PAPER 10

Demystifying the educational benefits of different gaming genres

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Abstract

As research continues into the use of computer games for educational purposes, educators still appear reluctant to incorporate them into their teaching. One contributing factor to this reluctance is the lack of information regarding the benefits offered by the different games available today. These differences appear to have been largely overlooked by the academic community, resulting in a lack of information being made available to both the academic and education communities alike. Without this information, educators will find it difficult to determine whether a game will suit their teaching needs, and will continue to avoid using them. This paper studies a selection of games from several different genres, assessing each one in its ability to fulfil a set of previously identified requirements for a good educational resource. The results of the investigation showed that there were indeed strong differences between the genres, allowing for some suggestions to be made regarding their use in education, as well as leaving room for some interesting future work.

Introduction

Research into educational computer games has become more prominent in recent years, with a number of important papers published from leading academic figures (Gee, 2003), (Gee, 2004), (Squire, 2003). However, despite this ongoing research, educators are often still reluctant to include computer gaming in their teaching activities. This could be due to a number of factors, including prohibitive start-up costs (regarding both time and money), weak institutional IT support, inflexible game-play duration, or even the negative social stereotyping of modern video games (Becker and Jacobsen, 2005) (Delwiche, 2003). Our own discussions with educators exposed another of these factors: the sheer variety of games available, coupled with lack of useful information on exactly how appropriate they are to the subjects they are trying to teach.

This lack of useful description extends to the research community. An oversight made by many of the field's authors (pointed out by Kurt Squire (Squire, 2002), (Squire, 2005)), is the classification of different gaming genres – or rather the lack of it. The prominent papers in the field discuss the different educational benefits offered by computer and video games, as if all genres of game can offer them with equal success. As the world of computer gaming has evolved tremendously since its beginnings, the diverse characteristics of modern games suggest that this is not the case. To explore this idea, we present an investigation into a number of games, taken from four different genres, where we assess their effectiveness at affording certain qualities useful to educational use.

Existing research

In his paper, "Changing The Game: When Video Games Enter the Classroom" (Squire, 2005), Kurt Squire discusses several potential benefits to education, offered by video games. While he himself uses the popular strategy game "Civilization III" as an example, he points out that it may not be the game for everyone, and that educators should expect different game-play experiences from games of different genres. However, as these different experiences are not discussed in further detail, a gap is left for our investigation.

Jan G. Hogle identifies several gaming genres, as well as some educational benefits offered by video games (enhanced motivation, increased retention of subject material, improved reasoning skills) (Hogle 1996). However, the two are never mapped to one another, and the proposed benefits are presented in a genre agnostic fashion. As such, the paper offers no real elaboration on the inter-genre differences highlighted by Squire.

Alan Amory *et al.* attempt to analyse the differences between gaming genres, but take a different approach to ours (Amory et al., 1999). Taking one game from each of four genres ("strategy", "adventure", "simulation" and a first-person shooter labeled as a "shoot-em-up"), a group of 19 users were asked to play the games, and evaluate how well they satisfy certain qualities. While the results show that there are differences between the gaming genres, there doesn't appear to be any sound rationale behind the selection of these qualities. In addition, only one game was taken from each of the chosen genres, failing to show how different games within a genre can still offer very different game-play experiences.

There are other papers which appear to make claims about what games will and won't offer the user, without any acknowledgement of the differences between genres. Fabricatore suggests an "interactive cycle", consisting of "analytical capabilities", "strategic thinking", "psychomotor skills" and "enrichment of players' knowledge" (Fabricatore, 2000). Yet, for example, turn-based strategy games require negligible psychomotor skills, and classic, reaction-based "shoot-em-ups" are unlikely to enrich the player's knowledge base to any noticeable degree. The elements of the cycle are potentially valid, but not universally so.

Paras and Bizzocchi discuss features of gaming, including "reflection", where the player considers their past in-game actions to inform their actions in the future (Paras and Bizzocchi, 2005). However, certain games – such as the kind of mini-games found prominently on the Web – have been shown as too short to offer opportunity for reflection. So again, while the claim that games offer opportunities for reflection is potentially true, it will not be in every case.

Method

In order to identify some of the differences between gaming genres, a set of these genres had to be chosen, followed by a number of games from each one. The genres we selected are by no means exhaustive, but represent a large proportion of games available today, and are different enough from one another to warrant distinction.

The genres we selected were:

- "First-Person Shooter" (a popular, combat-heavy genre where the player views the game from the perspective of the main character),
- "RPG Adventure" (a hybrid genre focusing on character development and problem solving),
- "Puzzle" (where the player has to solve increasingly more intricate puzzles, usually relying on a single, core mechanism)
- "Strategy" (where resource management, planning and strategic deployment are the main player requirements).

Having selected three games from each genre, we played through them, paying special attention to identify features from our previously developed taxonomy (Frazer, Argles and Wills, 2007), detailing useful requirements for an educational game.

Results

Here, we discuss some of the more poignant features demonstrated by the games we investigated, followed by a table detailing the complete observations from all of the games and genres.

First-person shooters

The games chosen to represent this genre were:

- "Half Life 2" (A story-driven game, blending combat, exploration and physics-based puzzle solving),
- "Team Fortress 2" (A stylised, online team combat game, featuring nine very different roles) and
- "Battlefield 2" (an online modern war game, with a strong focus on teamwork).

All three of the games allow players to talk amongst themselves using text chat or voice chat. Messages can be sent to all players in the game, or just to players on the user's team. In addition, Battlefield 2 distinguishes smaller groups of players, called "squads" and the opportunity for in-squad chat is also provided. In addition, the game identifies a separate role of the "commander", who has access to more complex troop communications. These different communication options could cater well to individual or group-based learning activities, with the "commander" role being potentially useful for instructors wishing to join in the game at the same time as their students.

New knowledge is presented in all three games, in different ways (non-player character interactions, documents within the game world, explicit text pop-ups). An additional feature of Battlefield 2 allows players to flag enemy positions on the radar when they are encountered in-game. This type of presentation could be interesting in an educational setting, allowing learners to teach each other whenever they find something out, rather than relying on the directions of their instructor.

Both Half Life 2 and Team Fortress 2 offer tools for users to create game levels, affording the creation of in-game environments. However, this requires skills in scripting, 3D modelling and texture design, not to mention the game design skills required to create a balanced level. So whilst possible, it is not necessarily feasible.

All three games promote exploration differently. The story-driven nature of Half Life 2 means that the game progresses in a somewhat linear way. As such, the exploration is afforded by side-rooms and secret areas, adding variety to the player's route to a predetermined story milestone. The multiplayer nature of the other two games encourages much more exploration. As the opponent is constantly mobile, the player is encouraged to use the whole level to their advantage.

Half Life 2 doesn't help too much in instructor feedback – because the player's success is merely a means to an end (story exposition), no "score" is offered. However, the other two games offer much more detailed information on player actions, potentially helping an instructor to see how a player acted within a play session.

Rewards are offered in two different ways. Half Life 2 focuses on in-game rewards – better weapons, vehicles, and access to new areas. The other two games focus more on external rewards – social standing, respect and acceptance into online "clans". In both instances, the

key is their benefit to the player in playing the game. The more they play, the more rewards they receive, the better their game-play experience, the more they are motivated to continue.

The FPS genre varies in the explicitness of its goals. Half Life 2, being a character-oriented game, tends to express goals as part of NPC story exposition. In order to make its goals clear, the game employs a well-written script, and frequent NPC interaction, helping to provide regular, contextually relevant goal information, preventing players from becoming lost in a potentially confusing world. Individual matches of TF2 revolve around an explicit goal (the game title is often the same as the goal in hand: ``capture the flag'', ``king of the hill''). In this sense, a multiplayer game is an excellent example of a single concept implemented as a game. As such, there should rarely be any confusion as to what's going on. Battlefield 2 relies on the explicit, military-style orders. As well the level-based goal of capturing command posts, additional instructions can be given in real-time by human squad commanders, providing their troops with well-defined short-term goals, as well as the overall long-term goals set by the game.

The games in this genre all offer a strong, immersive experience. The first person perspective literally places the player in the shoes of the character. The worlds they portray are all richly designed, helping to convince the player that they are, in fact, in the game world. There is a slight issue in the additional information that needs to be displayed (health, remaining ammunition, radar display). Typically, this is displayed around the edge of the screen, slightly shattering the illusion that the player is playing a game (this information wouldn't normally be floating in your peripheral vision).

RPG/ adventure

The three games chosen within this genre were:

- "Final Fantasy X" ("FFX", a Japanese, story-driven Role-playing game),
- "Grand Theft Auto III" ("GTA III", an action-adventure game set in a sprawling, modern city) and
- "Oblivion" (a medieval fantasy RPG/adventure, focusing on exploration and non-player character interactions).

Games within this genre often revolve around an epic quest, and as such, a great deal of new information is offered throughout. All three games use non-player character ("NPC") interaction to expose information. GTA III uses key characters within the storyline, where almost every character in the other two games has something to say. This provokes players to explore the game world to find information on their own. Other methods of knowledge demonstration include a series of books to be found, detailing back-story of Oblivion, and transparent overlays used to explain aspects of GTA III's game-play.

All three games rely heavily on exploration, with rich environments full of NPC's, items to be found, information to be gained and enemies to battle. However, they each limit how far a player can explore at a given point. FFX provides the player with a limited area until complete certain requisite tasks within it. GTA III restricts the areas of the city accessible to the player until they reach an appropriate stage in the story. Oblivion generally lets the player wander wherever they like, although venturing into an area with enemies much stronger than they are is likely to end in them losing the game.

RPG's rely heavily on player ''stats'' – values used to describe the level of their various physical and mental attributes, as well as the places they have visited, the enemies they have beaten and the items they have collected. These values could be incredibly useful to instructors looking to assess how a player has played the game. Oblivion and FFX are both fairly traditional RPG's, with players earning experience points ("XP") for in-game success, which in turn makes their character stronger. FFX earns overall experience points, which

increase a character's stats all at once in a predetermined way. Oblivion, however, increases certain stats according to a player's actions: use a bow successfully, and your archery skill increases; convince an NPC to do something for you, and your charisma goes up. In this way, the player's stats in FFX give an indication of how well the player is doing in the game at a given time, while those found in Oblivion give more detailed information on the actions a player must have carried out to reach their current status. GTA III is more of an action/adventure game, and the player character himself never gets any better. There are still, however, a large number of stats kept, purely for the player's interest. Numbers of lampposts knocked down, longest wheelies, furthest a car has been driven backwards: all of these facts are extracted from the player's game-play experience, and translated to a learning context, could greatly help the instructor see how a player actually played the game, as well as how they performed overall.

The balance of difficulty within RPG games is often difficult, typically relying on the process of "grinding": allowing the player to fight against weak enemies, each yielding a low number of XP, for a long time, in order to raise the level of their character. Taken to an extreme, a player could spend even longer than usual attacking these weak enemies, until their own experience level was so high, that the rest of the game would be ridiculously easy. Because of its tedious nature, "grinding" is seen as a very poor means to an end as far as enjoyable game-play is concerned. GTA III takes a different approach, avoiding the concept of XP altogether. Because of the game's free-roaming "sandbox" nature, the player is free to try out different things whenever they please. If they find themselves stuck on a particular element of a mission, they can take time out to practice that kill in their own time, returning to the mission once they feel comfortable. This allows them to progress with the story only once they are truly ready, keeping the level of challenge much more appropriate to their own skill level.

Goal provision varies between games. GTA III and Oblivion both have "missions" or "quests", where explicit objectives are marked on a map, along with clear instructions on what they need to do when they get there. However, FFX is much more vague. The player will often know roughly where they are going, or who they are looking for, but will not know what they are supposed to do when they get there. This is usually done to maintain dramatic tension within the story, but can often leave the player confused as to exactly what they should be doing.

Puzzle

The games selected for this genre are:

- "Tetris" (the classic, block-sorting game),
- "Polarium" (a game for Nintendo's handheld "DS" console, where players draw paths on the touch-screen to flip tile colours, in order to match those surrounding them)
- "Puzzle Quest" (similar to popular online mini-game, "Bejeweled", with an additional "RPG-lite" layer on top).

Puzzle games typically do not offer any new knowledge as the game progresses, and both Tetris and Polarium qualify this. All information required to play the game is revealed in the game manual or a simple tutorial level, with no "surprises" occurring later on. The games' complexity comes from more intricate combinations of the basic principles, rather than the addition of new game-play mechanisms entirely. Puzzle Quest offers an additional story, although it is very tenuously linked to the puzzle elements of the game. The interesting part of its RPG aspect is the process of "levelling up", which grants the player new skills to be used in the game. Whilst the story could be detrimental in an educational setting (by creating too great a divide between the educational segment, and the game-play section), asking players to factor their new skills into the way they play could be an interesting way of reinforcing what they are learning.

Puzzle games are quite limited in several of the fields identified as important. The only post-game feedback they offer to an instructor is a kind of score (number of "lines" removed in Tetris and Polarium, number of XP in Puzzle Quest), making it impossible for the instructor to see how exactly the player achieved success. All three games rely on a fixed play area, with new blocks, jewels or lines added when required, making exploration impossible. Polarium has a separate "puzzle" mode, where players can create small maps and share them with friends over the consoles' wireless connection. However, as the main play mode of all three games relies on a constant stream of falling blocks, traditional "level design" is practically impossible, and its lack of implementation makes environmental creation equally impossible.

The promotion of immersion may not seem an obvious feature of puzzle games – they are typically 2D, incredibly stylised and minimal in both appearance and function. However, puzzle games are some of the most renowned for promoting "zone" play, where the player becomes lost in the game in a state of "flow" (Csikszentmihalyi, 1997), working almost entirely on reflexes as they ignore external stimuli. Tetris and Polarium are more suited to foster this phenomenon. The hypnotic, constantly falling blocks, the trance-inducing music, and the constant focus on a single area of the screen all work well to keep the player engrossed in the game ahead of any external distractions. Puzzle Quest doesn't do this quite so well, as the story elements and skill-selection pane all distract from the main playing area. Engrossment in this game typically comes from a combination of the game's "levelling up" RPG element, as well as its central game-play mechanic.

Strategy

The three games chosen in this genre were:

- "SimCity" (a popular city development game),
- "Civilization IV" (an epic, turn-based game of expanding empires)
- "Company of Heroes" (a real-time strategy ("RTS") game, focusing on infantry and tank squads of the second World War).

Because information is essential to developing a robust strategy, all three games demonstrate new knowledge to the player in useful ways. SimCity expresses new knowledge through the state of the city itself. A player can learn that a city needs a better water supply because its houses will fall into dereliction. They will learn the importance of better inter-city roads when migration between their city and others decreases. A panel of "advisors" is also on hand to offer additional information when required. Civilization IV is perhaps even more rigorously designed than SimCity, with a player action having a great number of ramifications in numerous other areas of the game. In addition, almost all game-play milestones (technological advances, completion of building projects, declarations of war) are accompanied by brief, informative cut-scenes, again helping to provide a little additional information regarding important areas of the game. Company of Heroes expands the idea of cut-scenes, offering emotively-scripted, well-directed vignettes between each mission, along with detailed briefings and debriefings about the battles involved. This helps the player to understand the strategic motivations of their in-game actions, in turn helping them to realise why the things they are doing actually work.

Exploration is handled differently within the strategy genre. SimCity offers no real opportunity for exploration, as the whole map is visible (and empty) from the offset. However, both other games use exploration quite extensively as a game-play mechanism: Civilization on a large scale, exploring and conquering the world; Company of Heroes on a much smaller scale, infiltrating unknown enemy territory, using the terrain to your advantage as you encounter enemy troops and reclaim strategic points. In both cases, exploration into the unknown provokes tension, exciting the player as they progress through the game.

Similarly, difficulty balance occurs in different degrees. SimCity features a kind of implicit balance, whereby players are unable to access and build certain advanced structures before they have placed a number of key, basic ones. In doing this, the player demonstrates to the game that they are comfortable enough with the way basic structures work, such that they should understand how the advanced ones work. Civilization, on the other hand, doesn't really balance difficulty in-game. Once the player chooses a predetermined difficulty level at the start of play, they are bound to it for the rest of the game, and any signs of weakness are more likely to result in A.I. opponents wiping them out, than helping them out. Company of Heroes is even more punishing in this regard. As player's defending troops die, the enemy reclaims their outposts, and the player no longer earns resources from them. This means that they cannot afford to the replace the lost troops, allowing the enemy to easily move onto the next outpost to repeat the process. This negative feedback loop can be quite frustrating, quickly forcing the player into an inescapable situation without exposing it as such.

	First-Person Shooter			RPG/Adventure			Puzzle			Strategy		
	1	2	3	1	2	3	1	2	3	1	2	3
Conversation	X	X	X									
New knowledge	X	X	X	X	X	X			X	X	X	X
World creation	X	X						X				
World exploration	X	X	X	X	X	X					X	X
Useful feedback		X	X	X		X				X	X	X
Balance difficulty						X				X		
Clear goals		X	X		X	X	X	X	X			X
Contextualisation	X	X	X			X	X	X	X			X
Provoke curiosity	X			X	X	X						
Immersion	X	X	X	X	X	X	X	X	X			
Offer rewards	X	X	X	X	X	X			X	X	X	X
Unite resources				X	X	X				X	X	X
Blended support									X	X	X	
Full pedagogy												
Standards	X	X						X				

Table 1 The educational benefits offered by each investigated game

Again, because of the importance of information availability in this genre, all games could be good at displaying a wealth of pedagogical data, were methods to edit it made available. All three games offer blocks of text, voiceovers, cinematic pieces, numerous input options, as well as the main play "map" itself. The strategy genre demands this information be made accessible at a moment's notice – a strength that could be incredibly useful in information-heavy educational settings.

Analysis

Table 1 shows the complete results from the investigation, displaying the successes of each individual game. The first thing to notice is that the different genres do exhibit some differences in the benefits they each offer.

The FPS games perform strongly in affording conversation, displaying new knowledge, encouraging exploration, immersing the player and offering rewards for success. However, they are poor at uniting resources and balancing difficulty, and are generally too fast-paced to work in blended learning scenarios.

The RPG/adventure games lacked the FPS games' support for conversation, world creation and contextualization of information, but were much better at provoking curiosity and uniting different learning resources. This genre of game, therefore, may be better suited to a multimedia-heavy learning area, where learners need to explore a range of different

learning resources in a self-motivated manner. In contrast, the FPS genre may be better at providing a setting where the environment itself is the learning resource to explore, with its opportunities for conversation allowing multiple users to be present in it at once.

The puzzle genre lacks many of the benefits offered by the previous two game types, but excels in its clear provision of goals, its opportunity to contextualise information well, and its deep immersive properties. This type of game may be better suited to explaining a single, important concept. It would allow users to immerse themselves in a working example of the concept, in order to thoroughly explore its intricacies without external distractions.

The strategy genre excels at providing new knowledge, uniting different resources and expressing information extremely clearly. It also often works well in blended learning situations, making it a strong candidate to enhance current, information-heavy teaching styles. The game could easily be played alongside a traditional, instructor-led session, with its efficiency at displaying rich, dense information being a strong replacement for the textbook. The detailed feedback offered to the user regarding their performance would also assist the instructor in assessing how well the learner had done.

Conclusions and future work

The results of the investigation suggest that different gaming genres do indeed exhibit different features that might be useful in educational contexts. As such, when considering the usefulness of "computer games" as educational tools, it is important to consider these differences, as we have seen that where one type of game fails, another may excel.

While some existing, commercial games may be useful to educators without any modification, the findings are more likely to be helpful when designing an educational game from scratch. Once a set of required features has been determined for a particular learning exercise, a more informed decision can now be made on what type of game would be most suitable in offering them. As the results show, certain genres typically fail to feature certain game-play mechanisms. By using the required features to determine a genre, the game will be more likely to support these features than if a (potentially inappropriate) genre had been chosen first.

However, while an interesting indication as to how the genres can differ, the observations made in this study are likely to be biased, due to the small user-base. In order to gain statistical relevance, a further investigation will be carried out with a larger set of users. Questionnaires will be generated to assess users' perceptions of how well the games offer the examined qualities. The users will be selected from communities already familiar with the games in question (university gaming societies, online communities), to avoid lengthy installation and training phases. The results of the questionnaires will be used to validate the results of the previous study.

In addition, the genres chosen for this study are by no means exhaustive. There are others besides (simulations, sports games, the whole range of "casual" games), as well as within those chosen here (the Massively Multiplayer Online genre of RPG's deserve an entire section on their own, far beyond the scope of this paper). Similarly, the games selected for the study are only a few out of hundreds in each genre, selected as being representative, rather than exhaustive.

As such, plenty of room remains for further investigation in this area, broadening and deepening the community's understanding of the intricate differences between game types, and the similarities between them. In turn, a body of information will become available, helping educators to understand exactly what benefits a particular kind of game offers, helping them to choose – or design – the most useful product to suit their needs.

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