

A Generic Internet-based Game Design Environment for STI Education

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Abstract: The risk of acquiring a sexually-transmitted infection (STI) is unfortunately part of today's reality for adolescents all around the world. Numerous ways have been developed to inform teenagers and other at-risk groups of the dangers associated with various types of infection. Within the framework of a health education research program, *Simulations and Advanced Gaming Environments for Learning Project – SAGE* (2003-2007), one of the program teams has developed an Internet educational game which includes four aspects of STIs: prevention, prevalence, transmission and treatment. First of all, this report will present the generic game shell concept. It will then illustrate how the structure of the game *Parcheesi* has become a generic game shell. Next, it will describe the stages in the design of the game *STI: Stopping Transmission* created by medical practitioners associated with this research. Finally, there will be a brief explanation of testing which will take place in the Fall of 2006 in Canadian and Mexican high schools.

INTRODUCTION

The risk of acquiring an STI is, unfortunately, a part of life for adolescents all around the world. In 2005, about 58,000 people were living with HIV in Canada. About two-thirds of the declared cases fall between the ages of 15 and 24 (Public Health Agency of Canada, 2005). Gonorrhoea, the second most widespread STI, is an infection that is on the rise among young Canadians. In the United States of America, Chlamydia is considered the most widespread STI with close to one million declared cases in 2004. This data must be nuanced because HIV data is available only from 35 states which represent slightly less than half a million of the declared cases (AVERT, 2004). Gonorrhoea affects 330,132 people. It should be noted that the number of declared cases is quite different from and inferior to the actual number of cases because many people simply do not know that they are infected or refuse to see a medical doctor after being exposed to a risk of infection.

Different means have been developed to inform teenagers and other at-risk groups of the dangers associated with these types of infection. These means have caused the number of declared infection cases to go up, year by year, through infection awareness programs, improved detection testing and respect for privacy. Within the framework of the SAGE for Learning health research program (*Simulations and Advanced Gaming Environments for Learning Project – SAGE*, CRSH-INÉ, 2003-2007; ENJEUX-CANARIE, 2005-2007), one of the teams has developed an internet educational game, in collaboration with two medical practitioners. The goal is to teach and heighten awareness of four aspects of STIs : (1) Prevention : information on the proper methods of breaking the STI transmission cycle (types of condoms, identification of risky behaviour, etc.); (2) Prevalence : an overview of the situation on the spread of infection or cases of carriers of STIs and information on infectious vectors themselves (their nature, their effects, visible or invisible); (3) Transmission of STIs : information on the method of transmission of various STIs. This section allows the re-evaluation of strongly-held, widespread beliefs found within the general population; (4) Treatment: information on how to cure (or to live with) sexually transmitted infections. This section includes both information on how to prevent transmission when you have been infected – for instance, abstaining from at-risk behaviour until treatment is over - and information on what to do when you believe you have been exposed to an infection.

First, this report will present the concept of the generic game shell. Then, it will illustrate how the structure of the game “Parcheesi” was modified to become a generic game shell. Next, it will then describe the stages of design of the game *STI: Stopping Transmission* created by medical practitioners associated with the research. Finally, there will be a brief explanation of testing which will take place in the Fall of 2006 in Canadian and Mexican high schools.

THE CONCEPT OF GENERIC SHELLS FOR GAMES

The concept of generic shells for games has been developed by Sauvé (Sauvé et al. 2002) from the concept of frame games put forth 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 educational objectives and content. 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 an educational 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 which is adapted to the new target audience.

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. Generally, board games are the easiest to adapt to a game shell. There are numerous reasons why they are of interest in our research: (1) they are known by the public at large (who hasn't played Snakes and Ladders, or Tic Tac Toe or even Parcheesi?); (2) they offer simple structures, with few rules which thus facilitates adaptation and most of all (3) they correspond to the notion of “game” by distinguishing themselves from simulations or gaming simulations since board games are built from the imagination rather than from reality. Let us examine how the team adapted the frame of the game Parcheesi to make it into a generic game shell.

ADAPTATION OF THE PARCHEESI FRAME

The Educational Games Central website offers six generic game shells (<http://www.savie.qc.ca/CarrefourJeux/an/accueil.htm>) in three languages (French, English and Spanish). Hence, teachers are 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.

To develop a game shell, the research team used an adaptation of an interactive, instructional design model developed by McGriff (2000). Testing methods included expert internal validation and also a sampling of a target population as developed by Bordeleau and Perron (1994) and validated for online games by Sauvé et al. (2002) during the development of generic educational game shells. Let us now examine how the game of Parcheesi was adapted to become a generic game shell.

The Choice of the Game

Based on a systematic revue of writings (1998-2004) on educational impact of games (Sauvé et al. 2005a), 40 different games were analyzed (Sauvé et al. 2005b) and an inquiry, both in Quebec and New Brunswick, among students and teachers from both elementary and high school level (IsaBelle et al. 2005), different criteria were retained to finally select the new game shell.

As for the structure of the game, the shell had to represent a challenge to players and promote competition among them, it had to be playable by between 2 to 6 players; it had to allow for the creation and identification of teams; it had to encourage exchanges between players; it had to be playable on one computer or on a series of networked computers; it had to allow for the option of one playing alone and offer at least two paths on the board game so as to motivate students who answer correctly.

With regard to content, the shell had to allow for the inclusion of video or audio clips as well as pictures and illustrations embedded in the questions or learning activities so that players would experience real-life situations thereby promoting behaviour modification and complex learning. Tools also had to be included in order to design online learning modules. Reflection questions not associated with winning or losing and some open- and closed-ended questions with a real-time correction mechanism also had to be included.

Five Games were analyzed in light of the-above mentioned selected criteria: Parcheesi, Pay Day, Mille Bornes, Monopoly and MindTwister Math. As a result of the analysis, it was found that the structure of the game Parcheesi lent itself to the needs and objectives of the project.

Adapting the Structure

First of all, we identified the structural components of Parcheesi. Numerous adaptations were made in order to include educational aspects and to turn it into a generic game shell such as, the game board, the rules, the instructions, learning activities, educational material and, finally, the end-of-the-game ‘synthesis’ (or round-up). Figure 1 presents the description of the game as modified.

Generally speaking, the game board is rarely modified in a generic shell. In this case, we took into account educational requirements and added a second track, a faster one than the initial track on the board, all the while maintaining the same number of squares and the same square shape of the board. Materials for the game such as the number of pawns per player or per team or the number of dice were maintained. *Learning* cards (integration of the learning content), *Team* cards (all teams play at the same time) and *Chance* cards (randomness to increase or reduce the chances of winning the game) were added to respond to the learning objectives and to maintain motivation.

The rules that dealt with player movement were improved. The *procedural* rules describe the game’s components: the number of players or the number of teams, the role of each player, their activities, and the moves they are allowed to make, how the game begins, how players proceed through the game, scoring and, finally, the length of the game. In our adaptation, we included rules 5 to 8, 10, 12 and 13 which deal with player’s actions during the learning activities and the movement of the pawns along the regular track and well as along the second, faster track.

The rules for *ending* the game deal with how to win the game and how the game ends. Generally, the end of the game determines the winner; however, there are games that can end in a tie. In Parcheesi, the end of the game occurs when one player or one team reaches the end with all four pawns. We added a second way the game can be won while respecting the allowed time for a study period as shown in rules 2 and 14 of the adapted version. The *control* rules describe the consequences of a player executing an illegal action or not following the instructions and the preceding rules. In the Parcheesi game shell, there are no control rules tied to the original structure but we added certain limits in the movement of pawns to rules 5 to 7 when a team or player does not successfully complete the learning activities.

In board games, there is no distinction between rules and instructions, unlike computer games. In board games, it is the players who move their pawns around the board. In computer games, a game engine moves the pawns for players, identifies who starts the game and plays afterwards. The goal of these instructions, which we distinguish from the rules, is to facilitate players’ understanding of the limits imposed by the game engine. For instance, the instructions will indicate which player must click on the die or which player must complete an educational activity to obtain points. No one else can play until the player whose turn it is has finished playing.

Adapting Content

In general, a game’s content is entirely modifiable. We first added learning activities to the shell in order to reach the above-mentioned educational aims. The predetermined formats linked to the 11 types of different activities were integrated and presented as follows: open- or closed-ended questions, situations in the form of illustrations, audio or video clips, cases to be analyzed, logical sequences to be completed, etc.

Other tools were also integrated into the shell. These tools are for the design of educational material in the form of learning objects. This material is made available to players both before and after the game. A debriefing session was designed to be used for player feedback on the game. This debriefing is strongly recommended since it is considered an important step in the integration of acquired knowledge, emotions or attitudes developed by the game.

The Parcheesi generic game shell definitely offers designers all of the tools needed to set game parameters, generate instructions and rules dealing with player movement, construct educational activities and required educational material, establish criteria for how the game ends, elaborate player feedback instruments and finally evaluate the game in order to insure that the regular game revisions and also measure its effectiveness on learning.

Goal of the game: there are two ways to win the game:

- Be the first player or team to move your four pawns into the end zone and also succeed in the final challenge.
- After a set time for the length of the game, be the player or team with the most points when the game ends.

Number of players or teams: the minimum number of players is at least 2 players or two teams of two players and the maximum number of players is 4 players or four teams of four.

Length of the game: When players are creating their teams, they can decide in advance what the length of the game will be. They can also decide not to impose a time limit to the game and simply let the game go on until one team has moved their four pawns into the end zone and have completed the final challenge.

Game Play

1. The game must be played with a minimum of two players each forming a team or a maximum of 16 players divided into 4 teams. Any other combination is also possible.
2. Before starting the game, teams have to decide how the game is to be won:
 - When all four pawns of a team have reached the end zone and correctly completed the educational activity.
 - When the predetermined amount of time has elapsed.
3. To start a game, the system records the number of teams and their make-up. Four pawns are then automatically placed into each team's personal space.
4. Who begins the game is purely random. Each team clicks on the dice. Whichever team rolls the highest number begins the game.
5. A team must obtain a double (1-1, 2-2, 3-3-, 4-4, 5-5, 6-6) for the system to move a pawn to the *Start* square. The team then clicks on the coloured pawn they want to move to the *Start* square. When a pawn is placed on the *Start* square, the team in question must attempt to complete an educational activity which corresponds to the color of their pawn:
 - If the team successfully completes the *first activity*, they can then roll the dice and move the pawn the appropriate number of squares along the fast track.
 - If the team does not complete the first activity, the pawn remains on the *Start* square and the team waits their next turn to try again.
 - If, on the next turn, a team completes the second activity, the pawn on the *Start* square is allowed to move along the regular track.
 - If a team does not complete the second activity, the pawn remains on the *Start* square. The team must then wait another turn to try again until they do complete an activity.
6. As soon as a team has moved a pawn, turns will happen as follows:
 - Players must complete an educational activity corresponding to the colour of the pawn which was moved during the last turn.
 - If the team successfully answers the question in the time allotted, the team then clicks the dice and can move a pawn the number of squares corresponding to the result of the dice. A team can also decide to bring a pawn into the game if the result of the dice allows it. Two pawns from the same team cannot occupy the same square. This means that a team cannot bring new pawns into the game if there is already a pawn on the *Start* square.
7. When a team moves their pawn (either on the regular or the fast track) and crosses a *Start* square, the team must successfully complete an educational activity. This has to be done even if, given the results of the roll of the dice, the pawn crosses over the *Start* square. Successfully completing the educational activity is important since it determines which track the pawn will take, whether in finishing the move in progress or with regard to the next turn. If a team successfully completes an activity, the pawn may continue to move along the fast track. If the team fails, the pawn will move to the regular track. The same rule applies if the team lands on the *Start* square with an exact roll of the dice. When successful (in completing an activity), the team does not click on the dice but the pawn will go on the fast track at the next turn even if the team decides to move another pawn after having completed the activity. In other words, a pawn retains the ability to move along the fast track if the team has successfully completed an activity. When a pawn crosses a *Start* square before embarking on a track that leads to the end zone, the team must yet again complete an educational activity. If the team does not succeed in this, the pawn remains where it is. The team must complete a new activity before being able to take the track that leads to the end zone. If a team completing an activity has a pawn that was interrupted in its movement because it crossed the *Start* square, the pawn can resume its movement along the track that leads to the end zone.
8. Each team who successfully completes an activity earns points. The points vary according to the amount of time taken to complete the activity.
9. If a pawn lands on a square already occupied by another pawn, the latter is sent back to the *Start* square. If the returning pawn lands on a *Start* square which is already occupied by another pawn, it is sent back to the team's personal space.
10. Each pawn can only reach the end zone on the board with an exact throw of the dice. The result of the dice has to be the exact number of spaces needed to reach the end zone (the center counts as one space). When arriving in the end zone, the pawn is removed from the game and the team gets 200 points.
11. When a team throw the dice and get a higher number than the number of spaces required for a pawn to reach the end zone, they have two options:
 - The team can decide not to move the pawn until they obtain an exact result and, instead, move another pawn which can move according to the result obtained by the dice.
 - They can move the pawn to the center square and move the pawn back corresponding to the roll of the dice. For example: say the pawn is two spaces away from the end zone and the team rolls a 5, the pawn moves forward 3 spaces and then moves back two.

- The pawn cannot move back further than the first space of the track. If the pawn reaches this first space and still has moves to make, the pawn simply returns in the direction of the end zone with its remaining moves.
12. Once a team draws a *Team* card, all of the teams may compete simultaneously. The first team to successfully complete the activity earns additional points.
 - If a pawn of the winning team is on the *Start* square, it immediately accesses the fast track.
 - The team that drew the *Team* card does not lose their turn. Immediately after having played the *Team* card, their team may attempt to complete another educational activity.
 13. When a team draws a *Chance* card, the team then performs one of the following actions:
 - *Win a Free Start.* This card allows the team to move one of their pawns to the *Start* square, which requires that the team immediately attempt an educational activity. If the *Start* square is already occupied by one of the team's pawns or if all of the team's pawns are currently in play, the team may keep the *Chance* card and use it later on in the game to position one of its pawns on the *Start* square.
 - *Exact Throw.* This card allows the team to move one of its pawns (any pawn which is currently in play and not on the *Start* square) into the end zone. If the team has only one pawn in play and that pawn is on the *Start* square, the *Chance* card is kept by the team to be used later on in the game to move one of their pawns directly into the end zone.
 - *Go back to Start.* This card moves a team's pawn back to the *Start* square. If the square is already occupied by another pawn, the latter returns to the personal space of the pawn's team. If the team has only one pawn
- currently in play and that pawn is on the *Start* square, the card is kept by the team and the pawn will have to return to the *Start* square the next time it is moved. If the pawn associated with the card is removed from play before the card is played, the team puts the card back (it is discarded).
- *Fast-tracking.* This card allows a team to move the pawn used to pick the card from the regular track to the fast track without having to complete an educational activity, if the pawn is on the *Start* square or past it.
 - *A maximum of two Chance cards* can be retained at any one time by a team. If a team has two *Chance* cards in reserve, any new *Chance* card will replace the first *Chance* card held.
14. Game over:
 - When a team moves all four pawns into the end zone, successfully completing an educational activity, it wins. If a team picks a *Team* card as the final educational activity, the team wins the game only if they complete the educational activity. If the team does not correctly answer the question, the team must wait till their next turn to try to successfully complete another educational activity and win the game.
 - When the allotted time has run out, the team with the most points wins the game.

Figure 1. Structure of the Generic Shell of Parcheesi

AN EXAMPLE OF AN ONLINE APPLICATION

Starting with the Parcheesi shell game, two health specialists worked with the research team to develop a game on sexually transmitted infections (fig. 2). A number of steps were taken in finally developing this game : analysis of different shell games to finally choose Parcheesi; analysis of the game instructions and the writing of the game identification form; a library and Internet literature search to develop the four categories of educational activities for the game; development of 73 educational activities; the selection of activities to be presented using video clips (in collaboration with Mathieu Gauvin); selection of the illustrations for the game board; participation in the production of video clips and validation of their integration into the game and finally validation of the game for online play.



Figure 2. STI: Stopping Transmission

METHODOLOGY

By systematically using existing data, our aim was to considerably improve existing intervention programs for Education and Health. We also aimed to perfect the generic game shell as an instrument which serves to create

educational games adapted to particular educational needs. In this developmental research context, we have adopted an approach based on collaboration which aims to establish closer relationships between the fields of research and practice (that of practitioners in the field). Finally, the case study method was retained since we aim to document the use of educational games with young people from different backgrounds and to assess the results of their behaviour. To this end we will use a “predisposition to health” model which sheds light on three types of factors: (1) a predisposition to act which is determined by an individual’s perception of his or her vulnerability towards STI’s and the perception of the gravity and dangers of STIs; (2) the perception of practical and accessible solutions comprising an assessment of personal gain to be obtained from certain actions and an assessment of the scale of the obstacles preventing action and the cost of these actions and (3) action-inducing events like games.

The game *STI: Stopping Transmission* will be tested on groups of adolescents between the ages of 12 to 16 in different linguistic backgrounds (French, English and Spanish) in two countries: Canada and Mexico. During the experiment, different variables will be measured with the help of a questionnaire and a monitoring system integrated into the game environment: knowledge structuring and integration (Hamalainen et al, 2006) and attitude and behaviour modification towards STIs (Tingstrom et al. 2006).

CONCLUSION

Given the pioneering work in the development of generic game shells for Internet-based educational games, this developmental research allows health professionals to quickly develop educational games which can be made available to both teachers and students in Canada as well as around the world. To learn more and to become a game creator yourself, register at The Educational Games Central at the following site: <http://www.savie.qc.ca/CarrefourJeux/an/accueil.htm>.

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