



Masters Project Final Report January 2017

Project Title	Web Based Mathematics Learning Environment for G.C.E. (O/L) Students		
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	MIT	MCS	Research Implementation

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Web Based Mathematics Learning Environment for G.C.E. (O/L) Students

A dissertation submitted for the Degree of Master of
Information Technology (Multimedia)

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University of Colombo School of Computing

2017



DECLARATION

The thesis is my original work and has not been submitted previously for a degree at this or any other university/institute. To the best of my knowledge it does not contain any material published or written by another person, except as acknowledged in the text.

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ABSTRACT

The future of Sri Lanka lies in developing human capital that can deliver rapid growth in a knowledge-driven global economy. To generate new knowledge and use it innovatively a country requires a mathematically literate population. A quality Mathematics Education is vital for Mathematics literacy.

According to the statistics given by the Department of Examination, Sri Lanka, percentage of the fail students for Mathematics Subject (Ordinary Level) was very high. Therefore, Web Based Mathematics Learning Environment for G.C.E. (O/L) Students was selected as topic of the thesis to increase the mathematics knowledge among the students.

In this project, main area is Year 10 & Year 11 Mathematics Education (G.C.E. (O/L) Mathematics Education). This website will cover every lesson related to O/L Mathematics in Sri Lanka.

According to the syllabus in year 10 & 11, the lessons were divided in to three terms and each lesson has a different page. In that page, first user can go through the theory parts in the lesson and after that user can watch a video to get an idea about the answering structure of a question. Then user will be able to answer some questions relevant to particular lesson. There were few games for refresh the memory, exam papers related to O/L Examination and Educational Video Tutorials for every lesson in the year 10 & 11.

User interactive animations were created using Adobe Flash. Adobe After Effects, Adobe Premiere were used for create videos and all the pictures included in the lessons, animations, etc. were created using Adobe Photoshop. HTML5, CSS were used for frontend development and PHP was used for backend development of the website. NetBeans IDE was used as the development tool. Specially, Graphic tablet and head phone were used to create educational videos.

After the development, the system was tested by using various Testing methods. With the results obtained in testing and evaluation process, strongly feel that the above mentioned system was achieved its' goal. Therefore, Web Based Mathematics Learning Environment for Year 10 & Year 11 Students can be introduced to the Sri Lankan Students.

ACKNOWLEDGEMENT

I would like to take this opportunity to express my deep sense of gratitude and profound feeling of admiration to my supervisor Mr. Kapila Dias (Senior Lecturer) of University of Colombo School of Computing (UCSC), who guided me throughout the project.

The knowledge that I obtained in the lectures conducted at UCSC throughout two (02) years become great foundation for me to develop this project. Therefore, I would like to offer my sincere thanks to all of the lecturers for the lectures they have given.

Finally, I would like to offer my gratitude to my parents and my wife for the sponsorship, guidance, encouragement and assistance, and I would like to extend my gratitude to my friends, who assisted me during the project.

Thank You.

A.S.C. Madusanka

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LIST OF ABBREVIATIONS

UCSC	–	University of Colombo School of Computing
G.C.E.	–	General Certificate of Education
O/L	–	Ordinary Level Examination in Sri Lanka
WBE	–	Web based Education
UI	–	User Interface
GanithaGuru	–	Name of the Web Site relevant to this project
HTML	–	Hypertext Mark-up Language
CSS	–	Cascading Style Sheet

CHAPTER 1

INTRODUCTION

1.1. Overview

A well-informed and knowledgeable community is of vital importance for the economic and social development of a modern society. The knowledge and skills required for present day activities are much more complex than those required in the past. Today, many jobs require expert thinking and non-routine analytical skills, to identify and solve problems. Mathematics education focuses on developing a person's analytical and problem solving abilities. Thus a high quality mathematics education will ensure that students develop the skills that are essential not only in science and technology, but also in everyday life and the workplace. Mathematics is also an exciting subject which challenges the mind and offers opportunities for students to enhance their creative abilities.

The future of Sri Lanka lies in developing human capital that can deliver rapid growth in a knowledge-driven global economy. To generate new knowledge and use it innovatively a country requires a mathematically literate population. A quality Mathematics education is vital for Mathematics literacy. If students understand the basic concepts, appreciate important ideas and know how Mathematics is applied to everyday situations, high Mathematics literacy can be achieved. Therefore our main area is Year 10 & Year 11 Mathematics education.

At the present there are only few Websites available for learn mathematics in Sri Lanka. Hence, this web site will cover many lessons in Mathematics related to Year 10 & Year 11 local syllabus.

1.2. Problem

Out of all public examinations in Sri Lanka the largest number of candidates sits the G.C.E. (O/L) Examination. The certificate received on the results of this examination which is conducted at national level, is used not only to select those who are eligible for higher education but also to secure medium level jobs and it is a basic requirement to follow certain courses of study in International Universities. It is thus accepted due to its validity and reliability as well as its high quality.

The statistics (Table 1) given below indicate the difficulties of the O/L mathematics for students in Sri Lanka [1].

Grade	School Candidates		Private Candidates		Total	Percentage
	Number	Percentage	Number	Percentage		
A	40133	12.35	1138	2.31	41271	11.02
B	20794	6.40	1348	2.73	22142	5.91
C	41296	12.70	5284	10.70	46580	12.44
S	79270	27.39	16966	34.37	96236	25.70
W	143572	44.17	24630	49.89	168202	44.92
Total	325065	100.00	49366	100.00	374431	100.00

Table 1: Grades obtained by the Candidates - Year 2013 – O/L Exam [1]

Nowadays Mathematics Education has very high demand. But according to the above statistics we can conclude Mathematics Education is not in a good place.

Within school hours students have access to a number of resources to help them with their learning. These include textbooks and the teachers. However, once the student has gone home, their access to that kind of resources is limited. Currently lot of students uses Computers with the Internet. Today Technology with the Education is growing fast.

Therefore this Web based Mathematics Learning Environment designs to provide good Mathematics knowledge to learn Ordinary Level Mathematics in Sri Lanka.

1.3. Objectives

As mentioned in the problem there is very essential to improve Mathematics knowledge among the students. Therefore, this website was created according to the following objectives.

❖ Provide efficient learning Environment.

This website is mainly focused on Students. Therefore, there will be a good Environment to learn Mathematics.

❖ Create the attractive environment to learn.

In the Website there will be an attractive environment. Hence there will be small games, videos, user interactive animations, etc.

❖ Give easy navigation through the web page.

Easy navigation is essential for the website. Because if user has to wait sometime to load the webpage, user will not be able to come back.

❖ Provide a Forum area to share knowledge and ask questions.

In the Educational Website there should be a forum area to share knowledge and ask questions. Because students has questions or want to share knowledge there should be a place for that.

The main responsibility of this web based learning environment is to create good knowledgeable students for the Mathematics and increase the pass percentage of Mathematics Exam Papers specially in O/L Exam (Sri Lanka).

To be effective, this web site will be:

- Visually pleasing – Visually attractive Graphics will be used.
- Informative – Many theories of the lessons will be covered.

1.4. Project Scope

As a solution for the above identified problem while achieving above mentioned objectives to enhance the knowledge of Mathematics for G.C.E. (O/L) Students, I am proposing a web based learning Environment to learn Mathematics for the G.C.E. (O/L) Students. Main target group of this website is year 10 & year 11 Students.

Scope of the Website

In this website there will be an Administrator Module and a User Module.

Administrator module

Administrator module will have following functionalities.

- Add/Edit User Details
- Add/Edit Administrator Details
- View/Upload Exam Papers
- Add/Delete Upcoming Lessons
- Add/Delete New Lessons

User module

Following Pages are the Main Menu of the website.

- Home Page – This will give a simple idea about the website.
- Basic Maths – This Page will have videos and lessons relevant to basic knowledge of Mathematics.
- Year 10 & Year 11 Page – These pages will have the lessons relevant to the mathematics syllabus in year 10 & year 11.
- Forum – Users will be able to share their knowledge using the forum.
- Contact Us Page – Users will be able to directly contact the Administrator of the website using the contact us page.

Scope of the Lessons

Every lesson will have separate page and created according to the local mathematics syllabus in Sri Lanka.

Mathematics Lessons

Lessons will contain descriptions, pictures, animations, videos and questions to answer.

Other Important Components in the Website

There are other important components in the website, such as Games, Exam Papers, Mathematics Questions, etc.

- Games for All, Attached as appendices (APPENDICES F).
There will be few games to refresh the memory of students.
- Maths for All
In here there will be a some lessons not specially relevant to Year 10 & Year 11 Mathematics Syllabus in Sri Lanka but It will be useful for other students who are studying Mathematics in another grades.
- Mathematics Exam Papers
There will past papers of O/L Examination to download.
- Mathematics Questions
There will be user interactive questions to answer.

1.5. Overview of the Dissertation

- **Chapter 1 – Introduction**

The general introduction provides the details about the problem, overview of the project. Objectives of the system, Scope of the project are described as well.

- **Chapter 2 – Background / Literature Review**

Provides related literature reviews and background for web based Education & similar systems.

- **Chapter 3 – Analysis and Design**

This Chapter is consist requirement analysis according to the problem statement. Functional requirements and non-functional requirements will be also discussed. Additionally Design Decisions and Sitemap of the website are described as well.

- **Chapter 4 – Implementation**

Introduction relevant to implementation will be given. Also the Software and Hardware for the implementation will be discussed. Additionally, implemented user interactive animations will be discussed.

- **Chapter 5 – Evaluation and Testing**

Test Plan & User Evaluation will be discussed. Test cases will be also discussed.

- **Chapter 6 – Conclusions and Future Works**

Discuss about the final conclusions about the system and enhancements of the system which can be done in the future.

CHAPTER 2

BACKGROUND / LITERATURE REVIEW

2.1. Introduction to Web-based Education

Web-based education (WBE) [2] encompasses all aspects and processes of education that use World Wide Web as a communication medium and supporting technology. There are many other terms for WBE. Some of them are online education, virtual education, Internet-based education, and education via computer-mediated communication.

WBE is characterized by:

- The separation of teachers and learners (which distinguishes it from face to face education)
- The influence of an educational organization (which distinguishes it from self-study and private tutoring)
- The use of Web technologies to present and/or distribute some educational content
- The provision of two-way communication via the Internet, so that students may benefit from communication with each other, teachers, and staff.

There are number of important concepts related to Web-based education, such as E-Learning, distance education, and adaptive learning.

2.2. Importance of Educational Websites among Students

In this technology era, the passion of internet is boosting among the students. For any search they usually like to use the Google to collect the information. Similarly in the case of education, it is often helpful to use education websites as a means of collecting the relevant information about the concerned subject. Not only that, it has become very necessary for any new business to promote over the web. If we want to put up and enlarge your business in worldwide then it's vital for you to make a good web site, so that people can easily understands the mission and vision of your business and liberally enjoy the various services.

At present there are some attractive great education websites (Foreign) are available which directly conveys the useful information. Suppose you want to find the advanced theory in Science, these websites will help you to find out that theory easily.

The concept of education websites is still new in Sri Lanka but owing to its growing need, it is gaining popularity at a fast pace. Students have become more conscious about their knowledge so that picking right learning method is necessary as it is the merely way that ensures their good life. In this regard, they visit education websites and openly discuss their questions and seek all significant information.

These education websites are specially best for those students who like to share knowledge and learn individually. They can add their questions by mailing these education websites or use forums and fetch the instant responses. It is always advisable to visit education websites to develop the Knowledge.

2.3. Benefits of Adding Multimedia Content to the Website

There are several benefits of adding multimedia content to website.

- **Multimedia Increases Time on Site:**

We live in times of fast cars, fast internet speeds, audio books and people with small attention spans. The internet has radically changed the way we think and has dramatically reduced our attention spans. Given this fact, writers, journalists and bloggers have adapted their writing to compensate for this shift in our thinking paradigm. No matter how brilliant you think your piece is, if it's too long and without multimedia to aid in breaking-up the monotony, you will experience an increased number of Diagonal Readers and lower time spent on your page.

- **Multimedia Yields Better Branding:**

Adding multimedia to your website or blog is an effective way of drawing in more viewers. These days, people have become extremely visual. While video is one of the most popular multimedia choices, websites offering an even broader variety of digital media, like audio and slideshows, enjoy even more engagement. Honestly, you cannot effectively position a Brand without including audio, video and supporting images to build brand recognition.

- **Images:**

Images are self-explanatory. They are easy to share and can spice up your content. Imagine a cooking blog without images, that's almost impossible to visualize. Tutorials are also always better if they contain images that provide clear visual direction for people navigating their way around a product or service. If the high quality images included on the website, it will more attractive.

- **Slideshows:**

Slideshows are a fantastic way to feature multiple images, video and even audio. A well-organized slideshow has tremendous visual impact and can keep visitors to the website fully engaged.

- **Videos & Animations**

Videos & Animations are also best way to give an attraction to the website.

2.4. Videos for Education

Every educators aim is to get students energized and engaged in the hands-on learning process, and video is clearly an instructional medium that is compelling and generates a much greater amount of interest and enjoyment than the more traditional printed material. Using sight and sound, video is the perfect medium for students who are auditory or visual learners. With the added use of subtitles each child then has the choice to watch, listen to, or read each presentation. Video stimulates and engages students creating interest and maintaining that interest for longer periods of time, and it provides an innovative and effective means for educators to address and deliver the required curriculum content. [3]

- **Video Creates An Experience**

Consider teaching with the voices from the past by introducing students to great historians, political figures and famous people who lived centuries ago. Envision the classroom in which children hear the cry of a nearly extinct species and see the colours and hear the sounds of animals that thrive only in a remote wilderness half way around the world. And what about investigating the laws of motion, sound and energy transfer by viewing the launch of the space shuttle on its voyage into space? Think about how much easier it would be to understand the diverse cultures of people who live in other areas of the world if you could encounter them in their own environments - hearing their songs, observing their rituals or listening to their silence.

The benefits of using video in education includes providing a sensory experience that allows concepts and ideas to actually become an experience and come to life as students are guided through each adventure.

- **Video as a Flexible Teaching Medium**

Video provides a means of interactive instruction and is a very flexible medium. Having the ability to stop, start and rewind is absolutely invaluable. It provides the option to stop each video and challenge students to predict the outcome of a demonstration, and elaborate on, or debate a point of historical reference. You also have the option to rewind a section of the video to review a segment to ensure that children understand a key concept. You can ensure to add further interactivity by copying activities, conducting discussions or repeating demonstrations and experiments.

2.5. Animations for Education

First purpose of animation in academics is to fulfil a cognitive function. In this role, animations are intended to support students' cognitive processes that ultimately result in them understanding the subject matter. Animation can be used to make very exciting and fun animations into which education and training can easily be incorporated. Instructors can also use animation to demonstrate things and concepts visually exactly how they want to since they have control of every aspect of the animation. It can be used to show how things come together and work together. In science for example, the computer animation might be used to show how our solar system works, and in math, a computer animation might show a student how one can algebraically manipulate specific equation. Other subjects such as English, foreign language, music, and art can also be thought by using animation.

Secondly, as an affective learning tool that attracts attention, engages the learner, and sustains motivation. Such affective Animation Training is not focussed on facilitating comprehension of any academic subject matter itself and often portrays activities that are interactive, creative, fun and motivational.

The creative potential of animation is enormous, and integrating animation activities into the school curriculum offers the possibility of tapping this potential to meet a range of educational objectives. [4]

Benefits of Animations as an Affective Learning tool

Most of the websites in educational field, animations were used for following reasons.

- Emphasizes development of students' skills and understanding of creating and responding.
- Enables students to apply Imagination & Rational Thinking.
- Enables students to invent and explore multiple solutions to a problem.
- Enables students to understand the value of reflection and critical judgment in creative work.
- Facilitates positive peer interaction, including receiving and using feedback.
- Encourages self-motivation to create and problem solve.
- Uses artistic literacy as a natural enhancement to learning in other content areas.
- Fosters positive attitudes toward Art & Animation.

2.6. Related Projects

There are only few attractive educational websites specially design for Ordinary Level Mathematics (Local Syllabus in Sri Lanka). But there are several foreign Websites with attractive Multimedia content to learn Mathematics.

I. Math is fun Website [5]

This website (Figure 1) contains various lessons related to Mathematics and also there are so many animations and questions to answer. It has very attractive environment and very good colour combination in background, Pictures, Animations, etc.

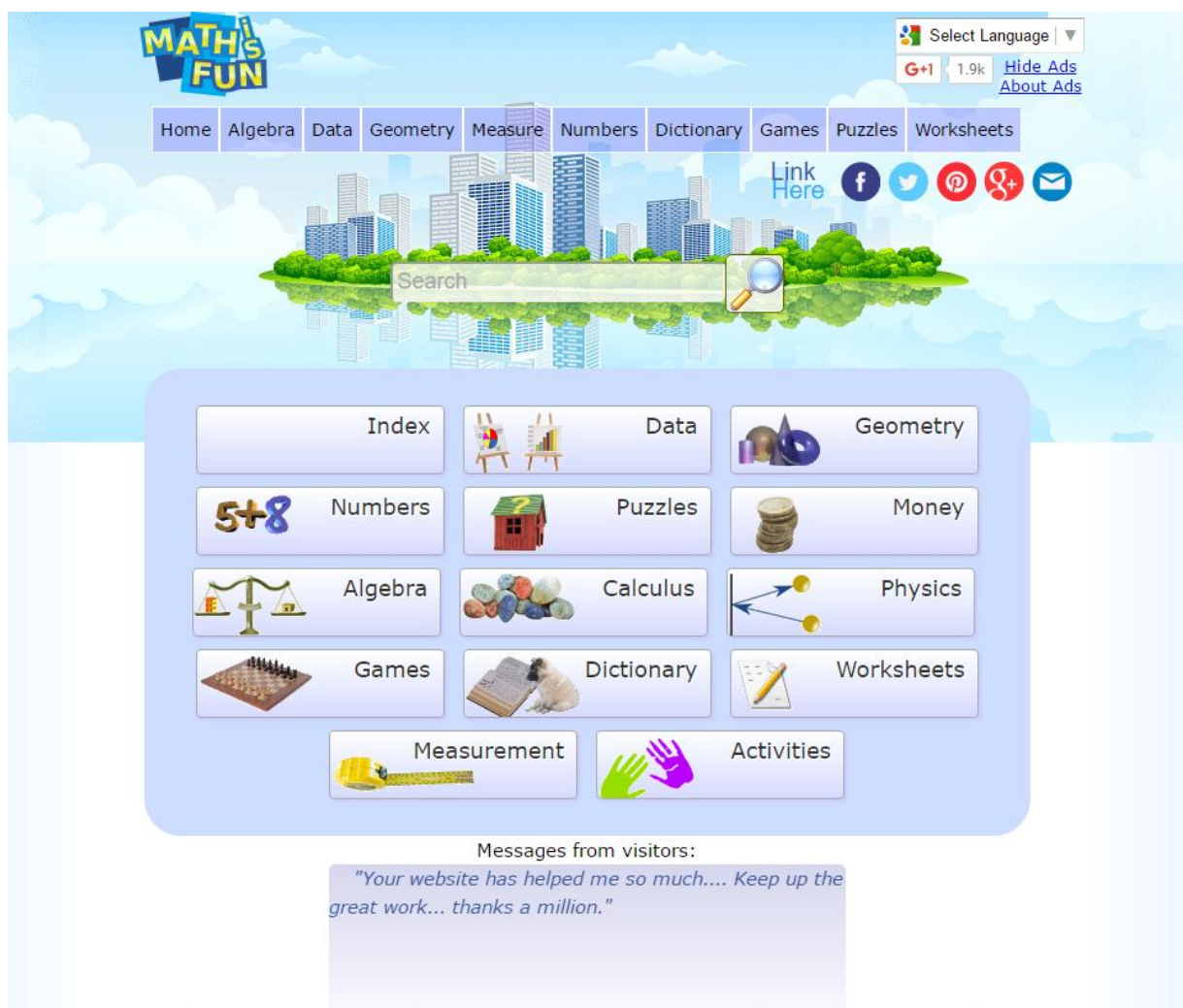


Figure 1: Home Page of the Maths is fun Website

Analysed details of the Math is Fun Website and the GanithaGuru Website

There were some similarities and some differences in the Math is Fun website and Web Based Mathematics Learning Environment for Year 10 & Year 11 Students (GanithaGuru Website). Following Table (Table 2) shows the analysed details of the Math is Fun website and GanithaGuru Website.

Math is Fun Website	GanithaGuru Website
Created to Learn Mathematics	Created only for Mathematics, but specially related to O/L Mathematics in Sri Lanka
There were specific Mathematics Lessons	There will be all the Mathematics Lessons relevant to year 10 & 11 syllabus in Sri Lanka
There were pictures for specific parts of the lessons	There will be pictures for specific parts of the lessons
There were lot of links. May be user couldn't find the relevant content of the lesson immediately	Easy to find the content due to all the lessons will have separate page and not have lot of links
Only some lessons have user interactive questions	Every lesson will be have user interactive questions
Only few lessons were have videos	There will be videos to demonstrate the lessons
All the Lessons were in English Medium	All the lessons will be in Sinhala Medium

Table 2 : Analyzed details of the Math is Fun Website & GanithaGuru Website

II. BBC Bite Size Website [6] - Foreign website for English, Mathematics and Science Subjects.

BBC Bite Size (Figure 2) is dedicated to provide English, Mathematics and Science in an attractive way. Therefore BBC Bite Size Maths (pre-2015) section [7] was considered for this project. There are several games and animations and also they are giving the code for free to embed the games in our Web Pages. The Games were built using flash and they were very complicated. BBC Bite Size offers unique experience that quickly guides the user to the knowledge they want to have.

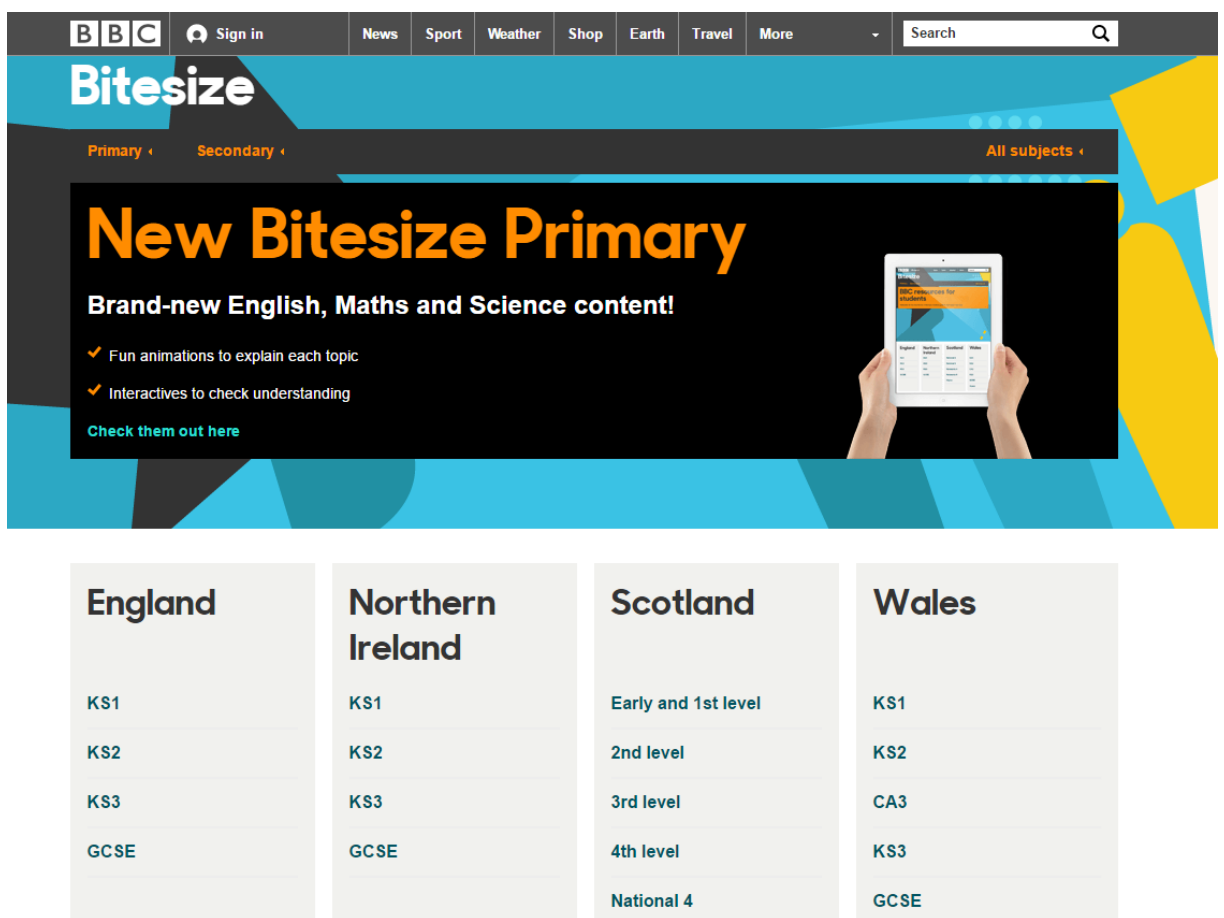


Figure 2: Home Page of the BBC Bite Size

Analysed details of the BBC Bite Size Maths (pre-2015) and the GanithaGuru Websites

Following Table (Table 3) shows the analysed details of the BBC Bite Size Maths (pre-2015) Website and GanithaGuru Website.

BBC Bite Size Maths (pre-2015) Website	GanithaGuru Website
In here there were only mathematics content, but main website was created for English, Mathematics and Science Subjects	Created only for Mathematics, but specially related to O/L Mathematics in Sri Lanka
There were specific Mathematics Lessons	There will be all the Mathematics Lessons relevant to year 10 & 11 syllabus in Sri Lanka
There were lot of pages. May be user couldn't find the relevant content of the lesson immediately	Easy to find the content due to all the lessons will have separate page and not have lot of links
Lot of user interactive activities	Every lesson will be have user interactive questions
All the Lessons were in English Medium	All the lessons will be in Sinhala Medium

Table 3 : Analyzed details of the BBC Bite Size Maths & GanithaGuru Websites

2.7. Summary

In this Chapter we discussed mainly about the Web based education and similar educational websites. Then we describe about the importance of using Animations and Videos for educational systems and analysed the similar websites. According to the similar websites mentioned in this chapter, Web based Mathematics Learning Environment for year 10 & year 11 students was created to give better user interaction with learning.

CHAPTER 3

ANALYSIS AND DESIGN

3.1. Introduction

Educational websites can be used to provide web-based instruction, which itself is a relatively recent phenomenon and research in this area is in its infancy. The online environment has become a powerful interactive medium for promoting higher order thinking skills in students. This environment uses a web based interface in which students interact with course materials, other students and the instructor. When developing educational web sites, features that support pedagogy should be given primary consideration. It is therefore important to identify key elements that will have maximum impact on learning. [8]

Some of the web-based educational materials are generally poor in educational content as authors of web based material have never had a course in learning theory and the web content they develop lacks foundations of learning theory. On the other hand, professionals such as teachers who may have knowledge of learning theories lack the technical skills to develop educational materials for the web. Educational web site development is not an exact science and these sites are built with a different set of criteria as compared to other sites, such as those having an e-commerce or marketing focus. More research is needed to build a theoretical foundation for educational web site design and web-based instruction.

According to the literature review, following variables were considered for the development of the project.

Usability

1. Ease of navigation through website
2. Visual appeal of web pages
3. Consistency of design between Web Pages

Learnability

1. Clearly stated objectives and instructions
2. Quality of instructional content
3. Good Interactivity

Technical functionality

1. Multimedia elements (such as audio/video)
2. Web page download/refresh time

3.2. Requirement Gathering and Fact Finding

Analysis phase is the most significant from the software development life cycle. It is necessary to get a clear idea about the problem domain and what are the user's requirements for the new system before start developing a system.

Therefore it is very essential for requirement gathering and fact finding. Since that is the most difficult, considerable amount of time has to be spent here. If for some reason analyst was unable in analysing the situation carefully, the whole project will become a failure due to that, because the delivered system would be something other than the requirements. Therefore understanding the requirements is important.

Requirements gathering in this stage can be done using various fact finding techniques, following techniques have been used for gathering requirements for this project.

- **Research and Knowledge.**

By doing research and existing Knowledge in related projects mentioned in literature review and the Mathematics Lessons, we have gathered the requirements which are needed in system development. Study the existing Educational Websites and content of those Websites are very helpful to gather the information on developing the new system. Therefore good quality Animations, Videos & Pictures relevant lessons will be have in the website.

- **Questionnaires**

A questionnaire allows getting a quick responds from users relevant to this kind of systems and results can be tabulated quickly, also easy to analyse. As for users (Students), sample of students were chosen and provide the questionnaire (APPENDICES B). Some users haven't used computers in their education. Therefore, questionnaires with answers indicated the use of the computers was only considered for the analysing.

3.3. Analysis of the Questionnaires

There were lot of students who are studying in year 10 & 11 with the knowledge of using computers. Practically, it was unable to contact lot of students. Therefore analysing purpose, sample was selected among the students who are studying in Colombo and Monaragala. Thirty (30) students were selected as for sample to distribute the questionnaire and analyse their feedback. This website was created for Local Syllabus students, therefore a questionnaire is in Sinhala medium (APPENDICES B).

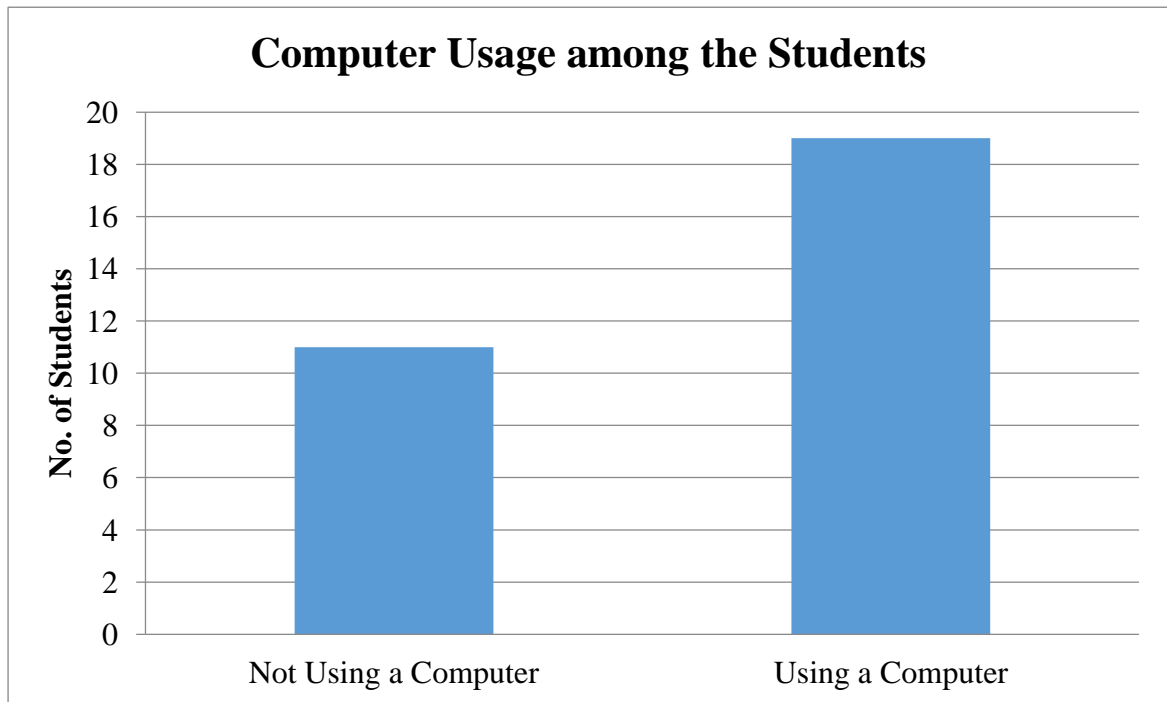


Figure 3: Computer usage among the selected students - using a questionnaire (APPENDICES B)

As for the feedback gave for the questionnaire, there were nineteen (19) students who has using a computer for their education (Figure 3). The answers given by the students for the questionnaire were analysed and created the content of the website.

3.4. Functional Requirements

In Software engineering and systems engineering, a functional requirement defines a function of a system or its component. A function is described as a set of inputs, the behaviour, and outputs.

Functional requirements may be calculations, technical details, data manipulation and processing and other specific functionality that define what a system is supposed to accomplish.

This Educational Website contains following users.

- Administrator
- Registered Users
- Non Registered Users

There are several Functional Modules in the GanithGuru website and the content.

- Users registration
User registration module will allow students to register. In the registration form shows all required text fields needed to be filed. After filling the required fields and clicking submit button a script checks the user input correctness and record the data in the database. Only Administrator can access the database to edit details.
- Users access
Access to the Website happens after verification of the user details in LOGIN (User Name & Password) with the records that is kept in the database. If the access details match, user can access the every area in the website. Only Registered Users can access the Exam Papers and Games area. All the Users (Registered or Non Registered Users) can access the Basic Maths, Year 10 & Year 11 in the Main Menu, Mathematics Questions, etc.
- Administrator Functions
There will be an administrator portal to do administrator functions. Only Administrator can add / edit Exam Papers, User Details, Upcoming Lessons, New Lessons, etc. to the Website.
- User interactive lessons
There will be user interactive animations for the lessons. In the animations, user will be able to select the correct answer or write the answer.

3.5. Non Functional Requirements

Non-functional requirements define the overall qualities or attributes of the resulting system.

Non-functional requirements place restrictions on the product being developed, the development process, and specify external constraints that the product must meet. Following Non-functional requirements was considered for the implementation of the website.

Therefore, following non-functional requirements were considered for development of this project.

- **Performance**

The Website should have a quick response time. All the Lessons, videos & Animations should be load quickly.

- **Reliability**

The Website should have little or no downtime and be able to handle multiple concurrent users. The ability of a system or component to perform its required functions under stated conditions for a specified period of time should be high. Reliability is often measured as probability of failure.

- **Availability**

This system expect, website to be constantly available all the time without error. Availability is one of the biggest challenges for hosting providers. Web based Mathematics Education Environment hope to be available 100% of the time. There would be no downtime - ever.

- **User Friendliness**

Interacting with the website should be easy for the user. All the Educational Videos and Animations should be watch without difficulties.

- **Security**

Details of the Registered Users will store in a database and only administrator will be able to access it.

3.6. Use Case Diagram

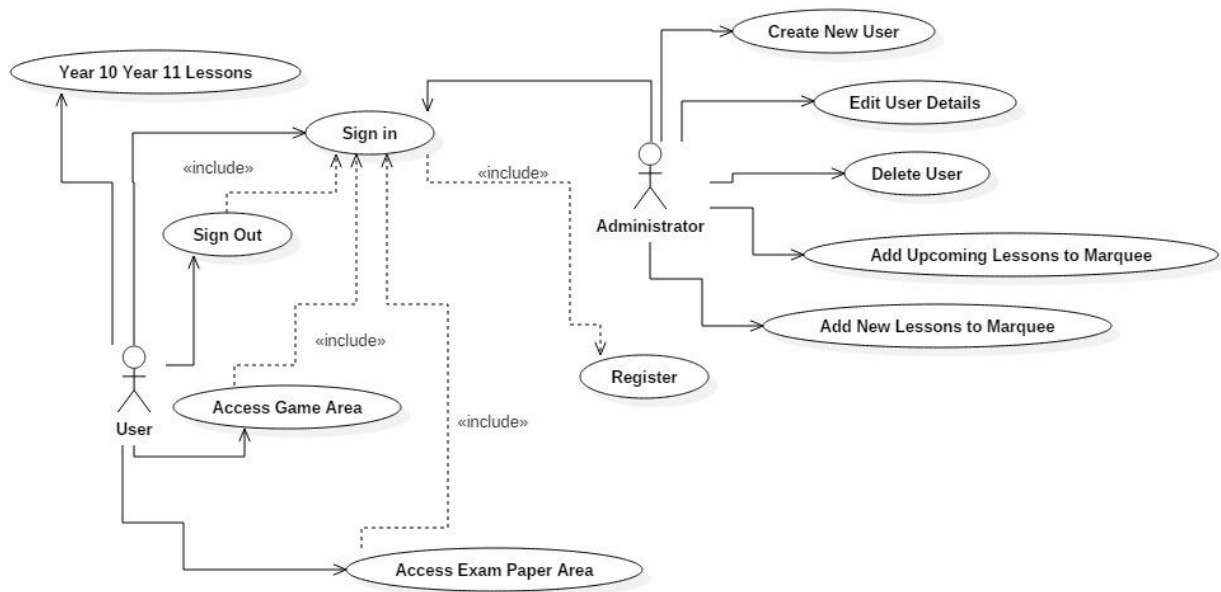


Figure 4: Use Case Diagram

Every user can access all areas in the website except Games Area & Exam Papers area. Only Registered Users can access Games Area & Exam Papers Area. Above diagram is the use case diagram for this website (Figure 4).

3.7. Design Decisions

There were some critical decisions should have taken to build the Educational website and Content of the Website.

1. Determine the Website's Purpose

Many websites provide information about subject of interest from the owner, as well as tutorials or opinions. Some consist of forums where users ask questions and discuss matters relevant to the users of the website. Many Foreign Schools have online classes available and there are also online encyclopaedias, such as Wikipedia, where people can find information what they want. Therefore we need to know the expectations and purpose for such a website.

- Is it to attract people to the Website?
- Is it to provide information to students or to the general public?
- Is the Content of the Website is relevant to the expected audience?

According to the project, attractive Graphics should be visually pleasing to attract the audience and this website mainly creating for the Students who have studying in Year 10 & Year 11 Ordinary Syllabus in Sri Lanka. Therefore content of the website should be relevant to Year 10 & Year 11 Mathematics. Name of the website is GANITHA GURU.

2. Identify the Pages and content of the pages in the website

One of the most notable trends in Educational websites is the Simplicity. The name of the Website should be clearly visible on every page. Some of the people can arrive at the website from the homepage and some of them will arrive on internal pages via search. For that, it is essential that users know which website they're looking at. By having the full name shown prominently on each page, it is easy for users to identify the website.

According to the project, Logo is shown in every page as a name of the website. When first looking at the website, visitors want to know why this website is special and what they can provide. Therefore Home Page should be explained everything why this Website is important. Regarding to the Purpose of the website other pages should be identified.

Therefore several pages were used for the content of the website. There were lessons for year 10 & year 11 students with rich multimedia content and few games for refresh the memory.

3. Type of Multimedia Content

If the website was multimedia rich it will be attractive and visually pleasing. For multimedia content, we can use Videos, Animations, Pictures, Games, etc.

Educational Videos, Animations & Pictures were the important parts of the content in this website. In here, lot of decisions should take.

- Content of the Educational Video and Animations - According to the Year 10 & Year 11 Syllabus Educational Videos, Animations and Pictures was created.
- Hardware and Software Requirements for create Multimedia Content - For create Educational Videos, Animations and Pictures, should have to take decisions how to make the videos and animations, what type of Hardware & software needed? How the video was recorded? Therefore, several software likes Adobe Photoshop and Adobe Flash were used to create animations and pictures. For Recording Purpose Graphic Tablet and Screen Recorder was used.

3.8. Sitemap of the Website

Sitemap of the website is as follows (Figure 5).

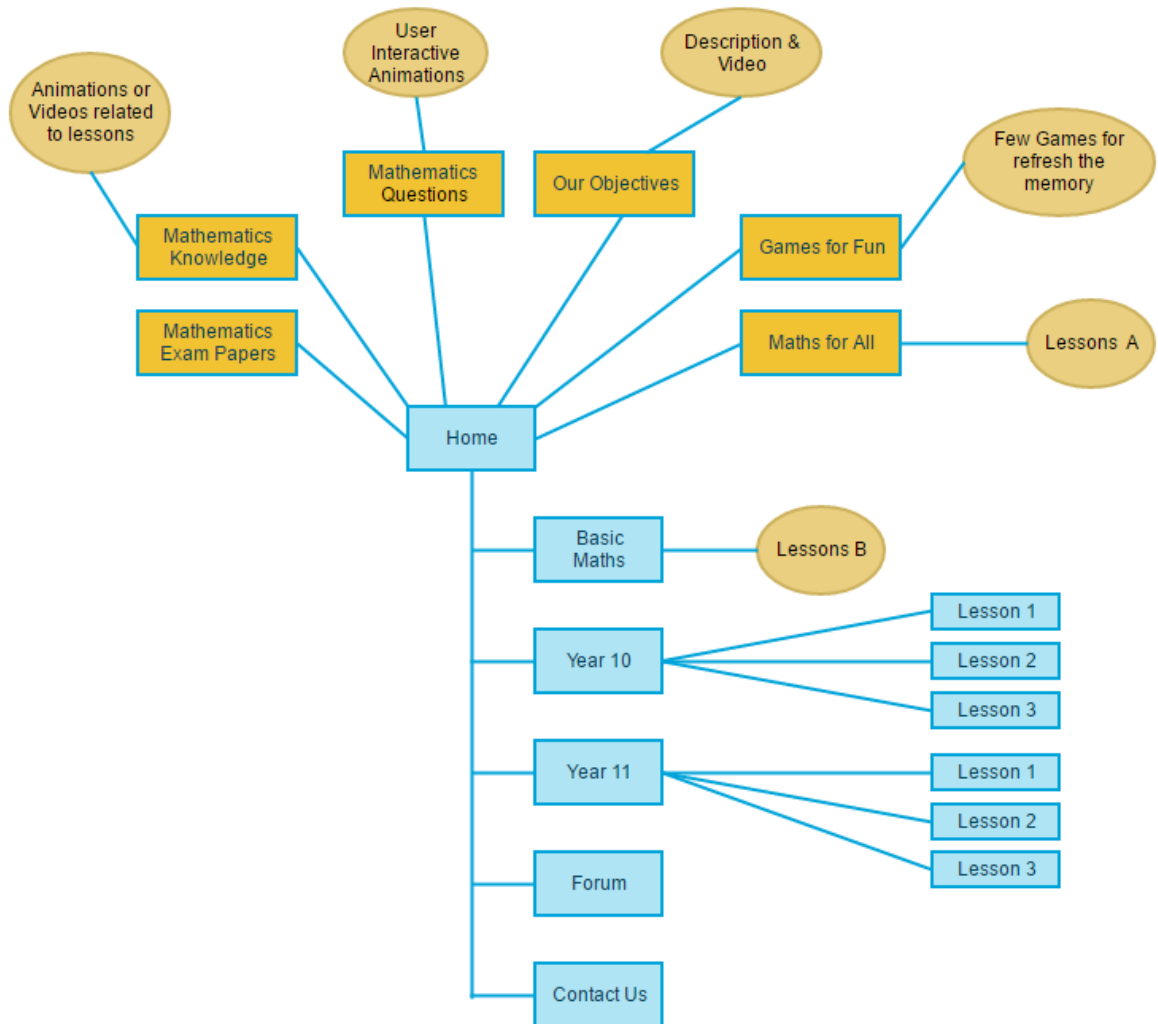


Figure 5: Sitemap of the Website

According to the above Sitemap (Figure 5), the website was designed. There will be lessons in Maths for All area (Lessons A) with animations and videos, not specially related to year 10 & year 11 Mathematics. If the students need some basic knowledge or request some basic lessons through the forum, the lessons with Animations and Videos will be uploaded to Basic Maths (Lessons B) area. If student want to ask questions or share knowledge, forum will be facilitate to their expectation. Lessons 1, 2 and 3, etc. will be lessons related year 10 & 11. If the users want to directly contact the Administrator of the Website, they will be able to use Contact Us page.

3.9. Design of the Website

This website was created for Educational Purposes. Therefore this website contained Mathematics lessons with rich multimedia content to learn and games to refresh the memory. In the Website English and Sinhala Fonts will be used. Some of the Educational Contents like Exam Papers can access only Registered Users.

With the results obtained from requirement gathering and fact finding (1.2), storyboards relevant to website were designed. According to the storyboard of the home page (Figure 8), following home page was designed. There were buttons for submenus (links for other pages) and buttons was created with an attractive look. According Syllabus of the Mathematics Lessons, content of the submenus was created. Sinhala and English fonts were used for the content. Home Page of the Website (Figure 6) was created is as follows.

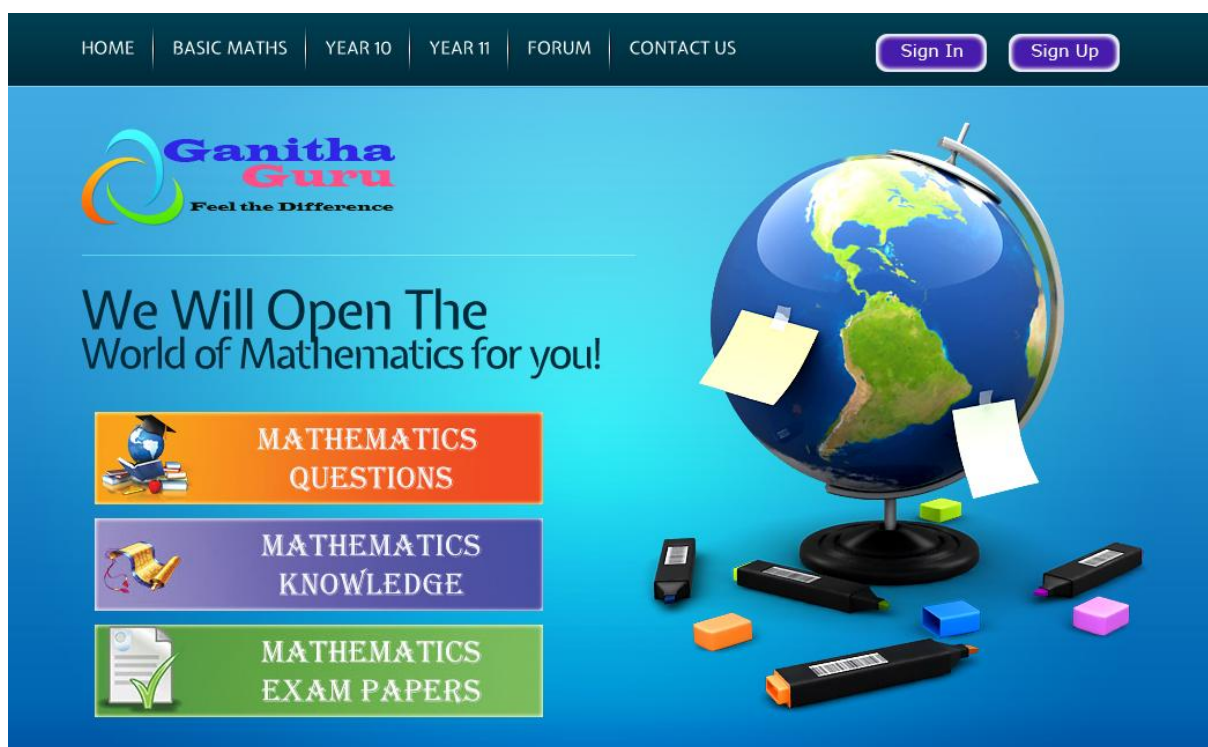


Figure 6: Home Page of the Website (First Part)

Buttons and Logo for the website were created to attract the students to website and background picture of the top area was chosen for the same purpose. Home Page was designed to get an idea about the entire website. Colours were chosen for buttons to give a good visibility.

After scroll down the page, user will see the second part of the home page (Figure 7).

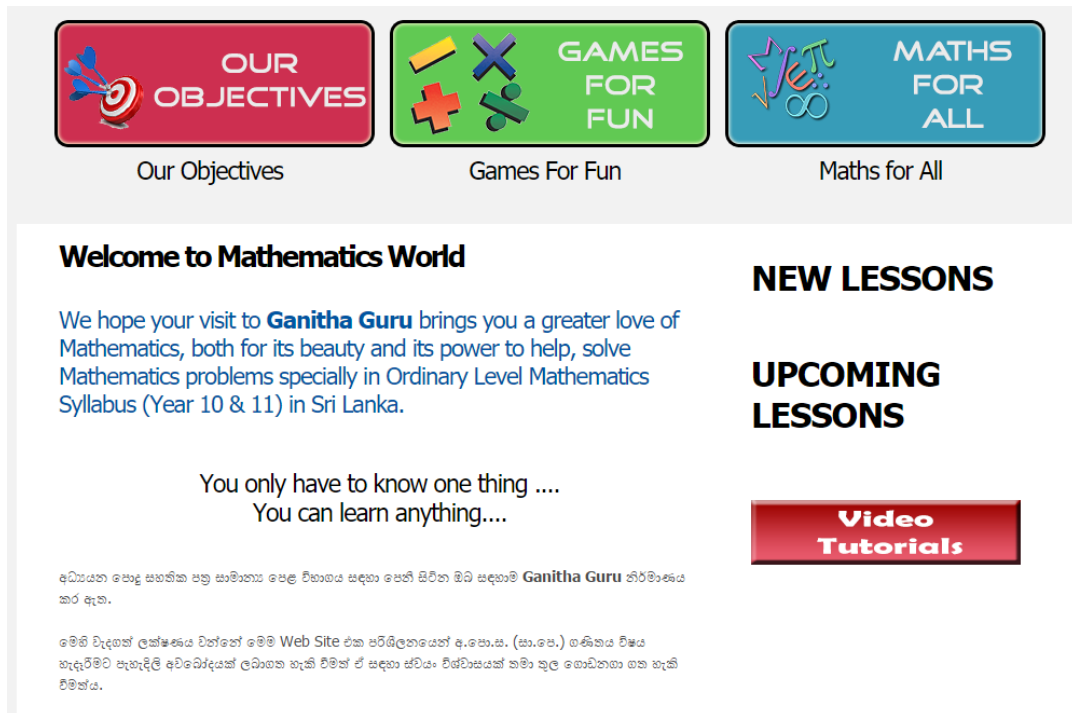


Figure 7: Home Page of the Website (Second Part)

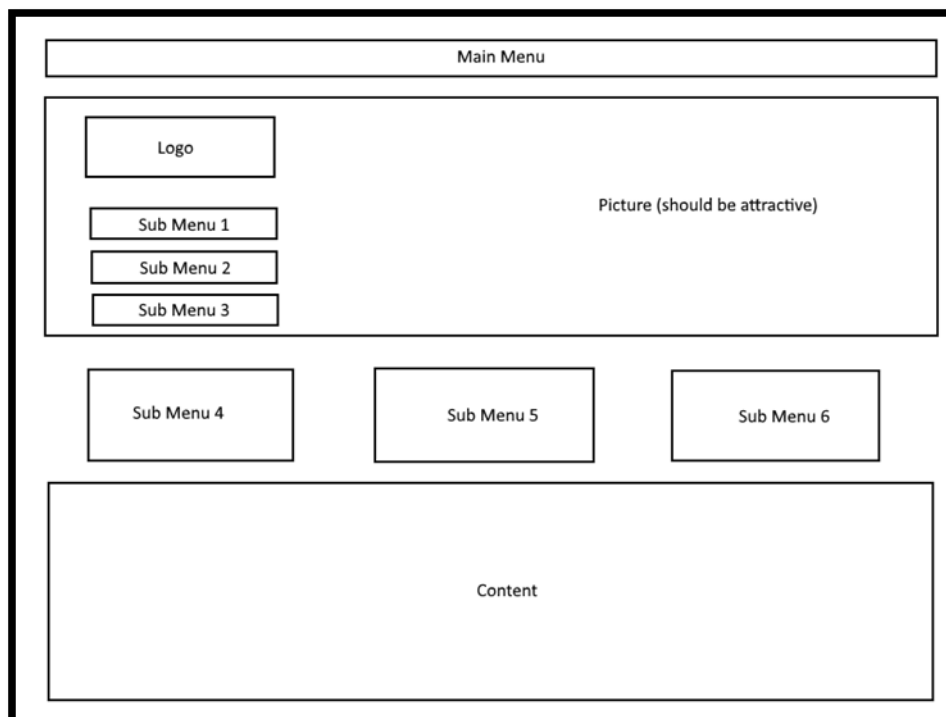


Figure 8: Storyboard of the Home Page

Name of the Main Menu Items and Sub Menus were decided according to the user requirements and specially, syllabus of the year 10 & year 11 Mathematics. Storyboards for other pages of the website will be attached as appendices (APPENDICES C).

Design of the Administrator Panel of Website

There will be some activities to do as an administrator of the website. Therefore following storyboard (Figure 9) was design to create Administrator Panel.

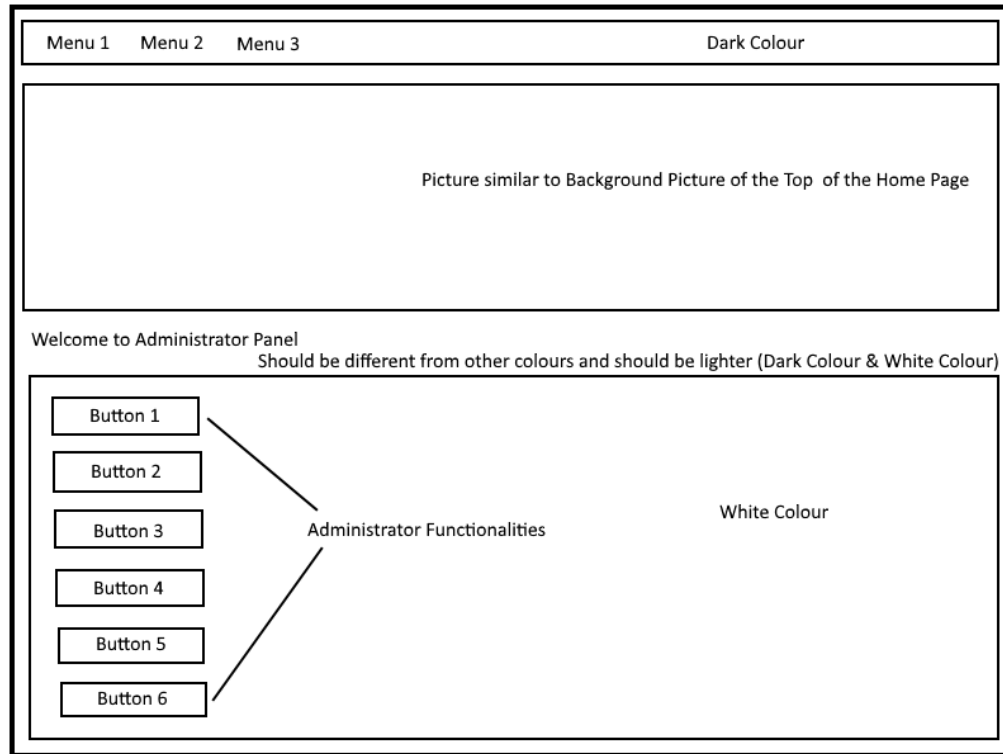


Figure 9: Storyboard of the Administrator Panel

Administrator will be able to Edit User details like add/delete and edit the details of the user as well administrator details. Only Administrator can edit the user details, because user details will be store in a database. There will be a page to show the exam papers in the website, therefore Administrator panel will have a place to upload the exam papers and delete the exam papers. Uploaded Exam Papers will be store in a folder. Finally there will be place to update/edit the details of New Lessons and Upcoming Lessons to show in marquee. Menu 1, 2 and 3 will be main functionalities of the Administrator responsibilities.

3.10. Design of the Educational Videos

Nowadays, the education scenario is in evolution and continuous change, and more and more people are turning to the Internet as a primary source of learning and knowledge. This new situation creates a huge opportunity for education. Any teacher with a normal computer can produce and publish quality videos that can reach a broader audience. Besides, online videos are a perfect way of reaching students “in their bedrooms”. Educational videos are an invaluable tool, because it is much easier to grasp concepts when students can see them. Educational videos can add a huge value to the learning process. Besides, the ability to pause or rewind a video gives the viewer the power to learn at their own pace, something a traditional classroom cannot offer.

For creating Educational Videos (Figure 10), Graphic tablet with pen, Headphone with Microphone and a Screen Recording Software were used. According to the Mathematics syllabus in year 10 & 11, content of the video was created. If the video has long duration, it couldn't get more attention. Therefore, duration of the video was reduced and only important content of the lessons was added and animated logo will display beginning of the video to get the attention of the users. Videos will be uploaded to YouTube and Embed with the Website.



[CheckOut this video for questions](#)



Figure 10: View of an Educational Video

3.11. Design of the Animations

In this website there will be different kind of user interactive animations. Every lesson which will be created for year 10 & 11, have user interactive animation. For Mathematics Questions area, there will be user interactive questions. Following storyboard (Figure 11) was used to create a user interactive animation for All Lesson Questions Part I (Figure 14 - One of the animations created for user to write the correct answer).

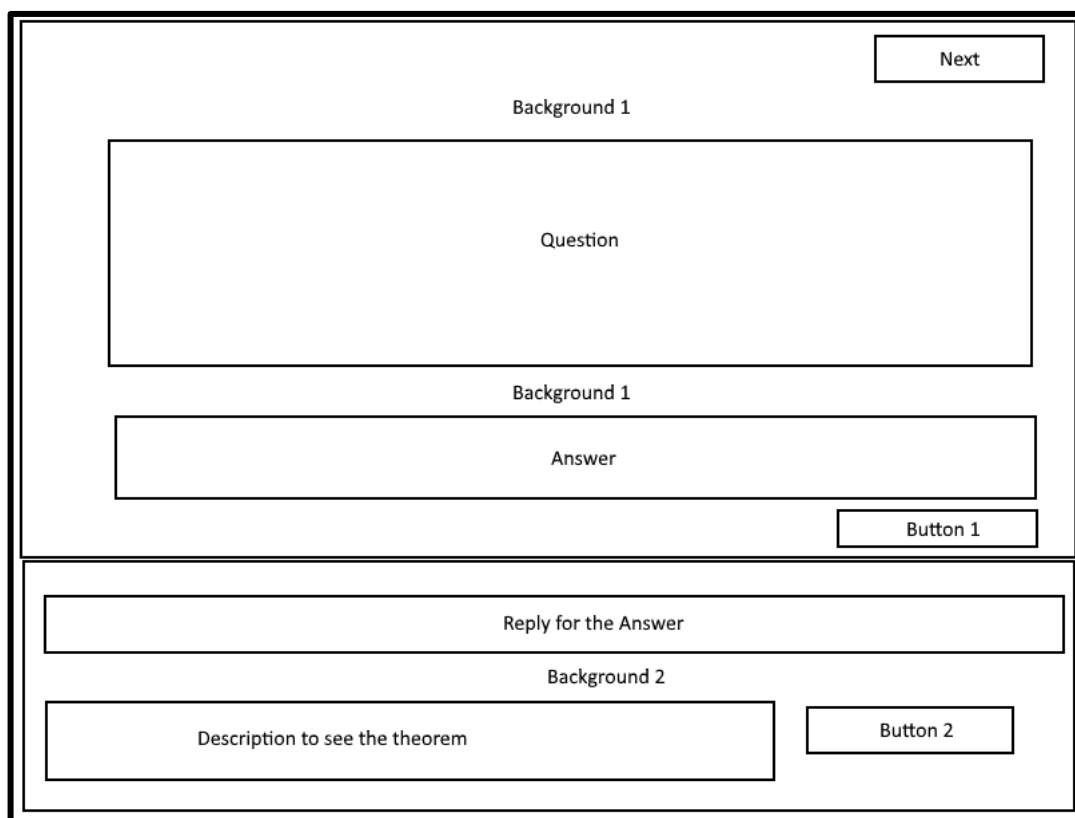


Figure 11: Storyboard of the All Lesson Questions Part 1 – Stage I

Above mentioned items in the storyboard (Figure 11) will have following functionalities and display the question related to mathematics syllabus in year 10 or year11 in question area.

- Next – next is a button to go to the next question.
- Background 1 – should be attractive background with a light colour.
- Question – Mathematics question will be display here.
- Answer – User will be able to write the answer in the given box.
- Button 1 – Button for check the answer and user can also press “Enter” button to check the answer.
- Reply of the answer – after user wrote the answer and check the correctness of the answer it will display a message about the answer whether it was correct or wrong.

- Background 2 – should be attractive background with dark colour.
- Description to see the theorem
- Button 2 – When the button was clicked user will be able to see the theorem relevant to the question.

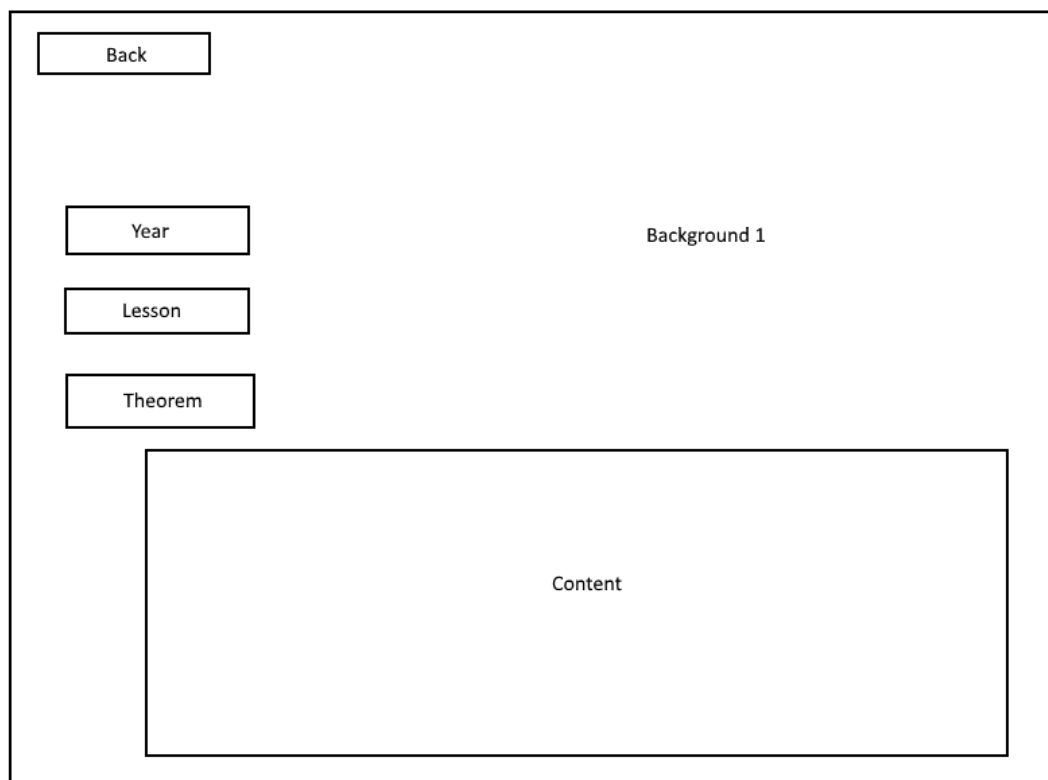


Figure 12: Storyboard for the All Lesson Question Part I – Stage II

Additionally in other questions (from 2nd question onwards) there will be a button in upper left hand corner to go to previous question.

When the user was clicked Button 2, theorem related to the question will display. According to the above storyboard (Figure 12), “All Lesson Question Part I” to display theorem was created (Figure 15).

Above mentioned storyboard (Figure 12) will have following content and functionalities.

- Back – Button for go to the question again
- Year – Year of the lesson (Year 10 or Year 11)
- Lesson – Name of the Lesson
- Theorem and Content – Theorem & Answer related to the question.
- Background – Storyboard of the background should be similar to Figure 11.

Other storyboards related to animations were attached as appendices (APPENDICES D).

3.12. Summary

In this Chapter we discussed mainly about the Analyse and Design of the Project. Relevant to the analyse part Requirement Gathering, Functional and Non Functional requirements were discussed in this chapter. In design part, Design Decisions, Sitemap, Design of the website, Design of the animations were describes.

CHAPTER 4

IMPLEMENTATION

4.1. Introduction

In this chapter, we have discussed about the implementation process. After doing all the analysing which is mention in CHAPTER 3, HTML, CSS & PHP for Web development and for the implementation of the content of the website, Adobe Flash, Adobe Photoshop, Adobe After Effects, Adobe Premier, etc. were used.

Content are what people come to see in the website. This can include text, images, and animations. As for the Multimedia rich website, lot of user interactive animations, pictures & videos were used in the website.

For the implementation process of the website, following factors were used.

- **Coding Languages**
HTML, CSS for frontend development & PHP for backend development of the website were used. Due to the requirement of the Database, PHP were used to connect with the database.
- **Programming Tool**
NetBeans IDE was used as the programming tool of this project.
- **Language for content of the Website**
In this website, mainly focus for the local students in Sri Lanka. Therefore, as the main language Sinhala and English as the second language was used.
- **Software for content creation of the website**
In this website, there are several user interactive Animations, Videos, Pictures, etc. Therefore the development of those multimedia content, Adobe Flash, Adobe After Effects, Adobe Premiere, etc. were used.
- **Hardware for Implementation**
For Videos creation Graphic Tablet and Head Phone were used. All of the development was done by using a Core i5 Laptop Computer.

4.2. Implementation of the Website

As for the storyboards (Figure 8, Figure 28, Figure 30), created in the designing part GanithaGuru website was developed. Using HTML and CSS frontend was developed and using PHP backend was developed. NetBeans IDE was selected as a programming tool. WAMP Server was used as web development environment. Details of the mentioned technologies was describes below.

- HTML

Hyper Text Mark-up Language (HTML) [9] is the standard mark-up language for creating web pages and web applications. All the implementation of the web pages was done by using HTML.

- CSS

Cascading Style Sheets (CSS) [10] is a style sheet language used for describing the presentation of a document written in a mark-up language. CSS was used to create webpages attractively.

- PHP

PHP [11] is a server-side scripting language designed primarily for web development but also used as a general-purpose programming language. In this web site have a database to store the details of users, Administrators, New Lessons & Upcoming Lessons. To connect with the database, PHP was used.

- NetBeans IDE

The NetBeans IDE [12] is primarily intended for development in Java, but also supports other languages, in particular PHP, C/C++ and HTML5. All the coding was done by using the NetBeans IDE.

- WAMP Server

WampServer [13] is a Windows web development environment. It allows you to create web applications with Apache2, PHP and a MySQL database. This was used as a local server and created the database using MySQL.

Screenshots of the few pages of the website is attached as appendices (APPENDICES C).

4.3. Used Software for Animation & Picture Creation

- Used software for Creating Animations & Pictures
 - For Flash Animations, I used Adobe Flash Professional CS6 software.
 - For GIF Animations & Pictures, I used Adobe Photoshop CS6 software (for creating pictures) & PhotoScape (free Software – for create GIF Animations).

Adobe Flash Professional CS6 Software [14]

Adobe Flash Professional CS6 is an authoring tool that you can use to create games, applications, and other content that responds to user interaction (Figure 13). Flash projects can include simple animations, video content, complex user interfaces, applications, and everything in between. In general, individual projects created with Flash Professional are called applications (or SWF applications), even though they might only contain basic animation. You can make media-rich applications by including pictures, sound, video, and special effects.

The SWF format is extremely well suited for delivery over the web because SWF files are very small and take little time to download. Flash projects often include extensive use of vector graphics. Vector graphics require significantly less memory and storage space than bitmap graphics because they are represented by mathematical formulas instead of large data sets. Using bitmap graphics in Flash projects results in larger file sizes because each individual pixel in the image requires a separate piece of data to represent it. Additionally, Flash allows you to select graphic elements and convert them to symbols making them easier to reuse and further improving performance when SWF files are viewed online.

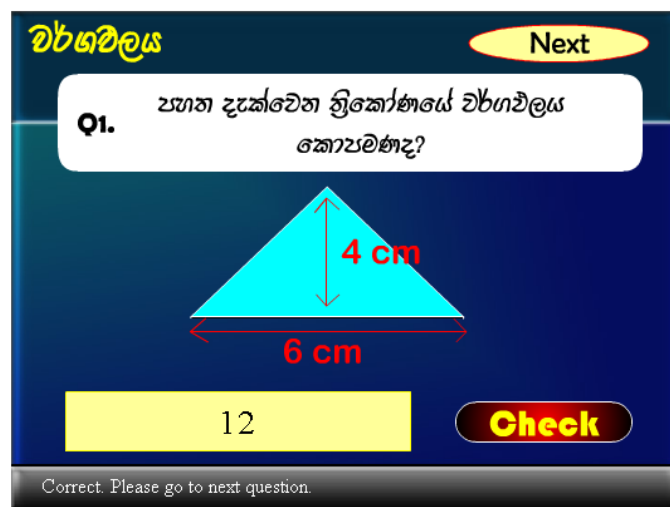


Figure 13: Flash Based Questions to Answer

Adobe Photoshop CS6 Software [15]

Adobe Photoshop CS6 brought a suite of tools for video editing. Colour and exposure adjustments, as well as layers, are among a few things that are featured in this editor. Upon completion of editing, the user is presented with a handful of options of exporting into a few popular formats.

CS6 brings the "straighten" tool to Photoshop, where a user simply draws a line anywhere on an image, and the canvas will reorient itself so that the line drawn becomes horizontal, and adjusts the media accordingly. This was created with the intention that users will draw a line parallel to a plane in the image, and reorient the image to that plane to more easily achieve certain perspectives.

CS6 allows background saving, which means that while another document is compiling and archiving itself, it is possible to simultaneously edit an image. CS6 also features a customizable auto-save feature, preventing any work from being lost.

Adobe Photoshop have used for create background images for Flash Animations and images for GIF Animations in this project. Also Adobe Photoshop have used for create buttons for the website & images for content of the Mathematics Lessons.

PhotoScape Software [16]

PhotoScape is free software and it can use for following functionalities.

- Viewer: View photos in your folder, create a slideshow.
- Editor: resizing, brightness and colour adjustment, white balance, backlight correction, frames, balloons, mosaic mode, adding text, drawing pictures, cropping, filters, red eye removal, blooming, paint brush, clone stamp, effect brush.
- Page: Merge multiple photos on the page frame to create one final photo
- Combine: Attach multiple photos vertically or horizontally to create one final photo.
- Animated GIF: Use multiple photos to create a final animated photo.
- Splitter: Slice a photo into several pieces.
- Screen Capture: Capture your screenshot and save it.

4.4. Implemented Animations

Different kind of animations were created and embedded with the web pages to give a better user interaction with this website. These animations were created according to the local syllabus (Sri Lanka) in mathematics. User interaction is very important for a good website; therefore I have created several animations with user interaction.

Following animation (Figure 14) was included questions in different kind of Mathematics lessons in local syllabus to write the correct answer in the given place. If the answer is correct, it will indicate answer is correct. Otherwise it will indicate answer is wrong. Additionally, user can lookout the theorem and the correct method to do the question. Following animation was created using the storyboard of Figure 11.

All Lesson Questions Part I

Following question are based on the past paper questions

Question 1 Next

ඊළඟේ දැක්වෙන තොරතුරු අනුව හොඳින්ම
පදයේ අගය සොයන්න

A

B 45° **y** **C**

Answer :

Check

ඉහත ප්‍රශ්නයට අදාළ සිද්ධාන්තය බලවීම
සඳහා Theorem

Figure 14: Animation for User Interaction (All Lesson Question Part I)

Final Interface was created according to the storyboard of Figure 12. View of the theorem interface (Figure 15) for the “All Lessons Questions Part I” is as follows.

All Lesson Questions Part I

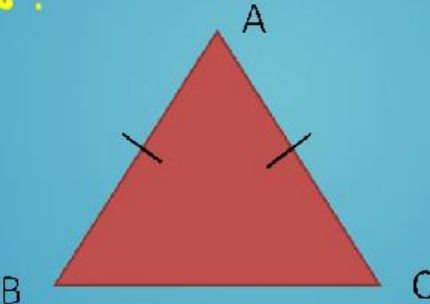
Following question are based on the past paper questions

Back

වකු : 10 වකු

පාඩම : ත්‍රිකෝණ 11

කද්ධාන්තය :



ප්‍රවේශය : ත්‍රිකෝණයක පාද 2 ක් සමාන නම් එම පාද වලට
සමමුඛ කෝණද සමාන වේ

එනම් ,

AB = AC බැවින්

^
ABC = ACB

Figure 15: View of the Theorem in All Lesson Question Part I

Details of other implemented animations were attached as appendices (APPENDICES D).

4.5. Used Software & Hardware for Video Creation

Hardware

- Graphic Tablet [17]

A graphics tablet (also known as a digitizer, drawing tablet, digital drawing tablet, pen tablet, or digital art board) is a computer input device that enables a user to hand-draw images, animations and graphics, with a special pen-like stylus, similar to the way a person draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the tablet surface. Capturing data in this way, by tracing or entering the corners of linear poly-lines or shapes, is called digitizing.

The device consists of a flat surface upon which the user may "draw" or trace an image using the attached stylus, a pen-like drawing apparatus. The image is displayed on the computer monitor, though some graphics tablets now also incorporate an LCD screen for a more realistic or natural experience and usability.

Users of this website will be having different kind of learning abilities. Some of the users like to watch video tutorials, some users may like to read and some users may like to have activities to do. In this website, Videos were included for the users who have to watch and learn. Therefore graphic tablet was used to capture the handwritten content.

- Headset [18]

A headset combines a headphone with a microphone. Headsets are made with either a single-earpiece (mono) or a double-earpiece (mono to both ears or stereo). Headsets provide the equivalent functionality of a telephone handset but with hands-free operation.

Headset was used for record the voice while the graphic tablet was used to demonstrate Mathematics Lessons.

Software

- Screen Recording Software

Screen Recorder called “Icecream Screen Recorder” was used for Screen Recording when the Graphic Tablet was using. It is easy to handle.

Icecream Screen Recorder, a tool that enables us to capture any area of our screen either as a screenshot or a video file. The intuitive and easy to use software offers a complete suite of tools and options for professional screen capture with audio. With this screen recording software you can record webinars, games and Skype videos in HD, and much more in a quick and hassle freeway.

- Adobe Premiere Pro CS6 Software

For finalized the video (editing), Adobe Premiere Pro CS6 software was used.

Adobe Premiere Pro is a timeline based video editing software application. It is part of the Adobe Creative Cloud, which includes video editing, graphic design, and web development programs.

- Open-Sankoré

Open-Sankoré is a multiplatform, open-source program that is compatible with every type of interactive hardware. It is also translated into many different languages. Its range of tools is adapted to all users from beginners to experts. We can use this software with a graphic tablet.

In this project, Open-Sankoré was used as a whiteboard to teach mathematics with the graphic tablet.

- Adobe After Effects CS6

For the video created to show objectives of the website and animated the logo, adobe after effects was used.

4.6. Summary

In this Chapter we discussed mainly about the implementation of the project. Implementation of the website, used software for create animations & videos were described and also the hardware used for create videos were described. Storyboards of a user interactive animation and screenshot of that animation, which was created using the mentioned software, were included in to this chapter.

CHAPTER 5

EVALUATION AND TESTING

5.1. Introduction

Evaluation and Testing of a multimedia title is essential so that the final application adheres to international quality standards and is not infested with bugs, technical snags, inaccurate information or simple grammatical or typographical errors. The process of evaluating (testing) and revising a multimedia application project is dynamic and constant.

Testing is a method of finding out whether a solution is working as it should, e.g. giving correct output, working fast enough, handling expected loads, responding to user inputs properly. Testing takes place during development as the solution is being built. Testing is carried out by the solution's developers.

Evaluation is a process of judging how well the system's original intended goals have been achieved. Evaluation happens after the solution has been developed, and its users have used it long enough to become familiar with it and can use it effectively. Evaluation usually is carried out by the solution's owners and users.

First stage of this chapter, details of used Test Plan, Test Cases and Test results were described. After that user evaluation method used for this project was described.

5.2. Test Plan

Making a Test Plan is the most important task of Test Management Process. Therefore test plan for this project was created. Following steps (Figure 16) was contained in the test plan created for the system.

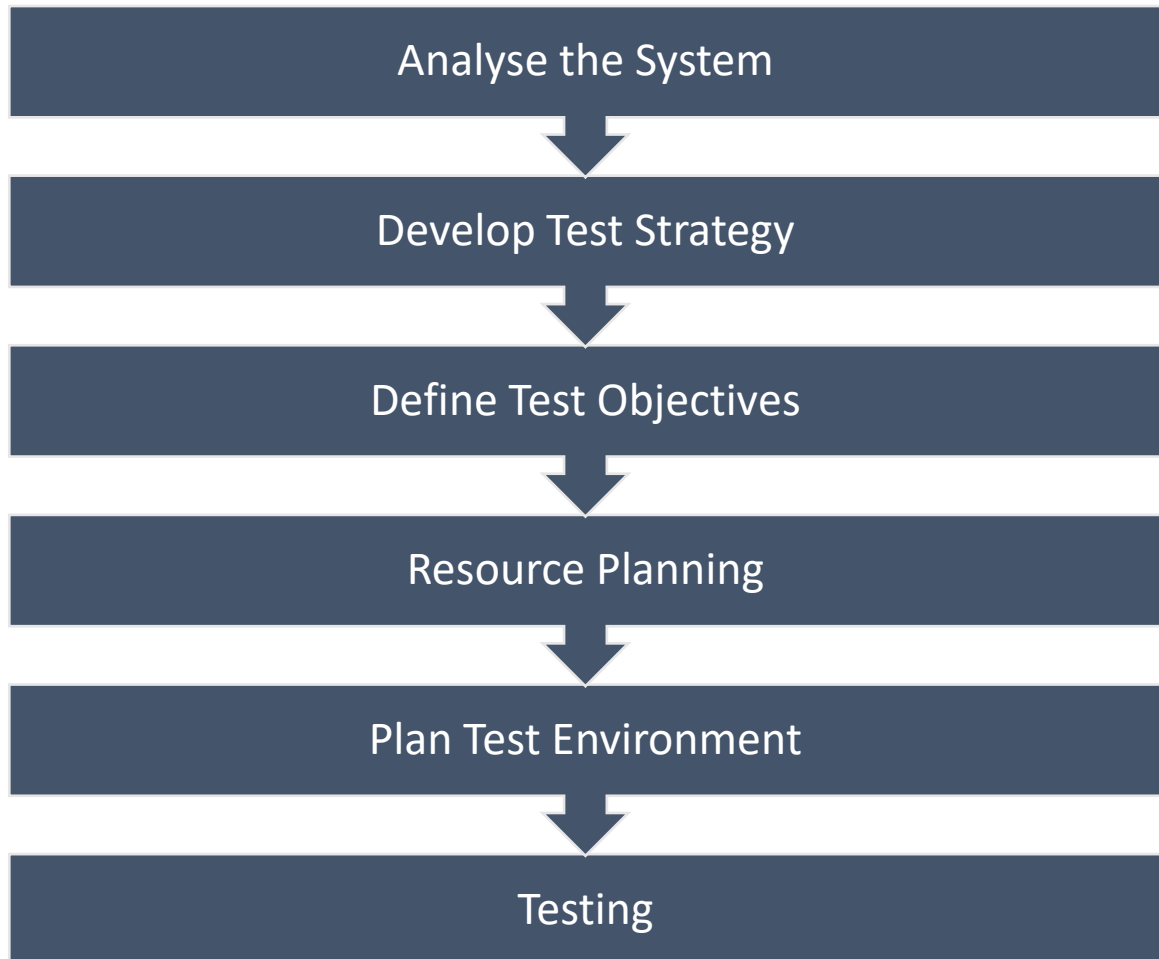


Figure 16: Test Plan

Details of the above steps (Figure 16) are as follows.

1. Analyse the product

Before start the testing, we had to know, the purpose of the system, about the users and final expectation from the system. In first three chapters we can get clear idea about the system.

2. Develop Test Strategy

Test Strategy is a critical step in making a Test Plan. Following steps (Figure 17) were considered for the development of the Test Strategy.

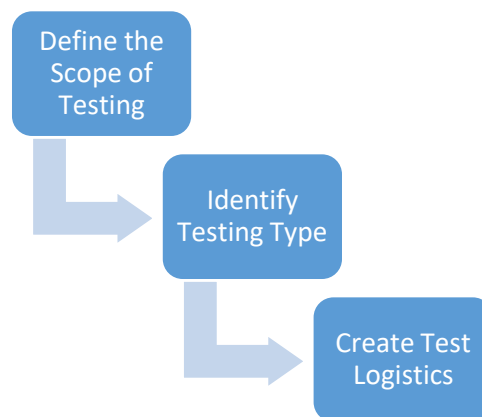


Figure 17: Steps for development of the Test Strategy

Details of the above mentioned steps (Figure 17) are as follows.

- Define the Scope

Under this we had to categorize the components of the system to be tested (hardware, software, etc.).

- Identify the Testing Type

A Testing Type is a standard test procedure that gives an expected test outcome. Each testing type is formulated to identify a specific type of product bugs. Therefore, in this step Test Type was chosen according to the scope of the test strategy.

- Create Test Logistics

In here, testing team was chosen.

3. Define Test Objectives

Test Objective is the overall goal and achievement of the test execution. The objective of the testing is finding as many software defects as possible to ensure that the system under test is bug free before release. Here we considered all the system features and the target or the goal of the test based on above features.

4. Resources Planning

For testing, following hardware and software were used. This Project only tested for local host. But after hosted in the Internet, this website can be tested using this test plan (5.2).

No.	Name of the Resource	Description
1	Computer	Any Computer with Internet facility
2	Server	WAMP or XAMPP Server
3	Web Browser	Any Web Browser (Firefox, Chrome, etc.), Should be work flash animation in the browser, should be latest web browser
4	Speaker	To hear sounds

Table 4: Resources used for Testing

5. Plan Test Environment

A testing environment is a setup of software and hardware on which the testing team is going to execute test cases. Therefore, test team's personal computers with the relevant software were used for testing.

6. Testing

According to the identified test types (5.3), the system was tested using test cases mentioned in 5.4.

5.3. Testing Types

Software Testing Type is a classification of different testing activities into categories, each having, a defined test objective, test strategy, and test deliverables. The goal of having a testing type is to validate the application under test for the defined Test Objective. Following Testing Types were used this project.

- **Functionality Testing**

Functionality Testing is used for test, all the links in web pages, database connection, forms used for submitting or getting information from user in the web pages. Under functionality testing, links, forms were tested.

- **Usability Testing**

With respect to the Users, easy navigation and usability of the interactive animations was tested.

- **Compatibility Testing**

Mainly Browser compatibility was tested here.

- **Performance Testing**

Mainly loading time of a web page, user interactive animations & videos were tested.

5.4. Test Cases and Results

Test cases and the obtained results were used for above mentioned testing types (5.3) are as follows.

Test Case No	01	
Test Case Type	Functionality Testing	
Test Case Name	Register to the Website	
Test Description	User has to fill specific information to register	
Test Data	Expected Output	Result
Input correct, User name, Email address and the Password	Automatically user should directed to Sign in Page	Pass
Input Wrong Email address (not using @ sign)	Error Message will be display	Pass

Table 5: Test Case 01

Test Case No	02	
Test Case Type	Functionality Testing	
Test Case Name	Sign in to the Website	
Test Description	Before the sign in, user has to register to the website	
Test Data	Expected Output	Result
Input correct, User Name & Password	Automatically user should directed to Home page	Pass
Input Wrong User Name & Password	Error Message will be display	Pass

Table 6: Test Case 02

Test Case No	03	
Test Case Type	Functionality Testing	
Test Case Name	Links of the all Web Pages	
Test Description	Ensure that upon clicking a link, the user is directed to the required or intended page/part of the website.	
Test Data	Expected Output	Result
Click a particular link	Automatically user directed to required page	Pass

Table 7: Test Case 03

All other test cases are attached as appendices (APPENDICES E).

5.5. User Evaluation

Most important evaluation method used for this project is the User Evaluation. User feedback is very important for a better outcome. Therefore, user evaluation method was used for this project to get an idea about the final outcome. There were two evaluation teams selected, one from colleagues and other one from students. Questionnaire was used for get feedbacks.

Used questionnaire for User Evaluation

GANITHAGURU WEBSITE (For Year 10 & 11 Students to learn Mathematics)	
Give your feedback for one by one (marks: 5,4,3,2,1) : 5 – Very Good, 1 – Very Poor	
1. Animations (Overall Marks)	
Are the Animations in the right place?	
Are the animations having good color combinations?	
Are the Animations appropriate to the intended audience?	
2. Videos (Overall Marks)	
Are the videos in the right place?	
Do all the Videos have appropriate name?	
Are the Videos appropriate to the intended audience?	
3. Navigation and Links (Overall Marks)	
Does the site navigation appear in the correct place?	
Is the page easy to navigate?	
Does the page contain a link back to the main homepage?	
Can you tab from link to link in the correct order?	
4. Text (Overall Marks)	
Is everything spelled correctly?	
Is the language used appropriate to the intended audience?	
Does the text appear in the correct size and font as intended?	
5. Layout (Overall Marks)	
Does the page appear on the screen as intended?	
Is the layout consistent with other pages?	
6. Other (Overall Marks)	
If the page contains a picture, does it in the right place?	
If the page contains sound or video, does it work as intended?	
Does this page meet the project objectives?	
Does the overall Graphics suitable for the audience?	
Time to Load an Educational Video?	

Any further comments about the Website and the Content?

Handwritten mark

User Evaluation Team 1

Colleagues were used for User Evaluation Team 1. Six (06) Colleagues were participated for this evaluation. Table 8 shows the user feedback (marks) given to the website by colleagues.

Category	User Feedback (marks out of 5)						Average Marks	Expected Result
	U 1	U 2	U 3	U 4	U 5	U 6		
Animations	4	3	4	3	5	5	4	4
Videos	2	3	2	4	3	3	2.8	3
Navigation and Links	3	2	4	4	3	4	3.3	4
Text	2	3	4	3	4	5	3.5	4
Layout	2	3	2	3	2	3	2.5	3
Other	2	2	3	2	3	3	2.5	3

Table 8: User feedback (User Evaluation Team 1)

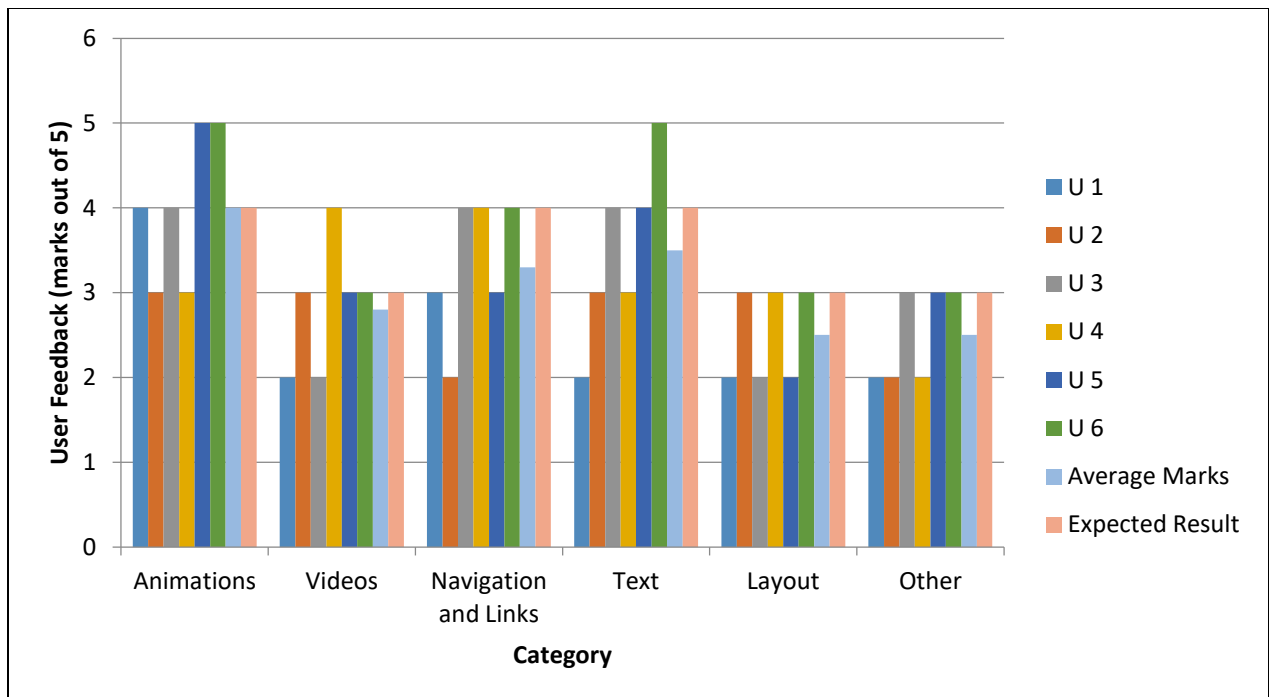


Figure 18: User Evaluation Team 1 Feedback

User Evaluation Team 2

Following results was obtained from students who have using computer and internet for their education. Ten (10) Students who are studying in year 10 & year 11 were participated as User Evaluation Team 2. Table 9 shows the students feedback for the website and the content.

Category	Student Feedback (marks out of 5)										Average Marks	Expected Result
	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10		
Animations	4	3	5	4	5	3	2	1	4	3	3.4	4
Videos	3	2	4	5	1	1	4	5	3	2	3	3
Navigation and Links	4	4	4	2	5	5	3	3	4	3	3.7	4
Text	4	3	4	3	5	5	4	3	3	4	3.8	4
Layout	3	4	5	-	-	4	3	3	5	4	3.1	3
Other	-	-	5	4	3	4	5	4	3	2	3	4

Table 9: Student feedback (User Evaluation Team 2)

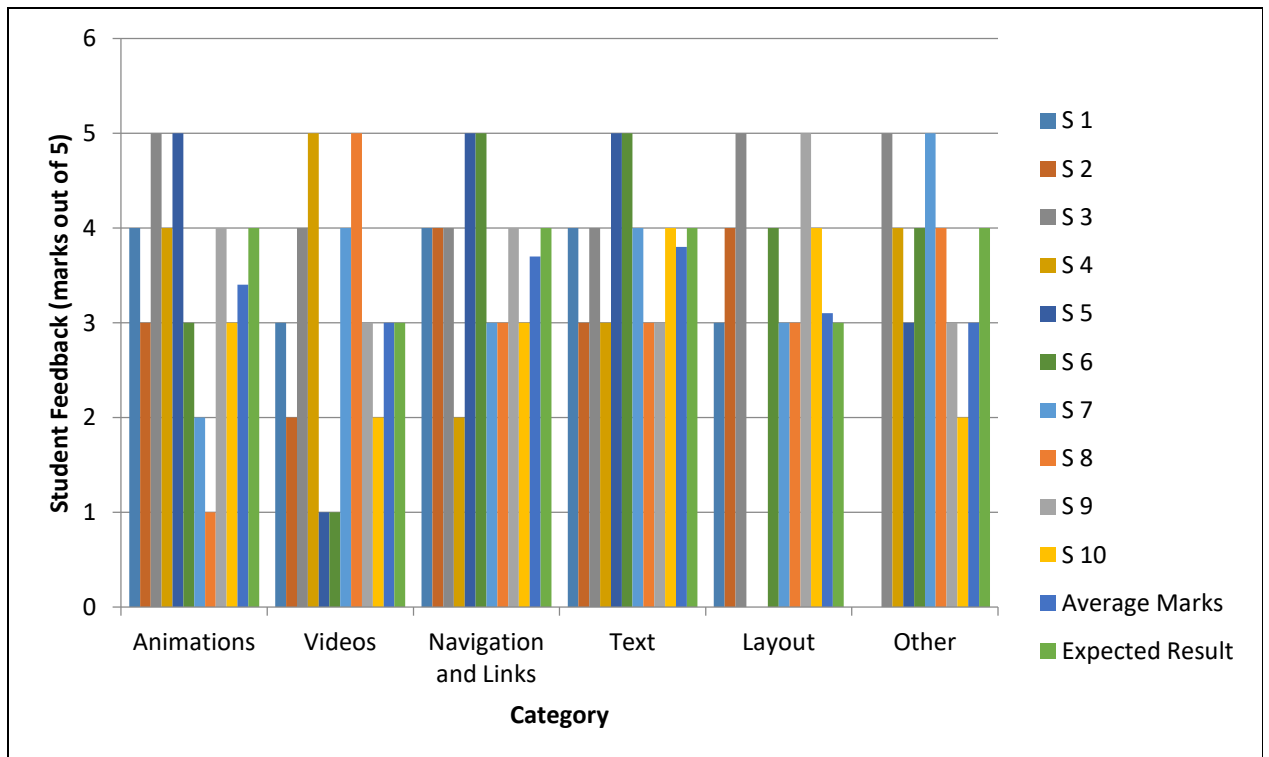


Figure 19: User Evaluation Team 2 Feedback

5.6. Summary

With the results obtained from the testing & user evaluation, clearly see some areas of the website should be developed furthermore. For an example videos should be implement furthermore and should be attractive. But average marks were nearly achieved the expected result. Therefore, this website can be ready to deployment and will be implemented this educational website with respected to the results obtained from the user evaluation in future.

CHAPTER 6

CONCLUSIONS AND FUTURE WORKS

6.1. Achievement of Objective and Goals

The main objective of this website is to give better knowledge for O/L Mathematics. Therefore several activities with the lessons were created. After analysing of the user feedback, it is clear this system is achieved its objectives.

This website will cover all the lessons relevant to year 10 & 11 mathematics. If the user doesn't understand basic theories in mathematics lesson may be needed to do some questions in particular lesson, user can request the lesson/theory by using the Forum. Therefore, this website will be covering every corner of the Mathematics syllabus in Sri Lanka. This website was achieved its goal to increase mathematics knowledge among the students and using this website user will be able to achieved their goals to improve the knowledge for mathematics.

6.2. Lessons Learnt and Conclusions

From the beginning of this project, it was great source of learning and experience to me. Because broader knowledge about web development and also the Adobe Flash, Adobe Photoshop, etc. was essential to create this system. Therefore, I had to learned web development and above mentioned software

However, this website was implemented with having the new knowledge every day. I had to watch Video Tutorials, go through some lessons in the internet, etc. to get knowledge about coding, creating animations, etc. Therefore this knowledge is great asset to me for create similar kind of systems in future. With the limited time scheduled, had to manage everything and the content of the website had to reduce without losing the quality of final outcome. Also from this project I got a skill of overcoming stress during the project which can apply to whole life.

As mentioned beginning of this dissertation, there are only few websites available in Sri Lanka to give mathematics knowledge specially for year 10 & year 11 students. Therefore, this website will be very important to the students who have studying in year 10 & 11.

With the result of the Testing & Evaluation, we can say there are some areas need to improve and some areas are quite good. But average values were nearly similar to expected results. Therefore we can say this application is ready to deployment and it will be an asset to all of the students who want the mathematics knowledge in Sri Lanka. Because, this website will be have the lessons according to the local mathematics syllabus in Sri Lanka.

6.3. Future Works

Beginning of the project, main objective is to give mathematics knowledge for the year 10 & year 11 students. But in future this website will be having mathematics lessons all of the students who want to have knowledge about mathematics.

As for the multimedia content, in future this website will have more user interactive animations with questions to answer, attractive educational videos for Mathematics lessons and also the website will have more beautiful environment and more functionality like a page to find all the necessary equations in local mathematics syllabus in Sri Lanka. In future there will be a place to upload animations (User created) to the registered users.

There will be another important user in future relevant to this website. That user will be a Teacher and will be a place to upload lessons created by them.

REFERENCES

- [1] “Department of Examination Sri Lanka,” 2013. [Online]. Available: <http://www.doenets.lk/exam/docs/ebooks/evaluation-report-2013-ol/sinhala/32S.pdf> .
- [2] V. Deved#ic, “Semantic Web and Education,” 2006. [Online]. Available: <http://www.springer.com/in/book/9780387354163>.
- [3] “The Benefits of Using Educational Video in The Classroom,” [Online]. Available: <http://www.zaneeducation.com/educational-video/education-and-video.php>.
- [4] [Online]. Available: <http://www.cgpundit.com/animation-in-education/>.
- [5] “Math is fun,” [Online]. Available: <http://www.mathsisfun.com/>.
- [6] “BBC Bite Size Website,” [Online]. Available: <http://www.bbc.co.uk/education>.
- [7] “BBC Bite Size Maths (pre-2015),” [Online]. Available: <http://www.bbc.co.uk/education/subjects/z6pfb9q>.
- [8] S. Hazari, “Feature Requirements in Educational, Web Sites: A Q-Sort Analysis,” Carrollton, GA, 2006.
- [9] “What is HTML?,” August 2012. [Online]. Available: <http://www.yourhtmlsource.com/starthere/whatishtml.html>.
- [10] “What is CSS?,” [Online]. Available: https://www.tutorialspoint.com/css/what_is_css.htm.
- [11] “What is PHP?,” [Online]. Available: <http://php.net/manual/en/intro-whatish.php>.
- [12] “NetBeans IDE,” [Online]. Available: <https://netbeans.org/>.
- [13] “Installing and Testing Wampserver,” [Online]. Available: <http://www.homeandlearn.co.uk/php/php1p3.html>.
- [14] 07 May 2012. [Online]. Available: <http://www.adobe.com/devnet/flash/articles/create-first-flash-document.html>.
- [15] “Adobe Photoshop,” [Online]. Available: <http://www.adobe.com/products/photoshop.html>.
- [16] “PhotoScape,” [Online]. Available: <http://www.photoscape.org/ps/main/index.php>.
- [17] “Graphics tablet,” [Online]. Available: <https://www.computerhope.com/jargon/g/graptabl.htm>.
- [18] “Headset,” [Online]. Available: <https://www.computerhope.com/jargon/h/headset.htm>.

APPENDICES A

USER MANUAL

System Requirements

GaniathGuru Website is the best place to learn O/L Mathematics Lessons in Sri Lanka. Therefore following requirements are needed, before using the website.

- Computer
- Internet Connection
- Keyboard, Mouse, Speakers
- Web Browser with flash content support

Users

The website has following type of users and each type of user has different access level.

- Administrators
- Registered Users
- Unregistered Users

Administrator's Manual

After the sign in following administrator home page (Figure 20) will be displayed.

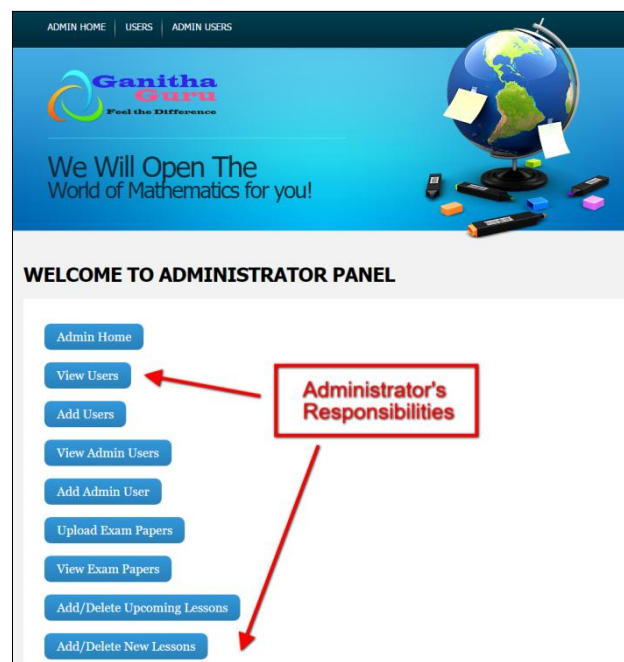


Figure 20: Administrator Home Page

Administrator will be able to add/edit user details from the view users' page, upload exam papers, and add/edit upcoming lessons & new lessons, etc.

- Add/Edit User details

After Administrator clicked the View Users buttons in the Home Page of the Administrator Panel, following page (Figure 21) will be displayed.

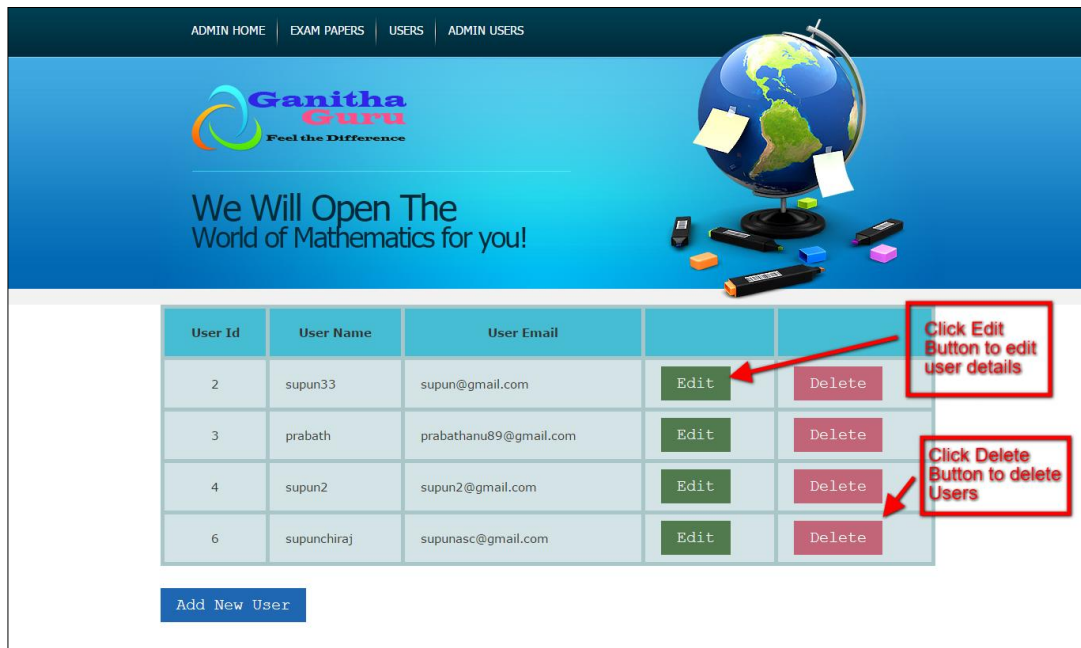


Figure 21: Add/Edit User Details Stage 1

After Edit Button Click, Administrator will be directed to following page (Figure 22) to edit user details.



Figure 22: Add/Edit User Details Stage 2

- Upload Exam Papers

Administrator can upload the Exam Papers using following page (Figure 23).

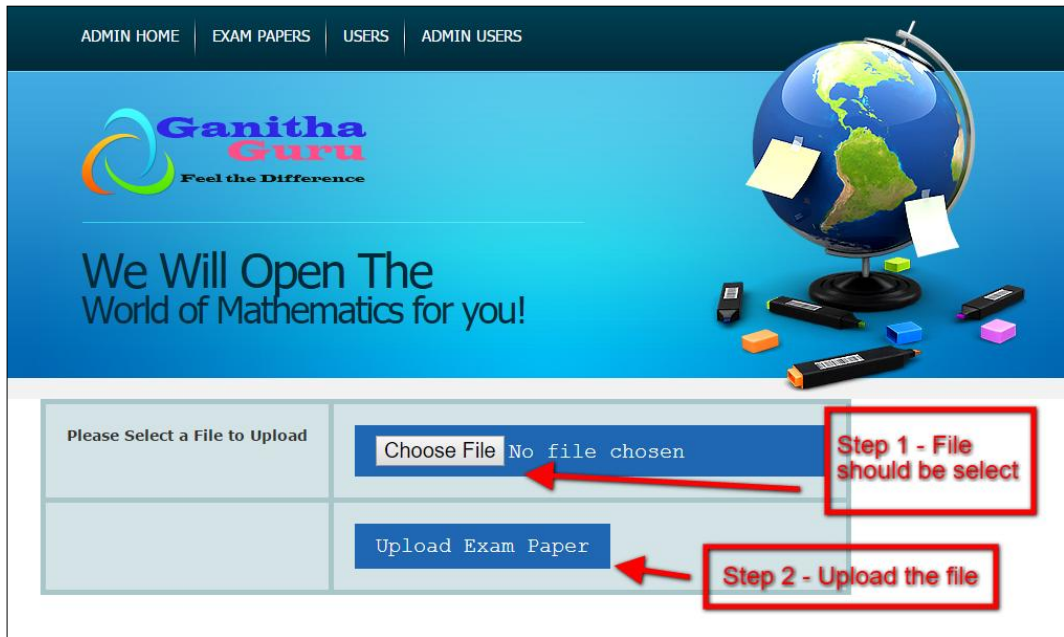


Figure 23: Exam Papers Upload Web Page

- Add/Delete Upcoming Lessons

Administrator will be able to add/delete Upcoming Lessons using following Web Page (Figure 24). After enter the name of an upcoming lesson, it will display in home page of the website under the Upcoming Lessons.

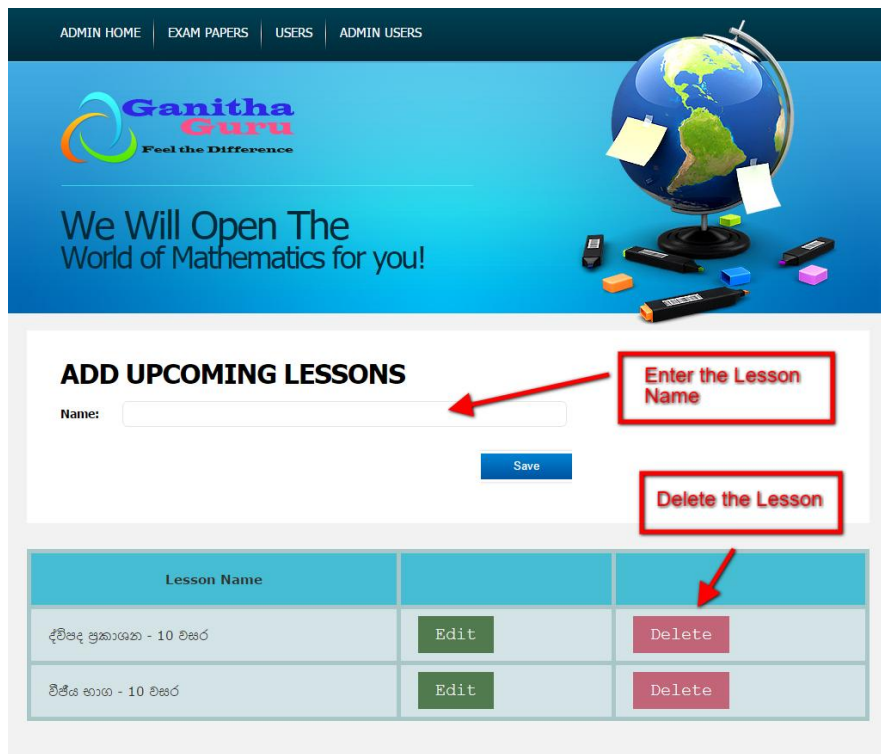


Figure 24: Add/Delete Upcoming Lessons

User's Manual

Only registered user can access games page and exam papers page.

- Sign in / Sign Up

Users can register to the website using following sign up form (Figure 25).

The image shows a registration form for Ganitha Guru. The form is white and set against a blue background. At the top left is the Ganitha Guru logo with the tagline "Feel the Difference". Below the logo, it says "Welcome to GANITHA GURU Registration". The form contains four input fields: "Username" (with a person icon), "Email" (with an envelope icon), "Password" (with a lock icon), and "Re-type password" (with a lock icon). Below these fields is a green button labeled "REGISTER NOW". At the bottom of the form, it says "Already have an account? [Login](#)". To the right of the form, there are two red-bordered boxes with red arrows pointing to the form. The top box says "User have to fill the specific details" and has arrows pointing to the Username, Email, Password, and Re-type password fields. The bottom box says "Register Button" and has an arrow pointing to the "REGISTER NOW" button.

Figure 25: Sign Up Form

After click Register Now Button, automatically user will redirected to sign in page (Figure 26).

The image shows a login form for Ganitha Guru. The form is white and set against a red background. At the top left is the Ganitha Guru logo with the tagline "Feel the Difference". Below the logo, it says "Welcome to GANITHA GURU Login". The form contains three input fields: "Email" (with a person icon), "Password" (with a lock icon), and a "Remember me" checkbox. Below these fields is a green button labeled "LOGIN". At the bottom of the form, it says "Register Now!". To the right of the form, there are three yellow-bordered boxes with yellow arrows pointing to the form. The top box says "User have to enter the email that used for registration" and has an arrow pointing to the Email field. The middle box says "User have to enter the Password that used for registration" and has an arrow pointing to the Password field. The bottom box says "Login Button" and has an arrow pointing to the "LOGIN" button.

Figure 26: Sign In Form

After sign in, User will be redirected to Home Page of the website. If non registered user clicked to go to game page or exam papers page, the home page will redirected to sign up page automatically.

- Navigation to Lessons Pages

Following diagram shows the navigation to lesson pages (Figure 27).

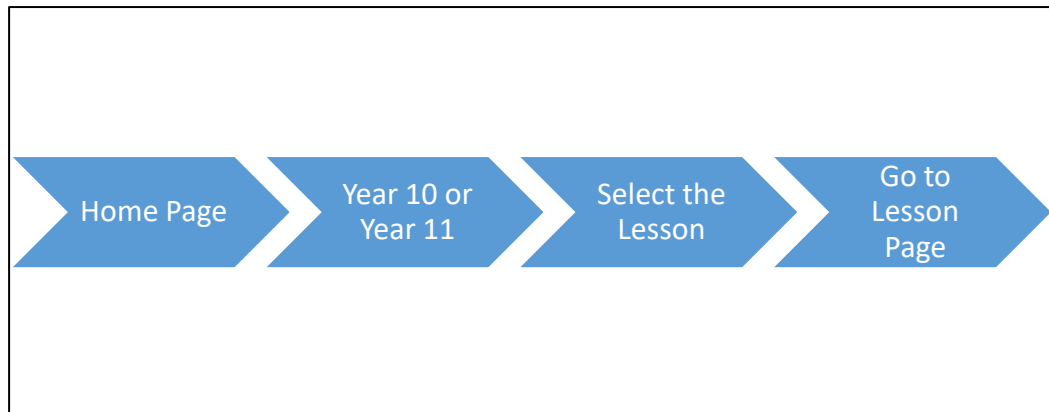


Figure 27: Navigation to Lesson Pages

APPENDICES B

QUESTIONNAIRE USED FOR STUDENTS

10 ශ්‍රේණිය සහ 11 ශ්‍රේණිය සඳහා ගණිතය

1. අධ්‍යාපනය ලබන ශ්‍රේණිය :

10 ශ්‍රේණිය	
11 ශ්‍රේණිය	

2. ස්ත්‍රී / පුරුෂ භාවය :

ස්ත්‍රී	
පුරුෂ	

3. ඔබගේ අධ්‍යාපන කටයුතු සඳහා **සතියකට** කොතරම් කාලයක් කැප කරන්නේද? (ප්‍රාසල් කාලයට අමතරව)

කාලය කැප නොකරයි	
පැය 2 කට අඩු	
පැය 2-7 අතර	
පැය 7-14 අතර	
පැය 14 කට වැඩි	

4. පහත සඳහන් වැකිය ගැන කුමක් සිතන්නේද ?

"පන්ති කාමරයක් තුළ අධ්‍යාපනය ලැබීම පමණක් මාගේ අධ්‍යාපන කටයුතු දියුණු කිරීමට උපකාරී වේ"

සම්පූර්ණයෙන්ම එකඟ වේ	
එකඟ වේ	
එකඟ වන්නේ නැත	
සම්පූර්ණයෙන්ම එකඟ නොවේ	

5. ඔබ පහත වැකිය ගැන කුමක් සිතන්නේද?

"මම ගණිතය විෂයට කැමතිය"

සම්පූර්ණයෙන්ම එකඟ වේ	
එකඟ වේ	
එකඟ වන්නේ නැත	
සම්පූර්ණයෙන්ම එකඟ නොවේ	

6. ඔබ පහත වැකිය ගැන කුමක් සිතන්නේද?

"මම ගණිතය ගැටළුවක් විසඳීමේදී එය විසඳිය හැකි බවට මට ආත්ම විශ්වාසයක් ඇත"

සම්පූර්ණයෙන්ම එකඟ වේ	
එකඟ වේ	
එකඟ වන්නේ නැත	
සම්පූර්ණයෙන්ම එකඟ නොවේ	

7. මම ගණිතය විෂය පහසුවෙන් ඉගෙන ගනී.

	ඔව්	මධ්‍යස්ථ	නැත
ගුරුවරයා උගන්වන විට			
පොත්පත් පරිශීලනය මගින්			
පරිගණකය භාවිතා කරන විට			
අනිත් ශිෂ්‍යන් සමඟ සාකච්චා කරන විට			
තමන් විසින්ම ගණිත ගැටළු විසඳීමට උත්සහ කිරීමෙන්			

8. ඔබ නිතර පරිගණකය භාවිතා කරනවාද?

ඔව්	
නැත	

9. ඔබ අන්තර්ජාලය අධ්‍යාපන කටයුතු සඳහා යොදා ගන්නේද?

ඔව්, පාසලේදී	
ඔව්, තම නිවසේදී	
ඔව්, පාසලේදී සහ නිවසේදී	
නැත	

10. අන්තර්ජාලය මගින් ඉගෙන ගැනීමට කැමති ගණිතය පාඩම් 3ක්, (පාඩම ලියා අදාළ වසර සඳහා X යොදන්න.

පාඩම	10 වසර	11 වසර

11. ඔබ ගණිතය පාඩමක් Web Site එකක් භාවිතයෙන් ඉගෙනගැනීමේදී, එහි අඩංගු විය යුතු අන්තර්ගතය පිලිබඳ ඔබගේ අදහස් දක්වන්න.

	ඔව්	මධ්‍යස්ථ	නැත
Animations භාවිතා කිරීම සුදුසු වේ			
Videos භාවිතා කිරීම සුදුසු වේ			
Pictures භාවිතා කිරීම සුදුසු වේ			
Sound භාවිතා කිරීම සුදුසු වේ			
අදාළ ගණිතය පාඩම සොයා ගැනීම පහසු විය යුතුය			

APPENDICES C

STORYBOARDS & SCREENSHOTS OF THE WEBSITE

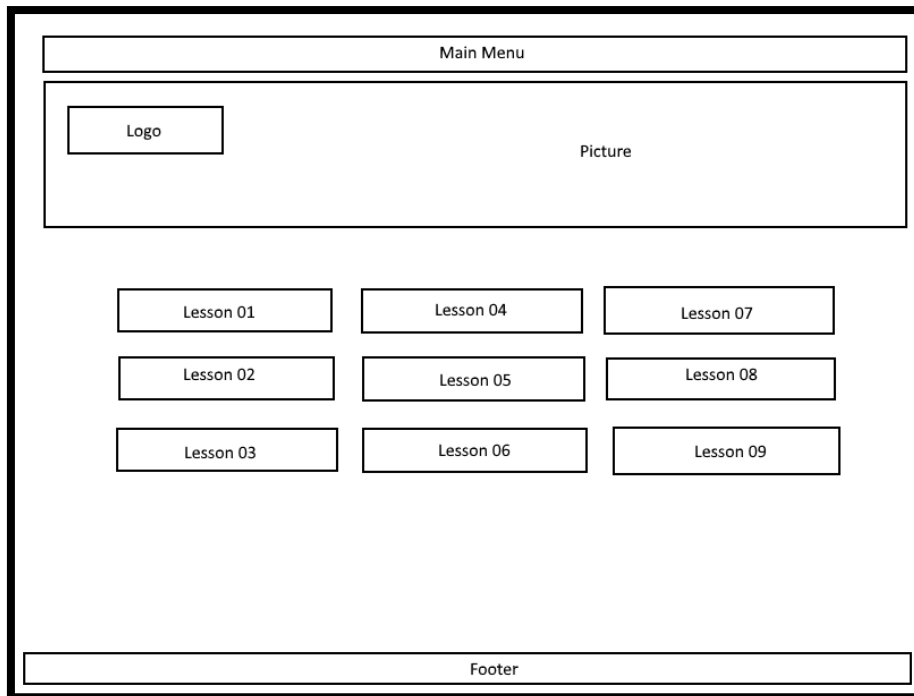


Figure 28: Storyboard of the year 10 & year 11 Pages

Year 10 & Year 11 pages was created like above storyboard (Figure 28). According to the above storyboard (Figure 28), following webpage was created for year 10 (Figure 29).

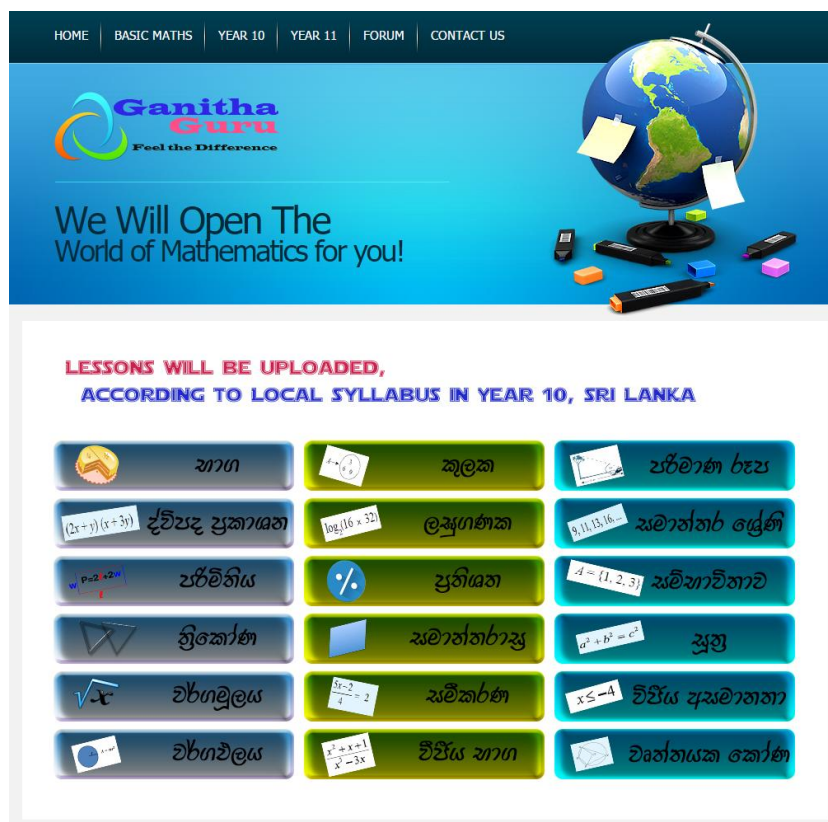


Figure 29: Webpage for the Year 10

Web pages related to lessons, games, etc. were created as following storyboard (Figure 30).

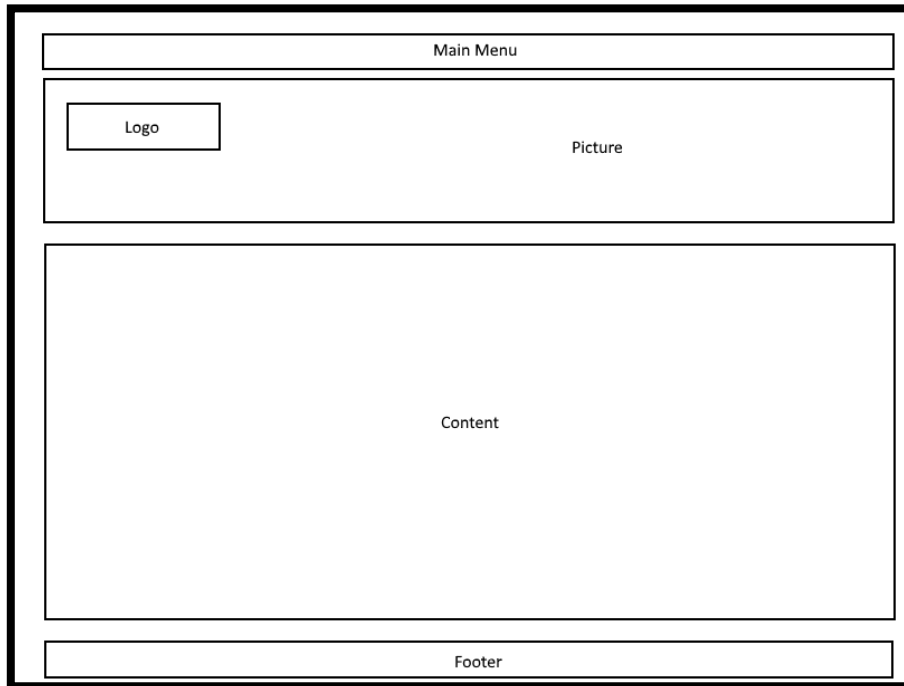


Figure 30: Storyboard for the lessons, games, etc. Pages

Picture will be same as Home Page Background Picture. Content will be different according to the page. For year 10 & 11 will have theories of particular lesson (Figure 31) and user interactive animation with a video.

නම	තල රූපය	වර්ගඵලය ගණනය කරන ආකාරය	වර්ගඵලය (A) සඳහා සූත්‍රය
සාම්ප්‍රදායික		දිග x පළල	$A = a \times b$
සමචතුරස්‍රය		(පාදයක දිග) ²	$A = a^2$

Figure 31: Content of a particular lesson

APPENDICES D

STORYBOARDS OF ANIMATIONS

According to the following storyboards, questions for Fraction Lesson were created.

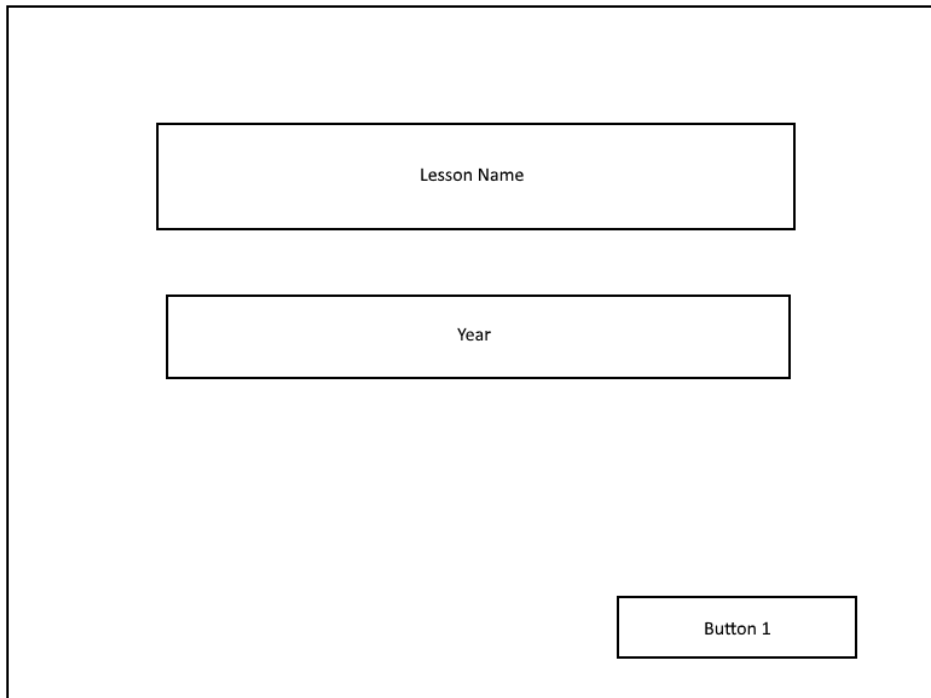


Figure 32: Storyboard for Questions (Fractions) – UI1

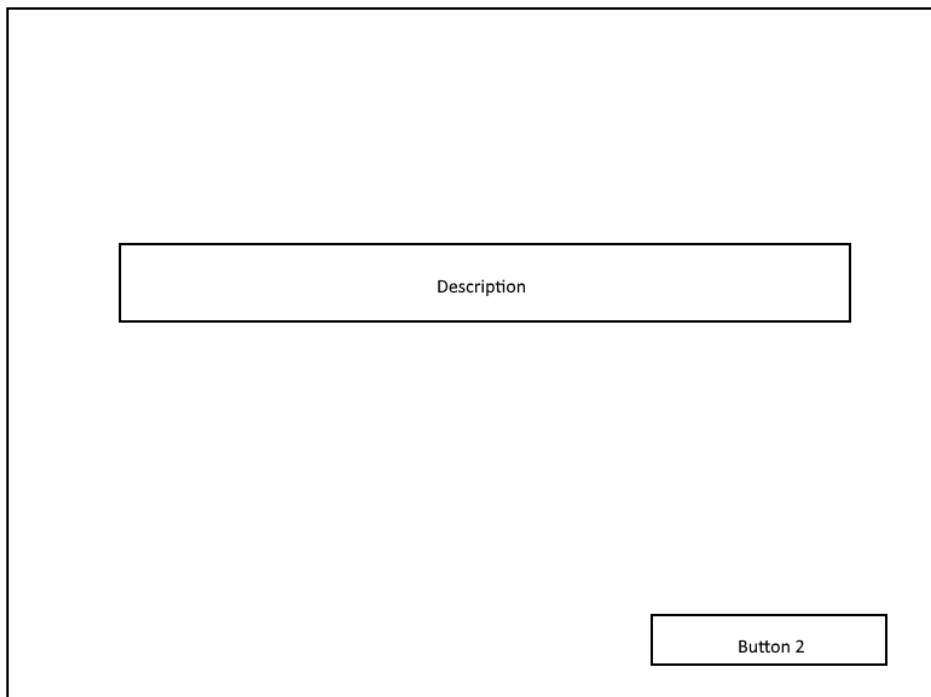


Figure 33: Storyboard for Questions (Fractions) – UI2

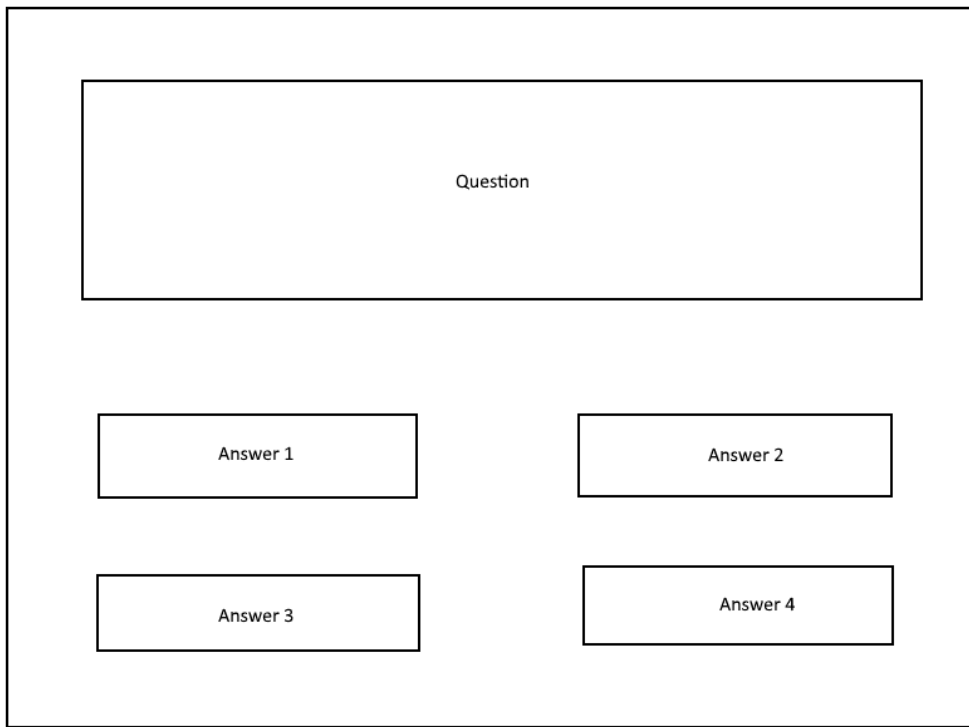


Figure 34: Storyboard for Questions (Fractions) – UI3

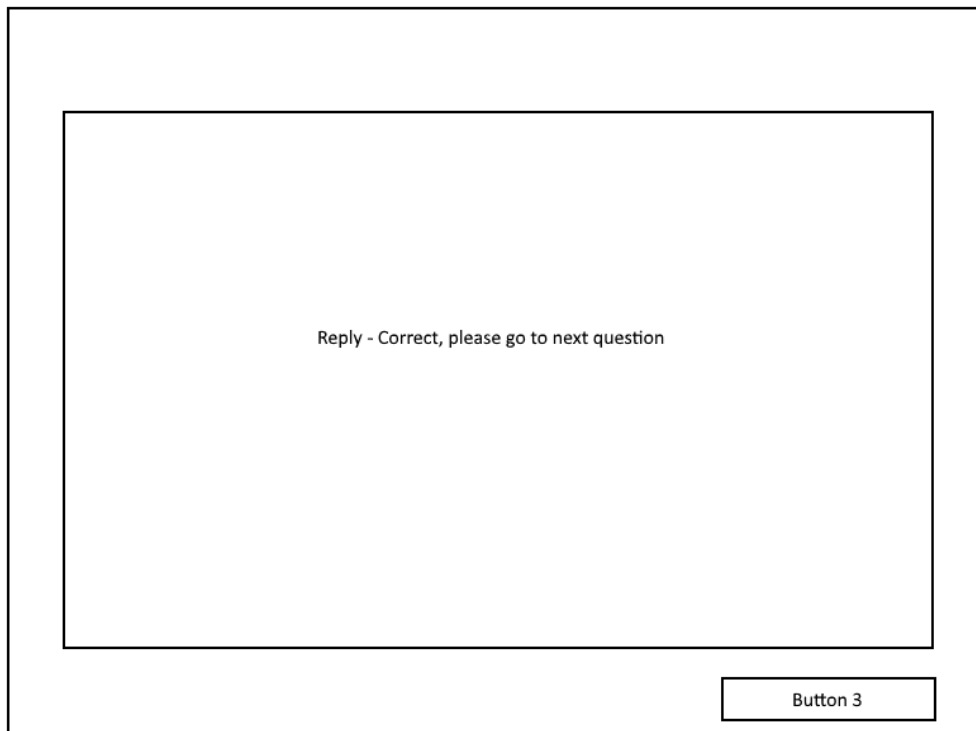


Figure 35: Storyboard for Questions (Fractions) – UI4

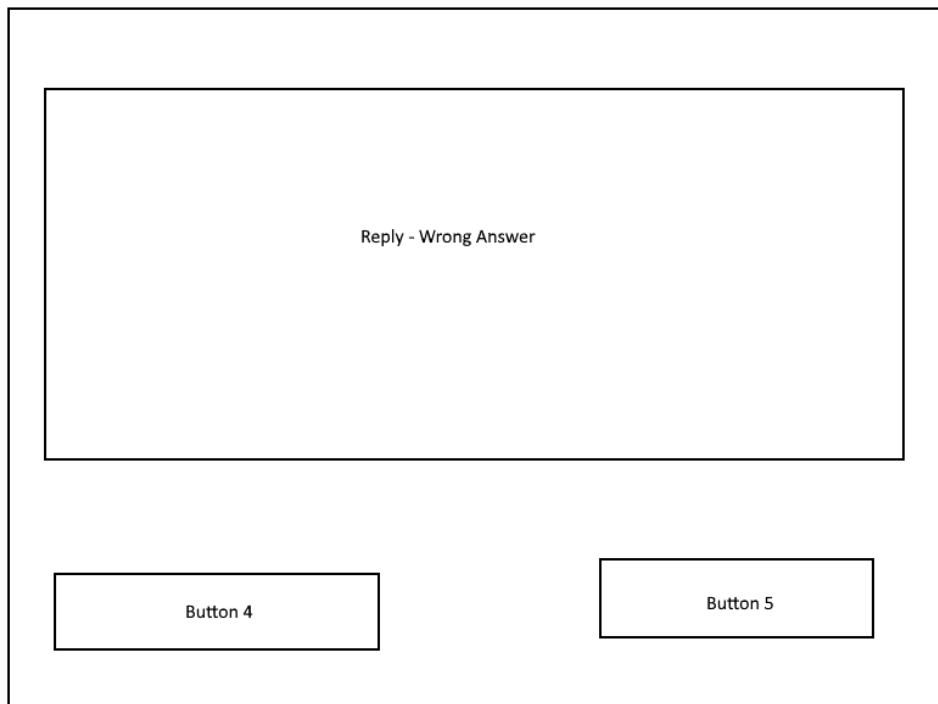


Figure 36: Storyboard for Questions (Fractions) – UI5

Functionality of the above mentioned buttons (Figure 32 to Figure 36) is as follows.

Button 1 – Go to the description page

Button 2 – Start the questions to answer

Button 3 – Go to next Question

Button 4 – Learn the way to do the question

Button 5 – Repeat the questions

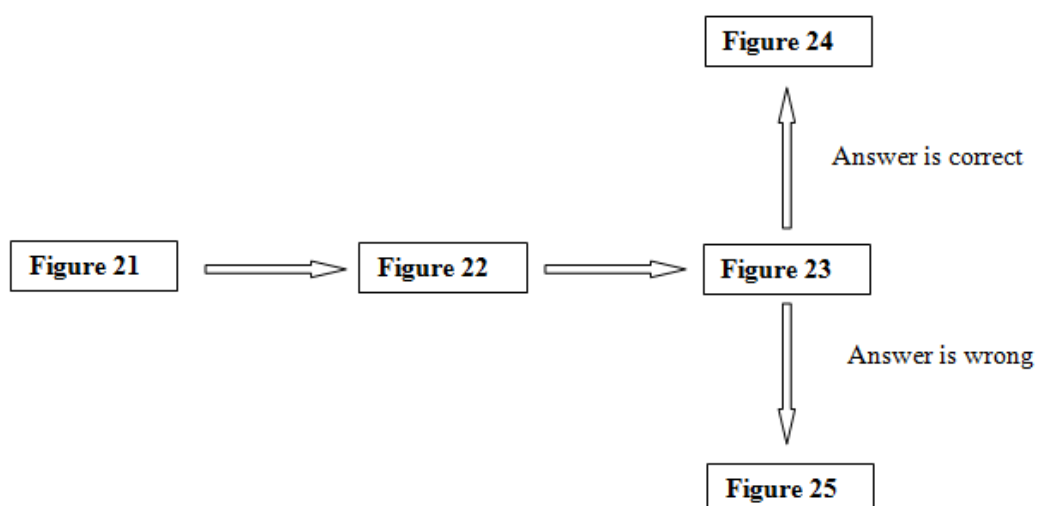
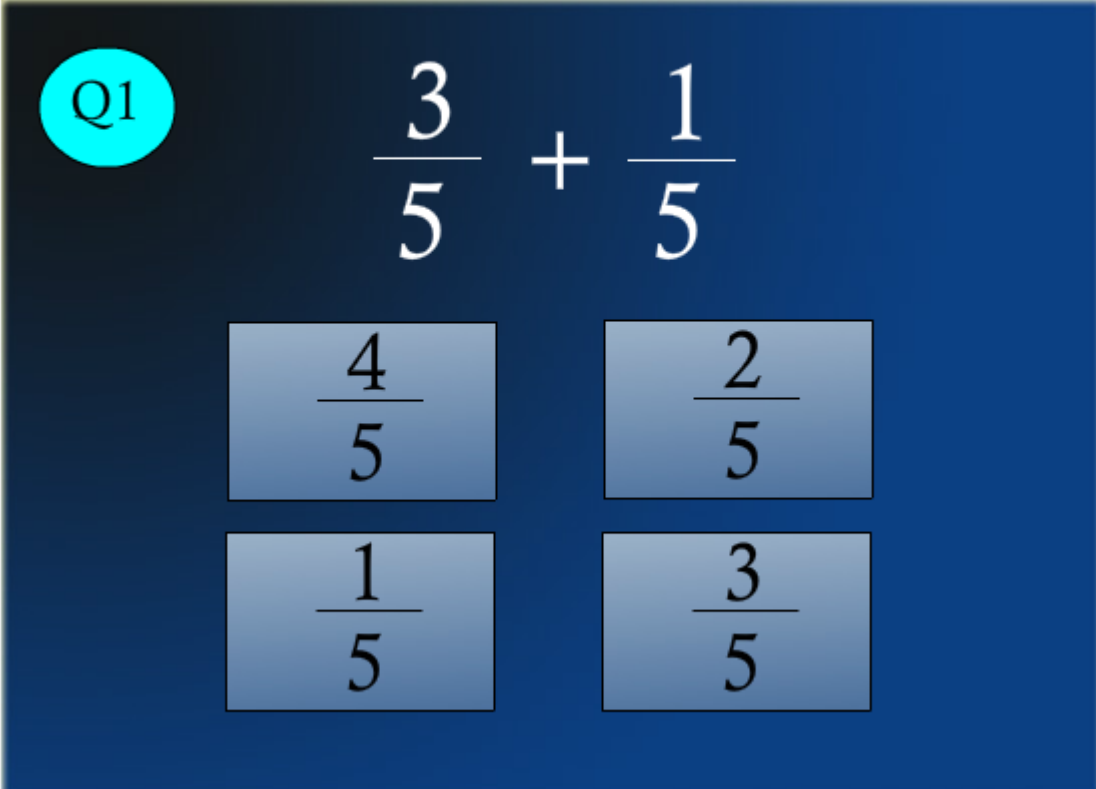


Figure 37: Process of the Question (Fractions)

Above figure (Figure 37) shows the process (User Interaction) of questions created for Fractions Lesson. If the Answer is correct user can go to the next question and if the answer is wrong user can go to see a simple animation relevant to the question for the answer or go back to same question again.

Following figure (Figure 38) shows the user interface of the fractions questions.

Try Yourself Now



Q1 $\frac{3}{5} + \frac{1}{5}$

$\frac{4}{5}$	$\frac{2}{5}$
$\frac{1}{5}$	$\frac{3}{5}$

Figure 38: User Interface of the Questions (Fractions)

According to the following storyboard, user interactive animation was created for Volume of Solids Lesson.

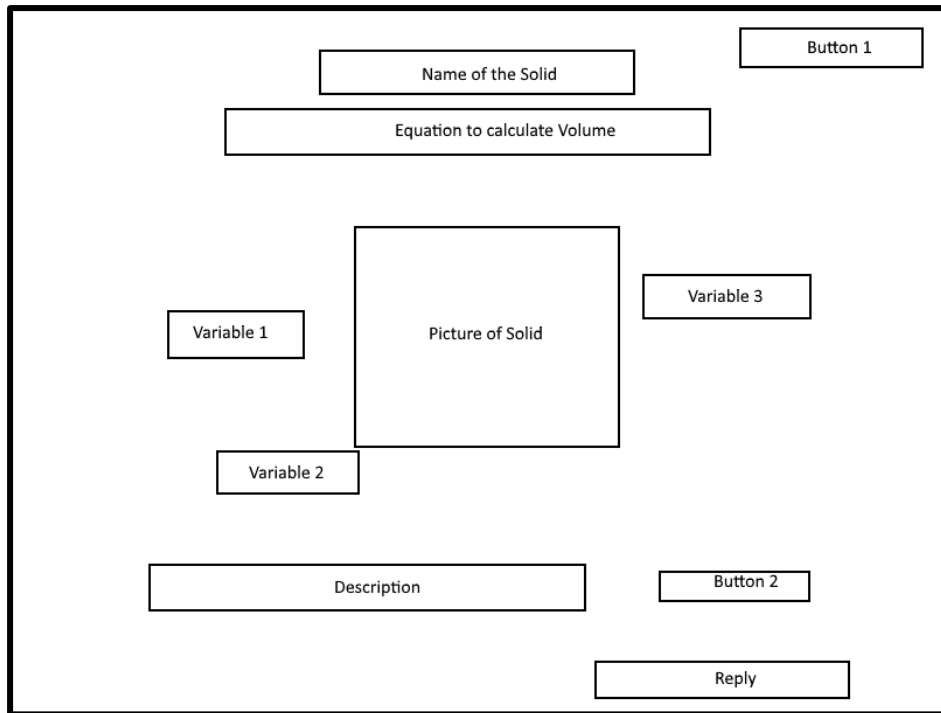


Figure 39: Storyboard of the Animation created for volume of solids lesson

With respect to the above figure (Figure 39) User will be able to change the variable 1, variable 2 & variable 3 values and calculate the volume of solids. Button 1, for go to next frame to calculate volume for another solid and Button 2, for calculation. Final user interface (Figure 40) for the above storyboard (Figure 39) is as follows.

සහ වස්තුවල පරිමාව ගණනය කර බලන්න

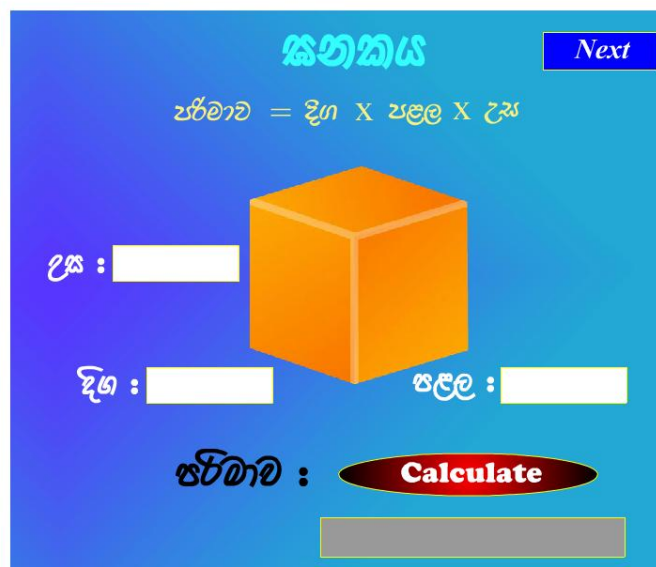


Figure 40: Final User Interface for calculate volume of solids

APPENDICES E

TEST CASES

Test Case No	04	
Test Case Type	Usability Testing	
Test Case Name	Easy Navigation through the Website	
Test Description	User has to navigate through the Website	
Test Data	Expected Output	Result
Navigation through all the links/Web Pages	Should be work all links/navigation of Web Pages correctly and easily	Pass

Table 10: Test Case 04

Test Case No	05	
Test Case Type	Usability Testing	
Test Case Name	Usability of Animations	
Test Description	User has to interact with animations, to do activities	
Test Data	Expected Output	Result
Clear understand of the given introduction	User should be able to do as for the given introduction	Pass
User has to do the activity, that animation was created to do	Should be able to interact with the animation correctly	Pass

Table 11: Test Case 05

Test Case No	06	
Test Case Type	Compatibility Testing	
Test Case Name	Browser Compatible	
Test Description	Should be Browser Compatible, Adobe Flash plugin should be needed	
Test Data	Expected Output	Result
Google Chrome	Should be compatible	Pass
Firefox	Should be compatible	Pass
Internet Explorer	Should be compatible	Pass
Microsoft Edge	Should be compatible	Pass

Table 12: Test Case 06

Test Case No	07	
Test Case Type	Performance Testing	
Test Case Name	Loading Time of a Webpage	
Test Description	Calculate the Loading time of a webpage	
Test Data	Expected Output	Result
Loading Time of Home Page	Less than 01s	Pass
Year 10 & Year 11 Page	Less than 01s	Pass
Pages contained Mathematics Lesson	Less than 01s	Fail
Mathematics Question Page	Less than 01s	Pass
Games Page	Less than 01s	Pass

Table 13: Test Case 07

According to the above Test Case (Table 13), loading time of Pages contained Mathematics Lesson was failed, due to content of the lesson. Syllabus of the lessons was different. Therefore some pages which have small content will be loading less than 01s and if the content has vast area, it will take more than 01s.

APPENDICES F

CREATED GAMES

If the website only contained the lessons, users will be boring after some time. Therefore, in this website few games were included to refresh the memory of students. These games will be able to attract users some more time in the website and some games can improve the ability of thinking and the memory.

Screenshots of the games were created for this website is as follows.

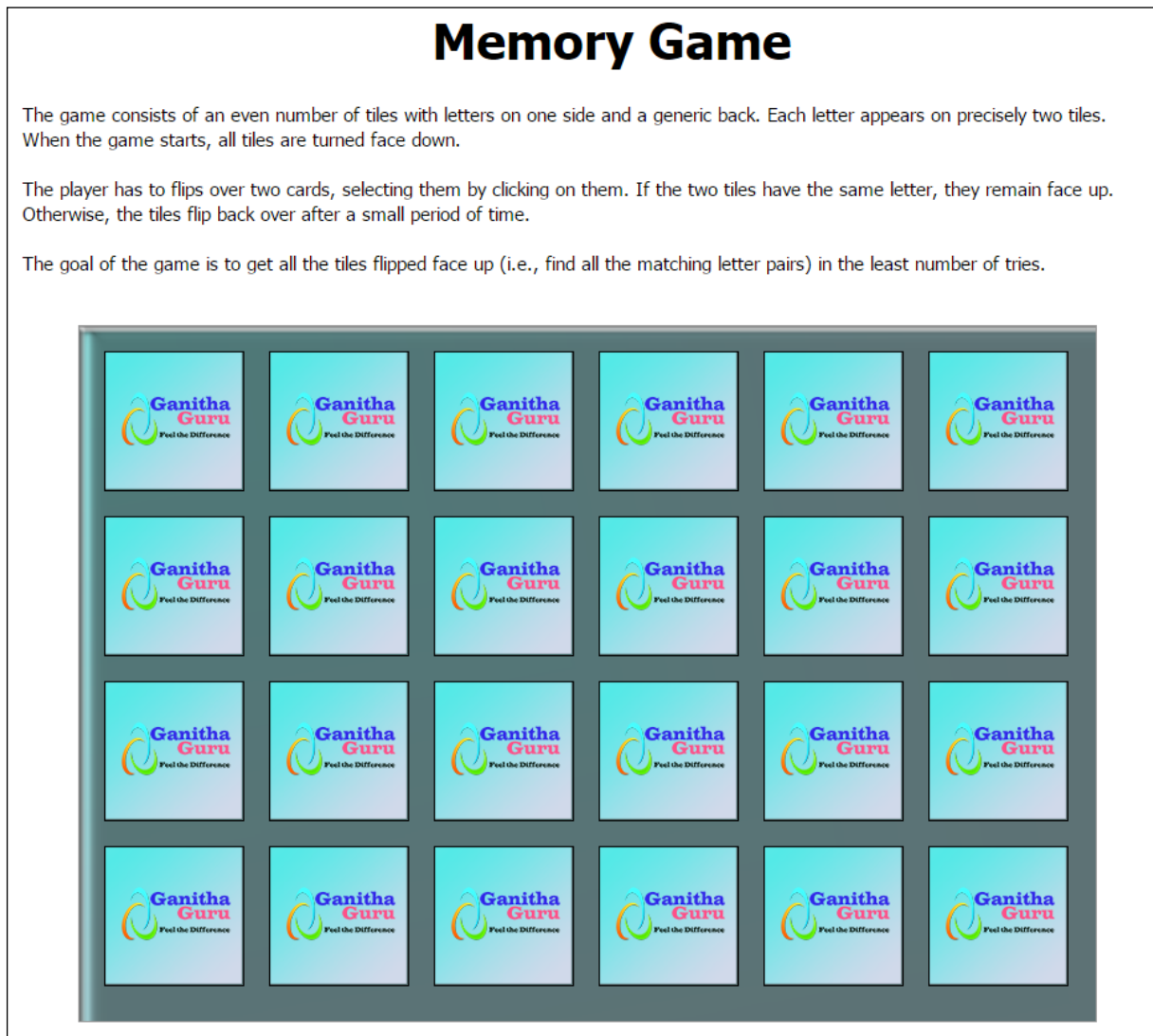


Figure 41: Game No. 01

Memory Game (Figure 41) was created using JavaScript and The Towers of Hanoi Game (Figure 42) & Tic Tac Toe Game (Figure 43) were created using Adobe Flash.

The Towers of Hanoi Game

At the start, all the disks are in the leftmost stack, with the largest disk on the bottom and the smallest on the top. The object is to get all the disks over to the rightmost stack.

You can only move one disk per move, and you can only move the top disk on a stack. The top disk of any stack can be moved to the top disk of any other stack, with the restriction that you can't move a larger disk on top of a smaller disk -- i.e., disks can only be moved to empty stacks or on top of larger disks.

To move a disk, click on it. (If you can't click on a disk, it means you can't legally move it anywhere.) you'll have to click on a stack to move it to.

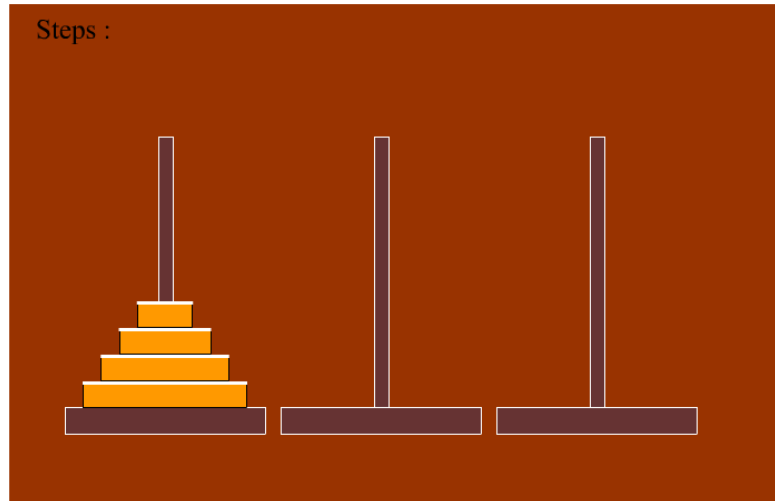


Figure 42: Game No. 02

Tic Tac Toe

The object of Tic Tac Toe is to get three in a row. You play on a three by three game board.

The first player is known as O and the second is X.

Players alternate placing Os and Xs on the game board until either opponent has three in a row or all nine squares are filled. O always goes first, and in the event that no one has three in a row, the game is draw.

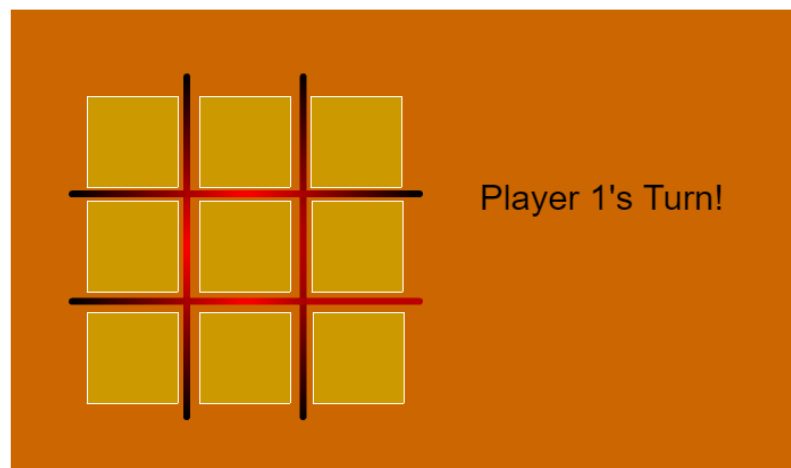


Figure 43: Game No. 03