ROLE-PLAYING GAME AND THE LEARNING OF MATHEMATICS –

A STUDENT’S EXPERIENCE

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ABSTRACT

Digital game-based learning was first mooted in the 1970s consisting primarily of edutainment involving mastery of language skills and mathematical computation competencies. It had since evolved to multi facet sophisticated games such as adventure quest, simulations and role-playing. As learning via such medium in mathematics is often informal and incidental, most schools are either hesitant to venture into such grounds or confined it within the safety arena of edutainment. Nonetheless, the appeal of such games cannot be undermined and its effect on the digital natives extremely powerful. In an attempt to gain better insights to the learning opportunities computer games present, four pupils were selected to undergo seven sessions of informal digital game-based experience, each lasting a minimum of two hours, where they played three different games selected for this study. Here, the learning experience of one Primary Five pupil for a particular role-playing game is described and illuminated for educators. The thought processes involved while playing such games will help educators gain better insights to learning mathematics through computer games and the vast possibilities this medium can offer.

INTRODUCTION

At the turn of the 21st century, the level of computer usage surged exponentially to an alarming rate that even toddlers as young as two years old are seen handling and navigating a piece of technology at ease before they can utter their first word. As educators, instead of shying away from the bane of computer game addiction, some attempted to win these digital natives over by revamping the way learning takes place through the use of computer games. Advocates for such digital-game based learning state reasons such as intense engagement through the evocation of fantasy, challenge and curiosity (Malone, 1980), linkage to real-life situations that integrates knowledge from various domains and thus give meaning to learning (Gee, 2007) and opportunities to make decisions and solve problems in fulfillment of certain
goals (McFarlane, Sparrowhawk and Heald, 2002). Nonetheless, skepticism remained high, as persistently, no studies has yet proven a positive casual relationship between the use of computer games and its effectiveness in learning. Undeniably, the incidental nature of learning through computer games and the wide array of computer games in the market prevented a more regulated and consistent approach to assess its effectiveness. Moreover, conflicting agendas among game creators, commercial agents and educators pushed this viable option deeper into the abyss of fruitless pursuit. It is neither the intention of this paper to prove otherwise nor an attempt to win more over to either side. This paper merely attempts to paint a picture of digital game-based learning from the perspective of a learner’s point of view in the hope that educators can gain a better insight into the application of such learning avenue.

METHODS

The study

The school involved is a government-aided primary school situated in the western part of Singapore. A few years ago, they constructed an internet café at the heart of the school canteen for pupils to access during recess and after school hours. Four active members of the Innovative and Enterprising Club were selected by their teacher-in-charge for this study. They were told to spend two hours playing three computer games of different genres namely; simulation, role-playing and quest for a period of a week in the internet café. An interview session was conducted for each pupil at the end of the week. Some interview questions posed were (1) Do you think any of the subjects taught relate to the computer games played? (2) Do you ‘find’ any mathematics in the computer games played? (3) Did you employ any mathematical skills, concepts or processes while playing the game? (4) Do you enjoy playing the three computer games? Why? (5) Do you think you will enjoy a mathematics lesson conducted using computer games?

For this paper, the experience of one of the four pupils involved while playing the role-play game will be illuminated. The pupil selected, who shall henceforth be called Pupil, was a boy from the third best class of the Primary Six cohort. Through excerpts of the interview, his experience is captured and illuminated in threefold, his sharing of specific mathematical skills used consciously and unconsciously, his thought processes in adopting strategies to solve the problems posed in the game as well as his affects and feelings generated when activating mathematics for the game.
The computer game

The role-play computer game highlighted here is Restaurant Empire. The player is to take on the role of Armand LeBoeuf who tries to re-establish his uncle’s restaurant. He has to set up a restaurant from scratch by renovating it, hire waiters and receptionist, create the menu and take up the role of the chef. There are different goals and targets to meet at various stages such as earning a certain amount of money, setting up a new branch and participate in cooking competitions. This game was highlighted because more mathematics was surfaced and it was the most enjoyable game identified by all three pupils.

FINDINGS AND DISCUSSIONS

The mathematics used

The need to use mathematics was apparent when Pupil was asked to identify the subject activated while playing the game. And the specific skill he noted was the knowledge of numbers and operations in terms of financial literacy.

“Mathematics, financial literacy, you need to know what’s your profit, your revenue, your costs, and find the difference between them.”

“there is a lot of (number) operations, for every food item, you need to find out the price. The cost price (see figure 1). You need to know the reasonable price.”

Figure 1: Cost makeup of a food item
When probed further regarding a reasonable price, Pupil activated his real-world considerations unknowingly and connected the game to the real-life by visiting various restaurants to check out the reasonableness and realistic pricing of the few dishes offered in the game in an attempt to help price his food appropriately.

“*I went to coronation plaza, there is a French restaurant and there is escargot, I also asked my mum what she thinks of the menu.*”

“*the gourmet pizza was $10 or $6 in the game. And when I went outside, its about the same price, about eight, seven bucks.*”

Realistic considerations is often regarded as absent from pupils while solving mathematics problem (Chang, 2004) yet in this instance, Pupil activated it automatically in association to the game setting. Interestingly, the game setting activated his natural instinct of reasonableness. This showed that given suitable and realistic situations, pupils are capable of connecting back to real-life considerations. Thus the issue lies more on the authenticity of situation posed rather than pupils’ ability to think realistically.

On another instance, Pupil commented that he looked at a bar to find out the skill level of the different server to hire (see figure 2).

![Figure 2: The bar that showed the skill level of servers](image)

“*they will show, they show a bar, the more it’s coloured, the higher skill.*”

“*Ah, I will say its model. But the coloured bars are really simple. For mathematics purposes, the bars are more complicated. I can’t do those.*”
However, he was not able to associate the bar displayed with graphical representation at all even after probing. He associated it with the Singapore Model Method rather than as a bar chart with the skill level as data implying a possible lack of statistical understanding especially with horizontal bar charts.

“what do you mean by graph? No, it only has minimum and max. I think its more like a bar thing.”

The problem solving strategies used

In the game, there were a few problems set up for the player. Pupil mentioned the following he had to handle: dealing with customers’ complaints, the cooking skill of the chef was not ideal, receptionist or waiters were rude, losses were incurred in the new branch and the food was served cold. Figure 3 below showed an example of an illustrated interface.

Figure 3: A customer’s complaint

While dealing with all the problems mentioned above, it was observed that Pupil consistently adopted a common strategy, in which he would first identify the problem then sought to find out possible solutions to overcome it. Pupil chose one of the possible solutions and implemented it. After a while, the effectiveness of that initial choice would surface through the response of the customer exhibited in the game. If the outcome was undesirable, Pupil will adopt the other alternate solution. Figure 4 illustrates the cycle of this problem solving strategy adopted.
The strategy adopted by Pupil mimic closely to Polya’s Four-steps of problem solving. Polya’s Four-steps consisted of ‘Understand the problem’, ‘Devise a Plan’, ‘Carry out the plan’ and ‘Look back’ (Poyla, . When probed further, Pupil had no idea what Polya’s Four-step was signifying that he was not exposed to it prior to the interview. In fact, he was adamant about employing any mathematical strategy at all. He was merely trying to get over the problem so that he might continue to move up the stages posed in the game.

“I think the math I used was like money, profit and loss kind of things, that’s all the maths, no other things. Where got math thinking and strategies at all.”

In fact, Pupil’s response was not unexpected. He associated mathematics with numeracy and hard facts rather than the development of a discipline or a certain way of thinking which is contrary to the intended learning outcomes for mathematics communicated by CPDD where both processes and metacognition formed part of the anchors of the Singapore Mathematical Framework (CPDD, 2001). This is noteworthy as it portrayed first, the way learning of mathematics is communicated and emphasized in schools, that mathematics equates the completion of numerous unauthentic problems for mastery and acing pen-and-pencil assessments. Second, there is a lack in encouraging pupils in schools to develop the mathematical habits of the minds such as Polya’s Four-steps.
The affects generated

“I just play the game. Naturally, the math just comes out like calculating the thing and you are happy! Not like in school when you are doing math, you are always dull and bored. This game (Restaurant Empire), they really concealed their math well. If this is for children to learn math, I’ll give it a thumbs-up. While playing, I do not know that I’m doing math. I know I’m doing calculations but I don’t feel like doing math.”

The above comment by Pupil echoed the desire of perhaps all pupils. Pupils in the 21st century are not satisfied with just being told about facts but hungers to learn through self-discovery, construction, interaction and fun. Pupil defined ‘fun’ as follows:

“I get to do things I can’t do in real-life. Like being a boss of the restaurant, they get to see the action, they are the ones who make the action, like you are the one producing a TV show sort of thing.”

Playing with computer game is fun because it engages and interacts. In a game context, the player takes on a new identity where it takes shape and evolves as the player undergoes different events or scenarios depicted in the game. While going through the scenarios, mathematics skills and concepts are required whether for calculation of some figures or strategies to overcome some problems. In fact, players became a producer as they co-design the game by their actions taken and decisions made (Gee, 2005). Players are no longer passive learners but active participants of every process of knowledge creation and this whets their appetite for more like what Pupil commented below.

“The person would want to come back and learn. They do some math and get to play. They have fun.”

Thus computer games allow opportunities for pupils to learn on their own, at their own pace through a self-discovery manner thereby promoting self-directed learning, the optimal outcome of any learners.
CONCLUSIONS

This paper merely showed some insights regarding the use of a commercially produced computer game Restaurant Empire through the eyes of a Primary Six pupil. As indicated earlier, the intention is not to promote or encourage learning mathematics through computer games but to surface the experience of a pupil. Although potentials of such a medium seemed obvious and harnessing it will greatly boost the current range of pedagogy teachers can use to engage pupils’ learning but great care must be exercised. First, given the wide range of computers games, often with violent content, educators must choose wisely. Second, the difficulty in balancing between rote-learning to mastery and engagement is a much debated issue. Often, aligning game content to include systematic acquisition of certain mathematical skills and concept often results in a standard drill and practice game structure which no longer engages a player as much as those who deviates from such rigid structures. Third, the impact of learning through computer games is difficult to measure and fourth, precious curriculum time forbids the luxury of playing computer games in class. But if we are committed to reach out to these digital natives, we may just need to examine further how to harness the potential of computer games by roping in the inputs of these minds and create the possibility of an amalgam of engaging pedagogies, past, current and future.

REFERENCES