Login

Main Screen

Instruction of Play → Show Instruction Screen

Configure Game
- Read User profile
- Get Points
- Get Badges
- Display Points and Badges

Check Points

Level 3 Write — Points between 200 and 300

Points between 100 and 200

Level 2 Trace

Check Points >300

No

Yes

Final Exam

Submit Answer

Store Answer

Display New Question

Submit Answer

Check Answer

True → Increase Points → Count Successive True +1

False → Decrease Points → Count Successive True = 0

Level 1 Explain

check count

count Successive=0

Gift

count=15

Bonus 4 Degrees — count=10

count =5 — Bonus 2 Degrees

Store Data

SUDAN UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF COMPUTER SCIENCE & INFORMATION TECHNOLOGY

EDUCATIONAL GAME FOR LEARNING JAVA USING GAMIFICATION SOFTWARE

لعبة تعليمية لتعليم جافا باستخدام برنامج GAMIFICATION

August 2015

THESIS SUMITTED AS A PARTIAL REQUIREMENTS 0F M.Sc. (HONOR) DEGREE IN COMPUTER SCIENCE

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EDUCATIONAL GAME FOR LEARNING JAVA USING GAMIFICATION SOFTWARE

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August 2015

PREPARED BY

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SIGNATURE OF SUPERVISOR

DR. Huwaida Ali Abdullgader

Date…………………………………………..

N   DEDICATIO

To my dear father

To my dear beloved mother

To my dear wife

To my dear fellow brothers and sisters,

To my best friend Mohammed Osama

To all my friends and all those who have conferred their favors upon me and paved my way to success, all words and expressions of gratitude and thankfulness will be a drop in your sincere wide… wide sea of help and support.

الحـــــــــــمد

الحمد لله الذي بنعمته تتم الصالحات وتكثر البركات وتهب النعم من رب الأرض والسماوات وأصلي وأسلم على خاتم المرسلين وأشرف المخلوقات عليه وعلى آله وصحابته أولي المناقب والصفات صلاة وسلاماً تمتد من أرض النيلين إلى الفرات ،اللهم صلي وسلم وبارك على عبدك ورسولك محمد صلى الله عليه وسلم وبعد.

الحمد لله الذي وفقنا لكتابة هذا البحث والذي اسأل الله ان يفيد ويكون مرجعاً للعديد من الدراسات وأسأل الله ان يبارك ويعيننا على كتابته وإخراجه إنه ولي ذلك والقادر عليه.

ABSTRACT

Recently, Gamification has become a popular trend to create more engagement in ICT (Information and communications technology) Systems. Gamified games have been created in order to help students to enhance their skills in programming during their leisure time.

Our thesis considered three computer programming's skills a student must enhance to be professional and they are: explaining of code pieces, tracing to find bugs and code writing. A Graphical User Interface (GUI) Java game has been designed using Gamification elements (Points, Levels, Challenges and Badges) and has been divided into three levels each level concentrate on one of the skills mentioned above.

The data of our research has been collected in several steps, firstly, a group of students has been tested with paper exam as first exam of their knowledge, secondly, they played our game, and lastly, they tested again as second exam.

The analysis of data showed a positive enhancement on student's skills by 30% in addition to that the survey about the game has been answered by them also give good satisfaction.

As conclusion, the use of Gamification elements in the course of java improves the student's skills and this is what has proved in this research.

المستخلص

اشتهر حديثاً استخدام ما يعرف بالـ Gamification كإتجاه عالمي لإدخال عنصر المرح والمتعة في مجال تقنية المعلومات. لذا صممت الالعاب بهذا المفهوم لكي تساعد الطلاب لتحسين مهاراتهم البرمجية اثناء وقت فراغهم.

يركز هذا البحث على ثلاثة مهارات من مهارات برمجة الحاسوب التي يجب تحسينها لكي يصبح المبرمج محترفا وهي شرح أجزاء الكود، واكتشاف الأخطاء البرمجية وكتابة شفرة البرنامج.

صممت واجهة رسومية بلغة الجافا باستخدام عناصر Gamification وهي (النقاط، المستويات، التحديات والهدايا) وقسمت الى ثلاثة مستويات كل مستوى يركز على واحدة من المهارات التي اختيرت سابقاً.

جمعت بيانات هذا البحث على عدة مراحل، أولاً: اختبر مجموعة من الطلاب بامتحان ورقي يقيس مهاراتهم الحالية كامتحان أول، ثانياً: قام الطلاب بلعب اللعبة المصصمة وأخيرا تم اختبارهم مرة أخرى كامتحان ثاني.

أظهرت نتائج البيانات التي تم جمعها نتيجة إيجابية في تحسين مهارات الطلاب بنسبة 30% بالإضافة لذلك صمم استبيان حول اللعبة وأظهرت نتائجه قبولاً جيداً لفكرة اللعبة.

إذاً فإن استخدام عناصر Gamification في مقرر الجافا يحسن من مهارات الطالب البرمجية وهذا ما أثبت في هذا البحث.

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LIST OF ABBREVIATION

CS1   Computer Science First

UML   Unified Modeling Language

HTML   HyperText Markup Language

IDE   Integrated Development Environment

OMG   Object Management Group

MOF   Meta Object Facility

OOP   Object Oriented Programming

CS   Computer Science

آيــــــة

قال تعالى:

أعوذ بالله من الشيطان الرجيم

﴿قُلْ هَلْ يَسْتَوِي الَّذِينَ يَعْلَمُونَ وَالَّذِينَ لاَ يَعْلَمُونَ إِنَّمَا يَتَذَكَّرُ أُولُو الْأَلْبَابِ﴾ سورة الزمر الآية 9

CHAPTER1

INTRODUCTION

1.1   Overview

The current methodology for teaching some of the practical computing courses, such as java, is explaining the concepts in lectures and applying examples and solving the exercises in lab sessions, most students do not practice until there is homework, this might decrease the understanding of students because some practical courses are prerequisites to other courses. There are several methods to solve this problem and the Gamification is one of these methods that have attention lately in researches and become part of Deloitte's top 10 Tech trends of 2012 and 2013, with Gartner stating that up to 25% of all business processes and 40% of global 1000 organizations will take advantage of Gamification by 2015[1].

1.2   Problem Definition

One of the most common reasons for poor academic performance in university students is the lack of time management due to distractions. With many students living with a new-found freedom it is not surprising that they find parties, movies and videogames far more entertaining than coursework; therefore, and to solve this problem, an alternative way should be providing to students that engage them to learn rather than entertain in own time. Thus, the Gamification is one of the methods that aims to add engagement to non-game context.

1.3   Objectives

- Increase understanding and engagement of student for the course of java.

- Enhance self-learning of students by considering explaining, tracing and writing code skills.

- Encouraging competition between students which stimulates productivity and creative inquiry among learners.

1.4   Hypothesis

The successful mastering of any new programming language or methodology can be a difficult task for students to achieve. To overcome this issue, a number of new teaching approaches have been formulated and applied to introductory of programming courses, and one of it is Gamification. The impact of it on education is already approved with positive effects in [2, 7, 14 and 15]; therefore, our attention is to show effect of it on enhancing of programmer skills explaining, tracing and writing.

1.5   Research Methodology and Tools

A game designed that take the basic principles of java by using java itself and the results has been stored in files.

Also, the learning on game has been approached through three levels that each one considers one of explaining, tracing and writing code skills. In fact, the progress of players was measured by points of every level.

The game was distributed to every student to play in his own time then after finish there are files created to store progress of student on it then these files gathered and analyzed.

The evaluation of students done through three steps, firstly, examined them as paper exam to measure their real skills. Secondly, they played game and finished three levels then evaluated them again as the second test.

1.6   Thesis Organization

This thesis is organized as follows. In Chapter 2, we give an overview of Gamification and related theorems that support it and based on it. In addition to that, we state the studies that done on education. Besides that, we consider the related work that states it. After that, in Chapter 3 describe the tools and technologies used in our research beside analysis and design, then, shows a demo of game. The next chapter, chapter 4, introduces the experiments results that tested on a group of students. Finally, the Chapter 5 concludes the thesis and shows the recommendations and future work to extension our game.

CHAPTER 2

LITERATURE REVIEW AND RELATED WORK

2.1   Introduction

Despite to human nature, students love playing but what happens if their playing accompanied by learning, this will be a motivation to play more, which refer to concept called Gamification. The purpose of this research is to consider it for programming courses. So, firstly, mention the theorems that based on it such as fun theory and game flow concept. Next, define it and consider their principles that related to the work, and lastly, show the impact of it on education generally and on teaching programming languages especially in related work section.

2.2   The Fun Theory

Since 2009 [1], Volkswagen has released a series of videos showcasing social experiments to prove what they call 'the fun theory'. It believes that by making things fun, people's behavior can change for the better, and it has created multiple experiments to showcase this. These include encouraging people to take the stairs by making it play the piano as people walk on the steps Figure 2.1; turning a bottle deposit bank into an arcade game with points and high scores; and making a trash of daily newspaper throws to funny way on Figure 2.2.

Figure 2.: The Fun Theory: Piano Stairs

Figure 2.: The Fun Theory: Trash of Daily Newspaper

The experiments were all successful: the stairs were used by 66% more people, the bottle bank was used by nearly 100 people in comparison to only 2 using an unmodified one nearby, and the newspapers trash become fun and the people motivated to throw the trash in specific places [1].

The fun theory is, in essence, the same concept behind Gamification: by making things fun, people are more likely to become engaged. According to Gabe Zichermann, this solves one of the core concepts that are missing from even the best business and strategy books: "without employee and customer engagement, the best laid strategies and tactics are doomed to fail"[6].

2.3   The Game Flow Concept

The concept of flow also emerges while playing a good game. One of the foremost characteristics of good games is good game play that engages the user, keeps him motivated to continue and puts the player in a psychological state of flow[7].

Sweetser and Wyeth suggest a new model for the concept of flow consists of eight elements as follow:

- Concentration - ability to concentrate on the task.

- Challenge Player Skills - perceived skills should match challenges and both must exceed a certain threshold.

- Control - allowed to exercise a sense of control over actions.

- Clear goals - the task has clear goals.

- Feedback - the task provides immediate feedback.

- Immersion - deep but effortless involvement, reduced concern for self and sense of time.

- Social Interaction- games should support and created opportunities for social interaction.

All these elements in combination will create the feeling of enjoyment while playing a game[8].

The flow zone also has described by Chen. He said that to engage user, the game must combine the components of flow to find the right balance between user feelings of boredom, if the activity is not very challenging, and anxiety, if the activity is too complex, for the zone of the flow [9] the Figure 2.3 show the zone of flow.
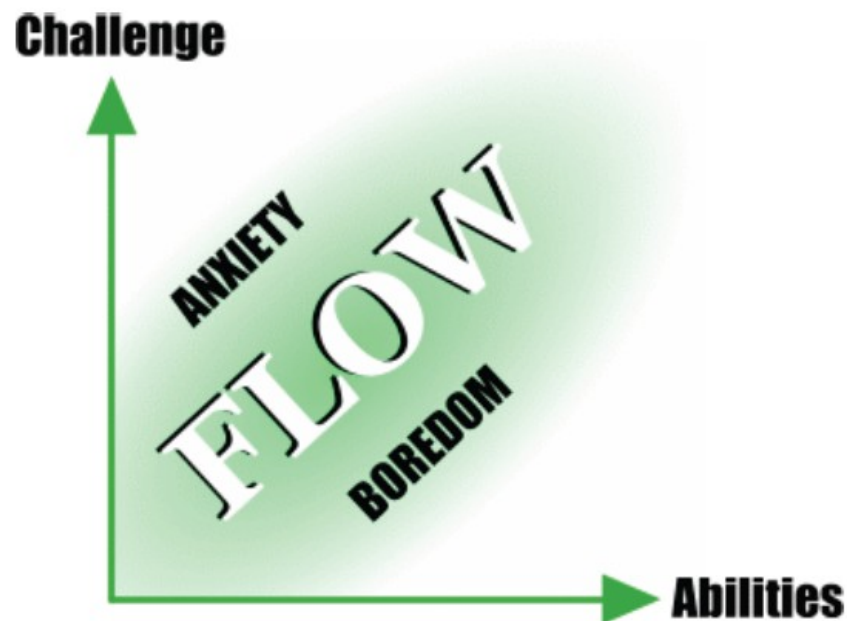

Figure 2.: The Flow Zone

2.4   Definition of Gamification

Gamification is the use of game mechanics such as rewarding points and achievement badges to engage target audience and encourage desired behaviors. In recent years, it has gained interest as effective approach to add engagement for new users and existing user of websites so we show the importance and effects of it on academic context and prove the user engagement is most important in every application.

Although the term 'Gamification' was coined in 2002 by Nick Pelling, it did not gain popularity until 2010 by Gabe Zichermann that is known as one of most persons they talking about it and he defined as "the process of using game thinking and game mechanics to engage audiences and solve problems" [6].There are more definitions available in [10][11] and the most appropriate definition is:

"The use of game elements and game-design techniques in non-game contexts".

Some people argue that Gamification is similar to Serious Games that are games designed for a purpose other than entertainment but Detering has another point of view and said a clear distinction between them that the gamified systems use game design elements for a purpose, but without the creation of fully-fledged games[12].

2.5   Importance of Gamification

A review paper on gamification shows that most studies on gamification find positive effects from gamification and used in several different contexts mostly business and marketing. It's touted as a next generation method for marketing and customer engagement in popular discussion and it's also reflected in an academic context. Figure 2.4 shows a dramatic

increase in the number of papers published on the topic. It is especially noteworthy that the appearance of the term "Gamification" in paper's titles has been increasing even more rapidly than general search hits. This suggests that Gamification is becoming a more popular subject for academic inquiry [2].
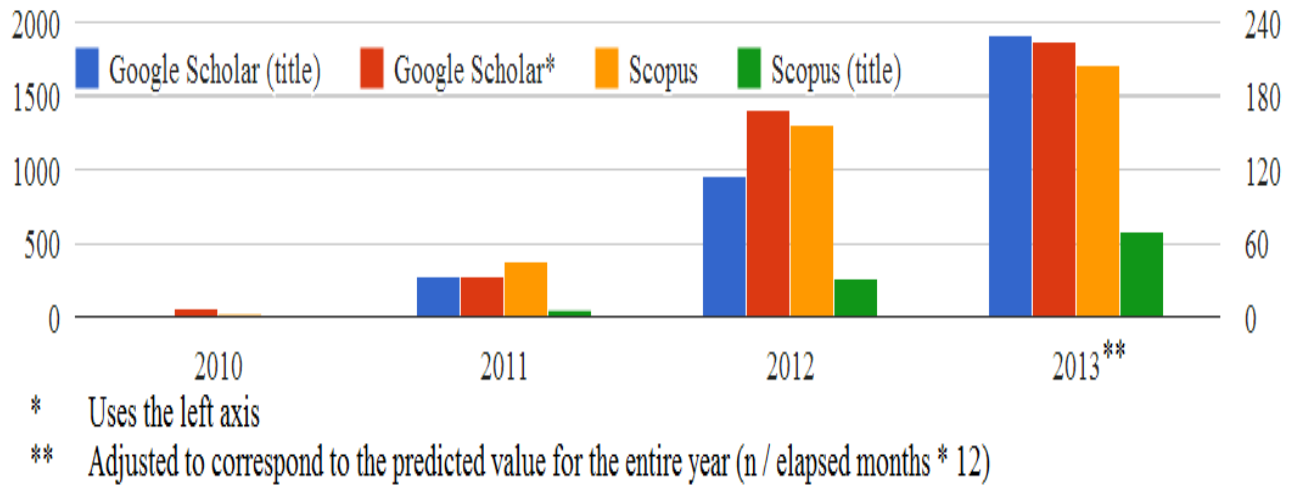

*   Uses the left axis
**   Adjusted to correspond to the predicted value for the entire year (n / elapsed months * 12)

Figure 1. Search hits for "gamification"

Figure 2.: Search Hits For "Gamification" [2]

After see the Gamification in education, now provide the evidence that prove the engagement as the main principle of Gamification in business. A survey made by M2 Research.inc Company about client implementation of using Gamification show the results that prove the user engagement is most valuable in Figure 2.5.
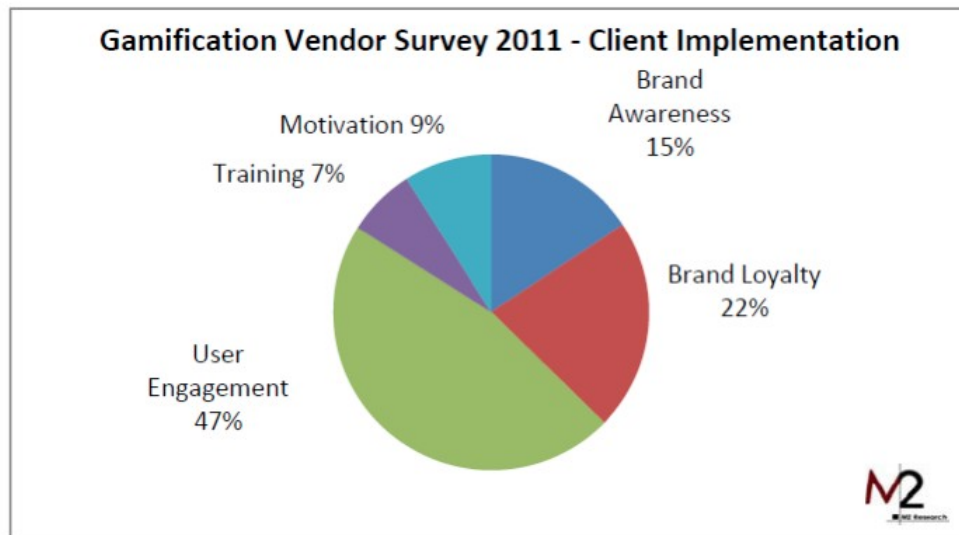
Source: M2 Research

Figure 2.: Client Implementation Survey

Another research survey made on market of Gamification in US[13], the highlights of survey include:

Gamification Market Forecast
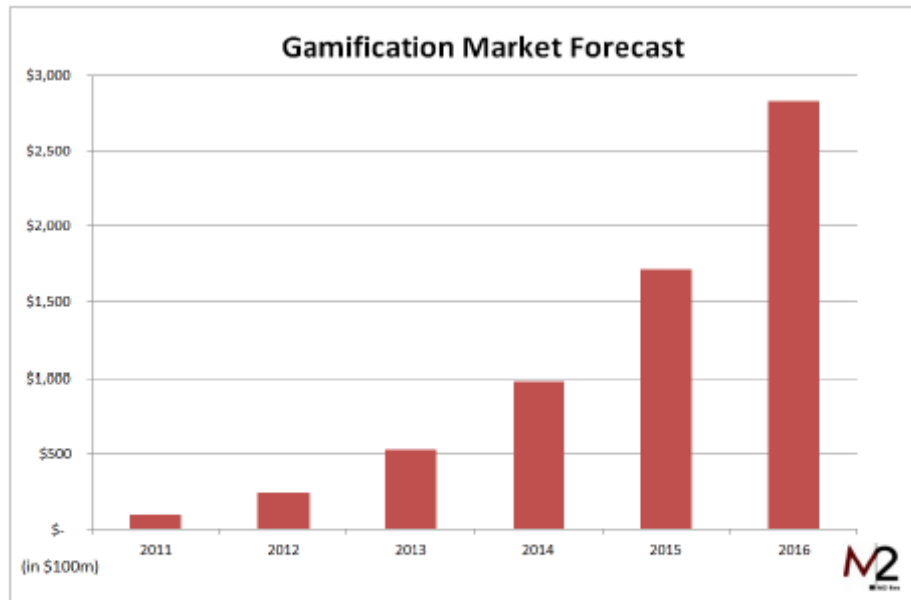
(in millions)	2011	2012	2013	2014	2015	2016
Total	$100	$242	$522	$980	$1,707	$2,830

Figure 2.: Gamification Market Forecast

The size of the gamification market, currently estimated at around $100 million, will grow to more than $2.8 billion by 2016 as shown in Figure 2.6.

Top Gamification vendors are projecting 197% growth in 2012, up from 155% in 2011; The Gartner Group forecasts that by 2015 the Gamification will be used by 70% of the Global 2000 organizations, this is measurement for important of using this concept we talking about.

This is true evidence that prove the important of Gamification in business and other domains. However, there are several research done in education domain and also provide evidence of its success, so talk about these researches that done in detail in the next section.

2.6   Game Mechanics

There are plenty of mechanics used in video game design, but not all of them directly transferable to Gamification. It has studied in most details in [10, 11]. Below is a list of the most common game mechanics that are used in it:

1. Points:

Users are given points whenever they accomplish something the system is trying to encourage them to do. Although, Points keep score, it provides an immediate feedback to player, and not only creates a sense of progression but it provides valuable data for the game designers[10].

2. Badges:

Werbach defines badges, that sometimes called achievement, as "a chunkier version of points" [11] and Zichermann describes them as a "visual points system" [10].

3. Leaderboard:

It allows users to see where they stand relative to each other. In fact, both Werbach and Zichermann warn about their use; although they can be incredibly motivating users, and support them for goals to accomplish, but they can also be de motivate, that is causing users who are very behind from the top to stop using the system.

Werbach & Hunter have dubbed the above three mechanics the PBL (Points, Badges and Leaderboard) triad, as they are common that they are found in most, if not all, gamified systems. In particular, points are some of the most widely used mechanics. Thus, they are powerful mechanics, and they provide immediate feedback for users about actions they just performed[11].

Despite this, there are other Gamification mechanics that can be used, and these were identified by Werbach and Zichermann in their respective books such as:

4. Levels:

Levels are a further indication of a user's progress within a game, and generally have one of two meanings. The first meaning indicates a user's status and mastery of a system (e.g. a "level 5" user is two levels higher than a "level 3" user).

The second meaning indicates a user's position within a system. For example, a gamified system may have ten levels or areas that a user has to progress through, and a user on level five is only halfway through [10].

5. Challenges and Quests:

Challenges are "puzzles or tasks that require effort to solve" [11]. They "give players direction for what to do within the world of the gamified experience" [10]. Usually, challenges and quests build on top of point-based systems and focuses on motivating users to accomplish even more difficult tasks.

2.7 Gamification Use in Education

Gamification was used in education and tested with several attempts to gamify the learning activities with two main purposes. The first purpose, aim to encourage desired learning behaviors, the other to engage students in learning, so in spite of that there are many researches that supports the education.

However, a review paper makes analysis and mapping between applying the Gamification in Education and categorized according to target audience[14] in Table 2.1:

Table 2. Primary studies categorized according to target audience or subject matter

Target audience	Number	Frequency (%)
Higher Education	12	46.15%
Non-specific context/level	6	23.08%
Training and Tutorials	3	11.54%
Languages	2	7.69%
Elementary Education	2	7.69%
Lifelong Education	1	3.85%

Table 2.: Primary Studies Categorized According To Target Audience

As see on Table 2.1, the most primary studies present Gamification approaches tailored towards supporting higher education students (46%); so this leads us to that it has been mostly applied in approaches for teaching on higher education. On the other hand, among the selected primary studies, elementary education got less attention: only two primary studies that discuss how to teach elementary students based on Gamification approaches.

The other six studies (23%) describe the benefits and shortcomings of Gamification-based models and educational strategies.

2.8   Related Work

There are many studies done in Gamification, so focus firstly on the studies that made to teach courses in higher education and secondly on programming language courses in form of a game and lastly mention the games that teach java specifically based on the Gamification concepts.

This research considers the studies that teach the courses of university colleges with Gamification. So, the first study carried out by Professor Clifford Lampe that utilizes Gamification principles in his 200-student lecture class Introduction to Information Studies. Also, he identifies four elements of gaming in particular as being effective in his classes: Choice (Freedom to Fail), Rapid Feedback, Collaborative Processes, and Competition, detailed on [15].

Figure 2.: Students Dress Up As a Character of Their Choice

Lampe also, notes that the vast majority of students are happy to have anything implemented in Figure 2.7 that cuts down on the 3 hours of being talked at[15].

This research considers the practical session part rather than theory part that is considered by Lamp.

In next two sections, another effort is done on developing games that teach the concepts of programming language while playing and apply the concepts of Gamification on it such as Light-Bot and CodeSpells. The first one targets a new programmer who not has knowledge of programming, the other one target a novice and experience programmers.

2.8.1 Light-Bot

Light-Bot is a puzzle game that uses game mechanics that are firmly rooted in programming concepts. It lets players gain a practical understanding of basic control-flow concepts like procedures, loops, and conditionals, just by guiding a robot with commands to light up tiles and solve levels, the last version is android version 2 and Figure 2.8 illustrates the game.
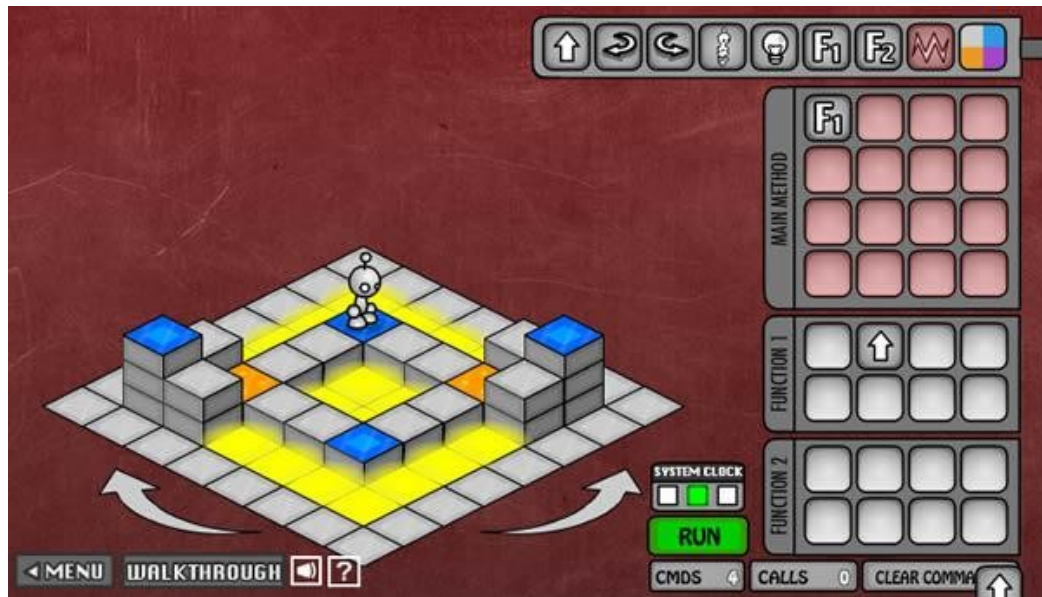
Figure 2.: Light-Bot Game Version 2

This game uses Gamification to introduce an array of the skills that a programmer needs to have. Basically, it turns learning the fundamentals of programming into a fun puzzle game that anyone can enjoy![16]

2.8.2 CodeSpells

CodeSpells is become the most powerful wizard the world has ever seen by crafting magical spells in code. It is a 3D immersive video game designed to teach Computer Science first (CS1) level programming concepts to novice students. It is meant to be a standalone system that guides students through CS1 concepts in an explorative way, encouraging students to engage in pre-defined quests that address particular concepts, but also informally through exploring the 3D world, see Figure 2.9 and 2.10. It started as the PhD research [22] aim to teach kids coding. Now it's being developed into something more than are search project.
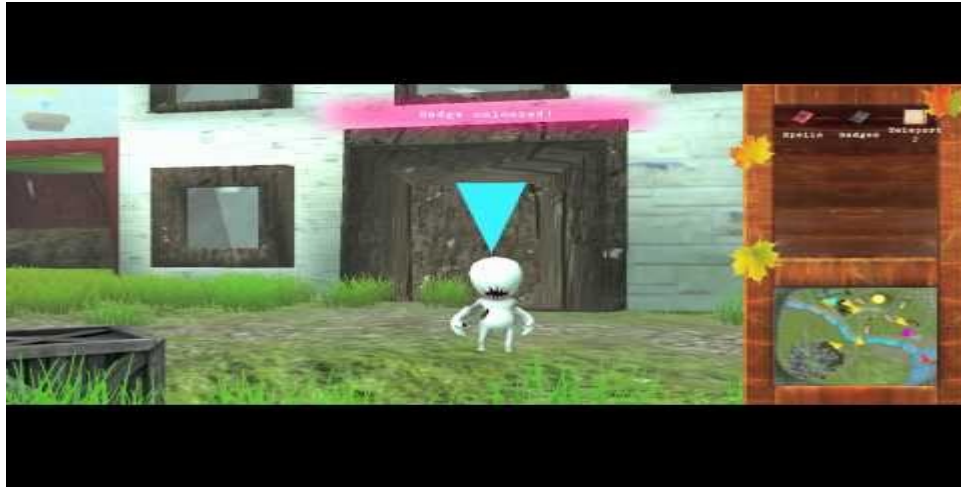
Figure 2.: CodeSpells Game

Figure 2.: CodeSpells Game Code

CodeSpells revolves around the idea of crafting your own magical spells to interact with the world, solve problems, and fight off foes. To do this, sleek coding interface using a drag-and-drop JavaScript-based language must be designed. This interface is designed for individuals (young and old) who want to learn coding for the first time. Skilled coders will also enjoy using their coding skills in new and creative ways! Players will be able to craft their own spells to build mountains, make an impenetrable force field around your character. Players can also earn badges by undertaking simple quests, which help them master the game's spells. By the time players complete the game's first level, they have learned the main

components of the Java programming language, such as parameters, for if statements, for loops and while loops, among other skills.

Researchers tested the game on a group of 40 girl's ages 10 to 12 in San Diego. They gave the students a brief overview of the game's mechanics, including how to write and edit code within the game's user interface. The girls were divided in groups of two or three, shown in Figure 2.11. Researchers encouraged them to explore the game and see what they could do. "We were purposefully vague," they wrote, "as we hoped to encourage a largely unstructured learning environment."

Figure 2.: Students In a San Diego Elementary School play with CodeSpells

The students were disappointed when they had to stop playing because the test was over. Their interest in the game didn't wane when they made mistakes while writing code[17, 18].

The implemented game is not like Light-Bot game that consider thinking like a programmer rather than enhance programmer skills although CodeSpell game is similar to implemented game but differing in two aspects: firstly, the environment design is online game rather than 3d environment, secondly, the learner must understand the structure of the game and must read the manuals and instructions to understand how to play but we don't.

CHAPTER 3

EDUCATIONAL GAME ANALYSIS AND DESIGN

3.1   Introduction

The previous chapters talked about Gamification, principles have been explained, related studies have been considered. This chapter will cover the proposed solution in more details with highlighting the following points: the tools used for development, the structure of implemented game, the methodology and testing process.

3.2   The Game Design Tools

To design and implement game, java programming language chooses as a case study, Netbeans Software to design forms and Enterprise Architect to analysis game and represented with Unified Modeling Language (UML) diagram.

The java has been choosing for developing after apply game in online environment that have some obstacles that let decision go to java. The game has been designed by game engine called Construct 2 Game Engine based on HyperText Markup Language (HTML) 5 and after tested online there are some problem of cross browser issued appear that make data collected inconsistent to analysis so repeated again with java forms.

3.2.1 NetBeans Software

Most developers recognize the NetBeans Integrated Development Environment (IDE) as the original free Java IDE. The NetBeans IDE provides support for several languages (PHP, JavaFX, C/C++, JavaScript, etc.) and frameworks.

NetBeans is an open-source project dedicated to providing rock solid software development products (the NetBeans IDE and the NetBeans Platform) that address the needs of developers, users and the businesses

who rely on NetBeans as a basis for their products; particularly, to enable them to develop these products quickly, efficiently and easily by leveraging the strengths of the Java platform and other relevant industry standards [19].

3.2.2 UML

The Unified Modeling Language (UML) is Object Management Group (OMG) most-used specification, and the way the world models not only application structure, behavior, and architecture, but also business process and data structure.

UML, along with the Meta Object Facility (MOF), also provides a key foundation for OMG's Model-Driven Architecture®, which unifies every step of development and integration from business modeling, through architectural and application modeling, to development, deployment, maintenance, and evolution.

OMG is a not-for-profit technology standards consortium, their members define and maintain the UML specification. Software providers of every kind build tools conform to these specifications. [20]

3.2.3 Enterprise Architect

Enterprise Architect is an exceptional tool with high end capabilities and a rich set of features to help manage information and innovate in today's complex and demanding environment.

Enterprise Architect has a long and proven track record in a wide range of industries across more than 160 countries. For 15 years it has been continually developed, enhanced and refined to meet the emerging needs of programmers, business analysts, enterprise architects, testers, project

managers, designers and others. Based on open standards and proven best-practice, Enterprise Architect can comfortably scale from small single user models to large team based repositories and even to globally distributed Cloud based solutions [21].

3.3   The Game Structure

The game consists of three levels, the first level concentrate on explaining, the second one on tracing and the last one on writing code skills challenges. The concepts that the game covers are:

- Variable assignment

- If condition

- Switch statement

- For loops, while and do-while loop

- Methods

- Arrays

- Strings

- OOP (Object Oriented Programming).

3.4   Analysis of Game

In Figure 3.1, the analysis of the game is drawn as state diagram to show details of game.

Figure 3.: The State Diagram of Game

3.5   The Game Strategy

This section explains in detail the strategy that game follows, so the methodology of questions and skills measurement as follow:

Firstly, the question makes in game put in specific way that divides the question to three categories mentioned in earlier chapters.

There is experiment done by Lopez on two semesters and conclude, the performance of students they concentrate on tracing and explaining of code will be enhanced on writing code skills[4, 5] so benefit from it to take it and apply it in challenges of our game.

The game applied on group of students of Computer Science (CS) consist of 20 students with the same level of knowledge in second year of computer college. The Gamification elements applied in our game are Points, Badges, Levels and Challenges.

When the player plays more than one challenge on the same level the rate of learning increase, by experience of solving of challenges, and the concept become clear.

3.6   Demo

To test game, open the first class welcome.java and run the screen look like Figure 3.2:
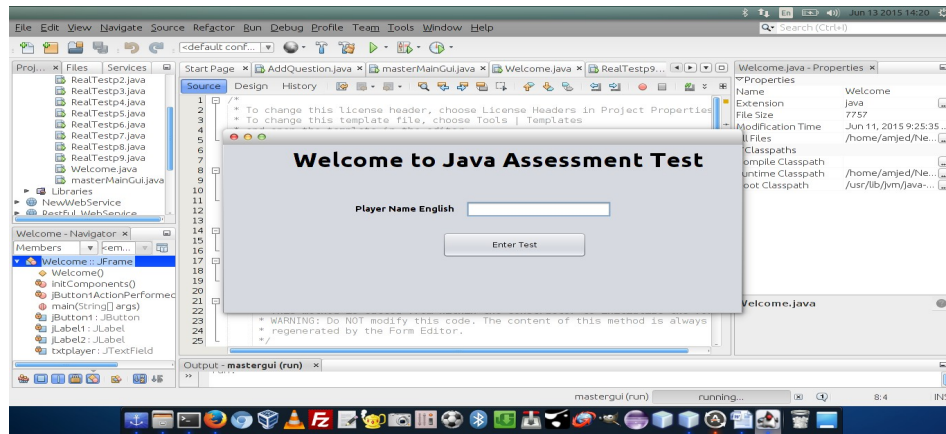
Figure 3.: The Welcome Interface

Enter name then click Enter Test to go to the next screen in Figure 3.3:
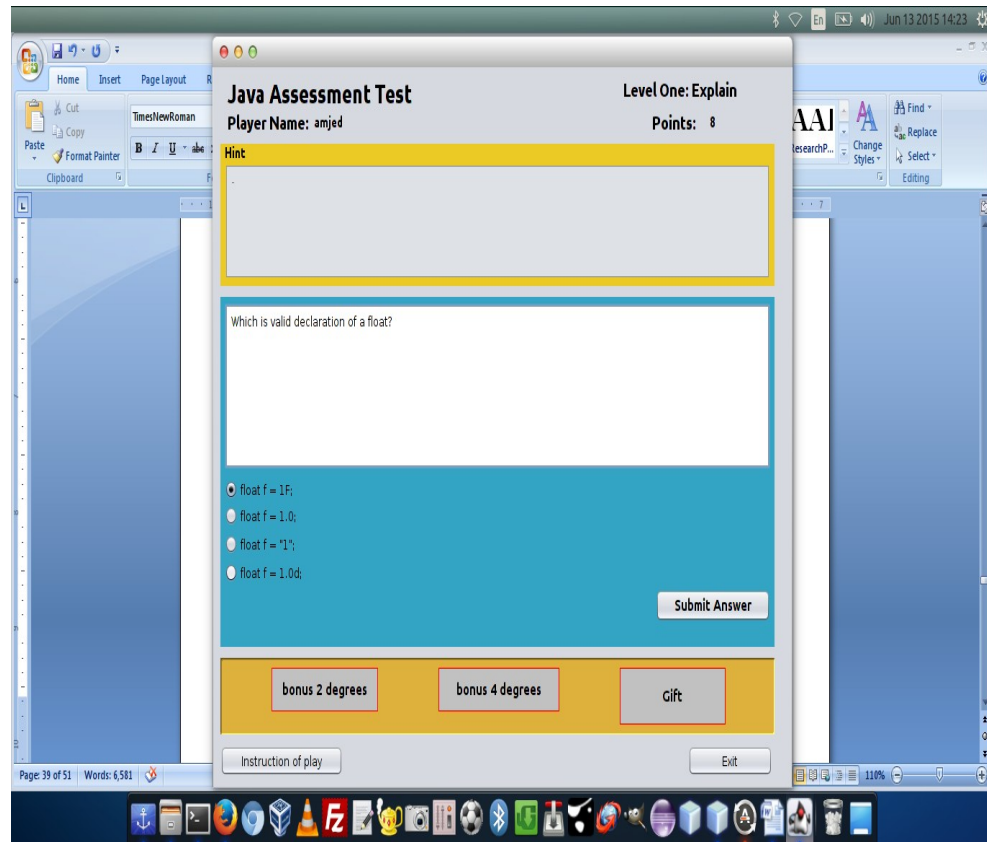
2

1

3

4

5

6

Figure 3.: The Question Area Screen

Then now you can play the game, in the upper right corner with square numbering (1) there is points of progress and name of level in (2). Also you have hint section in (3) that help to answer question in (4) with options in (5) then in bottom in (6) there are badges of game Bonus 2 degrees, Bonus 4 degrees and Gift. There are three level explain, trace and write missing code challenges levels, after finished it go to next screen Real Test to measure the enhancement of game on skills, Figure 3.4.
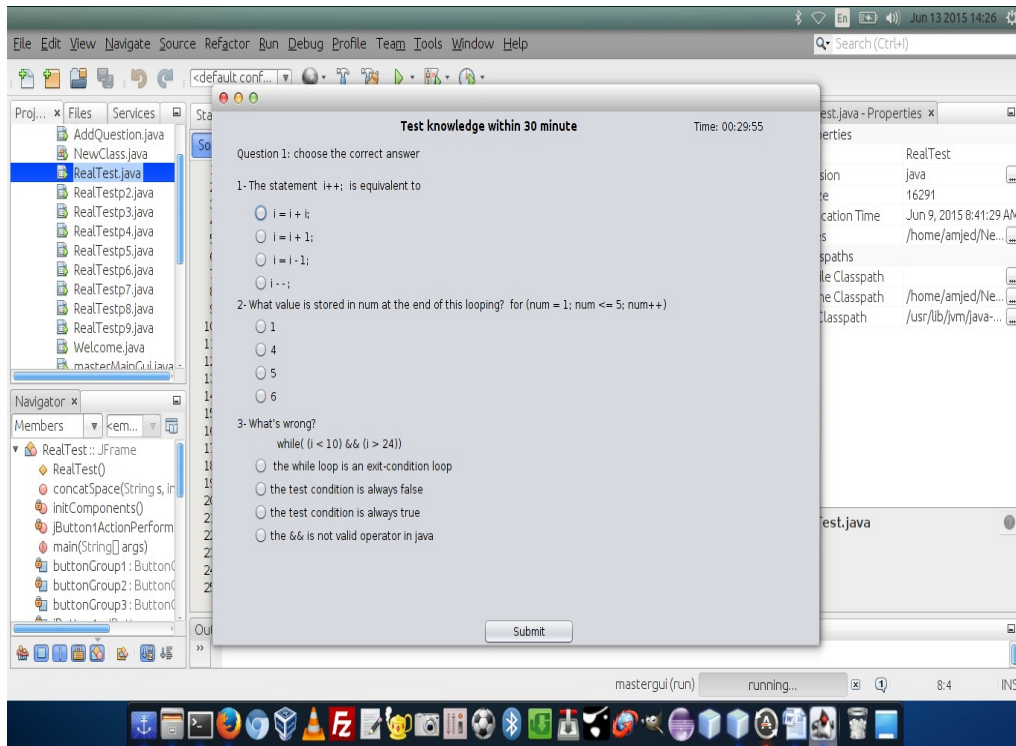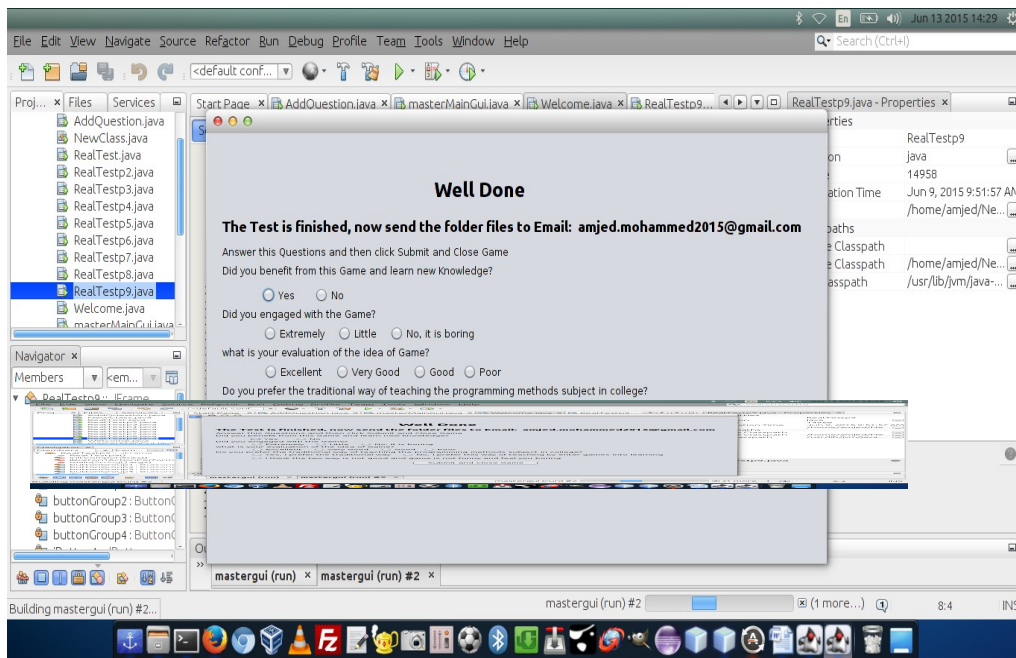
Figure 3.: The Real Test Screen

Figure 3.: The Survey Screen

After that asked student a survey of 3 questions that reflect opinion of students on game idea, Figure 3.5 show the survey questions.

CHAPTER 4

RESULTS AND DISCUSSION

4.1   Introduction

To show the effect of game on skills and knowledge of students do the following steps:

Step one: tested them as paper test

Step Two: calculated the degrees

Step Three: the students played game on own time

Step Four: tested again the second test

In game the second test is constrain with time constraint of 30 minutes for every screen of 9 screens.

Step Five: compared the result of first test versus second test as result of this research beside survey of the following questions:

- Do you get benefit from this Game and learn new Knowledge?

- Do you enjoy with the Game?

- What is your evaluation of the idea of Game?

The questions of two tests is same difficulty to guarantee quality of results and divided to three levels every level concentrate on one skill.

After analysis results begin with first graph that shows first Paper Test degrees of all students, the total mark is 46 degrees for two tests. the Figure 4.1 shows the results.

Figure 4.: Students Degrees of Test 1

The second result shows all the degrees of Test 2 of all students in Figure 4.2.

Figure 4.: Students Degrees of Test 2

The last diagram in Figure 4.3 shows the degrees of Test 1 compared with Test 2 degrees.

Figure 4.: Students degrees of Test 1 VS. Test 2

As shown above in Figure 4.3 the degrees of students have been enhanced after playing our game.

The result of survey of three questions is show as follow in Table [4.1, 4.2 and 4.3]:

Do you get benefit from this Game and learning new Knowledge?

Yes	No
80%	20%

Table 4.: Survey Result of Question 1

Do you enjoy the Game?

Extremely	Little	No, it is boring

60%	35%	5%

Table 4.: Survey Result of Question 2

What is your evaluation of the idea of Game?

Excellent	Very Good	Good	Poor
45%	30%	15%	10%

Table 4.: Survey Result of Question 3

In this research the game has been designed with Gamification elements to improve the investment of students in their pleasure time. The results have proved the effect of our game after comparison the result of test 1 with the result of test 2 in Figure 4.3.

The students have been excited and motivated up to challenges in the game, so, the degrees of test 2 is higher than the one in test 1, and that due to instinct to win.

Thus, after changed the tradition method in learning by using Gamification elements, the students motivated to exploit their pleasure time in revising the concepts of programming to be better in challenges and win the awards and bonus degrees that are badges of game.

Therefore, their skills have been enhanced and their degrees in second test improved by 30%.

Besides that, the survey showed that our game has positive impact measured by the percentage in the above mentioned result of the questionnaire which conducted. The detailed result was as follow:

1- 80% of students who evolved in the questionnaire acknowledge their benefit of the game in getting new knowledge.

2- 60% of them enjoyed the game.

3- 45% of them appreciated the idea of the game positively.

CHAPTER 5

CONCLUSION AND FUTURE WORK

5.1 Conclusion

A game was designed to test the knowledge of player and enhance the player skills of explain, trace and write code, after that the game was tested by group of students who took the course of concept of programming language.

The game design depends on Gamification principles to add engagement to the game and used points, badges and challenges and levels elements. As a result, the game shows a positive impact after being tested and the students have engaging with it. Moreover, the competition between students rise up the excitement on game; therefore, make them learn more to meet challenges.

5.2 Recommendation   and Future Work

To enhance this game and to add extra effort which make this game more experience there are some recommendation and future work to extend this work to be better in future research and consider more issues and skills as follow:

➢ Apply the game to more advanced topics.

➢ Enhance it to be included in teaching methodology.

➢ Extend game to add detail level of play like easy, intermediate and advance and consider more skills like problem solving, systematic thinking, analysis, speed writing.

➢ Connect or integrate the game with online compilers to give more feature of write real code and compile code immediately.

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