Open and Distance Educational Gaming: using generic frame games to accelerate game design

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Abstract: A research and development program initiated under the aegis of the Centre for expertise and research (SAVIE) developed a series of generic educational game design shells to enable teachers, trainers and community services workers to create educational games that provide effective learning conditions and are adapted to their distance learning needs. These environments were based on the frame game concept as formulated by Stolovitch and Thiagarajan (1980) and on the essential attributes of games as compiled within the framework of the longitudinal *Simulations and Advanced Gaming Environments for Learning Project (SAGE)* research project. In this paper, we will define the concepts of educational games and generic game shells. Then, an example will illustrate how a generic shell such as that of the Mother Goose Game can generate quality educational games adapted to the needs of distance learners at various levels of schooling.

Keywords : Educational games, generic game shells, frame games, online learning, distance and open learning, SAVIE, SAGE

INTRODUCTION

The advent of the Information Superhighway is heightening interest for the use of games for education, whether initial or ongoing (Johne, 2002). Studies by Sauvé *et al.* (2005, 2002) and Baranowski *et al.* (2003) show that games create favourable learning conditions, namely feedback, challenge, interaction, active participation of learners, motivation and skills development and reinforcement. In order to make games easier to use in instructional settings, a research and development study was initiated by SAVIE; this study was later integrated into the cross-Canada longitudinal research project named *Simulations and Advanced Gaming Environments for Learning Project (SAGE)*. The SAVIE study examines how to design generic educational gaming environments which take into account teacher and trainer needs and contents while creating effective learning conditions.

In this paper, we shall first define what we mean by educational game; then, we shall explain the concept of generic game shell. Finally, using an example, we shall illustrate how a generic shell such as that of the Mother Goose Game can generate quality on-line educational games.

1. WHAT IS AN EDUCATIONAL GAME?

Based on a systematic literature review of the conceptual foundations of educational games, Sauvé et al. (2005) define an educational game as an artificial situation (fictitious, fanciful) in which of a player or players are put in a position of conflict (struggle, confrontation), at times one being set against another (competition) or, at times, players being allied against other forces (cooperation), is governed by rules (game movements, game control and game over) which structure their actions with one aim in mind: winning (winners vs. losers), being victorious (overcoming chance, beating the computer, one or several players) or defeating an opponent, all while learning.

2. WHAT IS A GENERIC GAME SHELL?

The generic game shell concept is based on the definition proposed by Stolovitch and Thiagarajan (1980). A frame game is a teaching tool endowed with a structure that generates learning activities, promotes the use of various strategies, involves conflict and provides a set of rules governing player movements and criteria which allow players to end the game by declaring a winner. Such a structure can easily be adapted to a wide range of pedagogical objectives and content (Hourst & Thiagarajan, 2001; Sauvé & Chamberland, 2003). Any game can thus be broken down into two main parts:

- The structure (which becomes a generic shell in the game design environment) determines the way the game is played: the rules, the stages of the game or player movements, the challenges they must face and the winning strategies they can deploy to win. As for the game itself, what we do is "empty" the game of its content to expose its underlying structure. Once this structure has been identified and analysed, it becomes a "frame".
- The content refers to the information conveyed during the game. In the case of games of a pedagogical nature, this also involves the objectives pursued and the skills that will be developed by playing the game. Once the game has been designed, one needs only to slip in the new content with predetermined objectives to generate a new educational game with adapted to a new target audience.

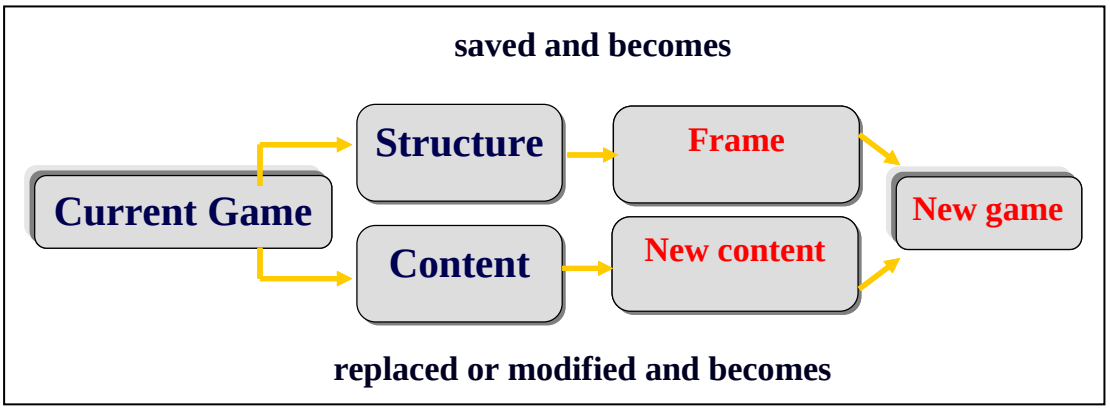

Figure 1: Interchangeable content

It is the structure that will generate the components to be programmed in the educational game design environment. Hence, any existing game is a potential frame game. However, a game must be closely analyzed for the structure to be separated from the content. A great game can be recognized by the harmony existing between structure and content; the frame game fulfills this requirement. But what makes the frame game especially useful is that other content can be substituted for the original content, while being perfectly compatible with the structure. It is this fundamental characteristic, that of interchangeable content, that makes the frame game such an interesting educational tool. Figure 1 illustrates how interchangeable content works.

In this way, a frame game can often respond to a large number of different educational needs. With any one frame game, an infinite number of new games can be created, as many as required by students and educators for virtually any educational content.

Taking into account this definition of generic shell, a series of analytical research studies of Web sites with online games were conducted (Sauvé & Samson, 2004; Sauvé et al., 2002; Sauvé et al., 2001) and repeatedly produced the following results:

- There are some on-line educational games with educational content, namely in mathematics and French;
- Most of the on-line games require tedious downloading or expensive purchases;
- There are few games offering educational content which meet the educational and technological criteria expected by teachers;
- There is little information about learning acquisition through online gaming and, when there is, it is in the form of basic statistics;
- There is an absence of on-line, computerized game shells such as defined in our study for the development of educational games adapted to the various levels of schooling.

Applying the frame game concept, five computerized, user-friendly generic shells were developed for the on-line modification of learning content. Teachers are hence able to create new games adapted to student needs. Help bubbles were designed to appear on demand to assist teachers using these shells throughout the content integration process.

3. AN EXAMPLE OF ONLINE APPLICATIONS

Taking into account the concept of frame games, five generic, computerized game shells were developed for the Educational Games central): Snakes & Ladders, Tic Tac Toe, Trivia, Mother Goose Game and Concentration (which can be found at the following address: http://egc.savie.ca. In every shell, the educational content can be modified online and in a user-friendly way so that teacher or trainers can create new games adapted to the needs of their specific pupils, students or clientele. Each shell also offers a Help section which supports the designer throughout the content insertion process.

Two university professors adapted the generic Mother Goose Game shell within 70 minutes to develop a game on theories of motivation in an instructional setting. In figure 2, a description of the original Mother Goose Game is presented. In figure 3, the adapted shell creating the game *Motivation in Play* is shown; the game board was modified to reflect the specific game contents.

Forty questions were written on various aspects of theories of motivation and the rules were redesigned and adapted to this specific content and appeared as follows:

1. Each player rolls the dice; whoever gets the highest number begins the match.
2. Players put their tokens on **Start** and begin playing, each one taking a turn. If a player correctly answers a question, his/her token moves forward, according to the number indicated on the dice. Otherwise, the token stays where it is.

Object of the game : The first player to arrive at square 63, with an exact throw of the die, wins the game.
Number of players : 2 - 4.
Time : 30 - 45 minutes.
Instructions :

- The players throw the die and advance their pawns accordingly. If a pawn lands on a square with a goose, that player gets another turn.
- When a player lands on one of the other squares with a symbol, directions are as follows:
    - a skull: go back 1 space;
    - a well: advance 5 spaces;
    - dice: go back 8 spaces;
    - a house: advance 3 spaces;
    - a prison: you lose 1 turn.
- A player wins when he reaches the end with an exact throw of the die. If he throws a higher number than is needed to arrive at the end, he must move back the number of extra spaces. For example, if a pawn is on square 62 and the player throws a 5, he has to advance his pawn 1 square and go back 4 spaces to square 59.

Material

- A game board that consists of a spiral road with squares numbered 1 to 63;
- Some squares have symbols with different directions;
- 4 colored game pawns;
- 1 die.

Figure 2. Description of the Mother Goose Game

3. When a **6** is rolled, a player gets to roll a second time. If the token lands on one of the squares with a symbol, the player has to abide by the rules which govern these squares before rolling the dice again.
4. When the token lands on the **teacher & pupil** square, a question is displayed on the screen. If the player correctly answers the question, his token moves forward three squares. If the player cannot answer the question, his token stays where it is.
5. When the token lands on the **medallion** square (which symbolizes teamwork), a question is displayed on the screen. If the player answers correctly the question, his token moves forward five squares. If the player cannot answer the question, his token stays where it is.
6. When the token lands on the lozenge -8 square, a question is displayed on the screen. If the player correctly answers the question, his/her token remains where it is. If s/he cannot answer the question, the token moves back 8 squares.
7. When the token lands on the **D** square, the player returns to Start.
8. If a token lands on the **scissors** square, the player misses a turn.

9. When the token lands on the **darts & dartboard** square, the player gets to play again if s/he correctly answers the question displayed on the screen. If the player cannot answer, s/he loses the right to play again.
10. If a token lands on a square where there is **already another token**, the token which was already on the square is automatically back to **Start**.
11. The game is over when one of the players lands on square 65 with an exact roll of the dice and correctly answers the question. If a player rolls the dice and gets a higher number than that which is needed to land on square 65, the token moves back the number of extra spaces. For instance, if a player's token is on square 62 and s/he gets a 5 by rolling the dice, the token moves forward 3 squares and then moves back 2 squares. The token thus ends up on square 63.

The analysis of the game shell offered online at Educational Games Central shows that the original version of the Mother Goose Game was adapted to allow teacher-designers the opportunity of integrating closed questions of various types (True or False, Multiple Choice, Fill-in-the-blanks). The game shell also has added features, such as requiring players to answer a question before their

Figure 3. The "Motivation in Play" Game (French language example)

token leaves Start or to return to Start when they have almost reached the end of the game. These challenges expose players to all of the required learning content and thus meet teachers' educational expectations.

CONCLUSION

Given the difficulty teachers face in trying to find Web-based educational games adapted to their needs, a research and development initiative was launched by SAVIE. This initiative widened its scope and became integrated into the SAGE network which is funded by the SSRHC Initiative of the New Economy program (2003-2007). This paper has presented its current results. To sum up,

definitions for an educational game and a frame game have been presented to show how computerized generic shell games were developed. Five shells were field-tested with teachers at all levels and an application of the generic game shell called the Mother Goose Game described.

A pioneer in the development of generic educational game shells on the Internet, SAVIE's research and development initiative provides teachers and professors, trainers and human resource developers with the possibility of quickly developing, on-the-spot, educational games while contributing to a growing bank of games which is constantly being updated and expanded by experts and teachers. This game bank is accessible to the entire Canadian teaching and learning community as well as around the world. It is entirely up to you to be a part of it by registering at Educational Games Central at the following url: http://egc.savie.ca

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