



Flexible role playing game engine for case studies in forensic accounting

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This paper reports on the design, development and first implementation of a role playing game engine to improve students' learning for a university course in Forensic Accounting, a specialty that has been growing in popularity in recent years. A role playing game (RPG) engine has been developed to allow students to act in a virtual environment as forensic accountants responsible in investigating potential fraud cases. It was observed that students were more engaged and class interaction was greatly enhanced. The gaming nature of the tasks also helped create a friendly competitive atmosphere and encouraged independent learning. Unlike other game engines, the developed system was designed specifically to allow teachers to create new and maintenance existing cases on their own with little need for technical assistance. The developed system is extremely reusable and is highly adoptable for other disciplines to be used in case studies activities.

Keywords: Accounting, educational game, case study

Introduction

Forensic Accounting is an elective course offered to final year students of the Bachelor in Business Administration (BBA) undergraduate degree program at the Hong Kong Polytechnic University (HKPU). Smith and Crumbley (2009) pointed out that there were divergent pedagogical views on what should be included in the fraud or forensic accounting curricula. As with most institutions in their study, the forensic accounting course at HKPU is limited to fraud examination and was based closely on the prescribed course textbook, *Fraud Examination* (Albrecht 2009). The course focused specifically on the prevention, detection and investigation of fraud.

Each of these areas is dealt with in the teaching curriculum as follows.

- Fraud prevention concentrates on reviewing the internal controls and procedures to ensure that there are appropriate safeguards in place to reduce the possibility of fraud being perpetrated. Students would have already been introduced to the fundamentals of internal controls in prior studies. In this course, they are required to apply their knowledge to review the internal controls, identify shortcomings and recommend improvements if required;
- To detect fraud, the students are required to analyze financial statements and based on the results, identify the nature of the fraud;
- Investigation of fraud involves identifying the suspected fraud perpetrators based on the financial information as well as the personal and other information available on the individuals involved in the operations.

Auditing is a pre-requisite to the forensic accounting course and internal control procedures and evaluation techniques would have been taught as part of the auditing syllabus. Students were also expected to have had exposure to financial statements analysis during their first two years of study in financial accounting and other courses. While students had acquired knowledge in these areas in prior studies, it was necessary to re-introduce students to the same in the context of the forensic accounting course. For example, auditing students would have learnt that assessment of internal controls was

necessary to determine the audit sample size rather than for purposes of identifying shortcomings and by extension, fraud opportunities.

2 online role playing games (RPG) based on real-life case studies were designed and used in the forensic accounting course as a pilot project January 2008. This paper discusses the motivations for developing the RPGs and the preliminary results from the students' and lecturers' perspectives. This paper also provides detailed information on the RPG itself.

Why use case studies?

Argyle (2002) noted that case studies have long been used in teaching. "Case" in the context of this paper is as defined in Windsor and Greanis (1983) and quoted in Argyle's paper, "a 'typical' true-to-life management situation or policy issue presented as a mystery or dilemma compounded of multiple dimensions" Argyle makes the point that in analyzing case studies, students have to think purposefully and demonstrate their knowledge of the subject. This will promote deeper learning in the students and also provide invaluable and timely feedback to teachers.

Studies by Jackson (2003 and 2004) conducted in a Hong Kong university confirmed the effectiveness of using case studies in teaching from both, the lecturers' and students' perspectives. The following are some of the benefits of using case studies as cited by the lecturers interviewed in the study.

1. develops problem solving skills and appreciate that there is more than one possible solution;
2. develops decision making skills - identify critical factors to enable decision making;
3. promotes understanding of real-life issues and problems;
4. provides opportunities for students to apply theories and concepts taught.

Jackson (2003) also found that the majority of students viewed the use of case studies in teaching positively and agreed that it promoted problem-solving and decision making skills while also exposing them to real business issues. This was consistent with the findings of Chang, Lee and Ng (1999) in a study conducted in HKPU where the majority of students agreed that case studies were beneficial in developing analytical skills and promoted long term retention.

Using cases to teach forensic accounting

The use of case studies in teaching the forensic accounting course was considered to be particularly useful due to the students' backgrounds and the nature of the course.

Students were required to have taken an auditing course as a pre-requisite to forensic accounting. They would also have learnt other aspects such as financial accounting and statement analysis in their earlier studies. However their familiarity with the theories and concepts would not necessarily translate effectively to other subjects or course contexts. The lecturers in this course often had to assist students by prompting them to apply prior knowledge in a different way and to adopt the necessary mind-set to enable them to deal with fraud detection, prevention and investigation. As noted above, using case studies was found to be an effective way to achieve these objectives as they encouraged students to apply knowledge.

The forensic accounting course also included teaching students about individual motivations and some basic psychology. This was applied mainly in the investigation of fraud to help identify the possible fraud suspects. This was a relatively new area for most of the business students concerned. Using case studies were particularly useful in that it challenged students' stereotypes and misconceptions about fraudsters.

Fraud takes multiple shapes and forms. They range from those that are relatively simple such as embezzlement to the more complex examples of financial statement and earnings manipulation. Fraud is also a constantly evolving subject as fraudsters will continue to find new ways to commit and conceal fraud. Educators will always necessarily be a step behind and so can only hope to prepare students' with some fundamental skills which they can apply to meet the challenges of the uncertainties of such a discipline.

For years, accounting educators have been using case studies in enhancing students' learning outcomes. Miline and McConnell employed problem-based learning techniques in constructing case studies to improve students' motivation and reasoning skills (Miline, 2001). Stewart and Daugherty's experiments indicated significant pre- to post-test improvement in exam performance for students learning with the case study approach (Stewart, 1993). Boyce et al. also attempted to enhance students' soft skills through

the use of case studies (Boyce, 2001). Klein and Calderwood (1988) noted that experts in areas where there is a high degree of uncertainty were more inclined to use their past experiences than abstract principles when making decisions. In the absence of significant past experience, Jonasson and Hernandez-Serrano (2002) prescribed using case studies which they found to be an effective substitute for actual experience. In effect, case studies help students better understand and learn from others' experiences or in their words, "understanding is functionally equivalent to experiencing".

Need for customizing case studies

There are several readily available case studies and online versions of the same which are used for teaching fraud examination. The Forensic and Valuation Services division of the American Institute of Certified Public Accountants (AICPA) has developed interesting online case studies which are freely available for use as teaching resources for forensic accounting. Indeed these cases were initially used in the forensic accounting course at HKPU. However, the need to develop Hong Kong based cases to overcome language and cultural differences quickly became evident.

The medium of education in the Faculty of Business at HKPU is English and although the students are bilingual, the majority speaks Cantonese as a first language. Accordingly, students were often unfamiliar with the colloquialisms and 'slangs' contained in Western case studies that were used previously. When Western cases were used, it was left to the teachers to "translate" or explain the unfamiliar terminology used to the students. This is consistent with the feedback from faculty members interviewed by Jackson (2004).

Jackson (2003) found that Hong Kong tertiary students expressed difficulty in understanding the cultural background of Western-based cases and noted that this problem was also faced by students in other Asian countries. It is widely acknowledged that business is conducted quite differently in different parts of the world. The forensic accounting teachers felt it was imperative to use case studies that the students could readily relate to and which closely reflected Asian cultures.

The game play

Most teachers are reluctant to develop educational games because the amount of time and technical resources, including developers, are often prohibitively high. While role-playing games such as the "Catch Me If You Can" series undoubtedly do wonderful jobs to present players a vivid sense of reality with fancy graphics and sounds, the game itself is not particularly scalable. Modification of existing cases and creation of new cases will definitely have tremendous resource implication to teachers. As a result, one of the primary focus in the design and development of the RPG engine was to ensure scalability and teachers' ability to economically manage existing and new cases.

The system developed essentially provides a role-playing-game environment for students to act as forensic accountants in investigation cases designed by teachers. In each case, a number of "characters" that are involved are listed for students to interview. Students obtain information to conduct investigation mainly by engaging in conversations with the characters in the cases. Three types of information could be gotten out of conversation with characters:

- Pre-set questions – pre-set questions of a particular character will be listed for students to ask during conversation with the character. The answer will be given without any variation and limitation.
- Cross-examination questions – students can also ask a character the question of "Tell me about..." another character in the case, trying to get more information by cross examining the people involved.
- Documents – during the interviews, some answers of specific questions will also lead to the provision of "documents" by the character involved to students.

Besides conversation, a dummy search engine is also incorporated into the game for students to perform keyword searching of information that may be related to the cases. It is noteworthy that the information provided by the conversation and the search engine are heavily "contaminated", with misinformation thoroughly mixed with key information that could lead to a break in the case. The intentional misinformation is designed to test and train students' ability to discern the quality and relevancy of the information obtained, which is often one of the biggest obstacle in real-world investigation and one aspect that is difficult to simulate with traditional, paper-based case studies.

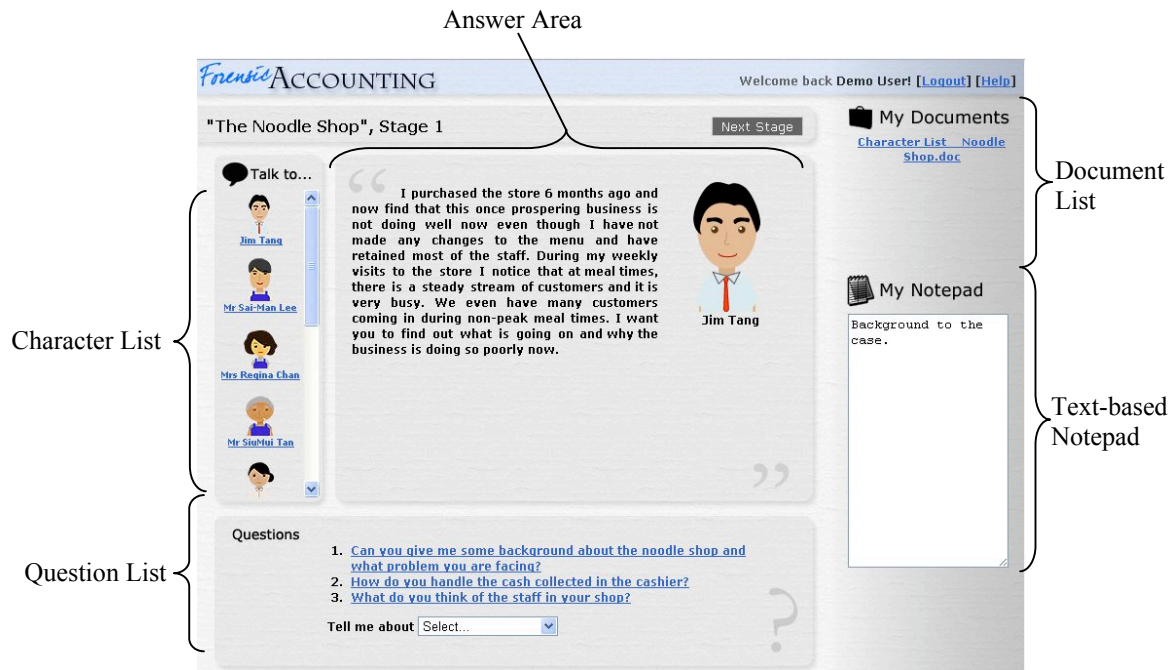


Figure 1: Main playing interface

One of the key learning objectives of the subject is to equip students with a systematic structure and process for conducting investigations. As a result, all cases in the game are all structured into three stages. While the game play and the form of interactions are identical across the stages, certain information is only available after the students have advanced to the appropriate stages. Each stage in the game has specific requirements of which students have to fulfill. For example, to advance from Stage 1 to Stage 2, students would have to submit a “Vulnerability Report” along with a preliminary ordering of suspects. In order to advance to Stage 3, students would need to narrow down the number of suspects, with the knowledge that they will only be allowed to “interview” those suspects in Stage 3. Finally, to complete the case, students will have to submit a finalized ordering of suspects along with a “Final Written Report”.

Constructing cases

One of the most powerful aspects of the developed game engine is the ease for teachers to construct new cases with little technical assistance. Actually, the most time consuming step for case construction is the creation of dialogs for characters to provide information to students. While it may seem trivial on the surface, designing a good case is an art in which the teachers must ensure that 1) information intended to be given out is indeed available through the dialog; 2) the information shall be evenly spread amongst the characters and stages so that they will be revealed in a progressive manner; and 3) sufficient misinformation is present. Ensuring all these criteria are met becomes more difficult as the amount of dialog and other information increases in the cases.

While the authoring of the dialog is mainly done within word-processing or spreadsheet applications, the development team actually uses a graphical “information map” to represent the information available through individual stage of the case. Figure 2 shows a sample of an information map used in one of the cases. Characters were presented as ellipse and hexagon (the hexagon usually denotes the person-in-charge or the owner of the company involved), while the rectangles denotes certain facts. Shaded rectangles denote article searchable through the search engine of the game. The arrows between the shapes represent information flow. For example, the arrow pointing from the hexagon back to itself means that dialog is available so that the character (James Tsang) will provide some information about himself. An arrow pointing from one character to another means that the source character will provide information about the destination character through the dialogs.

During the design phase of a case, information maps will be continuously updated according to the dialogs drafted and will be used extensively to evaluate the completeness of the case.

Once the authoring of the case is completed, teachers will be able to make use of a backend administrative interface of the game engine to create new cases, setup the characters, and then enter the designed dialog and other information into the web-based system without any technical help.

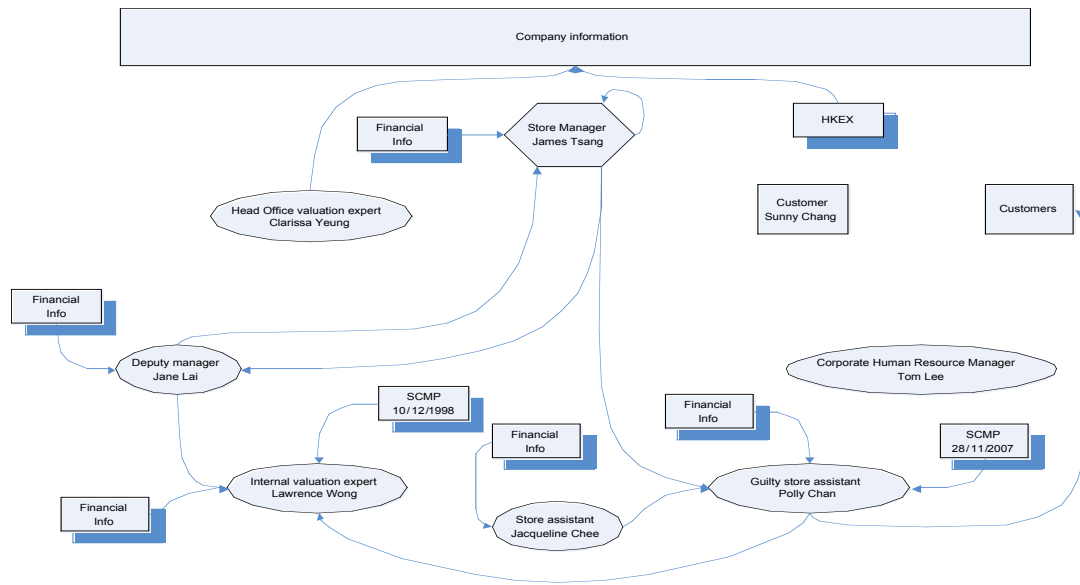


Figure 2: Sample Information Map

Reviewing students' work

Besides the gaming frontend and the administrative backend, the developed game engine also provides a Teacher Console for teachers to review students' performance, as show in Figure 3.

- DIAMONDS ARE FOREVER -

Back to case selection

[View by Group Name] [View by Student ID]

Student ID		Stage 1				Stage 2				Stage 3				Total Time
eldss id	eldss	Chart	Order	Hit	Time(min)	Order	Hit	Time(min)	Chart	Report	Hit	Time(min)		
abc	AF422001	N/A	View	N/A	10	2.4	N/A	N/A	N/A	N/A	N/A	N/A	2.4	
02501613t	AF422005	View	View	68	49.7	View	12	8.05	View	View	7	5.73	63.48	
02709018t	AF422005	View	View	68	49.7	View	12	8.05	View	View	7	5.73	63.48	
06011257d	AF422067	View	View	38	25.57	View	1	0.1	View	View	4	0.12	25.78	
06050930d	AF422067	View	View	38	25.57	View	1	0.1	View	View	4	0.12	25.78	
06029060d	AF422067	View	View	38	25.57	View	1	0.1	View	View	4	0.12	25.78	
132	AF422047	View	View	25	22.02	View	16	13.25	N/A	N/A	5	0.9	36.17	
132	AF422047	View	View	25	22.02	View	16	13.25	N/A	N/A	5	0.9	36.17	
08996550x	AF422044	View	View	16	20.68	View	3	1.95	N/A	N/A	5	14.82	37.45	
123	AF422045	N/A	N/A	19	33.23	N/A	N/A	N/A	N/A	N/A	N/A	N/A	33.23	
06166686d	AF422066	View	View	23	40.58	View	10	18.32	N/A	N/A	13	68.22	127.12	
06188672d	AF422066	View	View	23	40.58	View	10	18.32	N/A	N/A	13	68.22	127.12	
x	AF422034	View	View	44	20.65	View	9	7.92	N/A	N/A	17	53.65	82.22	
06032811D	AF422064	View	View	28	13.43	View	N/A	N/A	View	View	N/A	N/A	13.43	
06032782D	AF422064	View	View	28	13.43	View	N/A	N/A	View	View	N/A	N/A	13.43	
06015942D	AF422068	View	View	27	43.33	View	10	2.5	View	View	7	2.75	48.58	
06299639D	AF422068	View	View	27	43.33	View	10	2.5	View	View	7	2.75	48.58	
06259677D	AF422068	View	View	27	43.33	View	10	2.5	View	View	7	2.75	48.58	
06019560d	AF422070	View	View	27	39.4	View	N/A	N/A	View	View	N/A	N/A	39.4	

Figure 3: The teacher console

Listed in a tabular format, the teacher console provides teachers with key information in evaluating students' performance, such as time spent in individual stages, number of hits (a question is consider a *hit* if it leads to a key information about the case) as well as the suspect orderings and the reports submitted by the student at the end of each stage.

Pilot Implementation and evaluation

The game engine was piloted in a class of 150 students in the Spring Semester of the 2007/08 academic year. Three cases were developed for the pilot project. The first case was used as a practice case for students to get familiarized with the system, while the other two cases were used for actual assessment that counts toward course grades. Each of the cases were given to students at tutorial time in computer laboratories, where they would start the investigation with teachers and tutors answering queries arisen. Students were also asked to form groups with not more than three classmates to work on the cases together.

Some casual observation from students' participation in classes working the cases include:

- *Students' feedback.* Student feedback was positive. Although computer games and technology have been used extensively in teaching business subjects (Goffe, 2005), this was not the norm in this University and in accounting courses in particular. The students responded well to it and were also very co-operative in making suggestions for improvement. This is consistent with previous studies on the use of computer games in classroom teaching (Fripp, 1994; Jennings, 2001).
- *Working in groups.* Students were required to work in groups on a number of class assignments throughout the semester. The group size was kept to a maximum of three based on previous literature (Jaffe & Nebenzahl, 1990). It has been observed that in order to reduce the workload, students would often distribute responsibility for each assignment to a sub-group and/or allocate elements of each assignment to individuals in the group. While this is an effective way of reducing the workload, it tends to hamper their learning as teachers often found that only those individuals who did the work benefited from the exercise. We found that the students found these games engaging enough to attempt and be more involved in them even when they were not responsible for the assignment. Many students also requested access to the games after the assignment was submitted so that they could try it again.
- *Teachers' feedback.* Teachers found that students were more eager to learn the online exercises independently which was encouraging given the students were generally passive learners. The students also asked more questions and were more competitive with each other. The teachers also appreciated greatly the flexibility of the games platform which enabled them to make changes directly to the content of the games themselves.

A survey was conducted at the end of the semester to collect students' perception towards the learning experience brought by the role playing games. The questionnaire included questions related to the interface of the game as well as their perceived impact of the game to their learning. Some of the key findings include:

- 88% of the students agreed that the game stimulated their interest in the subject.
- 95% of the students agreed that the game was beneficial to their learning.
- 82% of the students agreed that the game helped them to better relate the concepts learned in class.
- Overall, 90% of the students are satisfied with their learning experience using the game.

When asked openly about the value of the game in their learning, some of the answers included

- It is highly related to the reality. I can apply what I have learnt from the lectures in the case.
- highly related to the lecture materials, also an interesting way to learn the difficult concepts which needs our ability to choose among numerous information
- All of the group mates could have chance to join together in sharing our point of view. Moreover, we can freely express our opinion in interesting way.

The feedback is encouraging and supports the original goal of the teachers to provide a learning experience to students that stimulates students' interest, allows students to apply learned knowledge in practical cases, while providing an investigative environment that is definitely more realistic than ordinary case study exercises.

On the downside, only 56% of the students agree that the actions available in the game were presented clearly, which indicates that the user interface is yet to be perfected to provide a more intuitive interactive environment to students. Some students also indicated that there are too few dialogs available in the

game, which the teachers also foresaw but was unable to enhance when constructing the cases mainly due to the time and resource constraints.

Conclusion and future plans

Several researches agree that simulation games have benefits when used in conjunction with traditional teaching methods of lectures and readings (Livingstone and Lynch, 2002; Laverie, 2006). The online games have several distinct advantages over the traditional hard copy case studies including –

- The games made it significantly easier to provide information to students in stages. Teachers were able to control the release of information to the students as they progressed through the games. Future development plans may include features where information is released based on students' responses and this could potentially result in some variations of the game.
- The games forced students to take stock of the information at each stage and make a preliminary assessment of the fraud and create a priority list of suspects. This was incorporated as a compulsory requirement and was a pre-requisite to progress to the next stage of the game. When traditional hard copies of case studies were used, students were less inclined to make preliminary assessments and there was significant wastage of time as a result. As students progressed through the cases at differing speeds, it was impractical to drip feed the information to them or to ensure that they had made the necessary assessments along the way.
- The games allowed teachers to provide an almost unlimited amount of information to the students very cost effectively. Therefore, it more closely represents reality as forensic accountants are required to select information carefully as there are often vast amounts of information available.

Based on students' and teachers' feedback, there is value in developing these online exercises further and there are many ways to improve the content including incorporating real and available information into the cases. Accounting information such as annual reports, financial statements, corporate public announcements are publicly available and can be accessed through the Internet. Utilizing such available information would make the exercises more realistic. There is also the possibility of using the games in other complimentary courses such as financial accounting and auditing.

The results cited only deals with the students' and teachers' perceptions of the games. It would be interesting to compare the results between students in a control group in which the online games were not utilized with that of students who participated in the online games to see if there was a difference in how effective the games were for learning purposes.

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