Learning Through Games - Interactive Case Study

By

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Dissertation submitted in partial fulfillment of

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CERTIFICATION OF APPROVAL

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A project dissertation submitted to the

Information Technology Programme

University Teknologi PETRONAS

In partial fulfillment of the requirement for the

BACHELOR OF TECHNOLOGY (Hons)

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Approved by,

_____

(Assoc. Prof. Dr. Ahmad Kamil Bin Mahmood)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

November 2012

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the reference and acknowledgements, and that the original work contained herein has not been undertaken or done by unspecified sources or persons.

_____

(Toh Kian Leong)

Abstract

The objective of the project is to create a game with interactive case studies which can to some extend replicate or simulate a business environment. It is meant to be a prove-of-concept, demonstrating games as a learning tool, even in higher education.

The game is aimed to be a low to medium requirements computer game. The platform was chosen on the basis that most college or university student either owns a personal computer or have easy access to one. Being a computer game, it may also be made available in computer assisted laboratories.

The concept for the game is taken from the fact that students lack a platform to apply the business theories they learn in the classroom. By providing this platform for the students, it is expected that the students can better understand and retain the information they gathered in class. This can perhaps counter the effect of students forgetting what they have learnt in class soon after the course is over.

By adding games as an additional learning platform, it may provide students with an interesting and engaging choice of acquiring knowledge. Games naturally demands attention of its players. Game objectives or challenges provide motivation for the players to keep playing and think through available options, choices and decisions before committing to them.

Research was done on game based learning theory and how it enhances student's learning experience. The positive effect of gaming is also studied and researched.

Further research on game designing and development was needed. It is important to fully understand what is needed to create a good game to retain the interest of its players. Research on the business environment and business strategies will also be required. Providing realistic challenges and business environment will be a major hurdle in this project due to the complexity of the business world. .

ACKNOWLEDGEMENT

LIST OF FIGURE

LIST OF TABLE

LIST OF CHART

Table of Contents

CHAPTER 4: Results and Discussion

CHAPTER 5: Conclusion

CHAPTER 1: INTRODUCTION

1.1 Background of Study

Video games have been around since as early as 1970s. It has come a long way since the first video game SpaceWars or the more famous Pong game was made. Today, video games are enjoyed by players of all ages and background. Sixty-seven percent, or more than two-thirds, of U.S. households hold individuals who play video games. College or university students today grow up with video games. They are accustomed to technology in their everyday lives and expect it. Thus it makes sense to harness its interactive powers to help students excel in their studies.

Game based learning is a learning approach that incorporates the use of educational games or software programs. While it should not replace proper classroom education, it could serve as a complimenting learning tool to students. Students will likely welcome a more interactive platform into their study routine as opposed to the usual dry and passive lectures and assignments. The hands-on experience provided by games serves as a pleasant and refreshing new learning process. Being hands-on, it engages the student's full attention and in that fashion helps with memory retention. Students are also expected to research and study to help them pass game challenges, promoting their self-study habit.

This educational subject that was chosen for this project is business startup and expending. The subject was chosen because it promises to be an interesting subject to develop into a game. The author has also recently taken several courses in business management as well as other business based subject and thus finds it to be a good choice.

The subject however will also serve to be a major hurdle as it is a complex and difficult environment to simulate. It is therefore important to note that the game will not be able to comprehensively cover all challenges of running a business but will be more a proof of concept on games as learning tool.

Computer has been chosen as the best platform for this project since most students own personal computers and universities naturally have computers or computer assisted laboratory for students to access.

1.2 Problem Statement

Students learn about managing an international business in class but are unable to experience and test theories that they have learnt. It is suggested that by practicing the skills they have learnt, students will better understand the theories and retain what they have learnt. A simulation game could serve as a platform for testing out their skills.

The key to successful learning is motivation. Applying what you learnt in the classroom also plays a role in retaining the knowledge learnt. A study has showed that practice by doing and applying what they have learnt has a major impact in memory retention. The table below shows the result of the study. Although a game does not necessary fit in the immediate application of learning in real situation method, it is hopefully just as helpful.

Teaching Method	Knowledge Retention
See / Hear - Lecture	5%
Reading	10%
Audio Visual / Video	20%
Demonstration	30%
Discussion Group	50%
Practice by Doing	75%
Teaching Others	90%
Immediate application of learning in a real situation	90%

Table 1.2.1 – Teaching Method and Knowledge Retention

With that table, it is clear that students should be allowed the opportunity to apply what they have learnt in order to retain that knowledge better. A game should serve that purpose to some extent.

Lectures more often uses slideshows and presentations, allowing the students to "lean back" and eventually drift away. A game would engage the full attention of the student, improving their focus and providing them with a more interesting learning experience. Games also present users with problems that should be solved strategically and provide reward through challenges.

1.3 Objectives

Project Objectives

1. Demonstrate games as learning tool.
2. Promote learning by doing.
3. Promote game as a learning tool as well as an entertainment medium.

Game Objective

1. To create an educative and interesting game that can serve as a complimentary learning platform for students taking business courses.

2. To simulate (to a degree) the challenges of starting a business and expanding the business.

3. To be able to capture users attention using attractive graphical interface.

4. To promote critical and reflective thinking.

5. To incite users to seek out more knowledge in attempt to achieve objectives.

6. To be fun as well as educational.

1.4 Scope of project

This project is targeted at younger university students which are composed of Generation Y. Students of this generation grow accustomed to constant stimuli from electric medium such as smart phones, tablets, etc.

The project aims to help promote video games as an education tool in this technological age where students do not respond as well to traditional education system consisting mainly of lectures and reading assignment.

1.5 Project Significances

With the advent of televisions, computers and other technology, the new generation of students, generation Y is constantly being bombarded by attention grabbing electronic media. They have grown to love these distractions and developed and honed their multitasking abilities to be as efficient and effective as possible. They like to keep themselves entertained or involved. Students are no longer satisfied sitting back in class and listening as the lecturer bestows knowledge upon them. Constant simulation is required grab a student's attention. Research has proven repeatedly that when students are engaged and stimulated in a way they find interesting, results can be impressive.

Generation Y will likely find assignments that allows the student to see the product of their effort, such as building a website, to be much more rewarding and time worth spending. The same students who can barely sit through an hour long class without feeling restless or daydream are also the same students who can sit in front of a computer monitor designing a website for hours. And what is better at providing instant gratification than video games, where each input from the user will likely provide an outcome.

Video games have always been seen as a time wasting and unproductive. Video games have already become a part of our culture, especially amongst the younger population. While there is no denying that games carries with them negative effects, their positive effects are often overlooked. And seeing as we cannot avoid them, there is no reason that we cannot use it to help educate students. This project will help demonstrate that games can be a valid educational tool as well as an entertainment medium

CHAPTER 2: LITERATURE REVIEW

2.1 "Does Game-Based Learning Work? Result from Three Recent Studies"

by Richard Blunt, Ph.D

The paper above describes the effectiveness of using games as a teaching tool. The paper takes three research studies and analysis them to prove the effectiveness of game-based learning or otherwise.

The author view game-based learning as a growing industry that has yet to be proved. Significant amount of funds has been poured into developing game-based learning. However these funds are not testaments to how well game-based learning works. Studies still need to be done.

Hence the author took three studies conducted at an East Coast University to examine the difference in academic achievement between students who did and did not use video games in learning. The rest of the literature review will focus on one of the studies.

Study 1 – Business Students

Study 1 is conducted by selecting a group of students taking "Introduction to Business and Technology" course. One fifth of the students were given a business based game to supplement their studies while the others are not. The table and chart below shows the result of the study.

	N	Min	Max	Mean	Std. Deviation
Grade w/o Game	801	15	100	79.18	16.16
Grade w/Game	227	58	100	91.50	11.74
Combined Sample	1028	15	100	81.90	16.12

Table 2.1.1 - Study 1 Descriptive Statistic
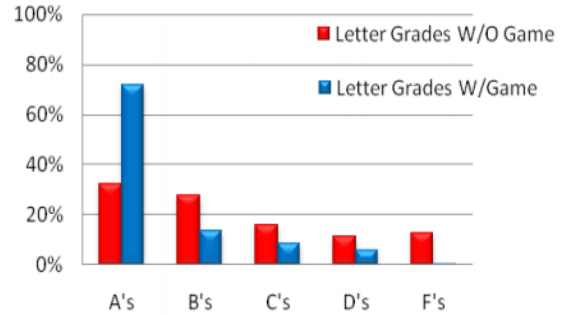
Chart 2.1.1 - Study 1 Distribution of Grades

From these, we can clearly see that game as a supplement learning tools has greatly increased the performance of the students.

The other two studies are similar but performed on Economics students (Study 2) and on Management students (Study 3). The results are equally consistent and positive looking for game-based learning. Below are the results of the two studies.

Study 2:

One-tail t Test: Hypothesis 2.1	No Game	Game
Mean	77.85	94.80
Variance	729.85	81.19
Observations	234	322
df	271	
t Stat	-9.23	

Table 2.1.2 - Study 2 Descriptive Statistic
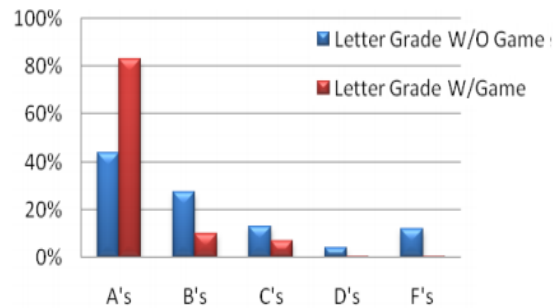
Chart 2.1.2 - Study 2 Distribution of Grades

Study 3

One-tail *t* Test: Hypothesis 3.1	*No Game*	*Game*
Mean	68.42	89.99
Variance	411.13	280.45
Observations	252	326
df	482	
t Stat	-13.65	

Table 2.1.3 - Study 3 Descriptive Statistic
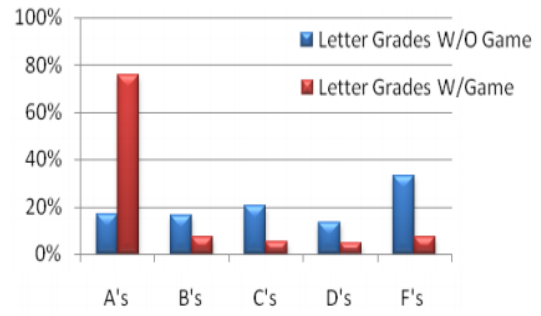
Chart 2.1.3 - Study 3 Distribution of Grades

2.2 Educational Game Design: Experiential gaming model revised

By Kristian Kiili

This paper introduces a methodology to building educational games. It carefully analyzes the mechanism of how games boost learning experiences to develop a model for designing educational games. The paper provides some useful insights on how each process in a game and describes learning as a cyclic process through direct experience in the game world.. Below is a diagram of the model.
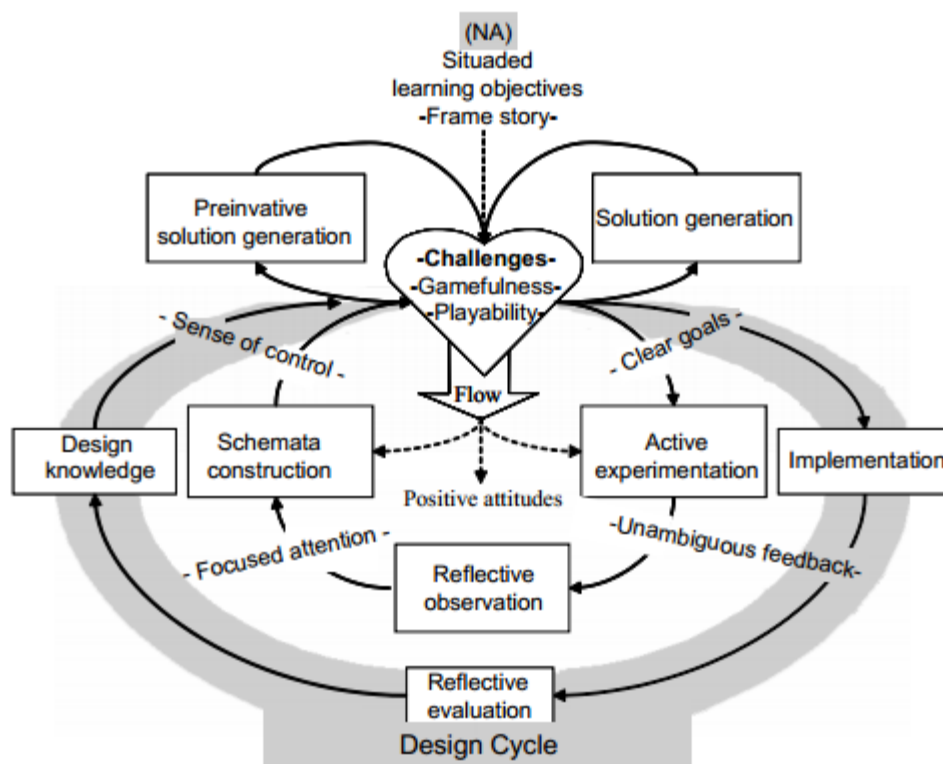
Image 2.2.1 – Experimental gaming model

The model works as a link between educational theory and game design. It analogizes the two as a human blood-vascular system. The heart is a challenge bank that motivates and engages the players by pumping challengers for him or her. The players then generate solution to solve the problems. This is represented by the upper loops. The lower smaller cycle (within the large cycle) is an "experience loop" where the players

test the solution they came up with. The lower larger cycle would represent the game development and design cycle.

While the model is experimental and will not be used in this project, the paper also provides useful guidelines for designing an educational game.

Antecedent	Design Guidelines
Challenge	Challenge should match on player's skill level. Level of challenge should be adapted to player's progression. Game should support skill development and provide rewards from development. Game should provide new challenges at appropriate pace. Challenges should be based on learning objectives.
Clear Goals	Game should provide clear main goal at the beginning. Game should provide clear sub-goals at appropriate pace.
Feedback	Game should provide unambiguous and immediate feedback on player's actions. Game should provide feedback on progression toward goals. Game should provide feedback on state of the game.
Focused Attention	Game should grab player's attention and maintain it throughout the game. Attention should be focused to relevant information from learning point of view. Player's attention should not be distracted with irrelevant things. Player's cognitive system should be heavily loaded but in its limits.
Sense of Control	Implement user interface so that player can feel sense of control over it. Level of freedom should not be restricted too much. Prevent possibilities to make errors that are hard to cover. Player should be able to achieve skill level where error marking is near zero. Create at least an illusion that player is in charge in deciding the progress of the game.
Playability	User interface and controls of the game should be easy to use and learn. Memorability of the game should be good. Provide appropriate tools to achieve goals. Do not overload player's cognitive system with unnecessary sounds and graphics. Animations should be utilized in macro-level structures. Do not overwhelm player with macro-level structures. Graphics and sounds should be utilized simultaneously. Community formation should be supported.
Frame story	Use frame story to integrate challenges to clear entity and to support perception of goals. Use frame story to situate challenges to meaningful context.
Gamefulness	Gains of the game should be constructive and linked to gameplay events. Provide wide set of challenges in nonlinear way.

Table 2.2.1 –Design guidelines for flow antecedents

2.3 "Ah Ha ..." Learning: Using Cases and Case Studies to Teach Sociological Insights and Skills

By Josephine A. Ruggiero

The study details on how case studies can be valuable tool for learning, yet it is underutilized. It states that students are able to retain memories and lessons where outrageous or surprising ideas are presented and when students experience a sudden understanding to the ideas. The literature describes such situation as an 'Ah Ha!' moment. Situation such as this quite often occur in case studies, where point-of-views of a single or a group of characters are used.

While the literature provide examples mainly from a social science perspective, some of the information will be useful in the author's current project. The literature details on how case studies should be applied to be more effective as a teaching tool. It also states how to differentiate between good and bad case studies, and how to generate and build good case studies.

The literature continues to elaborate on the benefits of using case studies for learning.

Below are few of the points given in the literature:

Case studies can help students to:

- identify goals,
- set priorities,
- develop feasible strategies for change based on their analyses of situations and/or problems,
- trouble shoot the likelihood of high, moderate, or low success of the
- intervention(s) they propose,
- identify the major intended and unintended consequences which may flow from the proposed intervention(s).

The literature concludes that case studies can provide a context in which students practice thinking critically about decision making and about the likely impacts of

different decisions. Through case studies students can "learn from experience" and gain valuable insights.

CHAPTER 3: METHODOLOGY

3.1 Development Methodology

The methodology used for software development for this project is modified Rapid Application Development (RAD).

RAD is a result-based methodology, developed to respond to the need of delivering systems as fast as possible. With the time constrain of this project, it is essential that results be deployed as soon as they are tested before the next phase is initiated.

The software for this project will consist of the main skeleton as well as case studies which are added as modules. Development will consist of first developing the skeleton, then the modules. Developing each case study individually as modules will allow as many prototypes to be completed as soon as possible in addition to providing an easier scaling in the future.

Image 3.2.1 shows the modified version of RAD that is used for this project.
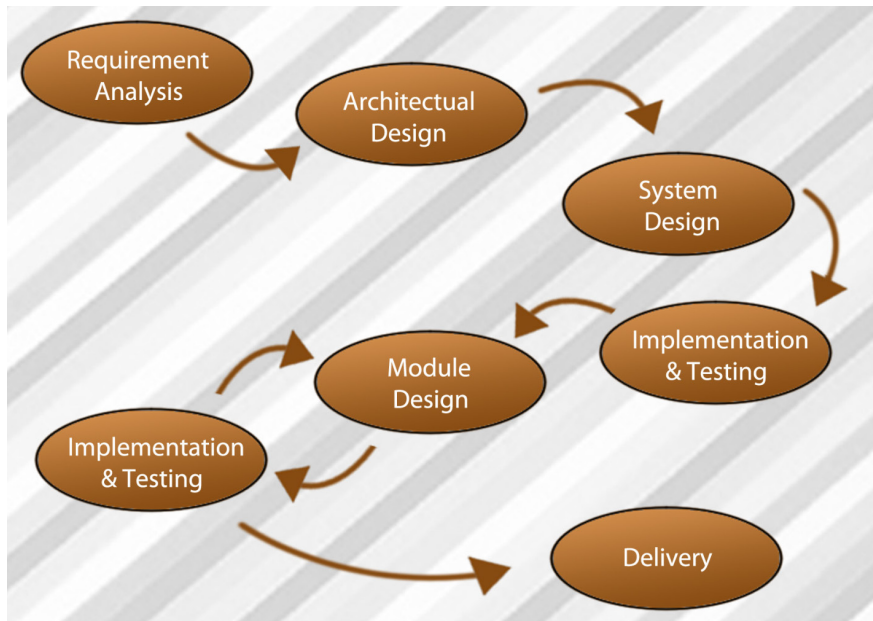
Image 3.2.1 Rapid Application Development

3.2 Project Tools

Aside from the development machine which is the author's PC, the most important tool for the success of this project is a game engine or a game development environment. After much research and debate, flash was chosen to be the best choice for the project application. Flash provides the needed flexibility and freedom for the author to develop the application as was planned. Flash is also well known for being low-requirement and usable across multiple platforms such as tablets, smart phones, etc. While the project application is meant for computers, its cross platform features may be useful should the project needs to be ported for other devices.

The next step after deciding on the game engine is choosing the development tool. While there are many applications available that can be used to develop flash games, Adobe Flash Professional provides the best user-experience, tools and libraries.
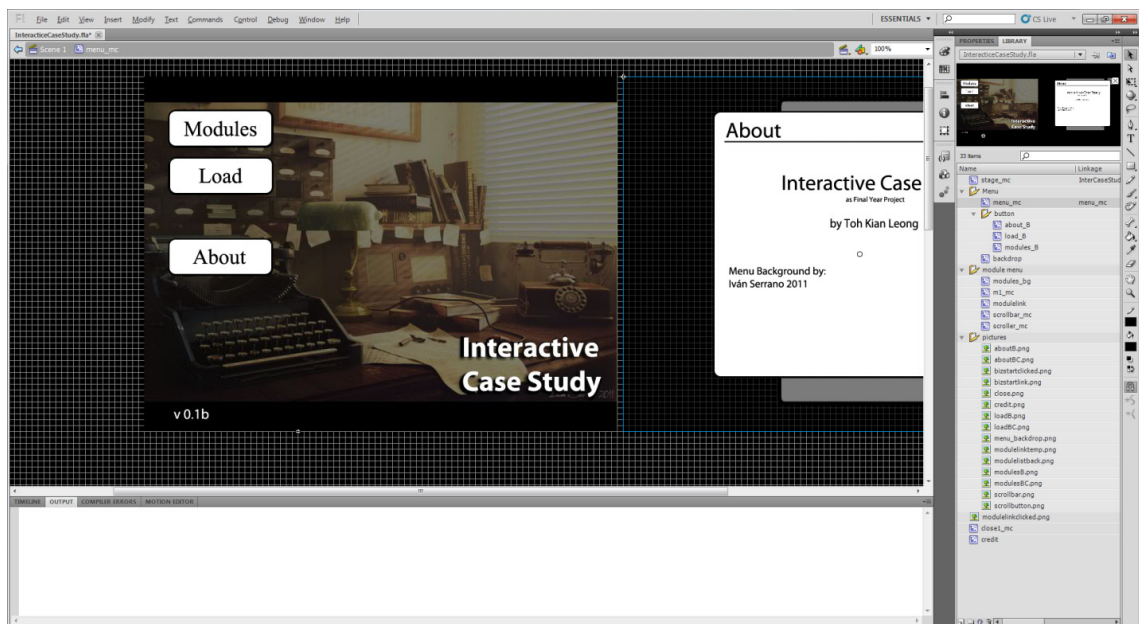
Image 3.2.1 Screenshot of Adobe Flash Professional CS5

3.2 Project Tools – (continued)

The project also involves many graphic elements that must be created from scratch or edited. Thus a graphic editor is required for the development of this application. Adobe Photoshop became the obvious choice to address this issue.
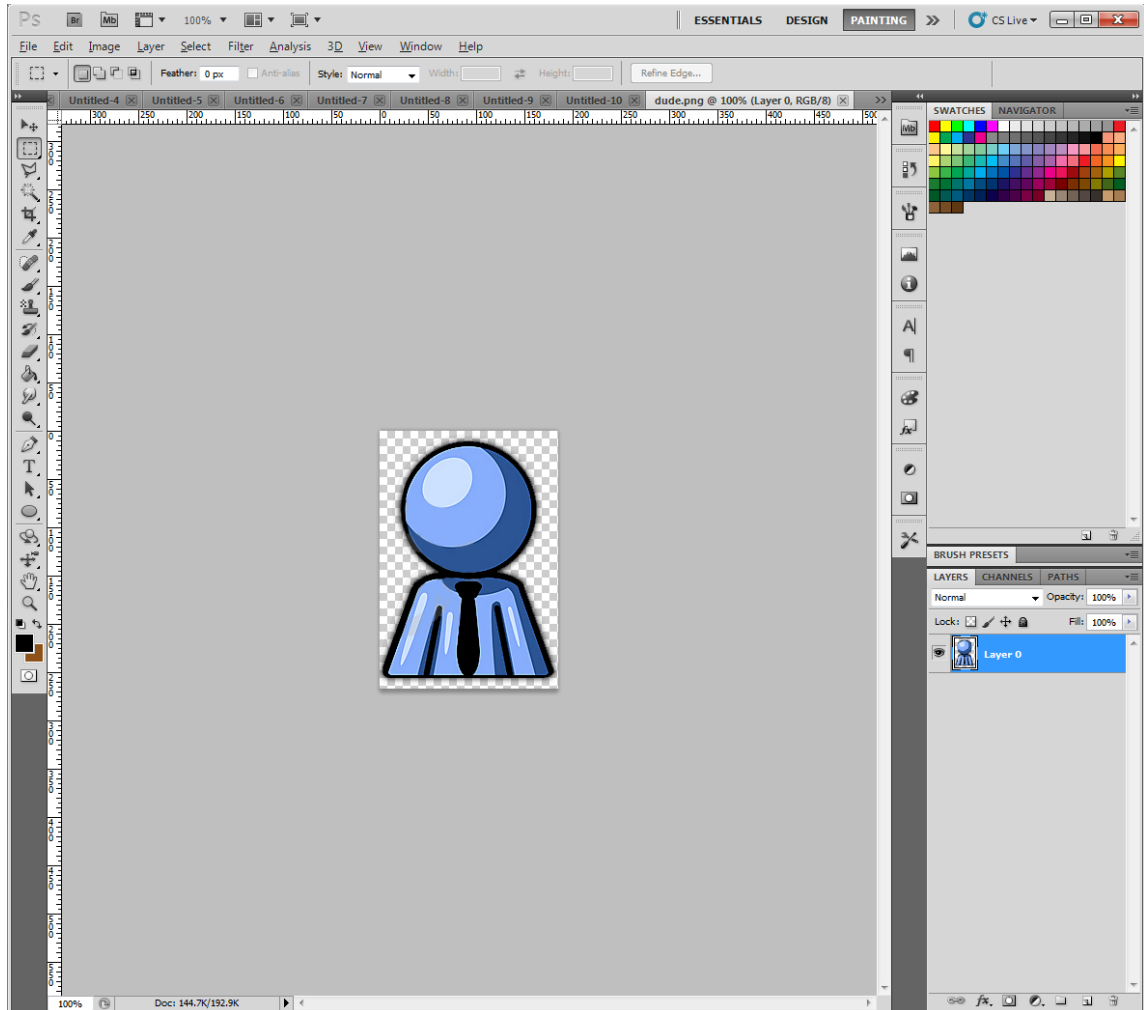
Image 3.2.2 Screenshot of Adobe Photoshop CS5

3.3 Project Activity

As can be seen from the previous image, the development will consist of several stages and one cycle.

- ➢ Project Analysis and Requirements Gathering

- ➢ Architectural Design

- ➢ System(Skeleton) Design

- ➢ System Implementation and Testing

- ➢ Module Design

- ➢ Module Implementation and Testing Cycle

- ➢ Project Delivery

3.3.1 Project Analysis and Requirements Gathering

This stage of the project is done to analyze in depth the problem statement of this project and how best to address it. The main objective derived from the problem statement is to demonstrate that games can be used as an educational tool.

In order to meet the requirement of the problem statement, the author must decide upon a game that can sufficiently capture the interest of university students via interactivity, graphics and design of the game. The game has to be sufficiently complex in order to grab the students' attention while at the same time simple enough for the author to construct within the given timeframe.

After considering some game genres and alternative, the author has decided upon interactive case studies, whereby students are placed in a situation where decisions are needed and the users has to choose amongst the options given. While this game does not give a large level of freedom to the users nor is it overly interesting, the author believe that it should demonstrate to a satisfactory level that games can be used as a learning tool.

3.3.2 Architectural Design

After deciding upon the game to develop, the next step is to draft out the basic architectural design, game concepts, game elements and flowchart.

To simplify the development process, the author has decided upon using flash engine as the best way to proceed. By utilizing off the shelves game engines, the author can concentrate on game elements and design instead of low level process such as detecting and reading user input.

Flash engine is chosen because it provides the required flexibility needed to develop the game as the author intend and that flash games are generally considered low-requirement games. Most computers will be capable of running a simple flash game.

Image 3.2.1.1 below shows a simple system architecture used by the game. It shows that once the game is started, the flash engine will render 2D graphic onto the computer screen and output audio using the speakers. Users will then read the display and provide an input. The input will be read by the flash engine and using the game logic, a response will be given via the output devices.

Image 3.3.1.1 System Architecture
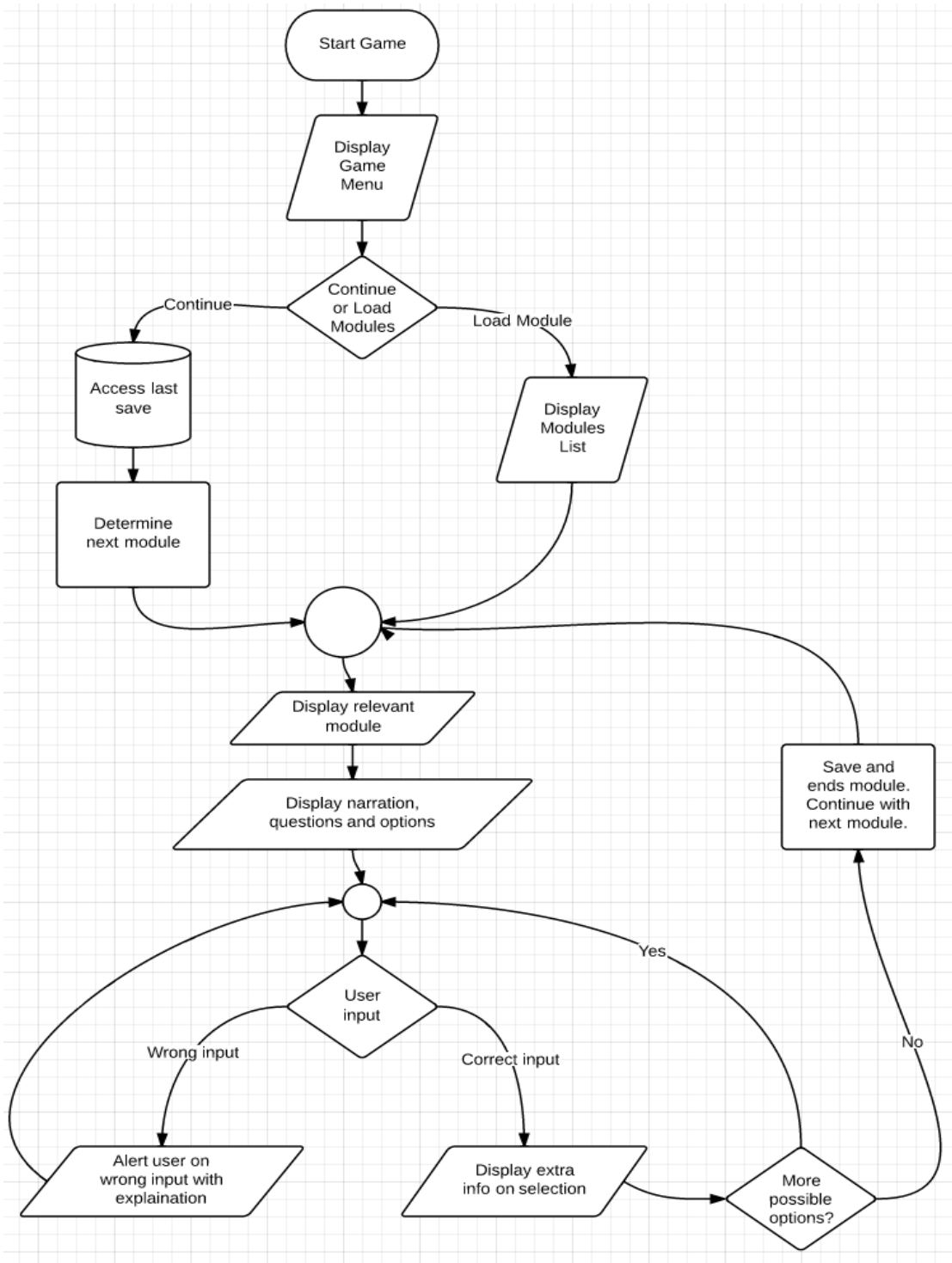
Image 3.3.1.2 Flowchart of Game Logic

3.3.2 Architectural Design – (continued)

The game logic is further elaborated using the flowchart in *Image 3.2.1.2*. It shows the basic game flow experienced by the user when playing a typical module. Once the users launch the game, they will be greeted by a menu screen. The menu screen gives users the option to either continue their game from their last checkpoint or to choose a module directly, from a list of modules. Once a selection is made, the module is presented to the users.

On a typical module, users are presented with a scenario and several options or answers. When the users select an option, tips or description may be presented to the users to help justify whether the option is correct or incorrect. When all the correct options are chosen, the module will end and the next module will be loaded.

3.3.2 System(Skeleton) Design, Implementation and Testing

This is the first stage of actual development. This stage consists of building the main menu and adding links to skeleton modules. The main menu is the first page the users will see and thus is also the title screen. Care is given to avoid clutter to avoid confusing the users.

Three buttons are placed on the main menu, "Modules", "Load" and "About".

Clicking "Modules" button will pop up a list of available modules for the users to select. "Load" button will allow users to continue from their latest checkpoint. "Credits" button will show a short description of the application and state any credits if required.

Simple functionality testing is done to ensure each element in the main menu is working correctly before proceeding to the next stage.

Image 3.2.2.1 (next page) shows a screenshot of the main menu. While Image 3.2.2.2 shows a screenshot of the module list popup.

3.3.2 System (Skeleton) Design, Implementation and Testing - (continued)
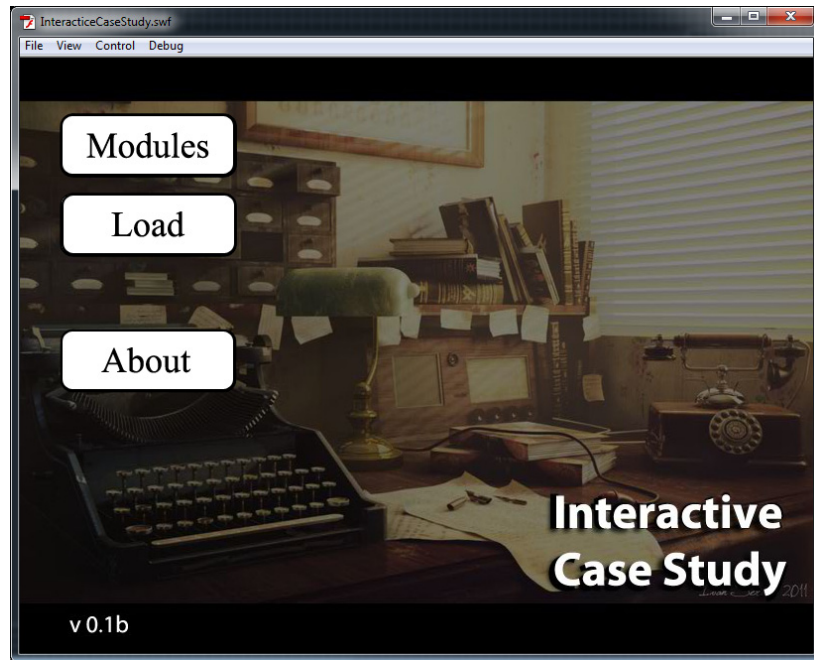
Image 3.2.2.1 Main Menu
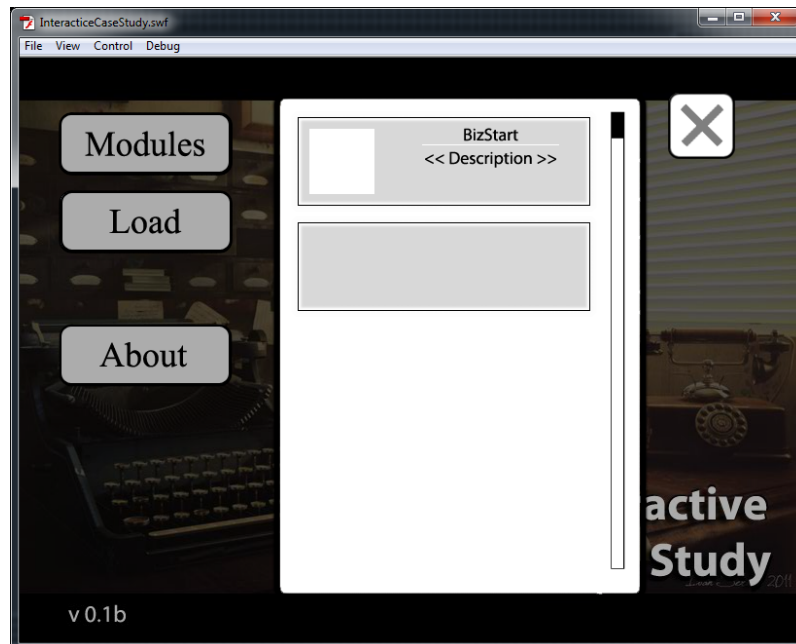
Image 3.2.2.2 Module List Popup

3.3.3 Module Design, Implementation and Testing Cycle

After ensuring the main menu is working correctly, the author proceeds to plan out a case study and develop it as an interactive module. Focus is given to design modules that are related specifically to business startup.

Image 3.2.3.1 shows how a typical module layout.
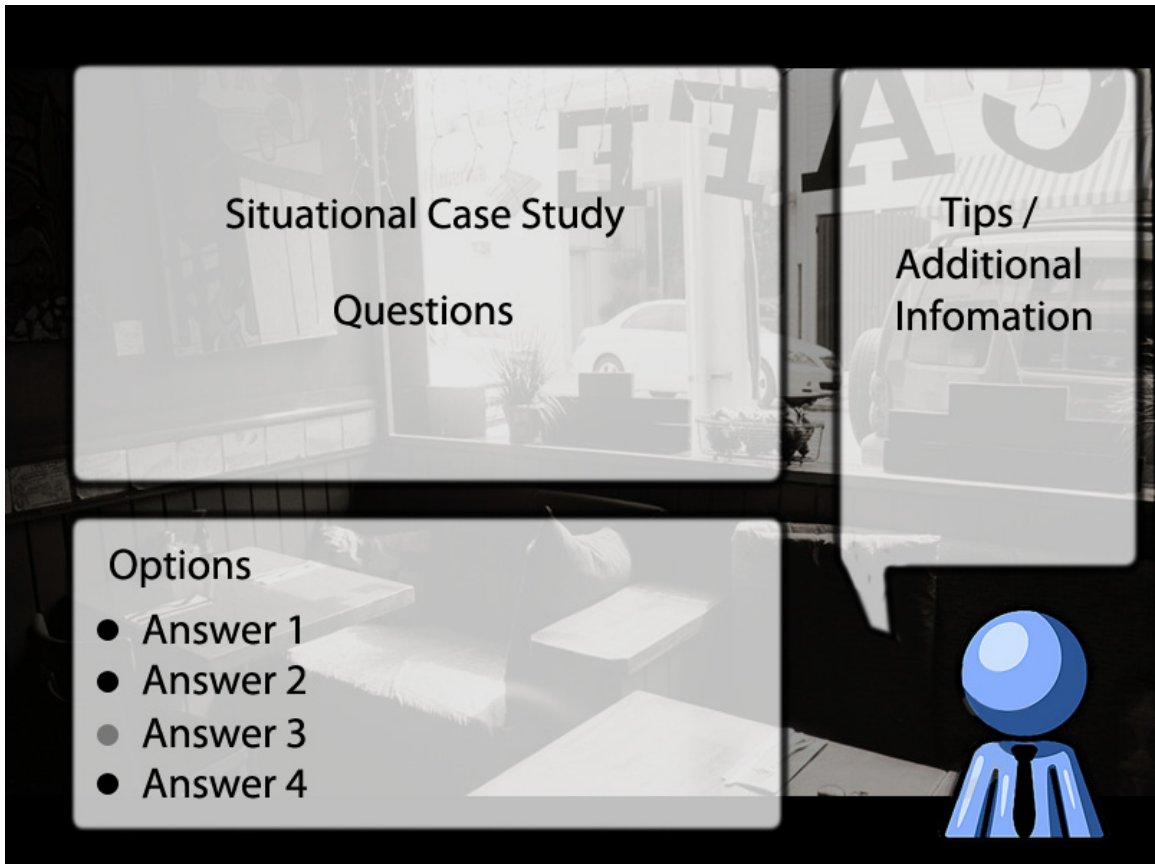
Image 3.2.3.1Module Layout

3.3.3 Module Design, Implementation and Testing Cycle

Design & Implementation

An example module concerning writing a Business Plan is described below.
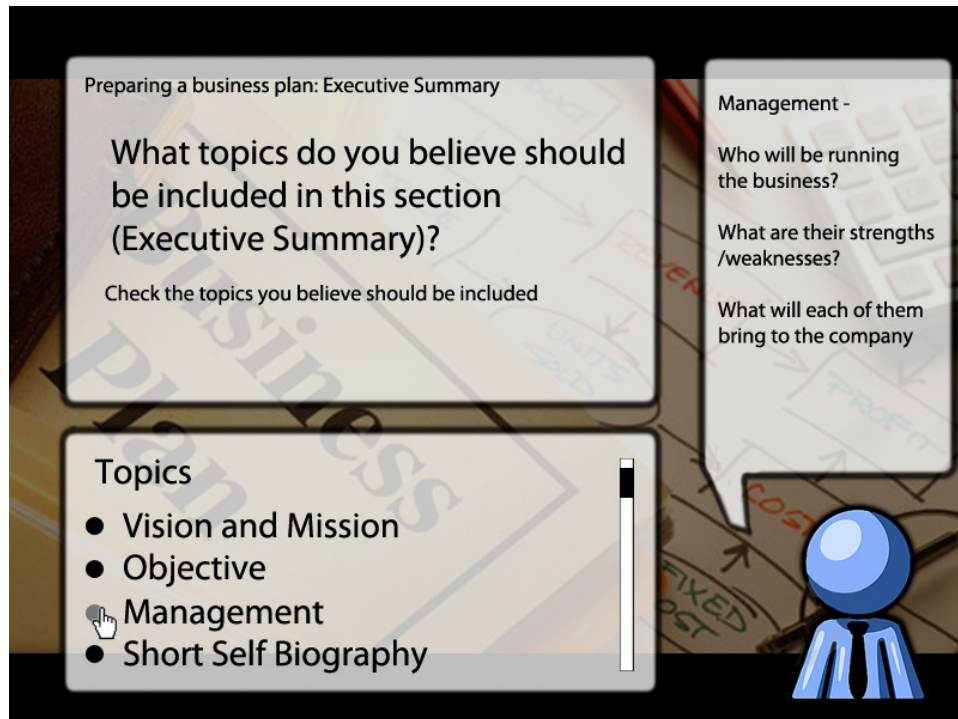
Image 3.2.3.2 Executive Summary Module

The user is presented with a question of which topics should be included in the "Executive Summary" part of a Business Plan. The bottom left box shows a list of possible topics. When the user clicks on a topic, the box on the right will briefly describe the topic. If a wrong topic is chosen, the box on the right will inform the users that it is an unnecessary topic. Users will continue selecting topics until all the correct topics has been selected or checked.

3.3.3 Module Design, Implementation and Testing Cycle – (continued)

<u>*Testing*</u>

Testing is done after each module is implemented. This is to avoid complications piling up and to ease in error finding and debugging. Testing is done on both the developer side and the user side.

Developer side has to ensure game elements responds in its predicted fashion. *Table 3.2.3.1* below shows a list of the test done.

Test No.	Type of test	Purpose
1	Static testing	Developer reviews the coding of the application or module to determine there is no left over junk code or poorly formatted code.
2	White Box testing	To find bugs and glitches in the system and eliminate them as they are found. Obvious bugs such as poorly linked buttons or missing graphics are usually found at this stage.
3	Incremental Integration testing	To test if newly added modules affect the previous modules or the whole system in unpredicted ways. This also includes breadth testing to exercise all the functionalities of the game.
4	Storage	Interaction with stored data files (database) are tested here.
5	Stress testing	User inputs are purposely aggressive and meant to trigger unexpected results. Developer will try to 'break' the system by randomly trying system's functionality.

Table 3.2.3.1 Developer side testing

3.3.3 Module Design, Implementation and Testing Cycle – (continued)

After the developer testing is done, the game is passed to users, for user testing. User side testing is mainly black box testing to ensures the game is playable and there are no obvious bug remaining.

Test No.	Test type	Purpose
1	User Interface testing	Test the "user friendly" aspect of the game. Buttons and game elements should be easily found and the interface clutter free.
2	Usability testing	Users are asked to try out the module to see if there are any overly complex or confusing aspects in the game. Users should intuitively know what to do next without too many considerations.
3	System testing	Users are asked to go through the flow and processes of the application to test for smoothness

Table 3.2.3.1 User testing

Bugs and glitches that are found during testing are immediately fixed and testing is redone to an extent.

Once testing from both developer and user sides are completed, the developer then moves on to designing the next module and developing it. After the module development is done, it is then integrated into the main application and the testing started is started once again.

This cycle, module design, implementation and testing is repeated while there is still time allowed for development. Once approaching the end of the time frame, the final stage is started.

3.3.4 Product delivery

Once the author enters the final week of development, the latest module development cycle is finalized. A final testing cycle is initiated to ensure the prototype is ready for delivery.

Test No	Type of System Testing	Purpose
1	Black Box testing	To test for system requirement and functionality without considering the internal architecture of the system.
2	White Box Testing	To test for internal functionality of the system. A final code cleanup to remove codes that was meant for debugging purposes
3	Unit Testing	To test for the functionality of each separated modules.
4	Functional Testing	To ensure the system able to performed all its intended functionality.
6	Usability Testing	To ensure the system is understandable and can be easily used by the user
7	Integration Testing	To verify that all different part of the system pages can integrate with each other and function with no error

Table 3.2.4.1 Final Test

Once the final testing is done, the application will be presented to a panel of examiners and lecturers. If the application gets favorable response, the project may be continued in the future.

3.4 Gantt Chart

A Gantt chart was used as a time management tool to help the author will tracking the timeframe of the whole project.

FYP II														
Month	Sept		October				November				December			
Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Game Design														
Draft Game Concept			▓	▓										
Draft Game Elements				▓	▓									
Story Board					▓									
Finalize Game Design					▓									
Progress Report				▓										
Game Development														
Development Flowchart					▓	▓								
Database Planning					▓	▓								
Development and Testing							▓	▓	▓	▓				
Module Design and Testing										▓	▓	▓	▓	
Final Prototype													▓	
Pre-EDX										▓				
Dissertation										▓				
Viva												▓		
Final Dissertation														▓

Table 3.4.1 Gantt Chart

Chapter 4 – Results and Discussion

4.1 Study Survey

For the purpose of this project a survey was done to view student's opinion on using video games as an educational tool, even for higher learning institutions. The survey contains 10 questions and a total of 30 participants responded to the survey.

The first two questions in the survey is meant to determine the relevance of the current study to the participant.

Question 1: Are you a university student?

The project is aimed at university or college level students. Survey answers from participants who are still in university level will naturally be more valued. However this does not mean input non university students are disregarded.

26 out of 30 of the participants are university students while 4 are not.
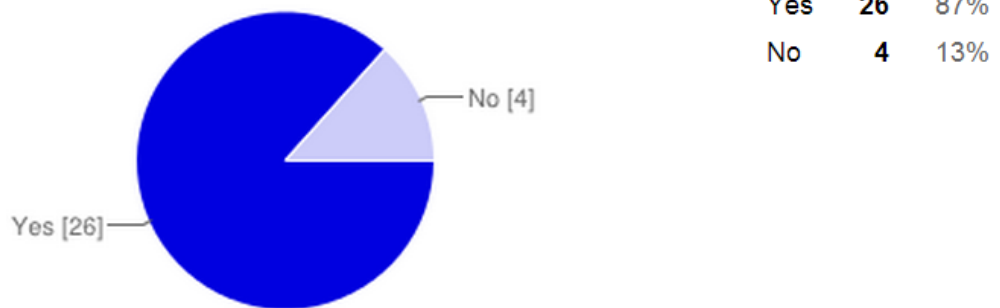
Image 4.1.1 – Question 1

Question 2: Are you a generation Y?

Perhaps even more important than being a university student is whether the participant is a generation Y. The project is targeted at the more technologically inclined generation Y. As discussed before in this report, being technologically savvy has changed the generation Y expectation and behavior. This project is aimed at catering to this change.

Only one participant out of 30 was not a Y generation .

Are you a generation Y?

Yes	**29**	97%
No	**1**	3%

No [1]

Yes [29]
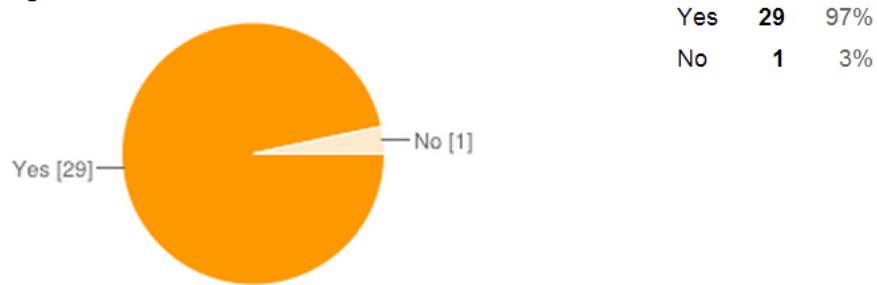
Image 4.1.2 – Question 2

Question 3: How much time do you spend on video games, if any?

This question was asked to survey the popularity of video games amongst the participant. Participants are asked to rate their regularity of playing video games on a scale of 1 to 5. The result was quite evenly distributed across the scale. With the most participants rating themselves as moderate "gamers"

The result is favorable to for the purpose of this survey as it shows that in general the participant population is not partial to or against video games.

How much time do you spend on video games, if any?

1 -Not much	5	17%
2	5	17%
3	9	30%
4	6	20%
5 -My favourite pastime	5	17%

Not much   My favourite pastime
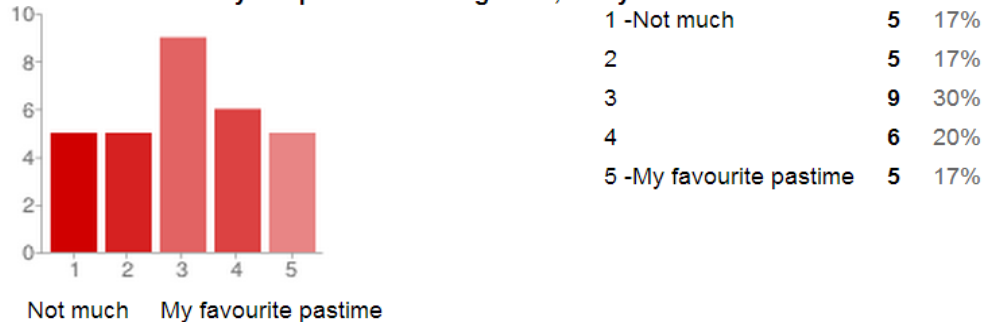
Image 4.1.3 – Question3

Question 4: Do you believe there are benefits to playing video games?

The question is asked to assess whether there are any participants who view video games as a completely worthless past time. From the result, it would seem that most of generation Y acknowledges that there are benefits to video games. If the results were to show many participants have a negative view towards video games, then perhaps this project is not suitable for the current generation of university students.

Do you believe there are benefits to playing video games?

Yes	28	93%
No	2	7%

No [2]

Yes [28]
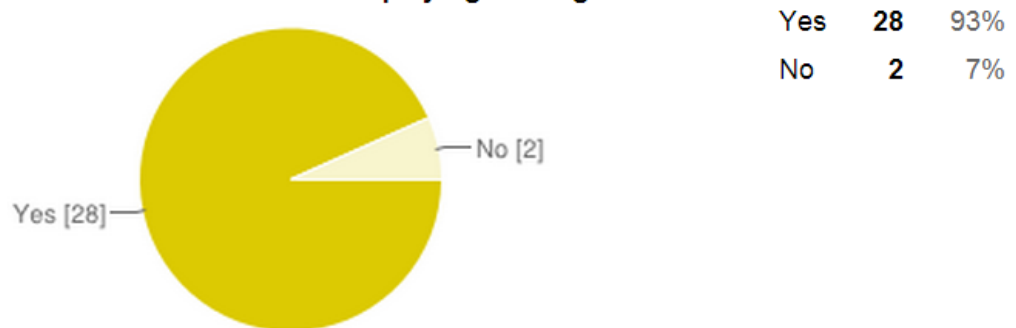
Image 4.1.4 – Question 4

Question 5: Do you believe video games can be used for assisting education?

The fifth question is ask the participants directly if they believe the education system can benefit from using video games as a tool. Majority of the participants seems open to the idea of video games being introduced into the education sector.

Do you believe video games can be used for assisting education?

Yes	29	97%
No	1	3%

No [1]

Yes [29]
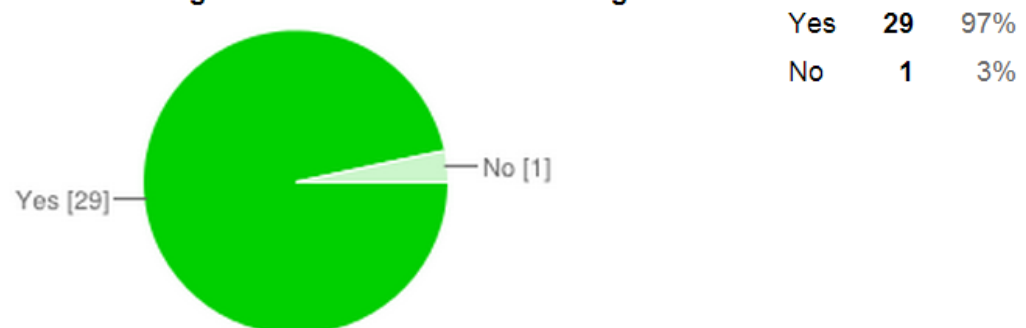
Image 4.1.5 – Question 5

Question 6: Do you think the current education system is sufficient? (The current education system is based mainly on lectures and reading/writing assignments)

This question attempts to find out if the participants are satisfied with the type of education they are currently receiving. The participants are asked to rank the current system from 1 to 5. Most participants have no strong feeling on the matter and opt to choose the middle rank. However lower ranks receives more votes while the highest ranking received none. This is perhaps a sign that students are willing to try new changes to the education system.

Do you think the current education system is sufficient?

1 -Insufficient	3	10%
2	2	7%
3	22	73%
4	2	7%
5 -Sufficient	0	0%
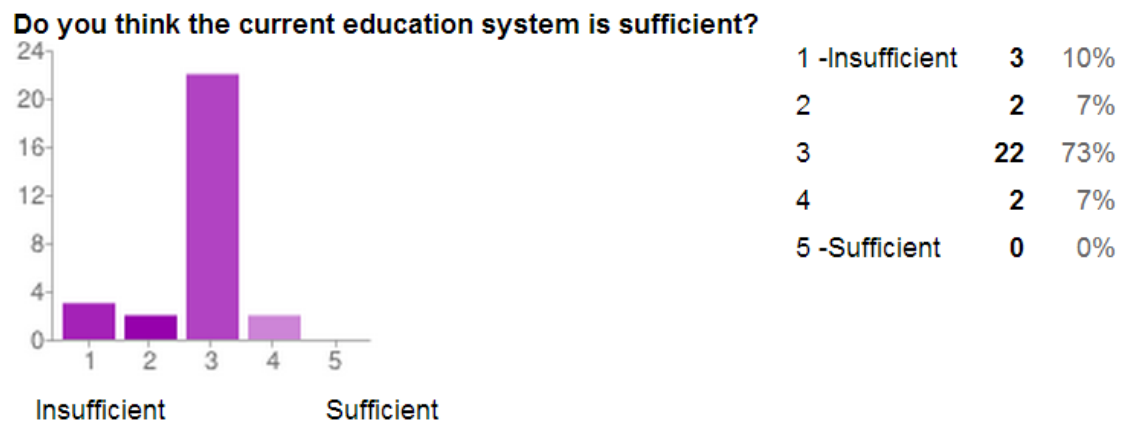
Image 4.1.6 – Question 6

Question 7: If video games were introduced to your curriculum, would you welcome it?

Question 7 asks the participants directly their view on having games as a part of their curriculum. From the result, it seems that many will embrace this new change. Only a few are unsure of the change and none seems to oppose the idea.

If video games were introduced to your curriculum, would you welcome it?

Yes	23	74%
No	0	0%
Maybe	7	23%

No [0]
Maybe [7]
Yes [23]
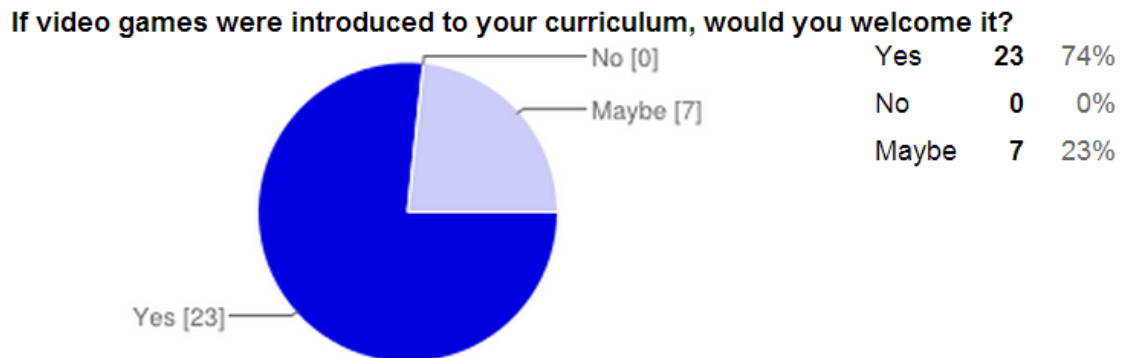
Image 4.1.7 – Question 7

Question 8: Do you find remembering or recalling things you heard in lectures hard?

This question aims to discover the effectiveness of lectures as perceived by the participants. From the result, most participants have difficulty absorbing the knowledge shared during lectures.

Do you find remembering or recalling things you heard in lectures hard?

1 -Easy	2	6%
2	2	6%
3	11	35%
4	9	29%
5 -Hard	5	16%

Easy   Hard
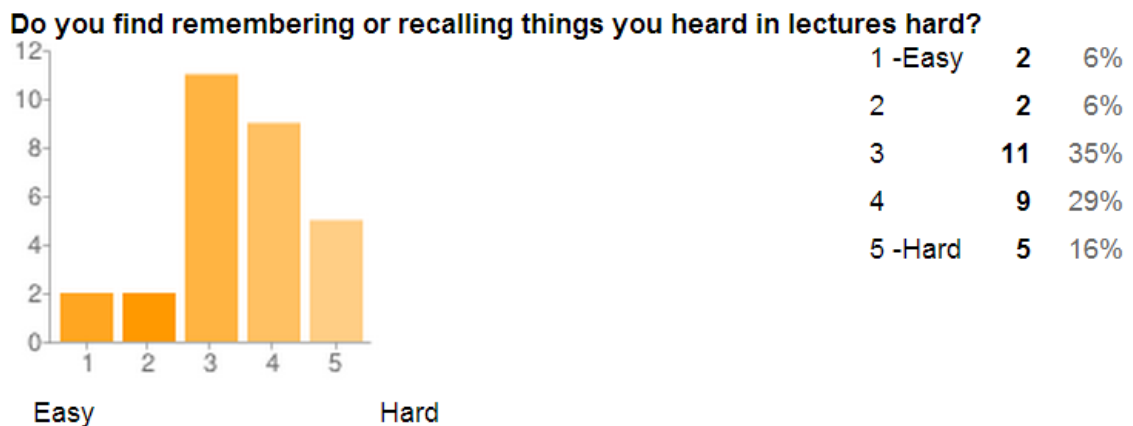
Image 4.1.8 – Question 9

Question 9: Do you find remembering or recalling things you learnt in games hard?

This question aims to discover whether games have an advantage over lectures. From the result it would seem that most participant find recalling "knowledge" from games as an easier task as compared to lectures.

Do you find remembering or recalling things you learnt in games hard?		
1 -Easy	15	48%
2	7	23%
3	6	19%
4	1	3%
5 -Hard	1	3%
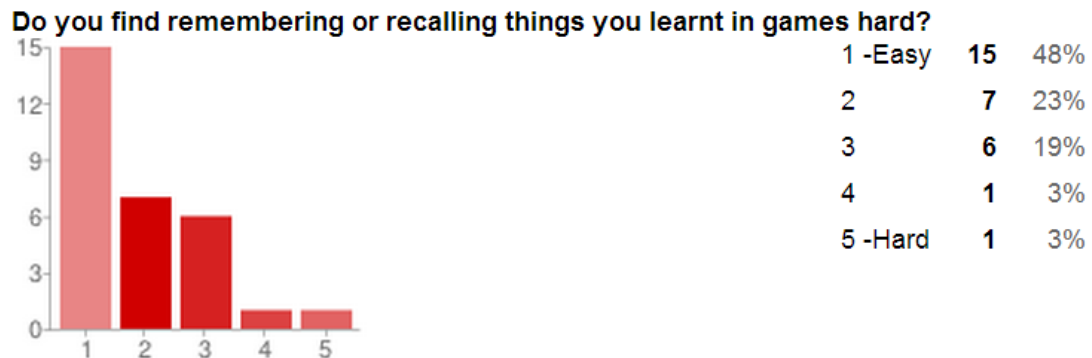
Image 4.1.9 – Question 9

Question 10: If you answered easy to the previous question, why?

Question 10 is an open question where participants can leave comment on why they believe it is easier to remember things from video games than from lectures. Most comments reasons that games are more attractive, fun and interesting. From the comments it seems find games as a more enjoyable experience and thus helped knowledge retention.

Some comments:

- Game is attractive!
- Interesting and exciting
- It is definitely more attractive
- Because games are more on visual. Human find it easier to remember visual things. (paraphrase to grammatical purposes)
- The nature of video game is very fun

Summary/Conclusion of survey

From the survey, it can be seen that should games be introduced into the education curriculum, it will mostly be well-received. This survey serves to strengthen the author's view that video games have a place in the education sector, even in higher learning institutions.

The survey however does not reflect any opinions on the game developed for the purpose of this project as the survey was taken before the completion or partial completion of the prototype.

4.2 Prototype

This project is based on video games being able to captivate their users and retain their attention. This to capture this ability displayed by games, the author attempts to break down the reasons why video games are fun and addictive.

Concepts and belief used as base for prototype:

Concept	Elaboration
Interactive/ Feedback	A game does not work without user interactions. Players must interact with the game for the game to progress. Each input given by a player is almost instantly greeted by a response. This give the player a sense of control while making him feel obligated to keep interacting with the game.
Progress/ Goal oriented	As more time is spent on a game, the game progress allows the player to get more and more immersed into the game. The player will keep playing the game as long as he feels like the game is progressing and goals are being met. Achieving goals keep the player focused and hints the player on what to do next. A good storyline is especially useful in this case as it pulls the player into the game and excites his imagination.
Reward/ Consequences	As decisions are made, the game tends to respond with either a reward or consequences. This keeps the players on their toes and forces them to think carefully before making a decision. Rewards will give the players satisfaction while consequences push the players to keep trying, provided they do not get fed up. The feeling of reward and achievement the players get from doing something right keeps the user wanting more and thus keep on playing. An element of surprise will likely be useful as players will not be bored by predictable outcomes

Learning Process /Skill	Games usually come with a learning curve. As players continue playing, their skills get better giving them as sense of achievement. This is boosted further if the players are competing against each other. As games get progressively more difficult, feels they are being challenged and strive to get better.
Logic / Creativity/ Strategy	Most games will most likely involve some form of thinking. Games that require logic, creativity and strategy stimulate the players' mind and push them to think and try out different approach to a puzzle. Their hard work is then rewarded with achieving their goals.
Visually appealing	Just a first impression is important when meeting a person, games can gather attention or turn away players depending on how visually attractive it is. Visually appealing games can give players a more enjoyable time when playing the game.

Table 4.2.1 Game Concepts

4.3 Challenges faced when developing the prototype

The main challenge in this project is to design a game that is within the author's skill level to develop while having most of the concept discussed in the previous sub-chapter. The author has previously never design or develop a game before. Knowledge on flash development is also acquired during the project period.

While the interactive case study sufficiently covers several of the gaming concepts, it is still somewhat lacking in others. The game is mostly point and click, without much action to excite the players.

Balancing between educational and entertaining is also an issue. As education tends to focus more on delivering information and not creative problem solving, it is harder to design a game that can be played intuitively and is entertaining.

The timeframe given for this project also become a limiting factor. While the time given is reasonably long, it also restrains the author from mastering the flash engine and game development part of the project. An actual game will require much more time or man power to produce.

CHAPTER 4: CONCLUSION

Conclusion

While there have been several research in the pass aimed at gaming as a potential educational tool, the trend seems to have subsided without much impact. Even though the researches have mainly provided favorable result towards games, few schools have adopted using video games in their curriculum.

This project is meant to demonstrate that games can be used as learning tool. The game that was developed with this project serves as a proof-of-concept, and not a complete deliverable game. It is hoped that it will provide the incentive for the further development of games for learning purposes.

Recommendation

It is hoped that the project will be carried on to provide future business students with a platform to try out the skills that they have acquired in class. It s provide a fresh and engaging new way to strengthen their understanding, acquire more knowledge as well promote self study habits. Game-based learning, while should never replace classroom lectures, could become an invaluable tool in the education segment.

New elements could be added into the game such as puzzle stages and some action stages to keep players interested in the game.

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APPENDICES

Survey Questionnaire

Learning Through Games - Interactive Case Study

Pew Pew!

Are you a university student?

○ Yes

○ No

Are you a generation Y?
Persons born between 1980s to early 2000s are considered Gen Y

○ Yes

○ No

How much time do you spend on video games, if any?
This includes facebook games! Visit my sim!

	1	2	3	4	5	
Not much	○	○	○	○	○	My favourite pastime

Do you believe there are benefits to playing video games?

○ Yes

○ No

Do you believe video games can be used for assisting education?

○ Yes

○ No

Do you think the current education system is sufficient?
The current education system is based mainly on lectures and reading/writing assignments

	1	2	3	4	5	
Insufficient	○	○	○	○	○	Sufficient

If video games were introduced to your curriculum, would you welcome it?

- ○ Yes
- ○ No
- ○ Maybe

Do you find remembering or recalling things you heard in lectures hard?
Eg. What are the 4Ps of marketing?

	1	2	3	4	5	
Easy	○	○	○	○	○	Hard

Do you find remembering or recalling things you learnt in games hard?
Name 5 pokemons!

	1	2	3	4	5	
Easy	○	○	○	○	○	Hard

If you answered easy to the previous question, why?

[   ]

[Submit]

Powered by Google Docs

Survey Results (Spreadsheet)

Do you believe video games can be used for assisting education?	Do you think the current education system is sufficient?	Are you a university student?	Are you a generation Y?	How much time do you spend on video games, if any?	Do you believe there are benefits to playing video games?	If video games were introduced to your curriculum, would you welcome it?	Do you find remembering or recalling things you heard in lectures hard?	Do you find remembering or recalling things you learnt in games hard?	If you answered easy to the previous question, why?
Yes		2 Yes	Yes		3 Yes	Yes	5	4	
Yes		3 Yes	Yes		2 Yes	Maybe	4	2	
Yes		3 Yes	Yes		2 Yes	Yes	4	2	game is attractive! interesting and exciting
Yes		3 No	Yes		3 Yes	Yes	5	1	It is definately more attractive
Yes		3 Yes	Yes		5 Yes	Yes	2	1	i dont understand your english!
Yes		3 Yes	Yes		2 No	Yes	3	3	hahahahahah
Yes		3 Yes	Yes		4 Yes	Yes	4	3	i love learning and games
Yes		3 Yes	Yes		3 Yes	Maybe		2	cartoon characters, theme song. Because games is more on visual. Human easy to remembered visual things.
Yes		3 Yes	Yes		5 Yes	Maybe	1	1	The nature of video game is very fun. While lectures can be very boring sometimes.
Yes		2 Yes	Yes		3 Yes	Yes	4	1	sometimes.
Yes		3 No	Yes		1 Yes	Yes	3	1	Its interesting!!
Yes		3 Yes	Yes		3 Yes	Yes	5	1	because its interesting.
Yes		3 Yes	Yes		4 Yes	Yes	3	1	Repeated exposure + research
Yes		3 Yes	Yes		5 Yes	Yes	4	2	research
No		1 No	No		1 No	Maybe	5	5	
Yes		3 Yes	Yes		4 Yes	Yes	4	1	Its entertaining
Yes		3 Yes	Yes		2 Yes	Yes	3	2	Because you learnt it thru passion
Yes		3 Yes	Yes		3 Yes	Yes	3	3	

Do you believe video games can be used for assisting education?	Do you think the current education system is sufficient?	Are you a university student?	Are you a generation Y?	How much time do you spend on video games, if any?	Do you believe there are benefits to playing video games?	If video games were introduced to your curriculum, would you welcome it?	Do you find remembering or recalling things you heard in lectures hard?	Do you find remembering or recalling things you learnt in games hard?	If you answered easy to the previous question, why?
Yes	4	Yes	Yes	3	Yes	Yes	5	1	idk..played Pokemon too much, I guess...
Yes	3	Yes	Yes	4	Yes	Maybe	3	1	Cuz i like games
Yes	4	Yes	Yes	3	Yes	Yes	2	1	FUN
Yes	3	Yes	Yes	3	Yes	Yes	4	3	
Yes	1	Yes	Yes	5	Yes	Yes	1	1	cause its gaming what else do you need ??
Yes	3	Yes	Yes	5	Yes	Yes	3	1	interactive and fun It is always easier to learn from those games!
Yes		Yes	Yes	1	Yes	Yes	3	2	
Yes	3	Yes	Yes	1	Yes	Yes	3	1	it's fun!
Yes	1	Yes	Yes	1	Yes	Yes	3	3	
Yes	3	Yes	Yes	4	Yes	Maybe	4	2	
Yes	3	Yes	Yes	4	Yes	Yes	4	3	
Yes	3	No	Yes	2	Yes	Maybe	3		

Interactive Case Study – Game Based Learning

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ABSTRACT

Interactive Case Study is an experiment on demonstrating the use of video games in the education segment. The developed game is meant to show that video games have the potential to be a great asset in helping teach students, even in universities. The idea is to provide an additional learning platform for students undertaking theory-based subjects. By giving students game, it can not only enhance their understanding and recall, but also encourage them to seek out more knowledge while playing to overcome game objectives.

Keywords: *Video Games, Game Based Learning, Education*

I. INTRODUCTION

Video games have been around since as early as 1970s. It has come a long way since the first video game SpaceWars or the more famous Pong game was made. Today, video games are enjoyed by players of all ages and background. Sixty-seven percent, or more than two-thirds, of U.S. households hold individuals who play video games. College or university students today grow up with video games. They are accustomed to technology in their everyday lives and expect it. Thus it makes sense to harness its interactive powers to help students excel in their studies.

Game based learning is a learning approach that incorporates the use of educational games or software programs. While it should not replace proper classroom education, it could serve as a complimenting learning tool to students. Students will likely welcome a more interactive platform into their study routine as opposed to the usual dry and passive lectures and assignments. The hands-on experience provided by games serves as a pleasant and refreshing new learning process. Being hands-on, it engages the student's full attention and in that fashion helps with memory retention. Students are also expected to research and study to help them pass game challenges, promoting their self-study habit.

This project hopes to demonstrate that games can have a place in the education sector and will have a positive effect on students studies if used correctly.

A. Problem Statement

There are 3 main problem statements of this project which are:
• Students learn many theories and facts in class but for most subject, there is a lack of platforms for students to experiment the theories on.
• Traditional teaching methods consisting of lectures and writing assignments are considered passive and lack the interactivity needed by students nowadays.
• Video games has been long considered a negative pastime.

B. Objective

The objectives of this project are as outlined below.
1. Demonstrate and promote games as a learning tool
2. Promote learning by doing.
3. Incite self learning.

C. Project Significance

With the advent of televisions, computers and other technology, the new generation of students, generation Y is constantly being bombarded by attention grabbing electronic media. They have grown to love these distractions and developed and honed their multitasking abilities to be as efficient and effective as possible. Students are no longer satisfied sitting back in class and listening as the lecturer bestows knowledge upon them. Constant simulation is required grab a student's attention. Research has proven repeatedly that when students are engaged and stimulated in a way they find interesting, results can be impressive.

Generation Y will likely find assignments that allows the student to see the product of their effort, such as building a website, to be much more rewarding and time worth spending. The same students who can barely sit through an hour long

class without feeling restless or daydream are also the same students who can sit in front of a computer monitor designing a website for hours. And what is better at providing instant gratification than video games, where each input from the user will likely provide an outcome.

Video games have always been seen as a time wasting and unproductive. Video games have already become a part of our culture, especially amongst the younger population. While there is no denying that games carries with them negative effects, their positive effects are often overlooked. And seeing as we cannot avoid them, there is no reason that we cannot use it to help educate students.

II.   LITERATURE REVIEW

A.   "Does Game-Based Learning Work? Result from Three Recent Studies"

Richard Blunt, Ph.D describes the effectiveness of using games as a teaching tool. The paper takes three research studies and analysis them to prove the effectiveness of game-based learning or otherwise.

The author view game-based learning as a growing industry that has yet to be proved. Significant amount of funds has been poured into developing game-based learning. However these funds are not testaments to how well game-based learning works. Studies still need to be done.

Hence the author took three studies conducted at an East Coast University to examine the difference in academic achievement between students who did and did not use video games in learning. The rest of the literature review will focus on one of the studies.

The first study is conducted by selecting a group of students taking "Introduction to Business and Technology" course. One fifth of the students were given a business based game to supplement their studies while the others are not. The table and chart below shows the result of the study.
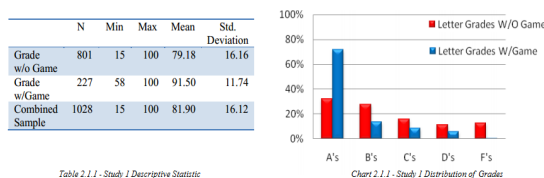

	N	Min	Max	Mean	Std. Deviation
Grade w/o Game	801	15	100	79.18	16.16
Grade w/Game	227	58	100	91.50	11.74
Combined Sample	1028	15	100	81.90	16.12

Table 2.1.1 - Study 1 Descriptive Statistic   *Chart 2.1.1 - Study 1 Distribution of Grades*

Figure 2.1- Study 1 Results

Two more studies done on economics students and management students respectively have shown similar result where students who were given video games scored significantly higher than their peers. Below are their respective results.
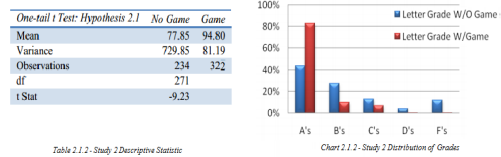
Study 2 – Economics students

One-tail t Test: Hypothesis 2.1	No Game	Game
Mean	77.85	94.80
Variance	729.85	81.19
Observations	234	322
df	271	
t Stat	-9.23	

Table 2.1.2 - Study 2 Descriptive Statistic   *Chart 2.1.2 - Study 2 Distribution of Grades*

Figure 2.2- Study 2 Results

Study 3 – Management Students

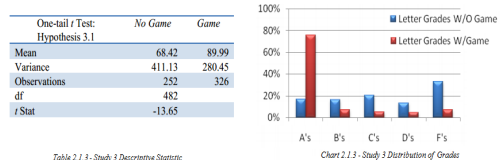| One-tail t Test: Hypothesis 3.1	No Game	Game
Mean	68.42	89.99
Variance	411.13	280.45
Observations	252	326
df	482	
t Stat	-13.65	

Table 2.1.3 - Study 3 Descriptive Statistic   *Chart 2.1.3 - Study 3 Distribution of Grades*

Figure 2.3- Study 3 Results

B.   Educational Game Design: Experiential Gaming Model Revised

Kristian Kiili introduces a methodology to building educational games. It carefully analyzes the mechanism of how games boost learning experiences to develop a model for designing educational games. The paper provides some useful insights on how each process in a game and describes learning as a cyclic process through direct experience in the game world.

The cyclic process model works as a link between educational theory and game design. It analogizes the two as a human blood-vascular system. The heart is a challenge bank that motivates and engages the players by pumping challengers for him or her. The players then generate solution to solve the problems. This is represented by the upper loops. The lower smaller cycle (within the large cycle) is an "experience loop" where the players test the solution they came up with. The lower larger cycle would represent the game development and design cycle.
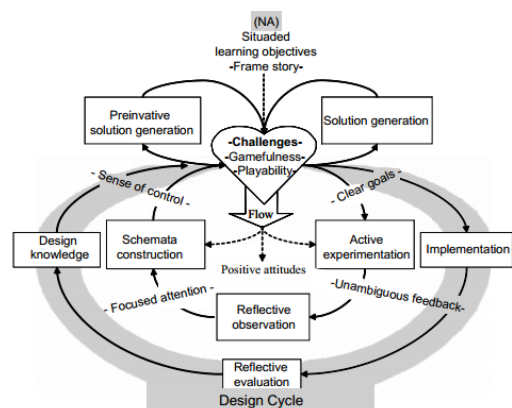
Below is a diagram of the model.

Figure 2.4 - Experimental gaming model

The paper also provided some useful guidelines for designing an educational game.

Antecedent	Design Guidelines
Challenge	Challenge should match on player's skill level.
	Level of challenge should be adapted to player's progression.
	Game should support skill development and provide rewards from development.
	Game should provide new challenges at appropriate pace.
	Challenges should be based on learning objectives.
Clear Goals	Game should provide clear main goal at the beginning.
	Game should provide clear sub-goals at appropriate pace.
Feedback	Game should provide unambiguous and immediate feedback on player's actions.
	Game should provide feedback on progression toward goals.
	Game should provide feedback on state of the game.
Focused Attention	Game should grab player's attention and maintain it throughout the game.
	Attention should be focused to relevant information from learning point of view.
	Player's attention should not be distracted with irrelevant things.
	Player's cognitive system should be heavily loaded but in its limits.
Sense of Control	Implement user interface so that player can feel sense of control over it.
	Level of freedom should not be restricted too much.
	Prevent possibilities to make errors that are hard to cover.
	Player should be able to achieve skill level where error marking is near zero.
	Create at least an illusion that player is in charge in deciding the progress of the game.
Playability	User interface and controls of the game should be easy to use and learn.
	Memorability of the game should be good.
	Provide appropriate tools to achieve goals.
	Do not overload player's cognitive system with unnecessary sounds and graphics.
	Animations should be utilized in macro-level structures.
	Do not overwhelm player with macro-level structures.
	Graphics and sounds should be utilized simultaneously.
	Community formation should be supported.
Frame story	Use frame story to integrate challenges to clear entity and to support perception of goals.
	Use frame story to situate challenges to meaningful context.
Gamefulness	Gains of the game should be constructive and linked to gameplay events.
	Provide wide set of challenges in nonlinear way.

Table 2.1–Design guidelines for flow antecedents

C. "Ah Ha .." Learning: Using Cases and Case Studies to Teach Sociological Insights and Skills

Josephine A. Ruggiero details on how case studies can be valuable tool for learning, yet it is underutilized. It states that students are able to retain memories and lessons where outrageous or surprising ideas are presented and when students experience a sudden understanding to the ideas. The literature describes such situation as an 'Ah Ha!' moment. Situation such as this quite often occur in case studies, where point-of-views of a single or a group of characters are used.

While the literature provide examples mainly from a social science perspective, some of the information will be useful in the author's current project. The literature details on how case studies should be applied to be more effective as a teaching tool. It also states how to differentiate between good and bad case studies, and how to generate and build good case studies.

The literature continues to elaborate on the benefits of using case studies for learning.Below are few of the points given in the literature:

Case studies can help students to:

- identify goals
- set priorities

- develop feasible strategies for change based on their analyses of situations and/or problems
- trouble shoot the likelihood of high, moderate, or low success of the intervention(s) they propose
- identify the major intended and unintended consequences which may flow from the proposed intervention(s).

The literature concludes that case studies can provide a context in which students practice thinking critically about decision making and about the likely impacts of different decisions. Through case studies students can "learn from experience" and gain valuable insights.

III. METHODOLOGY
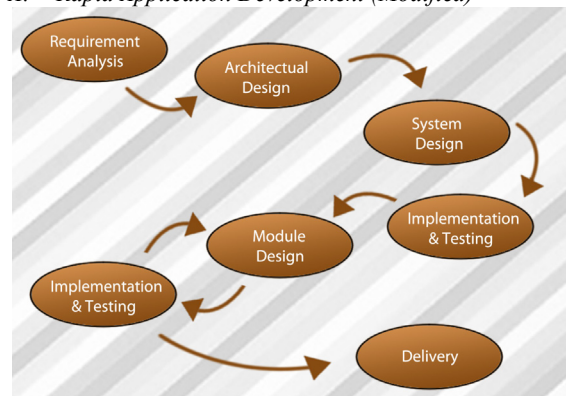
A. Rapid Application Development (Modified)

Figure 3.1 - RAD

The methodology used for software development for this project is modified Rapid Application Development (RAD).

RAD is a result-based methodology, developed to respond to the need of delivering systems as fast as possible. With the time constrain of this project, it is essential that results be deployed as soon as they are tested before the next phase is initiated.

The software for this project will consist of the main skeleton as well as case studies which are added as modules. Development will consist of first developing the skeleton, then the modules. Developing each case study individually as modules will allow as many prototypes to be completed as soon as possible in addition to providing an easier scaling in the future.

In order to meet the requirement of the problem statement, the author must decide upon a game that can sufficiently capture the interest of university students via interactivity, graphics and design of the

game. The game has to be sufficiently complex in order to grab the students' attention while at the same time simple enough for the author to construct within the given timeframe.

After considering some game genres and alternative, the author has decided upon interactive case studies, whereby students are placed in a situation where decisions are needed and the users has to choose amongst the options given. While this game does not give a large level of freedom to the users nor is it overly interesting, the author believe that it should demonstrate to a satisfactory level that games can be used as a learning tool.

To simplify the development process, the author has decided upon using flash engine as the best way to proceed. By utilizing off the shelves game engines, the author can concentrate on game elements and design instead of low level process such as detecting and reading user input.

Flash engine is chosen because it provides the required flexibility needed to develop the game as the author intend and that flash games are generally considered low-requirement games. Most computers will be capable of running a simple flash game.

Image 3.2.1.1 below shows a simple system architecture used by the game. It shows that once the game is started, the flash engine will render 2D graphic onto the computer screen and output audio using the speakers. Users will then read the display and provide an input. The input will be read by the flash engine and using the game logic, a response will be given via the output devices.
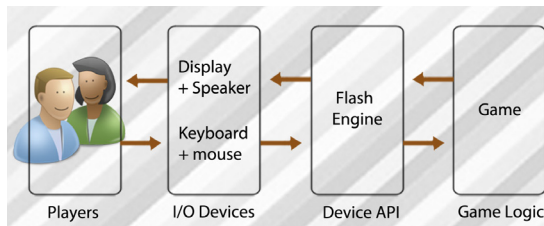

Figure 3.2 - System Architecture

The game logic is further elaborated using the flowchart in *Image 3.3*. It shows the basic game flow experienced by the user when playing a typical module. Once the users launch the game, they will be greeted by a menu screen. The menu screen gives users the option to either continue their game from their last checkpoint or to choose a module directly, from a list of modules. Once a selection is made, the module is presented to the users.

On a typical module, users are presented with a scenario and several options or answers. When the users select an option, tips or description may be presented to the users to help justify whether the option is correct or incorrect. When all the correct

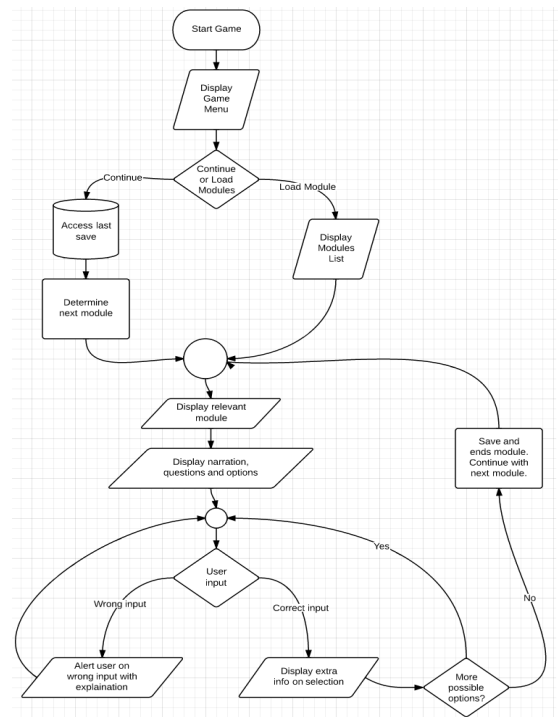options are chosen, the module will end and the next module will be loaded.

Figure 3: Flowchart of Game Logic

B. Project Tools and Software Required
Development Tools:
- Adobe Flash CS5
- Adobe Photoshop CS5

Required Software:
- Adobe Flash Player 11

IV. RESULTS AND DISCUSSION

A. Study Survey
For the purpose of this project a survey was done to view student's opinion on using video games as an educational tool, even for higher learning institutions. The survey contains 10 questions and a total of 30 participants responded to the survey.

From the survey, it can be seen that should games be introduced into the education curriculum, it will mostly be well-received. This survey serves to strengthen the author's view that video games have a place in the education sector, even in higher learning institutions.

The survey however does not reflect any opinions on the game developed for the purpose of this project as the survey was taken before the completion or partial completion of the prototype.

Next shows the question and result of several more important questions
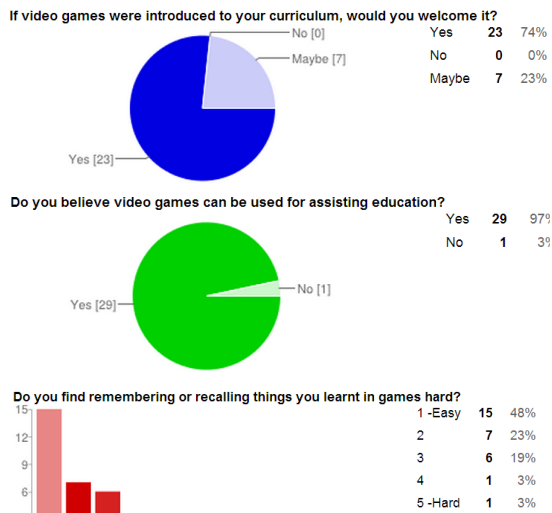
Figure 4.1 – Survey Highlights

B. Prototype

This project is based on video games being able to captivate their users and retain their attention. This to capture this ability displayed by games, the author attempts to break down the reasons why video games are fun and addictive. Concepts and belief used as base for this prototype are below:

Concept	Elaboration
Interactive/ Feedback	A game does not work without user interactions. Players must interact with the game for the game to progress. Each input given by a player is almost instantly greeted by a response. This give the player a sense of control while making him feel obligated to keep interacting with the game.
Progress/ Goal oriented	As more time is spent on a game, the game progress allows the player to get more and more immersed into the game. The player will keep playing the game as long as he feels like the game is progressing and goals are being met. Achieving goals keep the player focused and hints the player on what to do next. A good storyline is especially useful in this case as it pulls the player into the game and excites his imagination.
Reward/ Consequences	As decisions are made, the game tends to respond with either a reward or consequences. This keeps the players on their toes and forces them to think carefully before making a decision. Rewards will give the players satisfaction while consequences push the players to keep trying, provided they do not get fed up. The feeling of reward and achievement the players get from doing something right keeps the user wanting more and thus keep on playing. An element of surprise will likely be useful as players will not be bored by predictable outcomes
Learning Process /Skill	Games usually come with a learning curve. As players continue playing, their skills get better giving them as sense of achievement. This is boosted further if the players are competing against each other. As games get progressively more difficult, feels they are being challenged and strive to get better.
Logic / Creativity/ Strategy	Most games will most likely involve some form of thinking. Games that require logic, creativity and strategy stimulate the players' mind and push them to think and try out different approach to a puzzle. Their hard work is then rewarded with achieving their goals.
Visually appealing	Just a first impression is important when meeting a person, games can gather attention or turn away players depending on how visually attractive it is. Visually appealing games can give players a more enjoyable time when playing the game.

Table 4.1 – Game Elements

C. Prototype results

The author was able to partially finish the prototype to demonstrate several different ways of using games. Below are several screenshot of the prototype.
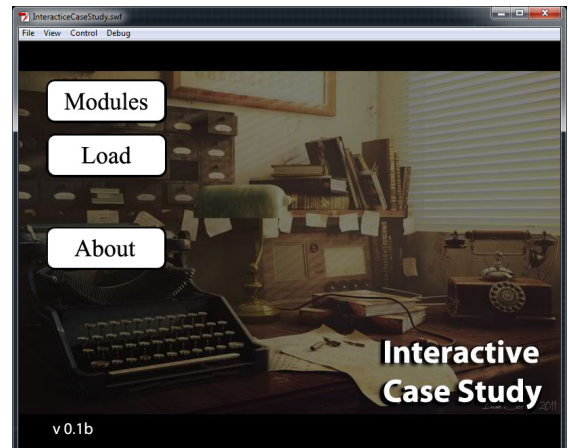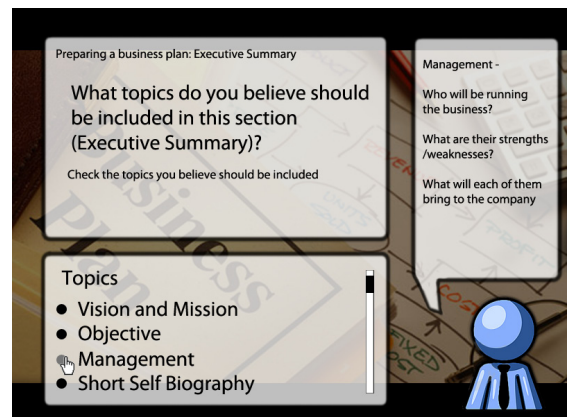

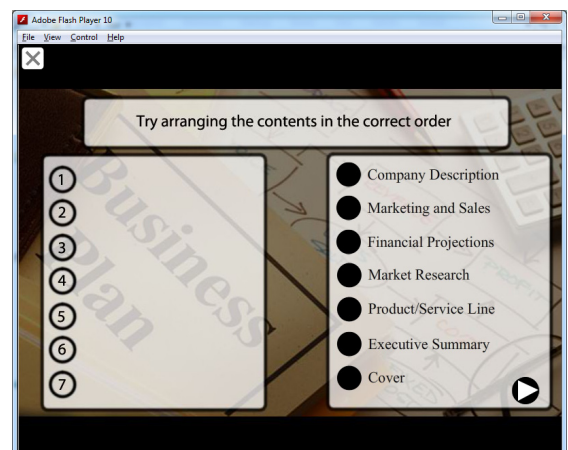Image 4.2 – Main Menu

Image 4.3 -Example Module 1

Image 4.4 – Example Module 2

5

V. CONCLUSION

While there have been several research in the pass aimed at gaming as a potential educational tool, the trend seems to have subsided without much impact. Even though the researches have mainly provided favorable result towards games, few schools have adopted using video games in their curriculum.

This project is meant to demonstrate that games can be used as learning tool. The game that was developed with this project serves as a proof-of-concept, and not a complete deliverable game. It is hoped that it will provide the incentive for the further development of games for learning purposes.

It is hoped that the project will be carried on to provide future business students with a platform to try out the skills that they have acquired in class. It s provide a fresh and engaging new way to strengthen their understanding, acquire more knowledge as well promote self study habits. Game-based learning, while should never replace classroom lectures, could become an invaluable tool in the education segment.

New elements could be added into the game such as puzzle stages and some action stages to keep players interested in the game.

VI. ACKNOWLEDGEMENT

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