

Role Playing Game Quest Design in Multiplayer Educational Game

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Abstract: *In this research, we discuss how to design learning activities in the educational role-playing games with balance between fun and knowledge. Two major stages in integrating learning contents into the educational role-playing games are proposed in this research. Moreover, four principles are recommended for designing learning activities in the games. Following with the two stages and four principles, the learning activities for Fundamental Java Programming are designed in a multiplayer on-line role playing game. To evaluate whether the learning activities designed by the research team can engage students' learning motivation or not, a semester-long experiment is designed in 2018 Spring in north Taiwan.*

Keywords: Game-based Learning, Role-Playing Game, Quests Design, Java Programming Language

1. Introduction

Learners in 21st century grew up in a digital world and are usually called digital natives (Prensky, 2001). The way they learn is different from the old age; they can learn easily with media-rich and interactive learning methods such as game-based learning (Chang & Kinshuk, 2010). Therefore, many researchers focus on designing educational games or applying the game elements into the learning contents (Bueno, Chacón, & Carmona, 2008). However, there is a common issue in most of educational games – the unbalance between fun and knowledge.

In order to balance the fun elements and the educational content as well as improve learners' learning motivation through the educational games, this research proposes some design principles while designing the learning activities in educational role-playing games. Section 2 introduces the education multiplayer online role-playing game used in this research. The in-game learning activity design process is described in Section 3. Section 4 shows the learning activity examples designed by following the design process proposed in Section in the Fundamental Java Programming course. The evaluation plan which will be executed in 2018 Spring semester is designed in Section 5. In the end, Section 6 concludes the research and discusses the future works.

2. Literature review

Numerous evidences reveal that the contextualization and cognitive activities in virtual environment are more likely to engage learners in embedded and well-designed questions for learning (Scacchi, 2015). Therefore, creating a virtual environment for learning is increasingly regarded as a useful tool in the modern educational system in order to motivate learners by capturing their interest and enhancing their learning experience (Ketelhut, Nelson, Schifter, & Kim, 2013). On the other hand, digital game industry grows fast in the recent decades. Learners spend more time in the game virtual environment in their leisure time because of the fantasy, curiosity, challenge, and control features in games (Malone &

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Lepper, 1987). Some researchers and educators start using games which integrates the learning activities into the game environments and aims to improve learners' self-confidence, problem-solving skills and the learning; this learning strategy is called Game-Based Learning (Liang, Lee, & Chou, 2010). To introduce the game to the player and have the interaction with the player, the easiest way for game designers is using the quests mechanism (Tosca, 2003).

2.1. Quests in Educational Games

The quests serve as a set of instructions, and they can be considered as a specific order of challenges by structuring the events for the participants which can well-integrate the game objectives (Tosca, 2003). A quest is designed as a value-seeking activity from a goal-oriented view by Howard (2008). While designing the quests, the quest-based contextualization process (QBCP) can be used to restructure a traditional lecture in terms of educational quests (Yilmaz, Saran, & O'Connor, 2014). By transforming part of a traditional lecture into a well-defined questing structure to create a learning experience, the game-based questing approach is the core of educational game. It is usually a set of sequential tasks defined by the game designer to reflect the instructional objectives of the course, formed as an interaction perspective from which a game system can be materialized. The common method to design a quest-line questing structure is to take the advantage of the chain of events or tasks of instructional text books.

In role-playing games, quests are usually treated as the navigation to direct players to explore the game story or give the reason and meaning to players' actions (Sullivan, Mateas, & Wardrip-Fruin, 2009). Quests are usually highly incremental in its nature which includes repetitive actions. Therefore, quests contain different elements – such as characters, events, and story plots – with a set of (success or failure) conditions. The story plots in the quests bring out the interaction between the player and the game world. Those interactions can be roughly summarized into using or collecting the artifacts or abilities, delivering or exchanging the artifacts, exploring the specific area, escorting or protecting the Non-Player Controlled Characters (NPCs) to a specific location, having a conversation with a specific NPC, killing or fighting the monsters or the bad guys (Sullivan et al., 2009; Tosca, 2003).

After players accomplish those interaction, they are award experience points which are important for upgrading their avatar's level (Daneva, 2017). In the role-playing game, the players begin the game with the beginner level. When the players accomplish the quests or kill the monsters, they can earn the experience points to advance their avatar's level. In other words, the players' progress is structured in terms of levels which increase along with the avatar's development (Klevjer, 2012). The players can take higher level or more difficult quests when their avatars reach the corresponding levels.

2.2. Multiplayer Educational Game for Assessment (MEGA World)

The Multiplayer Educational Game for Assessment (MEGA World) is a web-based multiplayer online developed by Chang and Kinshuk (2010). Teachers can design learning activities for different learning objectives in the games and make learners do the activities through exploring the geographical feature (in the world map) and buildings (in the village map) in the virtual world (Kuo, Chang, Kinshuk, & Liu, 2010). As we mentioned above, there are different interactions that between the game story and the players; MEGA world can realize those interactions through different types of quests. For example, the teacher can design multiple-choice quests / true-false quests to integrate the course material in order to assess the learners' learning progress. After learners (players) have signed in the game, they can take quests given by Non-Player Characters (NPCs) and use the knowledge learned from the course to accomplish the quests. Additionally, MEGA World also supports the level mechanism. When the learners complete the quest successfully, the NPCs offer them gold and experience points. If the learners get enough experience in one level, the avatars' level will be raised so learners can take higher level quests with higher difficulty.

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This research use MEGA World as the game-based learning platform to design the quests for Fundamental Java Programming course. Through the design process, the research team has proposed two major stages in quest design and several design principles when integrating learning activities in the quests.

3. Quest Design for Role-Playing Games

In MEGA World, the player can earn the experience by solving the quests to raise their avatars' level, and then take the quests which meet their current level. Therefore, the first stage of designing quests in the role-playing game is deciding how to assign the course materials into each level. This research uses Fundamental Java Programming course's material from the C University in north Taiwan as the foundation to design the role-playing quests. Eleven chapters are covered in the course, so there will be eleven levels of quests that players can take. When the players reach a higher level, they will meet more difficult quests. To prevent players from taking the wrong level quests, we assign eleven swords to different levels as a required item for the beginning quest corresponding to each level. Therefore, the players will never have a chance to take higher level quests when they are still in lower levels. Table 1 shows the rarity swords assigned to different level quests designed in this research. If the player only has the Ceramics sword, the systems will not allow he/she to get the quests in level 2 which is considered the Bronze sword as the required item.

Table 1. Sword mechanism for different levels.

Learning Contents	Learning Topic	Quest Levels	Required Swords
Chapter 1	Introducing Java programming language	Level 0	Ceramics Sword
Chapter 2	Structure of Java application	Level 1	Obsidian Sword
Chapter 3	Variable and data type	Level 2	Bronze Sword
Chapter 4	Operators	Level 3	Iron Sword
Chapter 5	Selection structure and loop	Level 4	Sapphire Sword
Chapter 6	Array	Level 5	Emerald Sword
Chapter 7	Function	Level 6	Ruby Sword

Since the objective of the game is evaluating learners' Java programming knowledge and skills, the quests should contain the questions assessing learners' knowledge corresponding to each chapter. Table 2 shows the sample questions for each level with various question types (e.g., single/multiple choice, cloze, order).

Table 2. The assessment question examples for different levels.

Question number	Question Concept	Question Content	Question Type
1-1	Introducing Java programming language	What are the predecessor and developed company of Java programming language?	Multiple Choice
2-5	Structure of Java application	Please select the option(s) that meet the variable naming principle.	Check-all-that-apply
3-1	Variable and data type	Please make up the following code to keep the value of the variable PI invariable: double PI=3.1415926;	Cloze

4-2	Operators	Please sort out the correct order of operations. A=b==1&&c++<=1 ! D<0!	Order
5-1	Selection structure and loop	Write the correct code according to the following notes: int a=1, b=4, max; _____ //a>b, max=a, otherwise max=b.	Text input

After mapping the questions to the levels, the next stage is constructing the game story. The story is a key factor that determines whether the role-playing game is attractive or not. Most of famous commercial role-playing games, such as World of Warcraft and Final Fantasy series, have attractive, fantastic stories and comprehensive, imaginable worldviews. Constructing the role-playing game story is similar to writing a novel. The story can be unrestrained to the real world, such as people in the story are living with gods and demons, and the player might be an adventurer or a brave warrior that need to save the world from demons' power. In other words, the story maker can put anything he/she likes into the story if it makes the story interesting and attractive.

Although the story of role-playing games can be unrestrained, there are three principles to follow while the research team constructing the story. First, the relationships between quests and NPCs build the framework or the foundation of the story. In other word, we have to construct the structure of quests before building the story. The structure of quests can be a series of linear main quest with multiple sub-quests. Players must finish one main quest and corresponding sub-quests and then move forward to take the following main quest. Figure 1 shows an example of the structure of quests. If the player wants to accomplish the quest 2, he must accomplish the quest 1 as the pre-quest for the quest 2 and have to finish the quest 2-1 and quest 2-2 to gain the required item of quest 3.

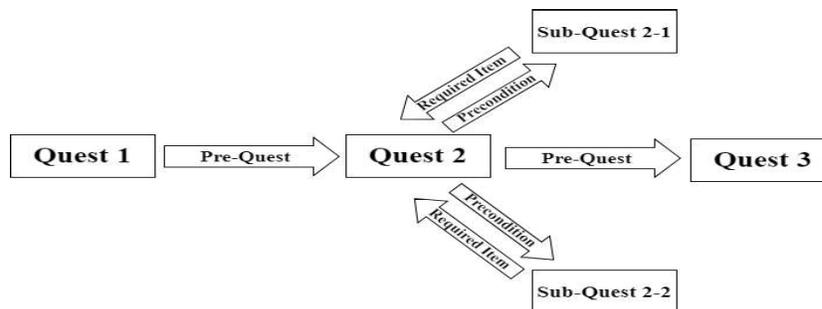


Figure 1. structure of quests.

Second, the learning contents would never be mentioned in the story. The term of learning contents should be replaced to the other vocabularies while constructing the story. Because the term of learning contents seems abrupt if it is mentioned in a fantasy story with gods and demons, much less if the era of the story is in ancient time. The players would not immerse in the story if they see the abrupt terms. We should replace the term of learning contents to other vocabularies which fit in the story. In this research, we never use the term “Java” in our role-playing game story. We replace the term “Java” with “ancient language” so that the learning contents can fit in the story smoothly.

Third, in the beginning of the story, there should be some greeting quests or introduction quests to teach players how to play this game and tell them what rules should be followed. Players will be confused and resist playing the game if they know nothing about how to play the game. There should be some greeting quests to introduce the game to players so that players would like to play this game and yearn to know the following story.

Finally, there are different types of assessment question which shown in table 2; integrating question type into story should be carefully designed. For instance, if the question is a multiple choice question, the story can be designed as the

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player has to help the archaeologist team to select the right translation paragraph of the ancient language (Java language) from several possible translation paragraphs. Similarly, if the question is cloze, the quest tells the player that they have to fill in the blanks in the incomplete paragraph of the ancient language on a magic stone stele in order to bring the magic power back.

Fighting is a crucial feature that makes the role-playing game attractive. However, there is no fighting mechanism in MEGA World for now. Fortunately, we can still present the fighting scenes in a narrative way. For instance, there is a giant monster going to attack the player, the player has to answer the assessment question correctly to dodge the attack. If the player dodges the attack successfully, he needs to answer another assessment question to attack the monster. At the end, player answers all the assessment questions correctly and defeat the monster.

4. Assessment Quests for Fundamental Java Programming Course

Based on the stages and design principles described in the previous section, the game for learning Java is designed in MEGA World. The game story we constructed is about a powerful demon called the Diablo which had been sealed by the gods a long time ago breaks the seal and tries to destroy the world. To save the world, players will face different conundrums and fight the Diablo's minions; they need to use their Java programming knowledge and skills to overcome those conundrums and seal the Diablo again. To let the player understand the story easily, the background story is described in the beginning greeting quest. Moreover, players must take a specific profession in training to take the corresponding quests; therefore, the player needs to become the Adventurer to take the quests for Fundamental Java Programming course. Figure 2 shows the greeting quest given by the city guard illustrating the current state of this world. Because the player haven't been the Adventurer yet as block A in Figure 2 shows, the quest also leads the player to the profession trainer in order to start the training.

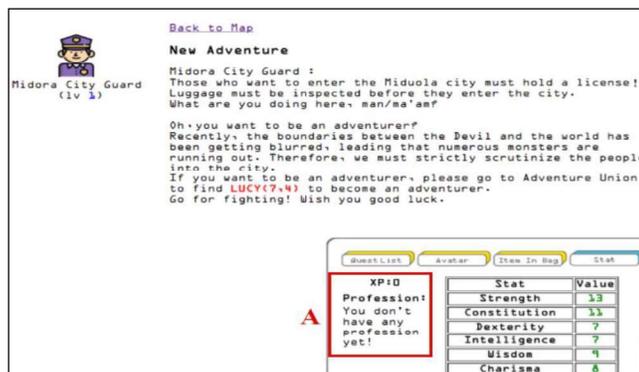


Figure 2. The greeting quest which presents the background story to the player.

One of the important principles of designing the role-playing quests is teaching players how to play this game or telling them what objectives they should pursue for. Figure 3 shows that after players becomes the Adventurer which shows in block A, the introduction quest from Lucy – the profession trainer NPC – informs players about the sword mechanism. She tells players about how to upgrade the professional level and players should meet her again to upgrade the sword before taking the higher-level quests. This quest also informs players that becoming the Supreme Adventurer is the main objective. After reporting this quest, players gain the level 0 sword – Ceramic Sword – and begin their journey.

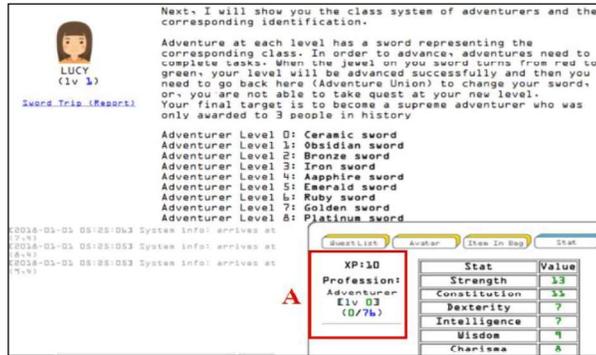


Figure 3. The introduction quest which introduces the game to the players.

As we just mentioned in Section 3, in order to let the player immerse in the story, we should never mention the learning contents in the story and replace it with other terms. For instance, we replace the “Java programming language” into “ancient language” as the part A of Figure 4 shows. Midora Lord asks players to help the relic survey group to translate the ancient language written in a book of history. The question of this quest is a multiple choice question about the predecessor and development company of Java language which shown in part B of Figure 4. Midora Lord gives player three translation fragments, and player should pick up the right one. Unlike traditional multiple choice question, we design three different items and use the possible answers (learning contents) as the description of each item rather than give three possible answers (learning contents) and let player choose from them directly. In this way, player can answer the assessment quests without abrupt.

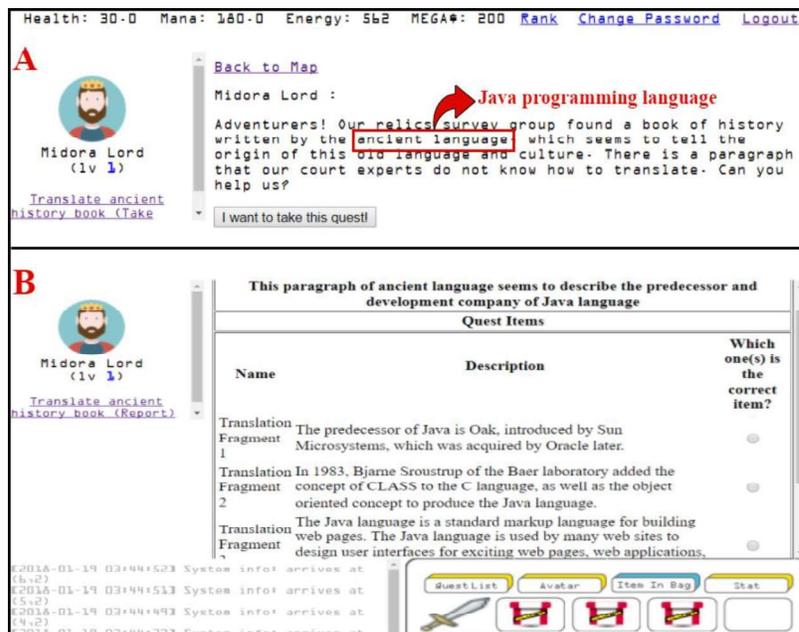


Figure 4. The example of single choice assessment quest.

An example of fighting mechanism in MEGA World is demonstrated in Figure 5. The monster Cracken has been released by a mystery man and is going to attack the player. The player needs to answer the assessment question correctly to aim and shoot the arrow into the Cracken’s eye which shown at the part A to part B in Figure 5. If the player sent the correct answer, the Cracken’s solid skin begins to melt; otherwise, the player has to do the assessment question again. At

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the end of the fight, the player also need to see through the weak spot and give the monster a fatal hit by answering the assessment question correctly which shown at the part C to part D of Figure 5.

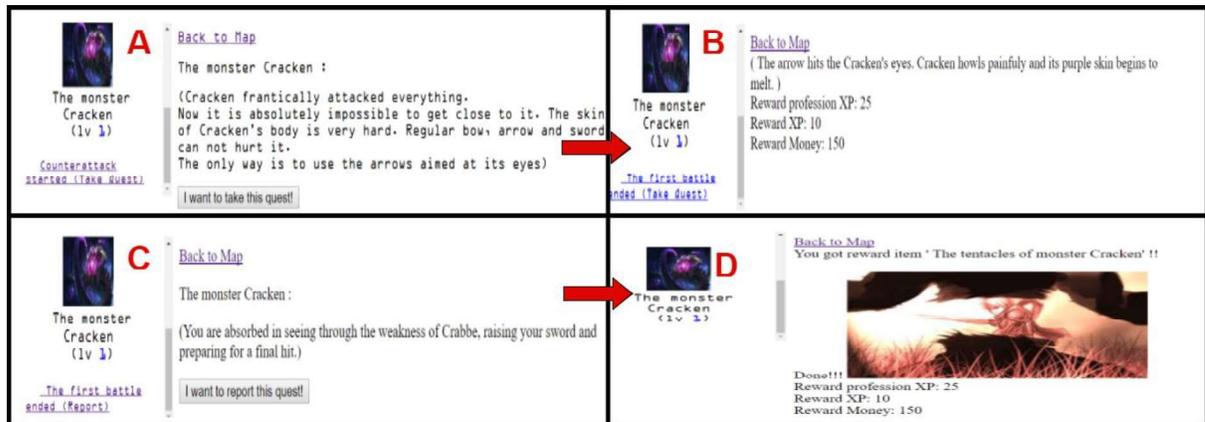


Figure 5. The fighting senses presented by quests.

5. Evaluation plan

To evaluate the educational game we created, the research team recruits the students who will take Fundamental Java Programming course in 2018 Spring from the C University in north Taiwan. In the beginning of the semester, the instructor will demonstrate the game to the students and the students will answer a questionnaire regarding to their game experience. During the semester, the students have to complete the quests of each level after their class each week. The instructor will collect students' data, such as their current avatar's level at the end of each week. Furthermore, to evaluate students' knowledge from time to time, quizzes with five questions will be arranged every three to five weeks. All the questions will be picked up from the assessment questions in the game.

In the end of the semester, the research team would like to know whether students' learning motivation is engaged by the quests designed in MEGA World. Besides using questionnaires, some in-game information can be observed as the indicators of students' engagement. Because the quest levels are corresponding to the learning content in syllabus, players' avatars' level shows which quest level they can take as well as which learning content they are working. For instance, in fifth week of semester, students are learning selection structure and loop in the class, which is corresponding to the quests in level 5. If one student's avatar's level is still in level 3 at that time, we can conjecture this student might have some problem in learning Java programming or he/she is not interested in the game. On the contrary, if the student's avatar's level is more ahead than the current week, we can assume this student might pay a lot of attention on this course or the game truly increases his/her learning motivation.

6. Conclusion

In this research, we have proposed two basic stages to combine the learning contents into the game and some principles in designing the quests and the story in the educational role-playing games to make the balance between fun and knowledge. The first stage is considering how to assign the course materials into the quests for each level. The second one is integrating attractive stories in the game to make players feel interesting. There are four principles to follow while designing the story:

- (1) The framework of the story is the relationship between quests and NPCs.

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(2) Integrating question type into story should be carefully designed.

(3) Greeting quests or introduction quests are important for teaching players how to play this game and tell them what

(4) rules should be followed in the beginning of the game.

The learning contents should never be mentioned in the story so the player will not feel abrupt while playing.

To evaluate whether the game we created can engage the learners' learning motivation, we design a semester-long experiment for one class of students who will take Fundamental Java Programming course in C University in 2018 Spring.

However, there are some limitations in this research. First, there is no fighting mechanism in the MEGA World yet. Although we present the fighting senses in narrative way and combine them with assessment questions. It can still reduce the attraction of our game. Second, the students must cooperate with the instructor well. If the students don't cooperate with the instructor or they actually don't want to learn through playing game at all, the data we collected might lack of credibility.

In the future, the fighting function will be developed to fulfill the requirement of fighting scenes which can make MEGA World more attractive. The quest design process can be standardized into a procedure to make the designing process more easily and universal. The teachers can design quests for different course by using the same procedure. Moreover, how to generate the quests with story narrative automatically can be an interesting research issue.

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