Effects of Question Type on E-Learning Performance

Hung Hong, Lane Harrison

December 2019

This document reports the different steps when running an online experiment on e-learning experiment.

Important Links

- Github: https://github.com/barryhong1995/e-Learning-exp
- Website: https://users.wpi.edu/ hphong/CS_525/e-Learning/index.html

1 Motivation

The goal of this project is to determine the effectiveness of different question types on e-learning experience and performance.

2 Experiment description

E-learning has been a main focus for many institutions as a mean of providing teaching and learning experience for teachers and students respectively in an efficient manner. Being heavily invested by many universities, educators aim to improve the e-learning systems to encourage more use of the technology. As a result, the effectiveness of the systems for providing quality e-learning experience needs to be understood and acted upon accordingly so as to ensure satisfaction of the users and their continuance.

This study replicated previous experiments [4] [3] on continuance intention for e-learning service in order to reevaluate many different aspects, such as perceived usefulness and ease of use, on the continuance intention of e-learning platform. I also extend the experiment to focus more on the type of question that are being used as part of the learner's self-evaluation after each lesson and see the impacts of question type on learning experience and performance. I emulated an e-learning platform setting where each participant was shown 2 lessons, and at the end of each lesson each participant was shown a short quiz to evaluate what they learned from the lesson. At the end of the experiment, each participant was shown a survey to express opinions on the e-learning service as well as different types of question.

3 Methodology

3.1 Experiment Design

Figure 1: Experiment design

Figure 1 summarizes the different steps I took to set up the experiment.

3.2 Create Trial E-Learning Platform

3.2.1 Preparing Lesson for Platform

This step consisted of creating a trial e-learning platform to be used as a test-bed for the experiment. Due to the time constraint of the project, the platform was fairly simple in term of design, consisting of two lessons: Lesson 1 about the Terrestrial Planets (Figure 2), and Lesson 2 about the History of Columbus's Day (See [1] for original lesson contents).

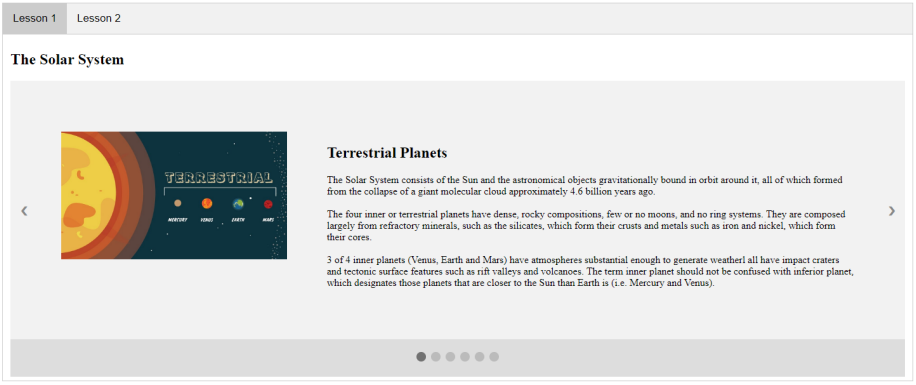

Figure 2: Lesson 1 - Terrestrial Planets

Each lesson consisted of several slides about the topic of the lesson, and each lesson had its own quiz at the end to test the participant's understanding of the lesson. Upon viewing the quiz, the lesson slides would be hidden, preventing participants from referring back to the lesson slides (Figure 3).

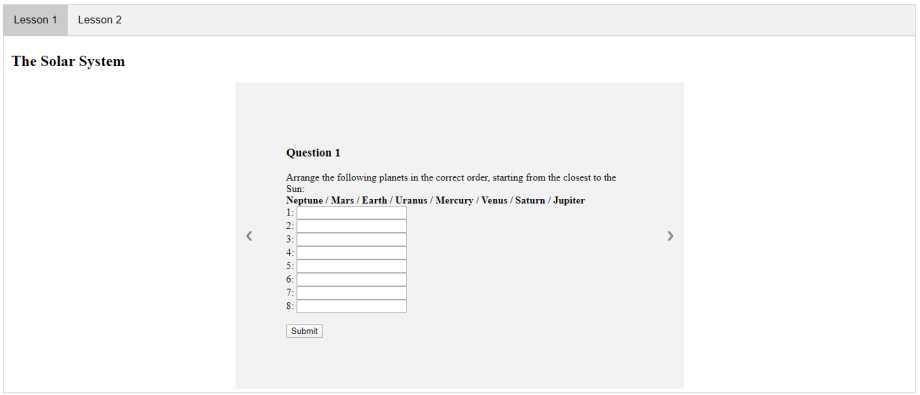

Figure 3: Question 1 for Quiz about Terrestrial Planets

3.2.2 Preparing Quiz for each Lesson

There were many types of question in the quiz formatted in different forms. The 4 main types that I investigated for this experiment were:

- Multiple Choice - can only choose 1
- Multiple Select - can choose more than 1
- Dropdown Box - prefilled list of responses
- Free Response - 1 answer field
- Free Response - multiple answer fields

3.2.3 Preparing Survey Questions

Once a participant finished both lessons, each would have access to the survey form for this experiment. Each survey form had 3 main parts: E-Learning Platform in General, Presentation of Question, and General Personal Information.

For the first part, I extracted some questions from Ming-Chi Lee's experiments to be used for our survey [3]. These questions are useful in understanding key facets of e-learning platform, including perceived usefulness, ease of use, attitude, perceived enjoyment, satisfaction and continuance intention. Participants were to provide their answer on a Likert scale ranging from 1 to 6 (1 for Very Strongly Disagree and 6 for Very Strongly Agree).

For the second part, I asked for participant's opinions regarding different question types, using the same principle of the first part and focusing on several key elements of a question type. Participants were to choose one from the list of question types that fit the description the most. The third part served as a demographic check for the experiment, asking about the age range, highest level of education, past experience with e-learning platform as well as the expectation

of participant regarding e-learning service and this experiment. The participant also had an opportunity to provide feedback about the e-learning system as well as how this experiment could be improved.

3.3 Setting Up Hosting Platform

The experiment is hosted on Worcester Polytechnic Institute CCC server. Afterward, its URL is published.

3.4 Data Storage

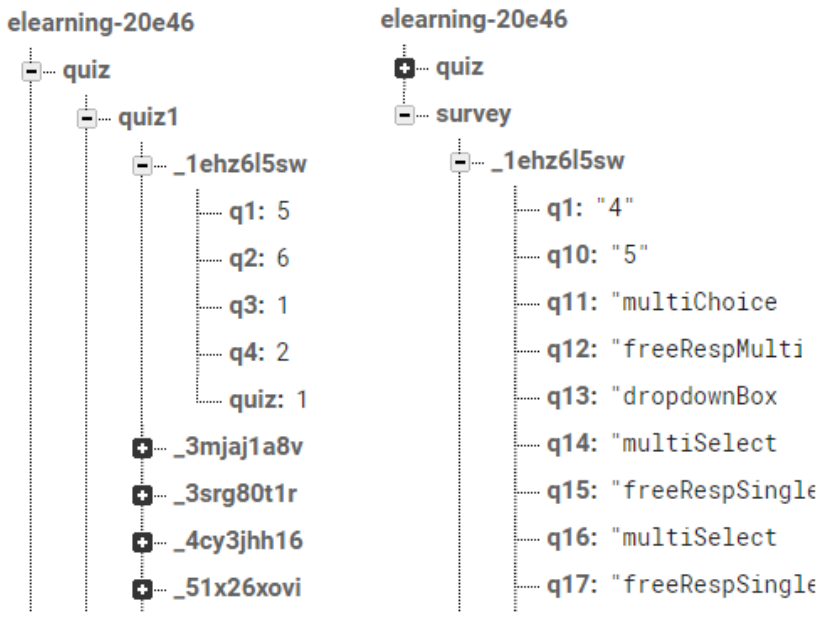

Figure 4: Database Structure in Firebase

Data are then stored in Firebase's real-time database[1]. The data scheme can be seen from Figure 4 in which all responses are classified into either Quiz or Survey Response. Each session has a unique ID and the responses are stored in their associated group.

4 Analysis and Reflection

Our analysis consisted of two main parts:

1. Statistical Analysis of Quiz Results

[1] `https://firebase.google.com/`

2. Statistical Analysis of Survey Results

The complete analysis[2] can be found in [2].

5 Conclusion

Due to the potential effectiveness of e-learning system in educational application, universities and institutions that utilize e-learning technology in teaching and training can benefit from this study. The experiment should give a better understanding on the effects of question types used in e-learning service. This knowledge should be useful in ensuring e-learning users to have a better learning experience using the platform.

References

[1] iSpring Suite. `https://www.ispringsolutions.com/ispring-suite/demos`. Online, Accessed: 2019-11.

[2] H. Hong. Analysis Results. `https://github.com/barryhong1995/e-Learning-exp/blob/master/analysis/analysis.pdf`, 2019. Online, Accessed: 2019-12-12.

[3] M.-C. Lee. Explaining and predicting users' continuance intention toward e-learning: An extension of the expectation–confirmation model. *Computers Education*, 54:506–516, 2010.

[4] K.-M. Lin. e-learning continuance intention: Moderating effects of user e-learning experience. *Computers Education*, 56:515–526, 2011.

[2] https://github.com/barryhong1995/e-Learning-exp/blob/master/analysis/analysis.pdf