

# Using Interactive Digital Gaming to Facilitate Learning in E-Commerce Logistics

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**Abstract** - Serious gaming has shown its potential for motivating and facilitating learning with examples of implementation in healthcare and military training. In an eLearning context, it engages and promotes understanding of specific and complex concepts. This paper focuses on developing an interactive digital game to facilitate learning in an e-Commerce logistics. Based on our preliminary evaluation with a small group of students, we are able to validate that our digital game was effective in deepening the students' understanding of e-Commerce logistics.

**Keywords** - Digital Game, E-Commerce Logistics, Evaluation, Facilitate Learning, Serious Game

## I. INTRODUCTION

Serious gaming is used in several different contexts to facilitate learning and training processes with examples of implementation in education and training [1-2], healthcare [3] and military applications [4]. In an e-learning context, serious gaming, especially digital games, increase student engagement and helps them to learn difficult concept (e.g. [5-6]) through powerful emotional responses enhancing curiosity, frustration and joy [7] and of course, intrinsic motivation construction [8].

In this paper, we attempt to develop an interactive digital game as a tool to learn the basic concepts of e-Commerce logistics. It can be used in eLearning courses to facilitate deeper learning and understanding. The digital game describes several concepts in e-commerce logistics and uses role-play to practice and implement the students' knowledge in virtual environment. To evaluate the effectiveness of our digital game in facilitating learning, we conducted two evaluation sessions. The first evaluation session is intended to gather feedback on learning objective evaluation, while the second evaluation session is intended to gather feedback on the overall game experience. From those sessions, we learnt that our digital game was able to increase the students' knowledge about e-commerce logistics.

The outline of the paper will be organised as follows: Section II presents the proposed digital game. Section III discusses the evaluation method to measure the effectiveness of our digital game in deepening the students' understanding. Section IV presents the conclusions and future research direction.

## II. DIGITAL GAME FOR E-COMMERCE LOGISTICS

ACE E-Commerce is a working prototype role-based simulation game adapted from the research work done by The Logistics Institute-Asia Pacific in the area of e-commerce logistics.

This game provides a risk-free environment for the players to experience the workings of e-commerce logistics without having the need for large start-up capital. It also protects the player from potential emotional distress that may occur should their business strategy fail or is bankrupt. The game also allows for multiple repeated play without the negatives mentioned earlier.

**A. Goals**

The main objective of this game is to create awareness and understanding on the basic operations involves in e-commerce logistics. The game also provides experiential learning of the basic e-Commerce logistics in a risk free environment.

As such, this game may appeal to different categories of players:

- Those without prior knowledge of e-Commerce logistics and supply chain.
- Those with basic knowledge of e-Commerce logistics and supply chain.
- Those currently taking basic e-Commerce logistics and supply chain module.
- Those who just want to have fun playing an e-Commerce logistics and supply chain game.

With these different player categories, different learning outcomes are expected. With that in mind, the game was designed to incorporate features that can adequately achieve the desired learning outcome.

**B. Learning Objectives**

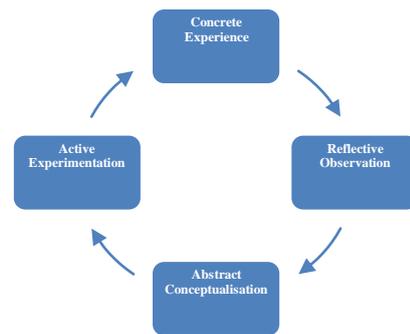
At the end of this game, the player should be able to:

- Identify the processes involves in planning, implementing and controlling the effective and efficient flow of goods or services from the point of origin to the point of consumption.
- Identify the important criteria in logistics.

- Differentiate between Conventional logistics and e-Commerce logistics processes and challenges.
- Describe the role of Logistics Service Provider (LSP) in e-Commerce logistics.
- Compare the differences between Aggregator and Online e-Commerce business models.
- Apply the knowledge of e-Commerce logistics operations effectively.
- Last-mile delivery in e-Commerce logistics.

**C. Methodology**

According to Kolb's experiential learning style theory [9], learning is achieved when the learner goes through the four-stage learning cycle (Fig. 1).



**Fig. 1** Kolb's Experiential Learning Theory

**• Concrete Experience**

This is basically the ‘do’ phase. The game was designed so that it may be played with or without prior intrinsic or extrinsic knowledge of e-commerce to play the game. Players just need to choose one of the available roles to facilitate ‘doing’ or ‘experiencing’ their e-commerce business.

**• Reflective Observation**

This is the ‘thinking’ phase. As the game progresses the player may need to make decisions, for example the product price setting or product quantity produced . The game is able to provide immediate feedback on the decisions they’ve made. If they set the product price too high, they will receive less orders or if they don’t plan their stocks

adequately they will have problems in meeting the customers' demand.

- **Abstract Conceptualisation**

In this phase, players will start to formulate strategies to improve their business plan. They may decide to try different product pricing strategies, for example, or maybe increase the size of transport fleet to cope with the larger quantity of deliveries.

- **Active Experimentation**

In this phase, the player will put into action the strategies or decisions that may constitute the best action plan. This happens at the start of each round. The player gets the chance to amend his/her pricing strategy or adopts a different business model. The player then repeats the cycle all over again.

#### D. Game Features

- **Play Mode**

There are two modes of play available in this game – single player and multi-player.



In the single player mode, the other roles are deferred. Depending on the player's strategy or customer satisfaction rating, the game will adjust the demand, supply and pricing accordingly.

In multi-player mode, a group of 9 player, 3 players per role, connected through a same network, simulating the real-life e-commerce world.

Players may choose between 3 different roles, either a Logistics Supply Provider (LSP), E-Retailer or Merchant to play. The game is played on a fictitious 3D map of two islands.

The end-customer's demands in both modes are generated automatically by the game.

- **Information Panels**

There are also information panels at selected waypoints in the game. The information provided are 'just enough' for the player to make an informed decision or to learn more about a particular learning point. This information is also available at the main screen, for those who wish to learn about basic e-commerce logistics.

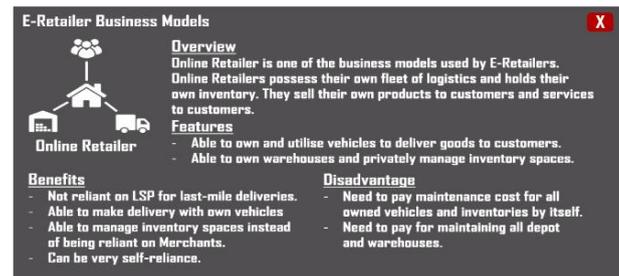
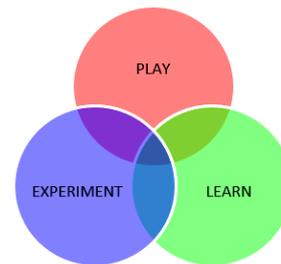


Fig. 2 Example of Information Panel

- **Design Considerations**

In this game, we incorporated 3 components to achieve a fun, risk-free, role-based simulation game that provides experiential learning. The three components are Learn, Experiment and Play.



- **Learn**

The Learn component provides players with summarise basic information on e-commerce strategies and business models, at specific game play juncture. This should help players without prior knowledge of e-commerce logistics to learn more about it.

For example, the game provides the user manual at the start welcome screen, so that players may be able to learn about the different types of roles available, its tasks in the game and many more related information.

The game may be used to reinforce the learning objectives of the e-learning module on e-commerce logistics and supply chain managed by providing the students a safe, realistic and fun way to practice what they have learnt.

- **Experiment**

The Experiment component details experiential learning for the players by allowing them to role play in each of the three roles (Merchant, E-Retailer and LSP).

Depending on the role, for example the E-Retailer player needs to fulfil the customer orders by delivering them on time.

They can also able to set their own pricing strategy to increase their competitiveness edge to attract more customer orders.

The game also incorporate a real-time chat system in the multi-player mode. They can use this feature to interact online with other players to setup their own business contracts or enquire about the price or availability of their supplier stocks, as in actual business life. This may create competitiveness between players.

- **Play**

The play has to be fun, easy and interactive. Each player is given a start-up capital for his/her business. Players may purchase stocks, warehouse and vehicles if their business requires it.

At the end of each turn, player is presented with a summary of their business health report and their customers' satisfaction rating. In single player mode, the number of orders received depends on this ratings. The higher the rating, the higher the number of orders they'll received.

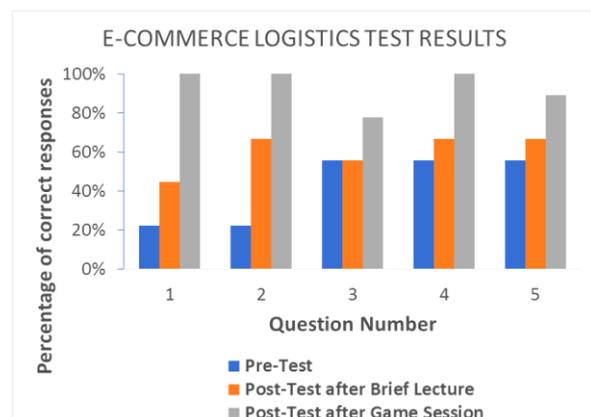
### III. EVALUATION METHOD

To evaluate the effectiveness of our game, we conducted two evaluation sessions and gathered two main feedback. These feedbacks are learning objective evaluation and overall game experience.

#### A. Learning Objective Evaluation

The learning objective is evaluated in the first evaluation session. The session was held in January 2018 in Singapore. Nine IT polytechnic students participated in this session. The students did not have or had a limited background knowledge on e-commerce logistics.

To simulate the eLearning processes, we divided the session into two parts, namely: 1) brief lecture on e-commerce logistics and 2) game session. We tested the students' understanding on e-commerce logistics in the beginning of the session (as pre-test) and after each part. We used the same set of questions for each test which consists of 5 multiple-choice questions and 3 open-ended questions. The summary of results for multiple-choice questions is shown in Fig. 3 and Table I, while the sample answers for the open-ended questions are shown in Table II, III, and IV for question 1, 2 and 3 respectively.



**Fig. 3** E-Commerce Logistics Test Results for Multiple-Choice Questions

**TABLE I  
SAMPLE ANSWERS FOR QUESTION 1**

Test type	Percentage of Correct Responses		
	Average	Standard Deviation	Increment*
Pre-test	42.22	0.16	-
Post-test after brief lecture	60.00	0.08	42.11
Post-test after game session	93.33	0.08	121.06

\* = from pre-test

**TABLE II  
SAMPLE ANSWERS FOR QUESTION 1**

Sample Answers	Test type
<b>Question 1: Please describe your understanding about e-commerce logistics.</b>	
Zero. Never even heard of it until now	Pre-Test
After a customer buys something online, and how the company will settle the goods and send the goods to the customer	Post-Test after Brief Lecture
e-commerce logistics is the management of the flow of goods purchased in online transactions from merchant to customer	Post-Test after Game Session

**TABLE III  
SAMPLE ANSWERS FOR QUESTION 2**

Sample Answers	Test type
<b>Question 2: Please mention two examples of e-commerce business model.</b>	
nil	Pre-Test
online-retail aggregator business model	Post-Test after Brief Lecture
online retail model aggregator business model	Post-Test after Game Session

**TABLE IV**  
**SAMPLE ANSWERS FOR QUESTION 3**

Sample Answers	Test type
<b>Question 3: Please describe the role of Logistics Service Provider (LSP) in e-commerce logistics.</b>	
The provider of logistics service	Pre-Test
the role is to provide the delivery service for the item from client to customer	Post-Test after Brief Lecture
The LSP takes orders from merchants then deliver their goods to the customers. It may offer better services depending on resources that are available to the LSP, such as more delivery vehicles and collection delivery points (CDP)	Post-Test after Game Session

The results show that the students were able to understand e-commerce logistics better after the game session. For the multiple-choice questions, the average of correct answers was increased from 42.22% in pre-test and 60% in post-test after brief lecture to 93.33% in post-test after game session. An T-Test performed on these multiple-choice result shows that there are a significant increment on the correct responses between the pre-test and post-test after game session ( $p$ -value  $< 0.0005$ ) and between the post-test after the briefing and post-test after game session ( $p$ -value  $< 0.0007$ ).

In the open-ended questions, the students were able to describe e-commerce logistics in a clearer and more precise manner. This confirms that the digital game was able to enhance the learning processes by allowing students to absorb new content through exploration, role-playing and experimentation.

Our results also correspond into the Cognitive Domain in Bloom's Taxonomy [9-13] where the digital game stimulates higher-level of learning for the students. It helps them to reach the top level of the e-commerce logistics domain.

### **B. Overall Game Experience**

The overall game experience is evaluated in the second evaluation session. The session was

held in February 2018 in Singapore. Nine professionals in logistics participated in this session.

The experience was categorised into four groups, namely: positive, negative, flow experience, and learning experience. Positive experience is described as a good condition where the player want to play more, rather than quitting. While negative experience is described as the opposite of positive experience. Flow experience is defined as a total engagement on the game that nothing else seems to matter [14]. This motivates the player to learn new skills and gain an understanding voluntarily. The enhanced learning experience is described as an ability of the game to transfer knowledge or learning objectives to the player.

For this evaluation, we were focusing on the learning experience to support e-learning. As such, we developed a questionnaire comprising of 6 questions on the learning experience and 1 question on each of the other three categories. The questions and its categories are summarised in Table V. The questionnaire used the 5-point Likert scale (5=strongly agrees, 1=strongly disagrees).

**TABLE V**  
**QUESTIONNAIRE TO EVALUATE THE GAME EXPERIENCE**

Questions	Category	Citation/Reference
The player felt challenged but he/she has the skill to meet the challenge.	Learning Experience	-
The content was efficiently presented.	Learning Experience	[15]
The learning experience was worthwhile.	Learning Experience	[15]
The game motivates the player to learn and/or discuss with others	Learning Experience	[16]
The game gave interesting information/knowledge	Learning Experience	-
The game content was interesting	Learning Experience	-
The game session was fun	Positive Experience	[16]
The game was boring	Negative Experience	[16]
The player was deeply involved and engaged in the game that he/she put all his/her thought into the game at that period of time	Flow Experience	[17]

**TABLE VI**  
**PLAYERS' RESPONSES TO THE GAME EXPERIENCE QUESTIONNAIRE**

Category	Average	Standard Deviation
Learning Experience	4	0.64
Positive Experience	4.4	0.5
Negative Experience	1.67	0.47
Flow Experience	3.67	0.47

Approximately 9 questionnaires were distributed. In all, 9 valid responses were received. Summary of the responses is shown in Table VI. The results show that the average score for the three experience categories (positive experience, flow experience, and learning experience) is above 3 and the average score for negative experience is below 2. This indicates that the players have a very good experience with the game and the players are able to absorb [9] the learning points. It is aligned with the learning objective evaluation result (described in previous sub-section).

#### IV. CONCLUSIONS

In this paper, we focus our empirical study on the development of the interactive digital game to facilitate learning in e-Commerce Logistics. We conducted two separate evaluation sessions. Based on our initial learning objectives evaluation session, we found that the ACE game does contribute to the learning of e-commerce logistics. In addition, we had good response from the overall game experience session.

Moving forward, we would like to collect more results from more sessions using the game, in order to evaluate the effectiveness of

achieving the higher learning outcomes, possibly in collaboration with an interested third party team.

## V. ACKNOWLEDGMENT

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**(Arranged in the order of citation in the same fashion as the case of Footnotes.)**

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