



MATHEMATICS GAME FOLLOWING KSSR FOR PRIMARY SCHOOL
STUDENT

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EXECUTIVE SUMMARY

The main purpose and user requirement of this project is to develop a Mathematics educational game as additional learning tool for primary school student. The gameplay that designed and created is applying the Mathematics knowledge to real world situation and makes learning mathematics become more interactive. Besides that, the gameplay designed is also following KSSR Mathematics syllabus from MOE. The game system is developed using Unity3D with JavaScript. The question of each game level are created randomly so that the question generate for every each session are different. To ensure the functional of this educational game, the functionality of each feature was tested. Moreover, user acceptance test were conducted to get the satisfaction from the target users which include the children, teachers and parents.

RINGKASAN EKSEKUTIF

Tujuan utama dan keperluan pengguna untuk projek ini adalah untuk membangunkan satu permainan pendidikan Matematik sebagai alat pembelajaran tambahan untuk pelajar sekolah rendah. Permainan yang direka dan dicipta menurut pengetahuan Matematik dalam situasi dunia sebenar dan menjadikan pembelajaran matematik lebih interaktif. Selain itu, permainan ini juga direka berikutan KSSR Matematik sukatan pelajaran dari Kementerian Pelajaran. Sistem permainan dibangunkan menggunakan Unity3D dengan JavaScript. Persoalan dalam setiap peringkat permainan yang dicipta secara rawak supaya soalan yang dijanakan untuk setiap sesi adalah berbeza. Bagi memastikan fungsi permainan pendidikan ini, fungsi bagi setiap ciri telah diuji. Bukan itu sahaja, ujian penerimaan pengguna telah dijalankan untuk mendapatkan kepuasan daripada pengguna sasaran iaitu kanak-kanak, guru dan ibu bapa.

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LIST OF ACRONYMS / ABBREVIATION / GLOSSARY

SJK(C)	Sekolah Jenis Kebangsaan (Cina)
KSSR	Kurikulum Standard Sekolah Rendah
MOE	Ministry of Education

CHAPTER 1 INTRODUCTION

INTRODUCTION

There are 2 types of game which are entertainment game and serious game. Entertainment game is created for pure entertainment only. While for serious game, it is designed with a specific purpose rather than pure entertainment. [1][2] There are a few purposes to develop a serious game where include education, training, communications, public policy, marketing, mental health therapy, and medical diagnosis. [3] Serious games are always designed for the purpose of solving a problem with simulations of real-world events. Although it can be entertaining, yet the main purpose is to educate the users of the game. Educational games are the games which created to educate users about certain subjects, expand concepts, or assist them in learning skill while playing. Game based learning is a type of game play which defined by specific learning outcomes. Generally, game based learning is designed for player to retain and apply the concepts to the real world through gameplay. [4]

1. Purpose of the Project

1.1 Problem Statement

Learning Mathematics is difficult for primary school students if just base on imagination. Students cannot understand well through explanation on book or imagine from the instruction given. Miss Toh Lee See whom a teacher from SJK(C) Hwa Lian No. 2 had explained the problem of the students in learning Mathematics. Their pre-school just learn some numbers and basic of mathematics. However, the students rarely apply what they had learned in their real life. Due to this, they have problem in learning mathematics and feel hard to catch up in class as they learn it via imagination only. No matter how much they learn in school, they will not feel that learning mathematics is just as easy as ABC since they did not apply their mathematics knowledge to real life. Currently, the students learning this subject by chapters which following the topics set in KSSR by MOE. Students were not interested with this. They prefer learn new things through other methods like games. There are plenty types of Mathematics game, not only available in PC, but also smartphone. Yet the existing games are not following the topics where stated in KSSR. Therefore, a game will be design in this project to educate the students by according to the topics so that they can master Mathematics in an interactive way. As such, problem statements for this project are identified as follows:

- i. Primary school students are having difficulties in learning Mathematics through textbook.
- ii. Mathematics textbook exercises are not attractive and did not apply to real world situation.
- iii. Existing games are not following KSSR (Kurikulum Standard Sekolah Rendah) Mathematics syllabus that had been set by MOE (Ministry of Education).

1.2 Objectives

- i. To design/create a gameplay that apply mathematics knowledge to real world situation and makes learning mathematics become more interactive.
- ii. To design a gameplay that follows KSSR Mathematics syllabus from MOE.
- iii. To develop a mathematics educational game as additional learning tool for primary school student.

1.3 Scope

- i. User
 - a. Primary school student (Year 1 to Year 3)
 - b. Primary school teacher
- ii. System
 - a. PC game (Windows 7 and above)
 - b. Input device : Gamepad
 - c. Gameplay according to the topics of Mathematics stated in KSSR
 - Comparison between numbers
 - Counting
 - Ascending and descending order
 - Addition

1.4 Existing system description

Nowadays, there are plenty games launched on the market in different platform. For example, there are smartphones, computers, and tablets where these devices are come with different operating systems. Among the operating systems, the most popular for smartphone are Android and iOS, while for computers are Windows and Mac OS. An interactive and interesting game will always come with multimedia which consists of text, graphics, audio, video and animation. A good game will be created not only with the game mechanic that fit well with the content, but also the game technology. Besides, a storyline or level of difficulty must include in the game as challenging the players. The existing system that had been studied for this project are Madagascar Math Ops [5], ABCya [6], Arcademic Skill Builders [7], and Cool Math Games [8]. The existing mathematics games are mostly puzzle games which does not have a storyline behind the game. Some of them may come with different level of difficulty, while some has only the record of top high scoring. These are not really challenging the players to play the game.

1.4.1 Madagascar Math Ops

Madagascar Math Ops is a game under smartphone which available in both Android and iOS platforms. There are two different version which is free and premier version. This is one of the mathematics games which comes with a storyline and have recognizable characters. This game is a physics game which is similar as Angry Birds but it is design to educate with interest way by rewarding good mathematic skills with the penguins who wear jetpacks at obstacles to free the other animal characters. This game consists of over 80 levels of physics-based gameplay and various kind of jet pack ammo. There are three difficulty modes of practice for addition, subtraction, multiplication, and division to address the children' needs. They will encounter many mathematics problems which is consistent with nation-wide school standards for mathematics. Besides, the power-ups will also exciting children to gain their gameplay experience more interesting.

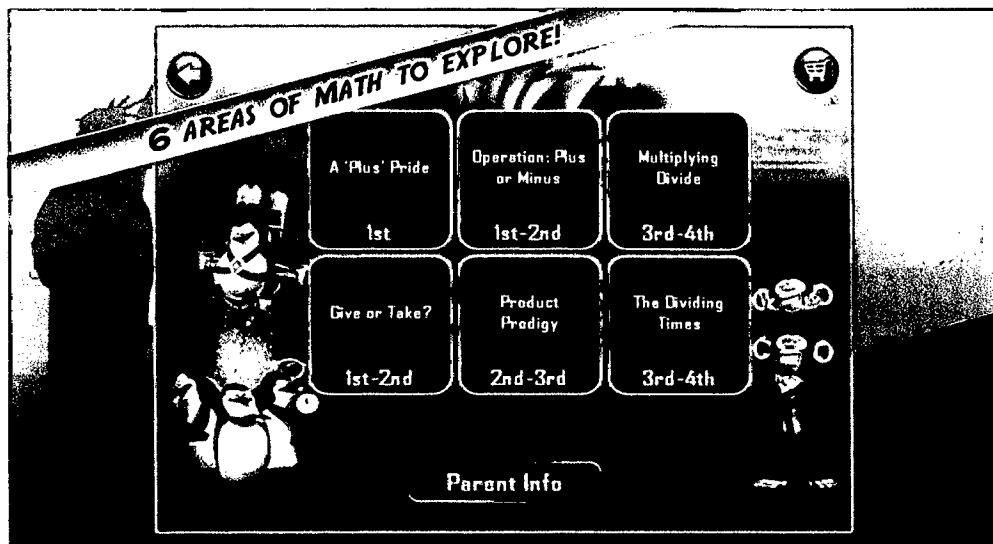


Figure 1.1 User Interface of Choosing Area in Madagascar Math Ops

Figure 1.1 shows the user interface which is for player to choose their gameplay. There are six different areas of mathematics game which includes addition, subtraction, multiplication and division.



Figure 1.2 User Interface of Gameplay in Madagascar Math Ops

Figure 1.2 shows the user interface that the animals were kidnapped and lock in the cages. In order to save the animals, the players need to help the penguins to solve the mathematics problems. There are pause button which let user to pause the game, a score view which record player's scoring.

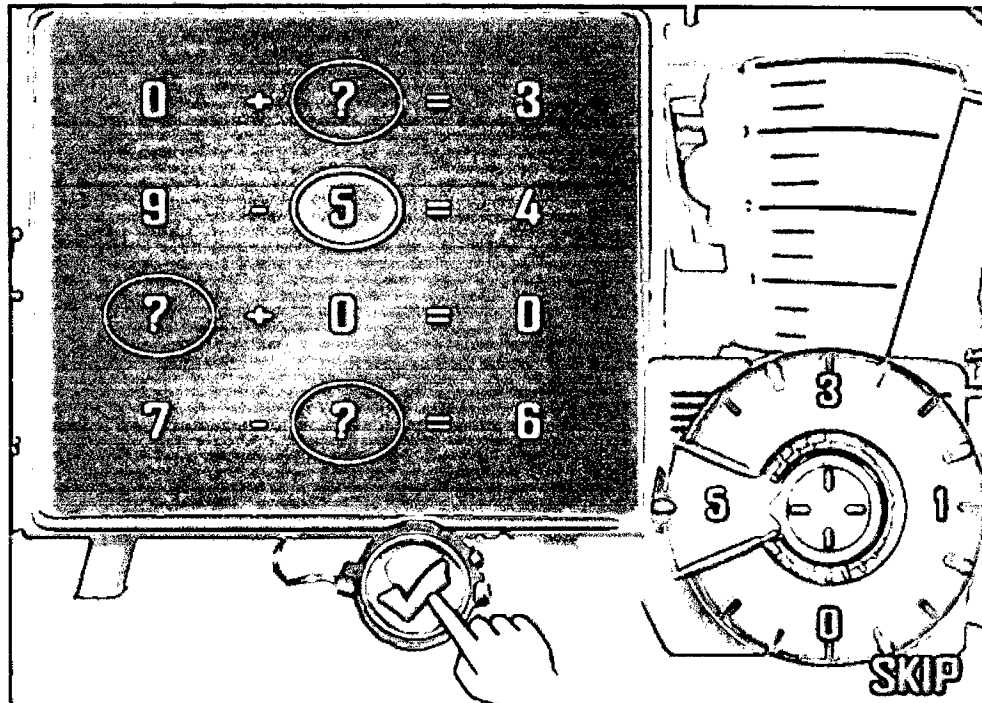


Figure 1.3 User Interface of Mathematics Question in Madagascar Math Ops

Figure 1.3 shows the mathematics problem where players need to solve based on addition, subtraction, multiplication and division. Those problems are based on the standard developed by professionals in mathematics field.

This application is good enough for children to learn mathematics but it does not follow to the syllabus which set by MOE in KSSR. Therefore, this project had to be carried out to design a gameplay according to the topic in the syllabus that set in KSSR by MOE.

1.4.2 ABCya

ABCya is a website game which available on web platform, and also had been launched for Android platform. This games and application consist of several types of educational kids' computer games and activities for children to learn. The game is free and was created based on primary grade lessons and let children to learn in an interactive way. The educational mathematics games and applications for children of this website were created by teacher and award-winning. The topics include are addition, subtraction, multiplication, division, fractions, percent, counting money and time telling.

Teacher Created

ABCya.com

For featured by Apple & The New York Times

ABCya.com is a teacher-created, award-winning website that provides educational math games and apps for kids. Our math games include topics such as addition, subtraction, multiplication, division, fractions, percent, counting money and telling time. Apple and The New York Times have featured math apps created by ABCya.com.

Featured Math Games for Kids

100 Number Chart Grades K - 2	MARBLE MATH Grades K - 2	Ball and POP! Subtraction Grades 1 & 2	BASE-TEN BINGO Grades K - 3
BASE TEN FUN Grades K - 5	Railway NUMBER VALUES LESS THAN • GREATER THAN • EQUAL Grades 2 & Up	Connect the Dots 1-10 Grades K & 1	Counting Fish Grades K & 1
Dirt Bike Proportions Grade 5	Grades 4 & 5	Counting Money Grades 3 & Up	TIME TRAVEL CAN YOU TELL TIME? Grades 1 & Up
Learning Coins Grades 1 - 3	Marble Drop Grades 2 & Up	WORD MATH Bingo Grades 3 & Up	Math Fact Shoot Out Grades 1 & Up
MATH MAN Grades 4 & 5	Grades 1 & Up	Math Quiz 10 Questions Print Scores Grades 1 & Up	Measuring Find lengths with a ruler! Grades 3 & Up
Measuring Angles Grades 3 & Up	Moon Rock Patterns Grades 1 & Up	NUMBER BINGO Grades K & 1	ROMAN NUMERALS Grades 3 & Up

Figure 1.4 User Interface of Categories in ABCya

Figure 1.4 shows the interface which had categorized in mathematics games for kids where user choose which game they want to play with. The game selections are suitable for different grades and gameplay.

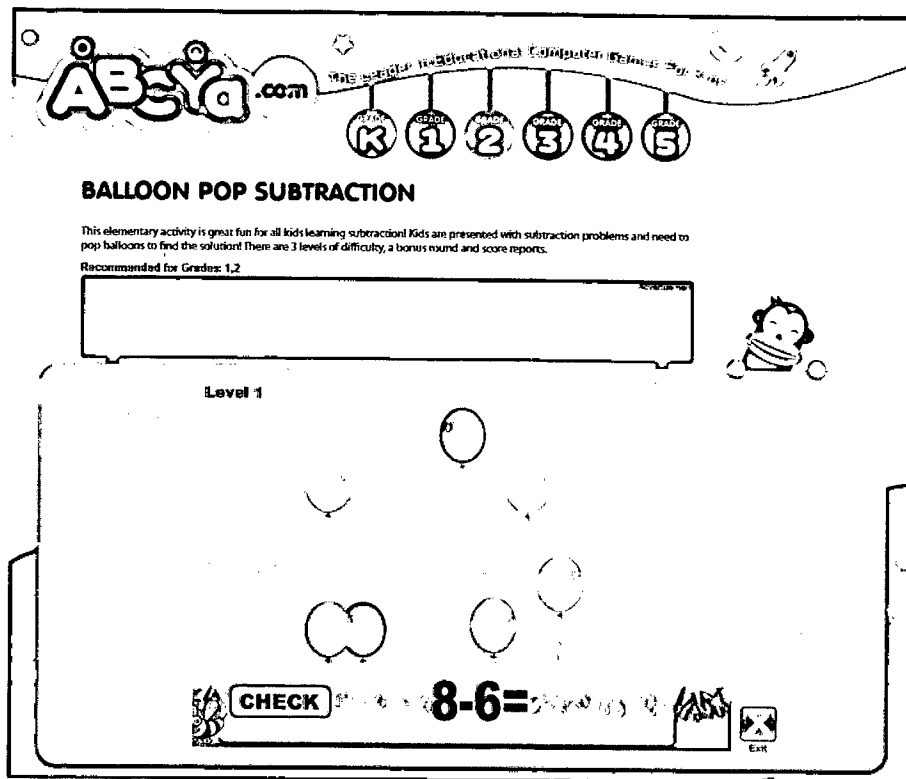


Figure 1.5 User Interface of Mathematics Question in ABCya

Figure 1.5 shows an interface of the “Balloon Pop Subtraction” where a formula will be given and children had to pop the balloons to get the solution of the subtractions problems. This game come with 3 levels of difficulty, a bonus round and score reports.

The games are puzzle game without any storyline behind. It has a score report but does not have a record of scoring that will challenge the children to play it. It had a few level of difficulty but it has not much mechanic of gameplay that may attract user to play with it. Besides, it also did not follow the syllabus set in KSSR by MOE.

1.4.3 Arcademic Skill Builders

Arcademic Skill Builders is another game on web platform. It is not only available on web platform but also available for the iPad and Android tablets. It does not have a storyline in this game too but it consists of many single arcade game. These games provide fun and focused repetition practice that enables automaticity and fluency in academic performance which help children to achieve levels of performance faster.

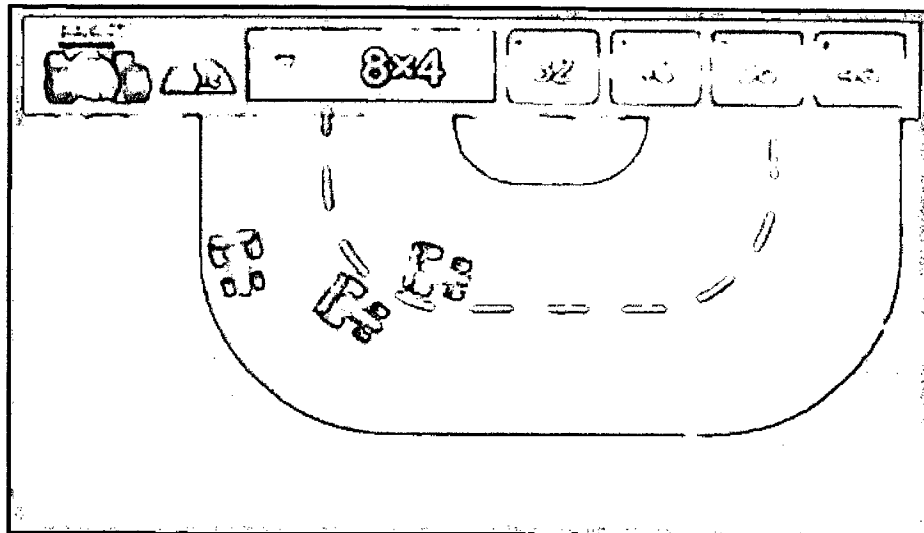


Figure 1.6 User Interface of Gameplay in Arcademic Skill Builders

Figure 1.6 shows the arcade game where player solve the question more faster, the car will moves faster, once the car reach the end point, the player will win the game. This mathematic problem solving is not related with the racing car.

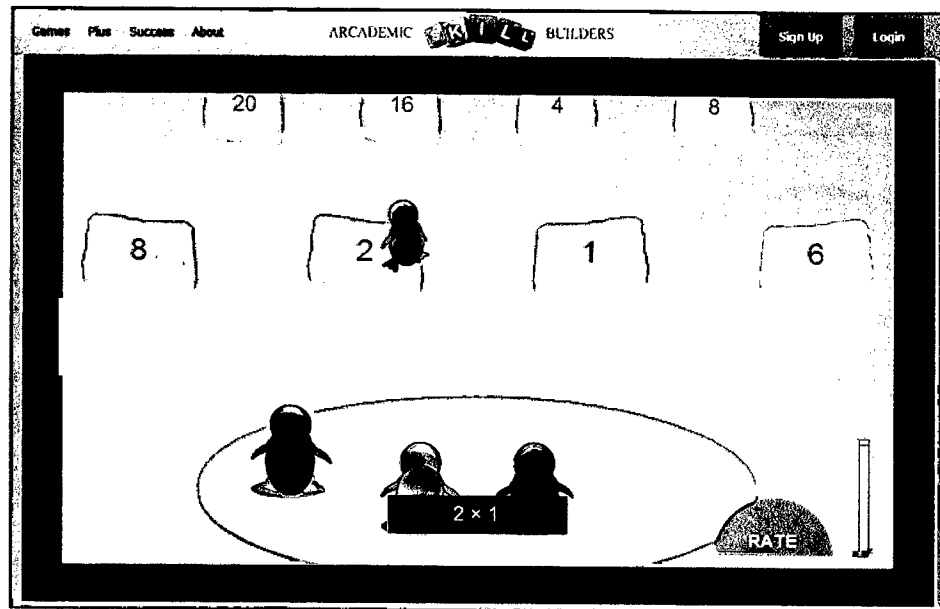


Figure 1.7 User Interface of Gameplay in Arcademic Skill Builders

Figure 1.7 shows another game called Penguin Jump which is a racing game for multi-player. This game let players to race with each other while solving mathematics problem of multiplication. There are 4 choices for each question with only one correct answer. Players need to get the correct answer so that it can go to the next question, answer the question faster and correctly so that to win in the game. If the answer is wrong, the penguin will jump and drop into the water.

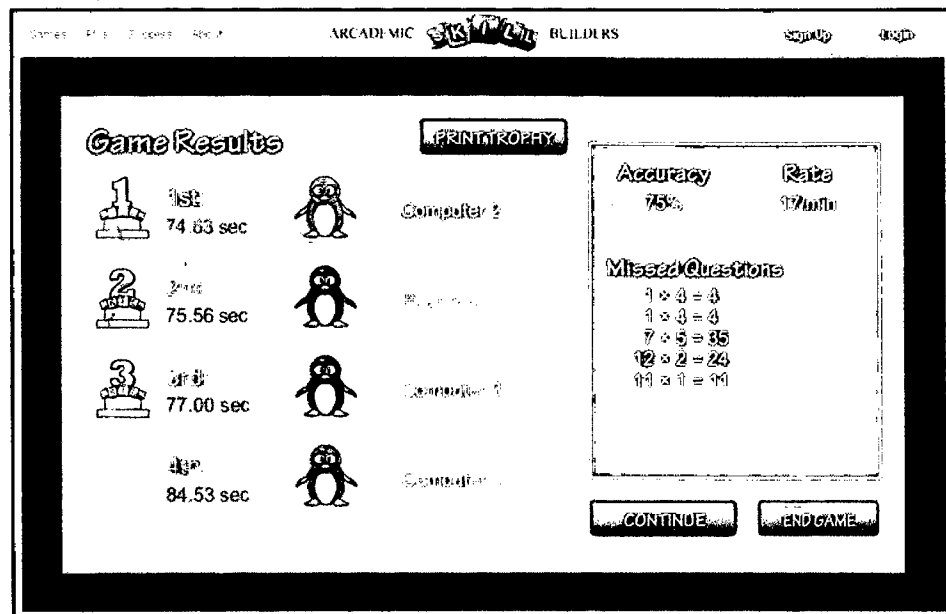


Figure 1.8 User Interface of Game Results in Arcademic Skill Builders

Figure 1.8 shows the game results of the game played. The result will show the time taken for the winning the game, accuracy, time rate, and also missed questions which players answer it wrongly. Player can choose to continue or end the game.

In this game, players need to solve the mathematics problem faster so that to win in the game. However, the game content is not well fit with the mechanic for some games. For example, the mathematic problem solving is not related with the car racing. Besides, this game is not design according to the syllabus in KSSR set by MOE.

1.4.4 Cool Math Games

Cool Math Games is a web platform flash game which also did not come with a story. It was designed for students who just need to get through in order to reach their academic goals. There is a negative of this website game which is it does not review actual mathematics skills such as addition and subtraction, but rather the logistical skills need to be performed those mathematical processes. One of the flash games was similar as Zuma which eliminates the balls rolling around the screen along the path given before the balls reach the skull structure. Player needs to fire a colored ball towards the chain of balls to prevent the balls reaching the skull. While in this game, they just add in the number on the balls and the gameplay is the same as Zuma.

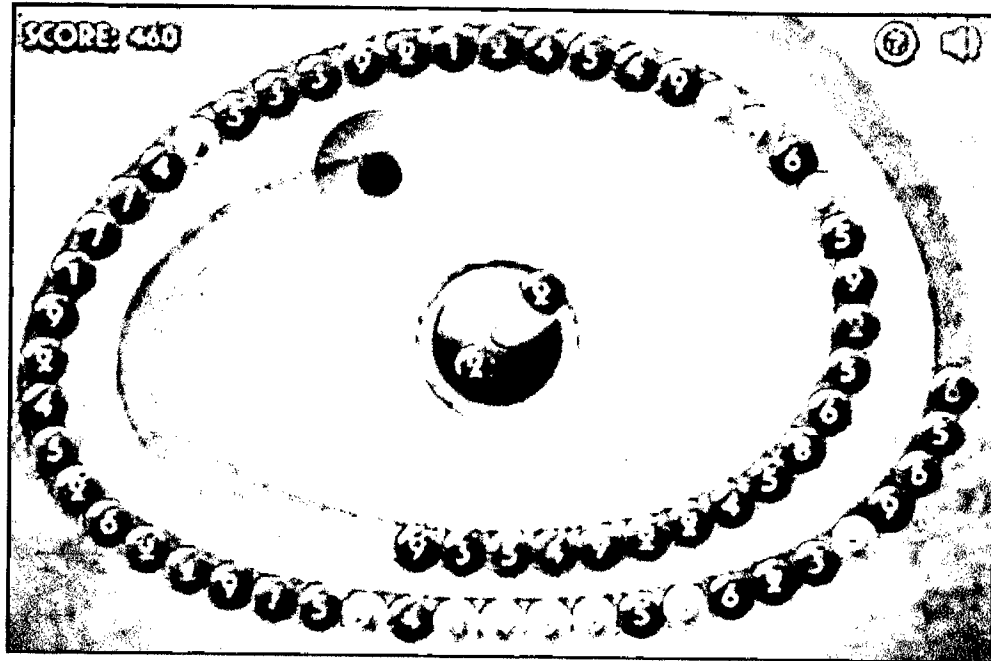


Figure 1.9 User Interface of Math Lines 10 in Cool Math Games

Figure 1.9 shows the game called Math Lines 10 where player needs to solve the mathematics problem by shooting the ball to the correct position so that to prevent the balls reaching the endpoints. Players can select the number you want to work on, for example the number player choose is 8, player had to shoot the ball to gets sum of 8. If the ball player is shooting is a 2, player need to aim at a 6 so that the 6 will blast. If player can't find a 6 to shoot at, shoot at another 2 so that player can get a group of 2's that player able to blast with a 6 later.

This game is quite familiar for those who played Zuma before. As such, this game does not have much more interesting way for players to keep on challenge in this game. It had no storyline behind this game and the game content does not really fit well with the game mechanic too. Moreover, it did not follow the syllabus set in KSSR.

1.5 Problem in the existing system

Table 1.1 Comparison Table of Existing System

	Madagascar Math Ops	ABCya	Arcademic Skill Builders	Proposed System
Gameplay	Solve mathematics questions by choosing the correct answer to save the animals.	Solve mathematics questions by simple puzzle games.	Solve mathematics questions by arcade game such as racing car.	Solve mathematics in real world problem solving environment
Game Content	Mathematics questions not fit well with game mechanic.	Mathematics questions fit well with game mechanic.	Mathematics questions fit well with game mechanic.	Mathematics questions fit well with game mechanic.
Mathematics Syllabus	Did not follow syllabus set in KSSR by MOE.	Did not follow syllabus set in KSSR by MOE.	Did not follow syllabus set in KSSR by MOE.	Follow syllabus set in KSSR by MOE.