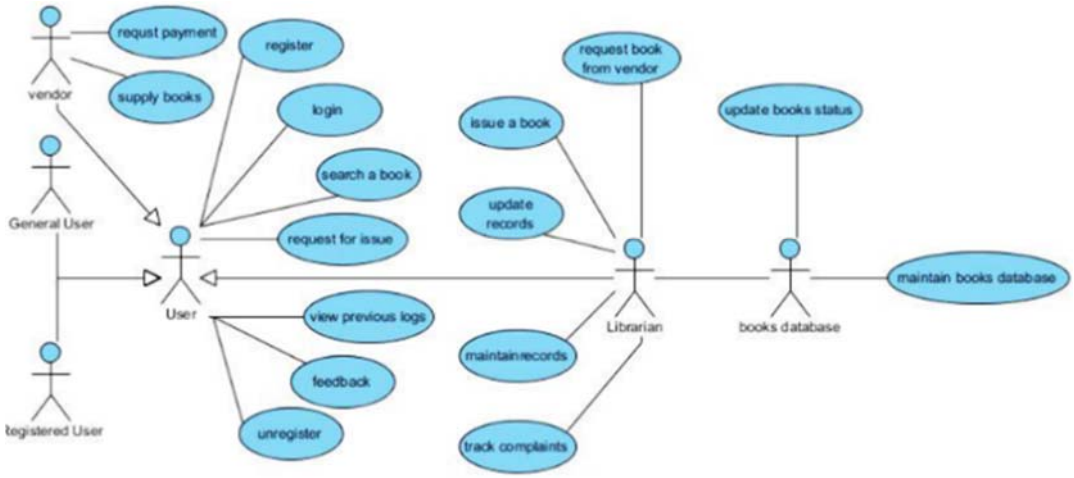

Fig. 3 Library management system business use case created with draw.io

Learning activity 3 (Figs. 4 (a)-(c)) is a major assessment presenting results in a business report for improving business processes for a Help Desk System within an organization. This assessment enables students to analyze and evaluate

organizational business processes and demonstrate understanding by applying BPMN visualization and modeling. Students were expected to complete tutorials to demonstrate understanding and applying concepts in the business report. The simulation of showing students how to answer questions in this business report such as conducting business problem identification, SWOT analysis and developing context and scope diagrams showed some enhancement students understanding of a top-down approach to business analysis and presenting it in a business report format.

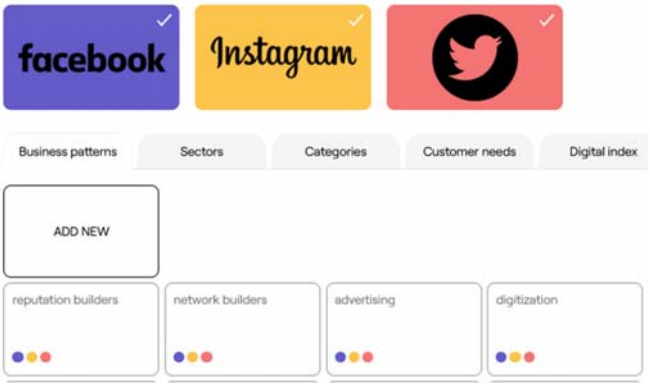

Fig. 4 (a) Vizologi mapping of selected organization's business strategies

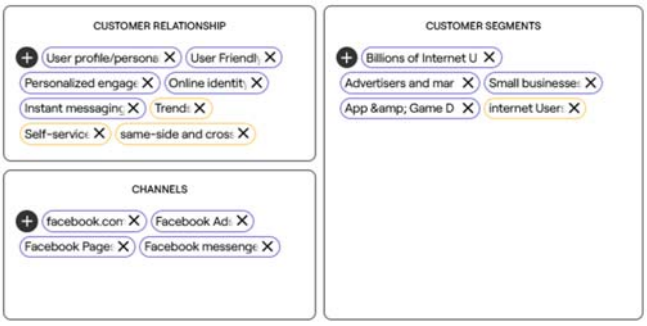

Fig. 4 (b) Vizologi mapping of selected organization's business models

Fig. 4 (c) Vizologi mapping of selected organization's SWOT analysis

Overall, HE students are required to acquire higher order thinking skills, knowledge and competencies to contribute to the workforce in the ever-changing business world [9], [10]. To facilitate this, we have conducted a pilot study to demonstrate how smart software tools could be adopted in a flipped classroom to enhance higher order cognitive skills for business process modeling to engage students for effectively achieving their learning outcomes.

V. Conclusions

In this paper, simulating experiential learning activities in a flipped classroom was explored in a higher education context. We demonstrated the application of smart tools to simulate business process modeling. The reported artefacts collected in a smart classroom environment suggest that experiential learning using smart tools could enhance higher order thinking skills, in particular conceptualization of business process models. The flipped room environment supported learning and teaching transformation from teacher-centric to student-centric knowledge formation through rich collaboration and experience.

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