Research and implementation of role-playing teaching mode supported by gamification

To cite this article: Xu Cui et al 2017 J. Phys.: Conf. Ser. 887 012054

View the article online for updates and enhancements.
Research and implementation of role-playing teaching mode supported by gamification

Xu Cui, Zhenglei Zhang and Lei Sun
Shandong Urban Construction Vocational College, Jinan, China, 250103
cuixu20021981@163.com

Abstract. The paper designs a Role-playing Teaching Mode Supported by Gamification to stimulate the interest of learners. In the process of creating the teaching mode, the factors of incentive factors, teaching mode and course selection are the most important factors gained by investigate and research. Then under the guidance of the three factors, a leaning framework of role-playing teaching mode which is called Gamification Learning Framework (GM1.0) is determined. In the design of GM1.0, First, collect problem cases which students interested in and select three courses which are Algorithm Design, Data Structure and Program Design. Then, extract the knowledge points of the three courses and merge into the problem cases to form game maps. Last, Learners gain a role-playing actor to join games with the support of game maps and finish selected tasks reaching a higher task level by upgrade checkpoints, experience promotions and award medals changing. After that, learners' enthusiasm for learning can be stimulated and the innovation abilities can also be improved gradually.

1. Introduction
One of the most authoritative reports “Horizon Report” [1, 2] said: Games and Gamification will be adopted in fields of higher education in two to three years, and the main relevant service fields are teaching, learning, and creative inquiry. Games and Gamification will be applied to education is not accidental. In recent years, Games and Gamification have already been used in the commercial [3], economic [4] and other industries [5, 6] including several education branches.

The “Horizon Report” results accord to the following facts: Almost everybody loves to play games and the game player's age distributes from several to dozens of years old. “Horizon Report 2013” [1] showed that the game players who are 18 to 35 years old accounted for 31% and “Horizon Report 2014” [2] showed that the game player number is 68% which was more than 18 years old. We know that 18 years old young people should learn a large number of knowledge, but in fact they waste a large amount of time playing various games. Students who are 18 years old in the University accepting higher education, are wasting more and more time playing games. They may do more meaningful things if they waste less time playing games.

This article will give an overall design method of “Research and Implementation of Role-playing Teaching Mode Supported by Gamification”. The ultimate objective of design is to maximize the mobilization of the enthusiasm of learners. Section 2 is about the teaching mode of present learning framework and the teaching mode of Gamification Learning Framework. Section 3 gives an introduction of the technology related to the article. Section 4 describes how to design the framework of role-playing teaching mode supported by gamification. The application of the gamification learning framework has been described in section 5. Section 6 concludes the paper.
2. The Teaching Mode of Present Learning Framework and Gamification Learning Framework

The present learning framework adopts the advanced project teaching method which organize knowledge information according to knowledge points and knowledge units [7, 8]. Students learn knowledge information following the prescribed order without any incentives to guide them. So in the learning process, learners often do not have higher enthusiasms.

The main solution to the proposed problem in this paper is adding gamification design to the learning framework, which focus on several points as follows after referring to some existing results [10-17]:

- Adding incentive factors such as reward, score, ranking and experience points to the gamification learning framework, to improve participation motivation and learning enthusiasm.
- Designing a role-playing simulation game environment to motivate participants cooperating with one another, to improve students' learning, comment and sharing abilities.
- Designing comprehensive game maps as teaching mode, to guide players learning knowledge information with the help of the excitation mechanism (incentive factors).
- Introducing several courses, refining knowledge points and knowledge units according to the game maps, to reach the goal of solving practical problems and cultivating innovation abilities.

3. Related Works

In the process of gamification leaning framework construction, several parts which are incentive factors, teaching mode and course selection play an important role. Investigate and research are one of the most effective methods in gaining the first hand data. We obtain the materials by the follow ways: Adopting a number of methods including the questionnaire, BBS, QQ, Micro-blogs, Micro-letters, E-mail and Telephone to reach the excepted investigate and research results.

To gain the proper incentive factors, mainly through the questionnaire and Micro-letters. We send 2000 questionnaires to university and college students and 1000 questionnaires to fraternal institutions and 2467 questionnaires were recovered. After sorting the recovered questionnaires, the incentive factors mainly concentrated in reward, score, ranking and experience points.

To gain the proper game mode, mainly adopt the BBS, QQ and Telephone. We have listed fourteen teaching modes which are ACT, AVG, FPS, and RPG and so on. The result is nearly 50 percent students selected the mode of RPG (Role Play Games).

A BBS has been set up, in which nearly 100 teachers coming from more than 30 colleges and universities related to information technology (IT) are invited to discuss the proper courses of the project. Finally three courses which are Algorithm Design, Data Structure and Program Design are identified as a basis for the gamification learning framework construction.

The above investigate and research results are regarded as the first hand data to the gamification learning framework construction to stimulate the interest of learners.

4. The Gamification Learning Framework

The construction of Gamification Learning Framework (GM1.0) consists of four parts which are Problem Cases, Knowledge Points Set, Game Maps and Information Organization which are related each other. When well designed the components of the four implementation sections, the framework can guide learners to love the gamification learning process and can guide learners to solve problems, stimulate interests and cultivate abilities. Figure 1 shows the gamification learning framework which referring to the students' learning characteristics and some mature research results [10-17].

From Figure 1, we know that the final target of the project is gaining the Game Maps, which plays a leading role in the gamification learning framework construction.
4.1. Gaining the Problem Cases

Problem Cases are questions needed to be solved. On one hand, the quality of case selection is directly related to the learners’ learning interests, on the other hand, the final purpose of the case selection guides the students to learn and to master most of the knowledge points and knowledge units of selected courses. So we collect, arrange and extract cases interested in by students, mainly including entertainment, sports, science and technology information.

Then it need to classify the collected cases and gain the mathematical models which can do well in gaining the knowledge points set and making up all courses we selected. Figure 2 describes the problem cases working contents.

4.2. Gaining the Knowledge Points Set

In [8, 9], Research of Knowledge Points and knowledge Units and the Reuse Knowledge have been well done. A Personalized E-learning System Based on Portal Technology [7] had been constructed in 2011. In the E-learning System, the extraction of the knowledge points and knowledge units had been finished with the completion of the teaching research project “Research on learning resource management in E-learning environment” (we finished it in 2011-2013).

In this part, some adjustment has been done to the knowledge points and knowledge units description. The new description and organization method are as follows:

- The description and organization of knowledge points
  - Knowledge point name: briefly describe the knowledge point and cannot be repeated.
knowledge point attribution: detailed. Describe knowledge point including text, graph, audio and video etc.
knowledge point relevance: describe one knowledge point's preamble, follow-up and relevant knowledge points information.

- The description and organization of knowledge units
  - knowledge unit name: briefly describe the knowledge unit and can not be repeated.
  - knowledge unit attribution: show the relevant knowledge points and can solve a complete problem.

Table 1 shows the organization of knowledge points and knowledge units and the relationship between knowledge points and knowledge units.

| knowledge points | knowledge units |
|------------------|------------------|
| name can not be repeated | name can not be repeated |
| text, graph, Audio, Video, etc | relevant knowledge points |
| relevance preamble, follow-up, relevant knowledge points | level difficulty level |
| level difficulty level | |

4.3. The Research of Information Organization

In figure 1, we know that the research of information organization includes Task Level, Upgrade Checkpoints, Experience Promotions and Award Medals which can optimizing the game maps.

- Task Level: Task Level is the demarcation point of different knowledge points or knowledge units. The setting of task level should be able to meet the following requirements:
  - The task between every two task levels is a complete task which can described by a knowledge point or a knowledge unit.
  - The sequence of task levels can be adjusted if it do not affect the completion of the task.
  - There must be more than one task marked key task in a task level.

- Upgrade Checkpoints: Upgrade Checkpoints is related to the key task which determine if the task has been finished.
  - If all key tasks of a game map have been finished, then the learners can upgrade.
  - If all key tasks and all other tasks of a game map have been finished, then the learners can upgrade and gain extra points.

- Experience Promotions: Experience Promotions are the mark who have higher abilities, then more advanced tasks would be opened to them.
  - If learners finish only lower level tasks, the experience promotions improves slowly.
  - If learners finish higher level task, the experience promotions improves rapidly.

- Award Medals: Award Medals is the mark who can exempt from examination and gain more than 80 points.
  - If learners gain all award metals needed, then he can exempt from examination and gain 80 point at least.
  - If learners gain all award metals needed and take part in an examination, then he can gain 90 point at least.

4.4. Composing and Optimizing Game Maps

After gaining the problem cases and knowledge points set which coming from three courses (Algorithm Design, Data Structure and Program Design), composing game maps including as many questions as possible has come.

In the process of composing game maps, the more relevant organization of information is the field of relevance of knowledge points which including preamble, follow-up and relevant knowledge points. Then learners do not need to search knowledge points which they prefer to learning, and they only
need to select the problem cases interested in to them, and they can obtain the knowledge points related to cases easily.

With the use of the mature cases, organizing relevant knowledge points into knowledge units, and optimizing all knowledge units to reach the purpose of no or less repeated knowledge points in different cases. Then the learners can obtain the highest learning efficiency.

4.5. The Gamification Learning Framework

A Gamification Learning Framework (GM1.0) is constructed with the support of problem cases set, knowledge points set, and incentive factors set etc. In GM1.0, every learner can register an account and can finish tasks by walking different level game maps and obtain upgrade checkpoints, experience promotions and award medals etc. Then learners can own different role-playing score, which is very close to playing games. Do not it attract the interest of learners and enhance the innovative abilities of learners? Yes, it can. Why? Please have a look at the application results in section 5.

5. Application

An experimental class which has 46 students and a regular class which has 42 students are selected to test the design result. In the process of teaching, the experimental class have privilege to use the GM1.0 while the regular class have no privilege and the rest teaching and learning conditions are the same. Table 2 shows the the comparison data of the two classes.

| Class         | Learning Interests | Innovation Abilities |
|---------------|--------------------|----------------------|
|               | Attendance (%)     | Failure rate (%)     | (%)                  |
|               |                    |                      |                     |
| Experimental  | 87.4a              | 2.2                  | 82.7b/46.3c         |
| Regular       | 82.3a              | 7.14                 | 72.4b/23.1c         |

a The average attendance.
b The rate preferring to finish the new problems.
c The rate finishing the new problems.

We have found some differences in learning interest and innovation abilities of the two kinds of class. In learning interest aspect, the experimental class has higher attendance and lower failure rate. In innovation ability aspect, the experimental class has higher enthusiasm in solving unfamiliar problems. From the statistical data in figure 2, the difference is obvious.

6. Conclusions

The ultimate goal of higher education is enhancing the learners’ learning interests and inspiring innovation abilities of every students. Then searching the most appropriate teaching mode plays an important role. The experimental data above shows differences in the use of different teaching mode. After using the Gamification Learning Framework (GM1.0), the learning interests and innovation abilities have been improved greatly. More and more students prefer to join the learning process and have higher learning efficiency through the use of Gamification learning framework. It is hoped that more and more students join in the GM, and the enthusiasm for learning is getting higher and higher.

7. Acknowledgement

Educational reform project: Teaching Reform Project of Vocational Education in Shandong, China (2017281).

8. References

[1] http://www.nmc.org/publication/nmc-horizon-report-2013-higher-education-edition/.
[2] http://www.nmc.org/publication/nmc-horizon-report-2014-higher-education-edition/
[3] Kai Huotari, Juho Hamari. Defining gamification: a service marketing perspective. Proceeding of the 16th International Academic MindTrek Conference. pp: 17 - 22.Oct. 2012.
[4] Juho Hamari. Transforming homo economicus into homo ludens: A field experiment on gamification in a utilitarian peer-to-peer trading service. Electronic commerce research and applications. 2013, 12(1/6)
[5] Luis de-Marcos, Adrian Dominguez, Joseba Saenz-de-Navarrete, Carmen Pages. An empirical study comparing gamification and social networking on e-learning. Computers & education. 2014, 75(Jun.)

[6] Adrian Dominguez, Joseba Saenz-de-Navarrete, Luis de-Marcos, Luis Fernandez-Sanz, Carmen Pages, Jose-Javier Martinez-Herraiz. Gamifying learning experiences: Practical implications and outcomes. Computers & education. 2013, 63(Apr.)

[7] Xu Cui, Shaotao Zhang. The Personalized E-learning System Based on Portal Technology, WISM 2011:433-440

[8] Xingwei Hao, Xiangxu Meng, Xu Cui, Knowledge Point Based Curriculum Developing and Learning Object Reusing, 6th International Conference on Web-based Learning, (2007LNCS Vol.4823):126-137

[9] Xingwei Hao, Xiangxu Meng, Xu Cui, A Network Course Content Authoring Method Based on Discipline Knowledge Ontology Base, International Conference on Machine Learning and Cybernetics, 2007, Volume: 7:4192-4197

[10] Ben W. Betts, Jay Bal, Alan W. Betts, Gamification as a tool for increasing the depth of student understanding using a collaborative e-learning environment, International journal of continuing engineering education and life-long learning, 2013, 23(3/4)

[11] Jorge Simoes, Rebeca Diaz Redondo, Ana Fernandez Vilas, A social gamification framework for a K-6 learning platform, Computers in human behavior, 2013, 29(2)

[12] Brock Dubbels, Gamification, Serious Games, Ludic Simulation, and other Contentious Categories, International journal of gaming and computer-mediated simulations, 2013, 5(2)

[13] Erik D. van der Spek, Towards Designing for Competence and Engagement in Serious Games, International Conference on Serious Games Development and Applications 3rd, Bremen, Germany.

[14] Diane Nahl, Leon James, Gamification in Instruction and the Management of Intersubjectivity in Online University Courses, International journal of web portals, 2013, 5(2)

[15] Maciej Laskowski, Aleksander Wojdyga, What Can Gamified University Classroom Teach Us? Advanced Science Letters, 2014, 20(2)

[16] Balraj Kumar, Gamification in Education - Learn Computer Programming with Fun, International Journal of Computer and Distributed System, 2013, 2(1)

[17] Baughman, A.K., Chuang, W., Dixon, K.R., Benz, Z., Basilico, J., DeepQA Jeopardy! Gamification: A Machine-Learning Perspective, IEEE transactions on computational intelligence and AI in games, 2014, 6(1)