NORTH SOUTH UNIVERSITY

Shikhon

An Interactive Learning Platform for Bangladeshi Children

A DISSERTATION
SUBMITTED TO THE DEPARTMENT OF
ELECTRICAL AND COMPUTER ENGINEERING
OF NORTH SOUTH UNIVERSITY
IN THE PARTIAL FULFILMENT OT THE REQUIREMENTS
FOR THE DEGREE OF
BACHELOR OF SCIENCE IN
COMPUTER SCIENCE AND ENGINEERING

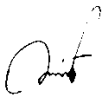
CSE 499B, Fall 2021
SENIOR DESIGN PROJECT

Declaration

It is hereby acknowledged that:

- No illegitimate procedure has been practiced during the preparation of this document.
- This document does not contain any previously published material without proper citation.
- This document represents our own accomplishment while being Undergraduate Students in the North South University.

Sincerely,



Jarif Al Nayem
1721487042

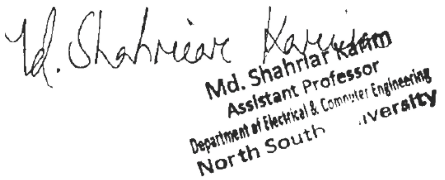
Md. Niaz Mahmud Shihab
1721274042

Md. Maruf Saklain Lingkon
1721081642

Tasmiah Morol Nilima
1620148042

Approval

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation.



Dr. Md Shahriar Karim
Assistant Professor
Department of Electrical and Computer Engineering
North South University
Dhaka, Bangladesh

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation.

Dr. Mohammad Rezaul Bari
Associate Professor & Chair
Department of Electrical and Computer Engineering
North South University
Dhaka, Bangladesh

Abstract

We have reached a point of technological advancement where computers are integrated in almost every corner of our lives. With that, the demand of talented individuals who are adept in the world of computer programming is also increasing. That is why, most countries in the world are creating an education system in such way that kids will get interested in programming at an early age. But explaining the concept of programming to the young minds is a bit tricky. We can't teach them the concept the way it is done to the adults. That is where the visual block programming comes into picture. Most kids are naturally drawn to pictures and animations. That is why we are seeing the integration of these things even in our traditional teaching methods. Block based programming languages are created in such a way that the user won't have to learn the complex code behind the blocks and will be able to play with the blocks and create different animations and moving objects. This became the perfect tool to introduce programming to kids. With this foundation, various online platforms were created with where block-based programming was implemented to attract the children. Scratch is the most prominent of them all as it is very popular among many English-speaking countries. But there is no such platform available in Bangla language. A platform like this could attract many Bangladeshi kids into the wonderful world of computer programming. With that goal in mind, we are creating a platform where kids could play with blocks that have Bangla titles and get interested in programming.

Acknowledgements

At first, we'd like to remember the Almighty Allah for allowing us to complete this report in time and successfully.

We would like to express our debt of gratitude to our honorable supervisor **Dr. Md Shahriar Karim**, Assistant Professor, North South University, for his constant inspiration, constructive criticism, generous guidance, and deep interest in this study. Without his proper guide line, the study might not be possible properly to complete in due time.

We'd like to express our sincere thanks to the chair of Department of Electrical and Computer Engineering.

We'd also like to thank so many amazing researchers all over the world who are currently working on this very issue. For this research we were not able to do any in person surveys or analysis because of COVID 19 situation. So, a good portion of our work depended on these amazing researches, journals, periodicals and research papers that were published by so many amazing researchers. Mentioning all of them here is almost impossible. We've acknowledged them through countless citations in all over our main body of report.

At last, we would like to thank our dear sir **Dr. Md Shahriar Karim** once again for giving us the opportunity to do this research which enriched all of us with our new found knowledge.

Contents

Table of Illustrations

1 Introduction and Motivation

1.1 Introduction

There have been numerous studies conducted before on how developing countries are lacking behind on implementing effective education system. Bangladesh as a nation is not far from that assumption. It is not so much that what we are learning in our schools are bad or out of place, we are just falling behind on implementing environments that are innovative and new. This is especially the case when it comes to kids.

While kids in other countries are familiarizing themselves with technology at an early stage and learning from it, we are still on our way to find suitable options to integrate technology in our learning process. There is also a debate on how to handle this situation also. Integrating technology on our current system is not the answer to all of this. The focus of our system should be making it easier for children to acquire knowledge. This is where technology and programming can be of big help.

We are not just lacking behind in terms of traditional teaching methods. Our children are also late most of the time in many other educational technological activities. Internationally, kids are learning to use computer and even computer programming at an early age. There are countries where kids are learning programming at as early as 7 years old. Our modern world is heavily revolved around computers and computer programming. While the children in other countries are learning difficult programming methods at an early age, kids in Bangladesh aren't even learning the basic concepts. Some may say that teaching complex methods like programming to children may be difficult but there are certainly methods that can ease that concern.

Children at an early age are really interested in visual learning. That is why it is thought that construction-based coding activities will be able to grab their attention. Various studies have already been conducted on this topic and it is understood that most children managed to adopt deliberative thinking and was able to understand and imitate mechanical thinking while coding in a block-based environment like scratch [1]. Block based programming platforms like scratch can easily grab the attention of the children with their visually appealing block systems and animations. Kids can master the foundational coding concepts while playing with these blocks [2].

Platforms like Scratch are surely popular but they are limited to English-speaking countries. Even though Scratch has recently added the Bangla language as their automated Unicode translation, the native environment still is a very foreign concept to our children from Bangladesh. It is full of generalized references which could confuse many children instead of attracting them. That is why an interactive platform for kids in Bangladesh is badly needed.

Apart from computer programming, visual cues can also help children's learning in other areas too. Scientific Experiments are a big example of that. Experiments and practical handling of scientific instruments are a must have for all children in order for them to grasp the meaning behind the theory that they are being taught. That is why, at the end of each chapter of our science books, we see many different experiments that ties the chapter's teaching together. Teachers are supposed to show the students how exactly these experiments work.

But most of the schools and colleges of Bangladesh do not have the necessary facilities or the experienced teachers to do these experiments live. Most of the time, the students just look over the written notes of the experiments on their book and tries to visualize it without any hands-on experimentation. This ultimately does not contribute to anything in their learning process. Even though, the schools are getting funding slowly, the necessary facilities are still just a dream for them. That is why an interactive platform for science experiment simulation could be a huge opportunity for these kids.

1.2 Motivation

Digitalization in our education sector has started almost like 10 to 12 years ago. But have our teaching methods changed that much in that time? Sure, the kids are not learning from the old and worn-out syllabus but the learning process that we had are still in place to this date. The goal of integrating technology was to bring ease to the learning process but our children are still on that text-based learning path while the rest of the world are experimenting with different innovative ideas. Even our neighboring country India has platforms like Byju's where children are learning different topics in ways different than the text books and other traditional oral format [3].

Creating an interactive platform where children can interact with different programs while learning from it is our primary goal. We don't want to teach them anything new. We want to present the things that they are already learning in a different manner to see if they are interested in visual learning systems. Along with that, we also want to introduce our children to the amazing world of programming with the help of block-based programming languages. Platforms like Scratch have already proved that teaching children programming concept at an early age gives them slight edge over those who picks up later [2].

As things stands right now, most kids in our country are unaware of basic programming concepts. Without a proper and easy to use platform, we cannot reach them. As a result, most programmers in our country starts their programming experience later than those from other countries. We have already seen the usefulness of block-based programming and how they can affect children from the success of Scratch and Scratch Jr. The goal of our project is to use the same concept but instead of the default blocks, we are going to use blocks that can be easy to understand for the Bangladeshi children. We are hoping to create an environment such that kids from our country can relate to them and learn the basic concepts of programming by playing with them.

1.3 Overall System Architecture

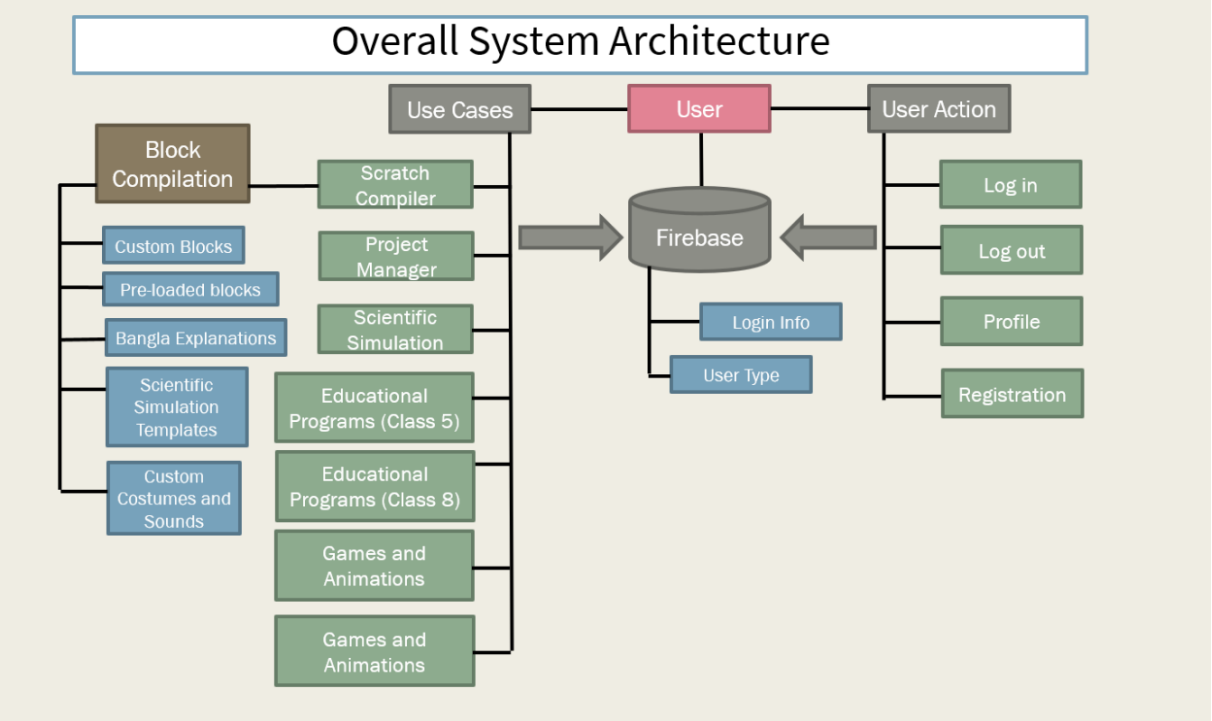


Figure 1: System architecture design that provides the basic structure of the platform

The basic architecture of our platform revolves around two distinct wings of operations.

- User Actions
- System Actions

The user actions revolve around the interaction with the system and its' components. Specifically, user actions have two directories. User can interact with the system to edit user information and user can interact with the system in order to access the blocks for compilation. The system actions take commands from the users and perform background operations in order to deliver the desired results.

It is important to mention that the components of the system are accessible by both types of actions. The system has generalized components mostly other than the compiler portion which has many individual private components like 'Block Translator', 'Block Processor' etc. Most basic component structure looks like this,

- User Interface
- Database
- Block Compiler
- Communication and Interaction

2 Literature Review

2.1 Interactive Learning Platforms and Bangladesh

E-learning platforms has many different features. While there is abundance of learning platforms on the internet, most of them are not interactive. Her by interactive we mean to say where students can interact and change the variables presented on the site. This can be animations, moving blocks, eye tracking etc. Platforms like these are can be very effective learning tools as they are very compelling to the children. Ani Matei and Catalin Vrabie of Romania's National School of Political Science and Public Administration think that distant learning platforms are slowly overtaking the traditional administrative learning system [4].

Some researchers believe that design of the product on the learning platform may have significant influence on its effectiveness. Meng-Dar Shieh and His-Yin Hsieh briefly discussed about the motivation and effectiveness of proper product design on their studies [5]. Their argument was that children's motivation to go through the desired platform is heavily dependent on the content and their interactive aspect [5]. In most of the cases, kids did not like contents that are too tight knitted and are similar to traditional text-based form [5].

A group of 7 Indian researchers found that dual mode online platforms have some amazing results in e-learning [6]. Dual mode online platforms are the type of platforms where along with the provided content, there are continuous exchange of content between educators and students. This type of platform is more suitable for older group of students. But, in a situation like the covid 19 pandemic, this kind of platforms have also showed their effectiveness for children and their academic learning process [6].

Unfortunately, most of the learning platform in Bangladesh do not have that smartness factor to them. They are mostly video-based platforms that creates content in video format [7]. Some prime examples could be '10-Minute School', 'Shikkhok Batayon', 'Amar Pathshala' etc. Honestly, they are pioneering e-learning in Bangladesh specially '10-Minute School' is really popular among young students [8]. But these are not the kind of platform that we are looking to build. We mean to build a platform where content can come from both sides in an interactive manner. That is why block-based programming is also a part of our platform.

2.2 Programming Platform for Children

When we look at other works that are done in this field, we will see that most of them are done for a generalized term of kids. So, we are going to work with these generalized studies which are applicable for all rather than the Bangladesh aspect.

A study by Amanda Strawhacker and Marina Umaschi suggests that block-based programming can certainly make the kids understand the concept of programming but their level of understanding and the level of problem-solving skills are varied in different age groups [2]. They argued that different teaching methods for different age groups like kids, pre-teen, and teenagers could improve the learning capabilities of children [2]. This concept was also used by Scratch as they launched 'ScratchEd' and 'ScratchJr' focusing on two different age groups among kids. Our platform could also use a little diversification but we don't see that happening right away. This could be something that can be implemented in future but right now we are focusing on just one platform.

Another study by Sofia Papavlasopoulou, Michail Giannakos and Letzia Jaccheri suggests that children learn the concept of programming very easily with block-based programming but keeping them interested is a bit tricky [1]. Their study suggested that if the platform can offer things like new games and changing animations then kids are more likely to stick to programming without losing their interest [1]. Platforms like Scratch and ScratchJr already has features like these where you can create small games and share among friends. This is something that can be easily integrated in our project too.

Thamizh Selvan on the other hand went on a different route with his study. He looked at different instances of kids learning programming and tried to understand what format of teaching can guarantee a more complex understanding of programming while also making it fun [9]. His study found that the usability of the platform greatly influences the attention of the kids. He suggested that animations and sound are a great way to keep them interested [9]. He also found that kids find joy by sharing their work and watching other children's work. Community sharing is certainly something that we are hoping to achieve.

All these studies focus on the kids and many technical aspects which makes them interested in programming. We are certainly hoping to integrate some of these technical aspects which would improve our platform's usability. We were hoping to find studies focused on how breaking language barrier can help with programming study but we could not find such studies.

3 Method and Methodology

Previously we have built the core of the project using all kinds of visual programming language with Scratch 3.0 and Blockly at the center of it. In this run of our project work, we have decided to implement those tools to demonstrate the usefulness of visual programming languages in first hand. Our goal was to reach the children of all social classes and make a platform that can attract them naturally. The platform has to be inclusive to all children of the same age. At first, we were starting to target children at general. But later we understood that a more concentrated attention on a select few age group would give us better result in the long run. That is why we chose two age groups specifically. We started with Elementary classes and ended with classes lower than JSC. We have felt that this could be the correct mixture of target samples.

3.1 Materials and Personnel

As this is an educational development project made by students, we are not looking to use any large capital expenditure. Our goal is to use whatever free and open-source developmental tools we can gather and use them. That is why we looked for materials that has less licensing hassle and can be used on the go without any legal trouble. Our project is a software platform based on entirely cloud-hosting. So, we did not need any kind of hardware materials for this project.

First and foremost, for the kid's programming part of our platform, we needed to select a bloc-based programming language. At first, we looked at Google's 'Blockly'. Blockly is a block-based visual programming language which is used mostly by entry level programmers and it provides a mostly error-free coding environment with its natural language integration [4]. But it lacked some sophistication and, in the end, we went with something similar and a language that was actually made in collaboration with Google's Blockly.

So, for the compiler of the programming platform, we went with Scratch 3.0 language. We already know the vast popularity of Scratch's platform in the realm of kid's programming. Unlike Blockly, this is already catered towards and created thinking of children and their growth. Like Blockly, Scratch 3.0 is also open source and various components of its's compiler's code base is readily available on GitHub.

From the numerous source codes that were available on GitHub for Scratch, we had to pick one that would be easily developable. At first, we went with Scratch Blocks. But soon realized that it is only going to give us the block component but not the full compiler. After some rigorous searching and researching, we decided to go with Scratch

GUI, as it has a stable code base where all the other components of the scratch development kit could be inserted into.

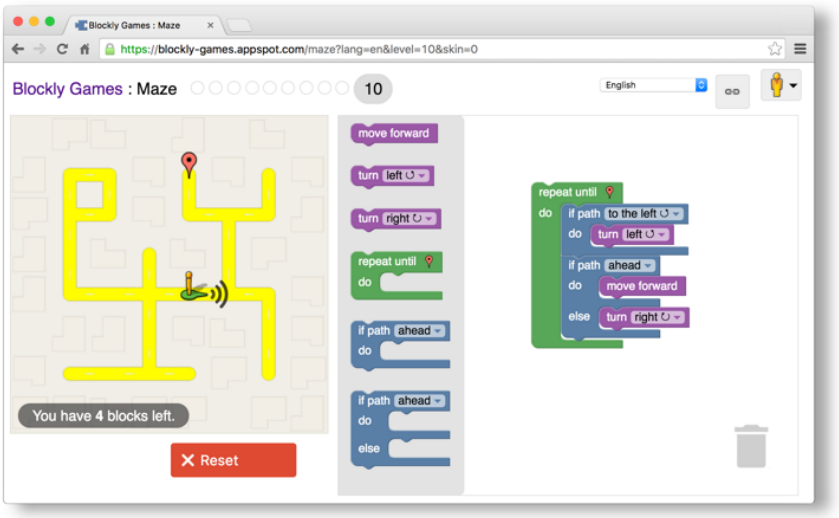


Figure 2: Blockly and Scratch Block Configuration

Apart from the components of the compiler, for now we built a web-based platform. This platform was created around the compiler of Scratch. For this we used some basic web designing languages like HTML, CSS, PHP etc.

Now that we have the materials or building blocks of our project sorted out, we focused on the personnel who are going to use our platform. Like we have said before, this is an interactive learning platform for kids in Bangladesh. So, our primary focus is kids. But so far on our development, we have only touched the technical aspect of our project and built the foundation upon which we are going to decorate our platform. So, we have not yet done a survey or any data collection from our potential users. We are leaving that for future development.

3.2 Design Approach and Content Planning

For the design of the 'Explore' portion of our project, we have first chosen to follow some of the topics that are taught at school. For this we decided to go over the contents of text books provided by the NCTB and use them for the necessary visual programs that we are going to create in this portion.

As we have said before, the two concentrated age groups include elementary or primary education class and pre-SSC education class. With these two groups in our mind, we have selected the following topics from the text books of NCTB.

3.2.1 Elementary Contents

All of these contents were selected from NCTB provided curriculum. But we have taken inspiration in only the topic part. In the actual execution of these programs, we have stayed with our original plan and designed the programs in a way that is interactive and holds its educational integrity at the same time.

- **Addition-Subtraction:** This program simply interacts with the user and performs various addition and subtraction problems along with solves it and shows the answer. At the start of the program, we offer the option to select between addition and subtraction. Upon selecting any of the option, it provides various addition or subtraction problems to the user and asks for solution. If the user is able to answer the questions correctly then the program adds a number to the total score. This continues until the user gets one wrong and then it stops calculating the total number of correct runs.
- **Multiplication-Division:** This works in the same way the 'Addition-Subtraction' program. The UI and user interaction is exactly the same. But this time the program offers only multiplication and division problems to the user.
- **Bangladesh:** This is an interactive program which has a goal of teaching the history of Bangladesh to the users. This not only teaches some historically significant aspects of our country but also some geographical aspects.
- **Basic Anatomy:** This program teaches the basic anatomy to the users. As it is under elementary portion of our project, it does not include and internal organs or anything. This is basically one for one anatomy that are taught in primary schools all over the world.

- **Equivalent Fractions:** For the final program of this section, we have chosen equivalent fraction as the topic. This is a fairly easy concept that many children struggle with. We created a simple UI for this where users are given bunch of random number and are asked to create bunch of fractions that are equivalent to each other. For every group of equivalent fractions, the program resets itself and provides new options and adds 100 score to the user's inventory. The program ends when the user can no longer make out any more equivalent fractions.

3.2.2 Pre-SSC Contents

This part includes just some of the content provided in pre-SSC text books in our country. So, this is mostly for class six, seven and eight's children. We have focused only on contents from science books for this portion. Two of these programs are biological, one is chemistry related and the other can be found in physics section.

- **Cell:** This is an infographic that shows and tells the different parts of an eucaryotic cell's organelles. The UI is interactive, so user can choose whichever part of the cell they want to know about. The program will zoom in on that section and offer some detailed information and also provide an option to announce the dubbed version of the written part.
- **White Blood Cell:** The inner workings of this program are the same as cell. This just focuses more on white blood cells.
- **Acid-Base Game:** This program offers a bunch of acids and bases at the initial period. The users can mix them up together and the program will offer a result of the chemical reaction and what salt was crated because of their mixing of the two compounds.
- **Simple Electrical Circuit:** This program shows the inner working of a simple electrical circuit. The user can interact with the UI and learn how a simple circuit works and how it can be used.

3.2.3 Games and Animations

This part of the project shows some simple games and animations that can be made using the provided scratch compiler. This can offer some refreshments along with some needed educational content for the user.

- **Nouka-Baich:** A racing game inspired by a popular local boat racing competition. It has an option for multiplayer feature where two users can interact with each other.
- **Science Game:** This program provides yet another educational program but with its focus on interactive UI, its actually less educational and more on the evaluation spectrum.
- **Car Racing:** A traditional computer car racing game. This is a throwback to the early mobile games that are very popular. Like them it works in a additive manner and offer rewards for overtaking vehicles along the way.
- **Joy-Bangla Game:** This was initially a passion program for one of our group members. Later we decided to add it to the project as it has a patriotic aspect to it. It is a traditional click and shoot game as you shoot at the target of some war criminals.
- **Corona Awareness Animation:** Features the popular characters from Meena cartoon where Meena and Meethu goes over the various to dos during the pandemic to control the spread of corona virus.

4 Result and Analysis

4.1 Initial Contents

As per the described design on methodology we conducted our initial implementation of contents. The contents were created on Scratch 3.0 compiler as it is integrated on our platform. All of the content were created with visual and auditory features as we have heavily emphasized how visual and auditory learning can help children in their learning process [2].

The contents do not deviate that much from the information provided in the NCTB text books but the information presentation helps kids to grasp the content much faster. Because of the interactive aspect of the programs, they also do not get bored too early so it delivers on the promise of engagement.

Initial contents were created as an experimentation as we planned on changing some specification of the content after getting direct feedback from both our instructor and the kids. Getting first hand feedback from children is the best possible way for us to improve on our content. So, the initial contents had options of changing features. Still, all of them were complete programs with the necessary features.

On the concept of these programs, we have to admit that we cut some corners. We made some assumptions on what could be appealing to the children and what could not. We decided to make the contents of primary students heavily focused on graphic and animation. This is important for grabbing their attention and keeping them active on the content. But we did not do the same for the Pre-SSC contents. This is the early teenage and teenage groups. We felt like some of them are mature enough to dislike overuse of animations. So, in their contents we cut down on moving objects and focused more on simulations and experiments.

We also did the same in terms of auditory aspect. For kids' contents we decided to replay the instructions both in text and audio format. As there are animations involved, audio queues were prominent in this sector. But for the teenage group, we cut down the audio to the bare necessity and decided to give them more freedom on their information intake.

4.2 Focused Survey Design

Previously in the design section, we arranged our content in such a way so that we can conduct a survey later on to get direct feedback from children of any primary or high school. We selected class 5 and class 8 for our survey group as they can be a good representation of both primary and high school level. Most of our content was also focused on math and science as we felt like getting feedback on these subjects would be easier as the result from these subjects can be quantified very easily.

To go to the next phase of our survey, we decided to do two different surveys on these two focus groups. But that doesn't mean there wouldn't be any generalized questions as both of these groups are going to use our UI and other functions. We planned to conduct the survey on two parts. One for the contents provided on the platform and other for the programming learning feature.

4.2.1 Generalized Questions

First of all, there will be some general-purpose questions for students of both of these classes. These questions are crafted in a way that it will give us an idea about their current learning process and the level of satisfaction that they have with their current process. The general part of the questionnaire is mainly to get acquainted with the students so there is not much to quantify here.

1. How do you feel at school? (Evaluative)
    a. Happy
    b. Neutral
    c. Sad
    d. Don't want to come
2. What is your favorite subject?
    a. Math
    b. English
    c. Sociology
    d. Science
    e. Other _____

3. What is the most memorable topic you have learnt recently? (Mention one or two) (Evaluative)

_____.

4. What made the topic easier to understand?

_____.

5. How long did it take to understand that topic?

_____.

6. Do the pictures on your text book help you learn faster? (Evaluative)
    a. Yes
    b. No
    c. Neutral
7. Do you have a smartphone or computer at home?
    a. Yes
    b. No
8. Do you know how to use the internet?
    a. Yes
    b. No

9. If yes, what do you generally do on smartphone or computer?
    a. Play Games
    b. Watch Videos
    c. Use social media (Facebook and others)
    d. Communicate with friends.
    e. Other _____.
10. Have you ever taken help from the internet to understand any topics?
    a. Yes
    b. No

4.2.2 Concentrated Questions

After the general-purpose questionnaire, we are going to show some programs to both of these groups from our platform.

- For class five, for now we have chosen 'Small or Big' program which teaches students which number is smaller and which number is greater and also help them understand how to make largest and smallest possible numbers from some pre given digits. This is a topic from the first chapter in the math book given out by NCTB.
- For class eight, we have chosen 'White Blood Cell' program. This will help them understand basic structures of a white blood cell. This is from chapter two of science book developed by NCTB.

We will also let them interact with other programs and infographics available on our platform. But the next set of questionnaires will be on the above two topics.

Class Five

1. Was the program fun to interact with? (Evaluative)
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
2. Do you now have a clear understanding of the problem?
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
3. Which part of the program intrigued you the most?
    a. Animation
    b. How it reacts to your command.
    c. Voice lines.
    d. Other _____.

5, 3,2,4,8 are some digits. Now answer question 4 and 5.

4. What is the greatest odd number possible from these digits?

_____.

5. What is the smallest even number possible from these digits?

_____.

6. Are the animations better than still pictures from your book?
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
7. Does the audio description of the instruction help you understand better than reading?
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
8. In the evaluation part, how do you want to interact with the digits?
    a. Dragging them
    b. Clicking them.
    c. Re-arranging them.
9. Do you feel comfortable using programs like these along with your text book?
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree

e. Strongly Agree

10. Would you be interested to make such a program yourself?

    a. Yes

    b. No

    c. I don't know how to.

This last question will be a segue way to introduce the kids programming section of the platform. We will then show the Scratch compiler to them and how it's used. Similar question was also created on the contents provided on students from class eight.

4.2.3 Survey on Block-Based Programming

We designed this part of the survey to gain feedback on the kids' programming section and what could be improved upon further on.

1. Making animations seems very hard-

    a. Strongly Disagree

    b. Disagree

    c. Neutral

    d. Agree

    e. Strongly Agree

2. Instruction for the process was adequate enough-

    a. Strongly Disagree

    b. Disagree

    c. Neutral

    d. Agree

    e. Strongly Agree

3. Dragging is better than clicking-
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
4. More audio description would be helpful-
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
5. Default language change should be easier-
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree
6. Platform should be on mobile devices-
    a. Strongly Disagree
    b. Disagree
    c. Neutral
    d. Agree
    e. Strongly Agree

4.3 Focused Survey Result

4.3.1 Generalized Question Result

The feedback on the generalized questions is mostly positive towards trying to find a new form of learning. The children replied positively on the UI situation as they thought it was very easy to use. For the primary age group, there was some students who opted for a more colorful UI.

100% of all students replied that they have smartphones or computer at home. 70% of them said that they know how to use internet. 40% have said that they have taken help from internet before on their study. 90% of the students thought the animations provided on the platform was better than still pictures on their text books. The rest 10% remained neutral. There were no negative feedbacks on animation and visual elements of the platform.

4.3.2 Class 5

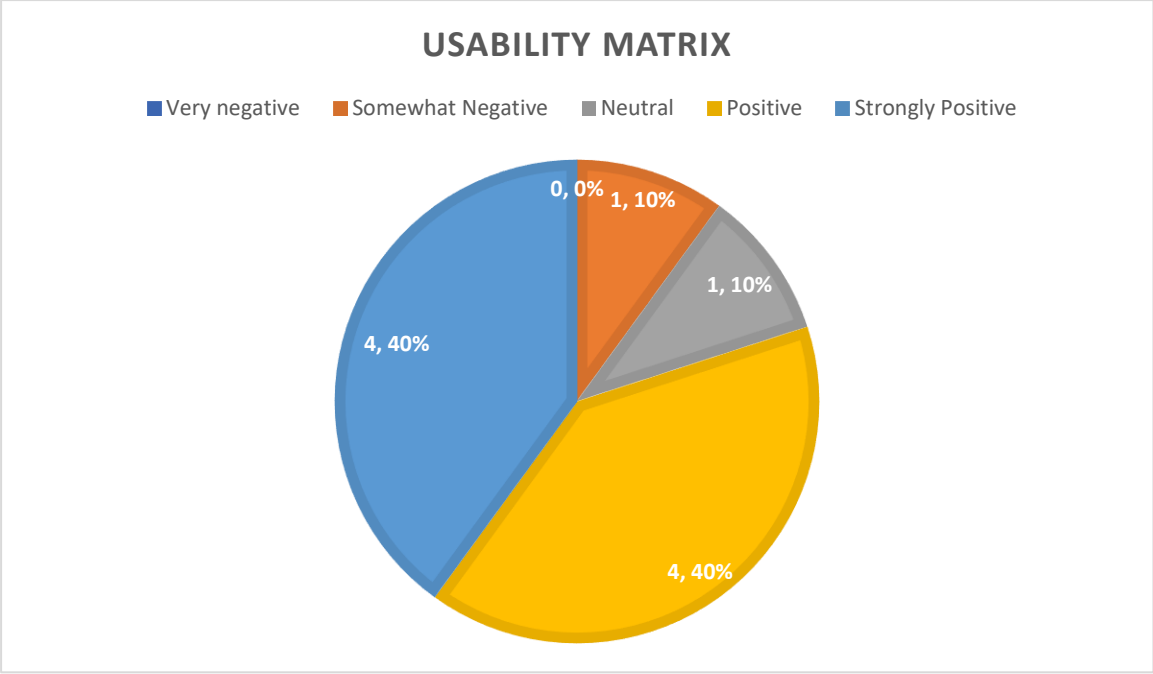


Figure 3: Class 5's consensus on usability of the platform

The survey was conducted on 10 class 5 students. The above chart shows the usability matrix of the evaluative questions. The chart below shows the content satisfaction from the evaluative questions.

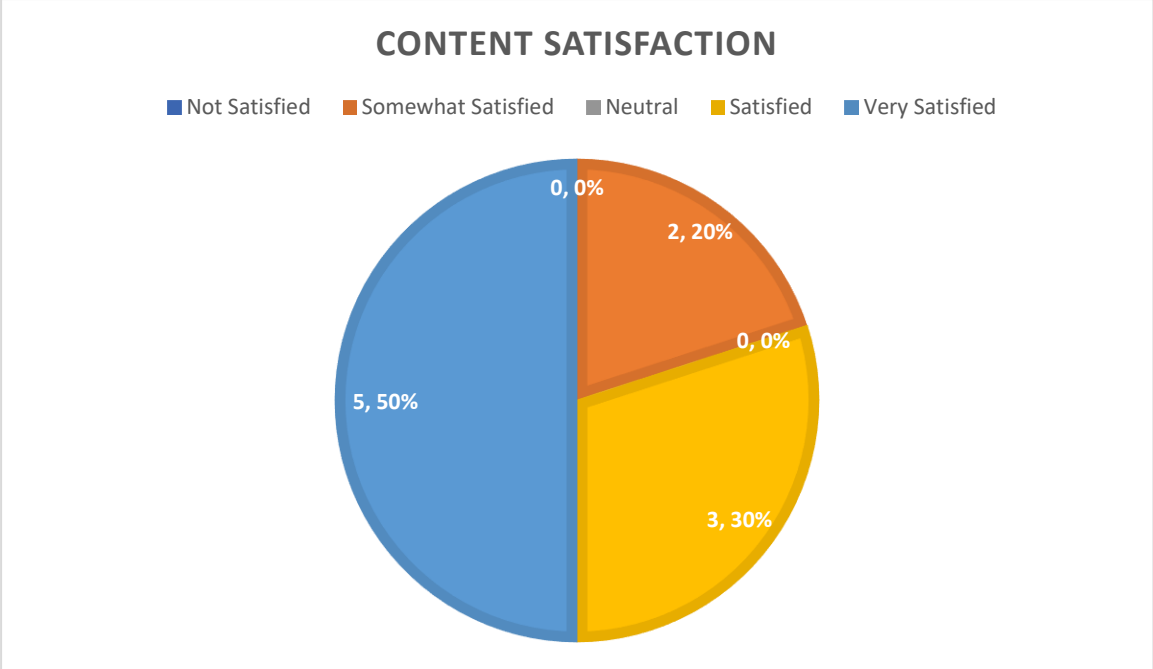


Figure 4: Class 5's consensus on content satisfaction

4.3.3 Class 8

The survey was conducted on 10 students from Betagi Model High School's class 8 students. They were provided with the platform technicalities beforehand. After evaluating all the questions, we are presenting here the two areas of feedback. One is on the usability of the platform. The other is the content satisfaction.

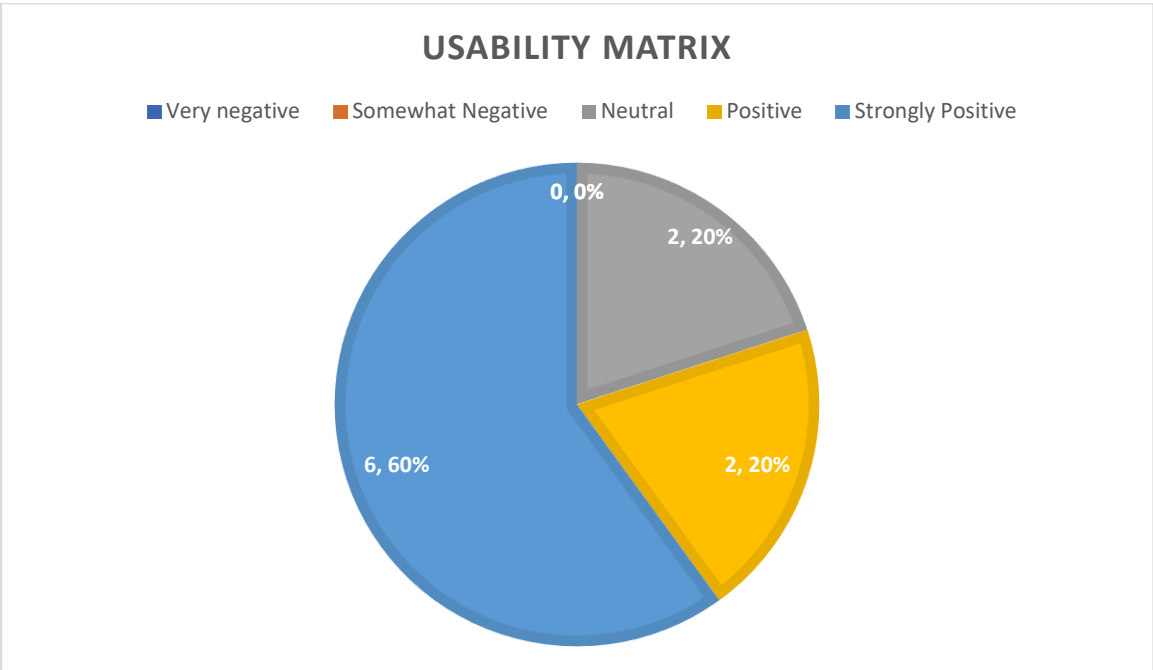


Figure 5: Class 8's consensus on usability of the platform

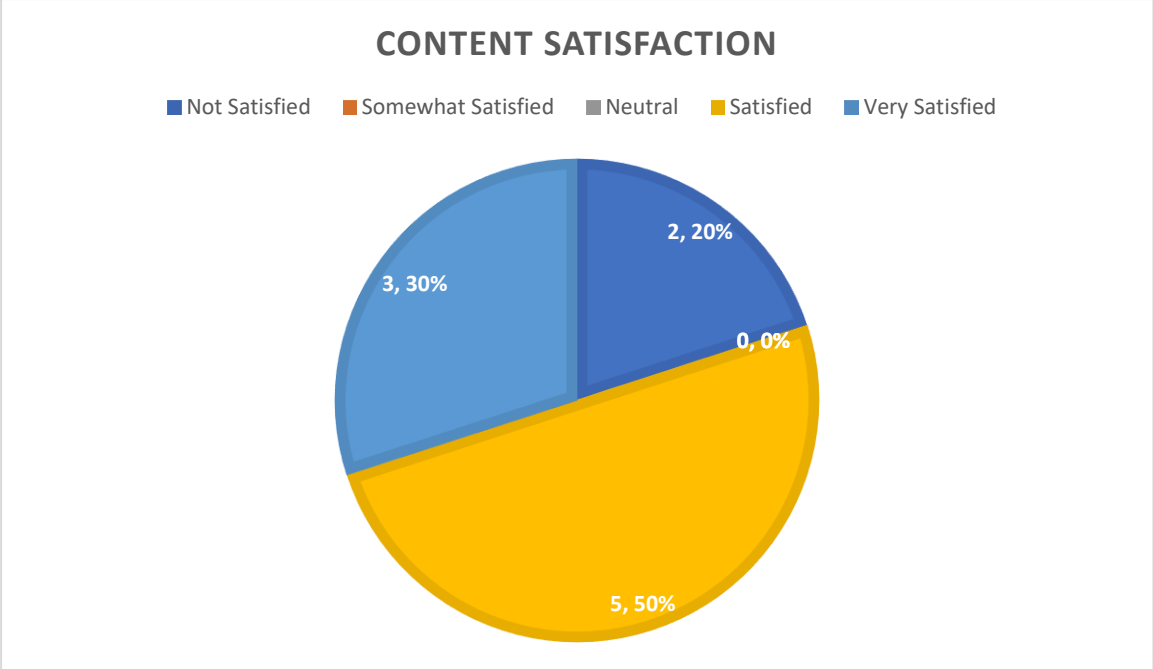


Fig 4.4: Class 8's consensus on content satisfaction

4.3.4 Programming Portion Result

For this portion, we evaluated the result and compiled it into only concerns. Rather than focusing on every question's individual answer, we focused on what each students felt strongly about on the survey on each question.

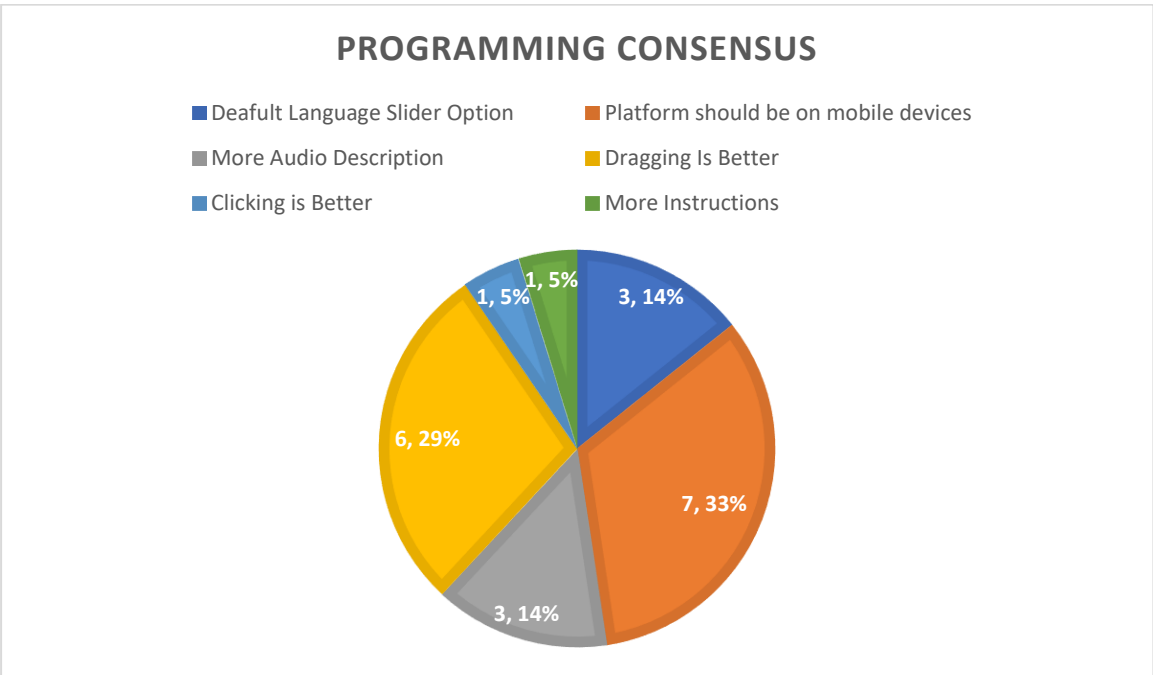


Figure 6: All Students' consensus on Programming Section

4.4 Result

4.4.1 Elementary Contents

- Addition-Subtraction
    - An addition subtraction simulation software that teaches the fundamental theories of addition and subtraction. The program also offers quizzes and interactive puzzles that can be solved using fundamental knowledge of addition and subtraction.

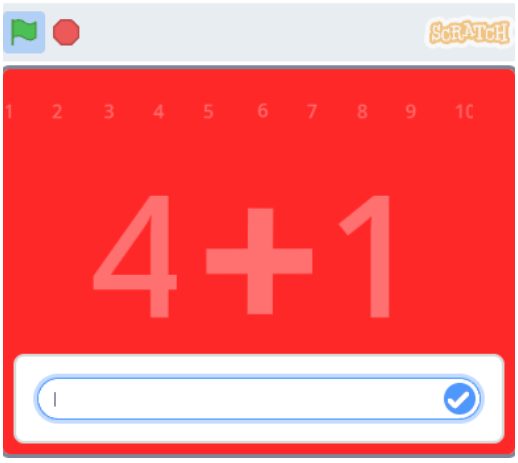


Figure 7: Addition-Subtraction simulation to teach fundamental Mathematical theories

- Multiplication-Division
    - A multiplication- division simulation software that teaches the fundamental theories of multiplication and division. The program also offers quizzes and interactive puzzles that can be solved using fundamental knowledge of multiplication and division.

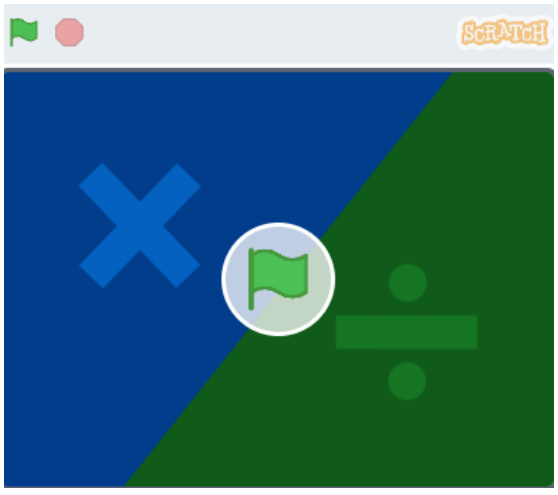


Figure 8: Multiplication-Division simulation to teach fundamental Mathematical theories

- Bangladesh
    - Offers many geographical facts about Bangladesh in a graphical manner instead of words. Clicking on any area of the map will trigger a voice command that describes the fundamental geographic facts about that area. Children can take part in interactive quizzes based on geographical knowledge of Bangladesh. To reduce stress of text-based quizzes, all implementation done here are done from a graphical standpoint.

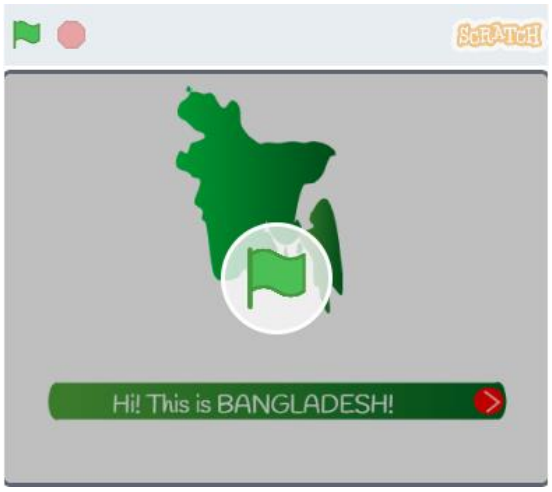


Figure 9: Interactive "Map" describer

- Basic Anatomy
    - Offers basic information about anatomy of a human body. It is designed in a way to accustom children of different ages to different body parts and their general works. Like the previous programs, this is also focused heavily on graphics and voice commands as we thought that would attract the attention of kids more. Clicking on any specific anatomy on the body would show a close-up image and its information. There is also a further information tab that links to a Wikipedia page of human anatomy.

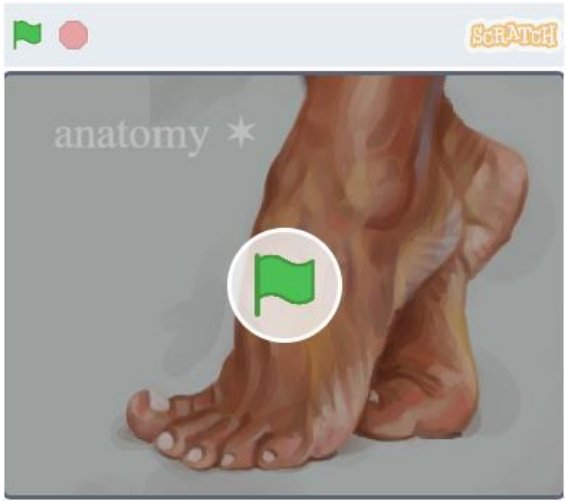


Figure 10: Interactive "Basic Human Anatomy" describer

- Equivalent Fractions
    - This is from class 5's math book. This program teaches children about the basics of equivalent fractions and its usages. The content taught in this program is taken from the NCTB text book but the information is presented in a new manner that is appealing to the children. There is also an interactive puzzle game involving equivalent fractions.

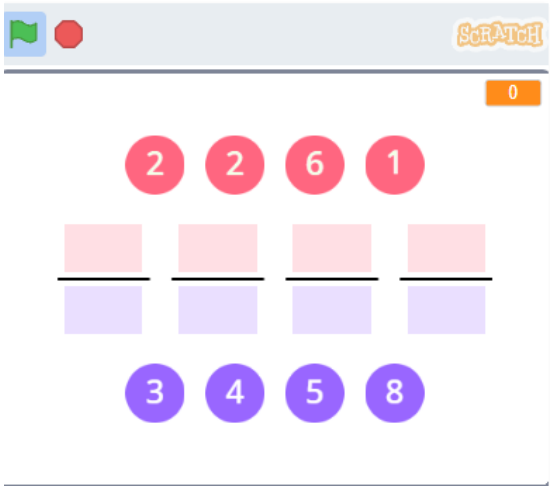


Figure 11: Equivalent Fractions simulator to teach about fractions

4.4.2 Pre-SSC Contents

- Cell
    - Gives the students the basic idea of what a cell is and provides graphical information about a eukaryotic cell. Information is presented in both text and voice form as the older kids might prefer either of them. Clicking on any part of the cell will prompt a new window which will show or say information about that specific part.

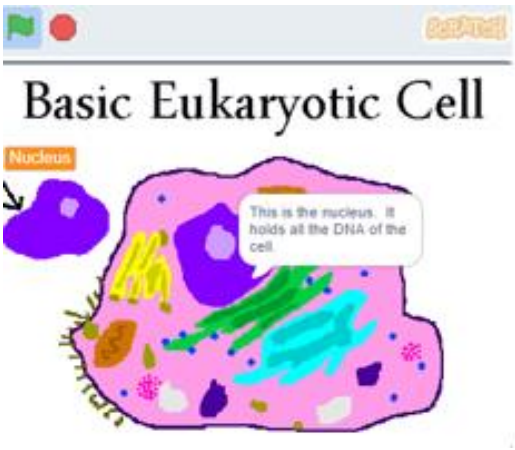


Figure 12: Interactive "Cell" describer

- White Blood Cell
    - This content is taken from class 8's science textbook. This program describes what a white blood cell is and its inner workings. Similar to the previous program, it provides graphical interpretation of white blood cell rather than focusing on the text-based information that is provided in our children's text books. Both text and voice-based presentation is applied here also.

Figure 13: Interactive "White Blood Cell" describer

- Acid-Base Game
    - Provides information on acid and base's nature in a puzzle form and students learn different aspects of these chemicals through interactions rather than information memorizing. Each level of the game opens with some basic information on the nature of acid and base and their relation. Based on that information, the students are then asked to complete different tasks. As the level of the game progresses, the difficulty and depth of information presented also increases.

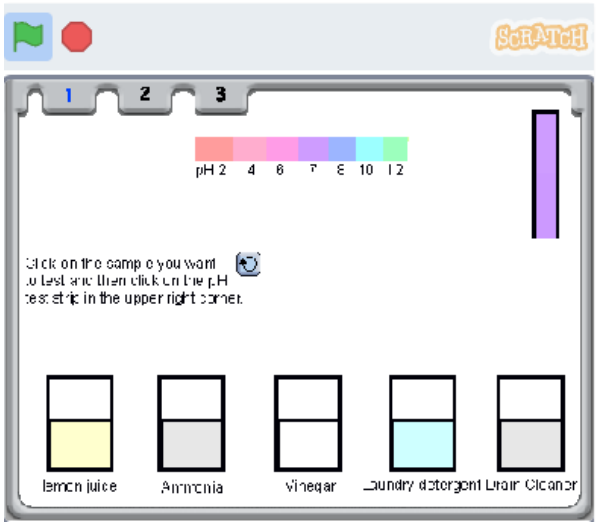


Figure 14: Acid-Base Game to teach fundamental Acid-Base characteristics

- Simple Electrical Circuit
    - This gives a demonstration of a simple electrical circuit that is provided in our high school text books. Rather than a still picture, this demonstration happens live and students are able to see how electrons travel from negative to positive end. The interactive nature of the program dictates the circuit such a way that students are able to remove and add more components and are able to see what changes happens in real time. This program is useful for students who don't have practical knowledge of electrical circuits.

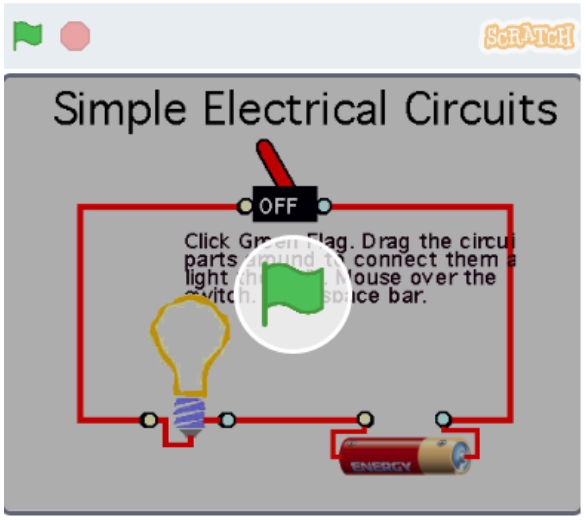


Figure 15: Interactive Electrical Circuits to show the electron and current flow in a simple circuit

4.5 Android Application

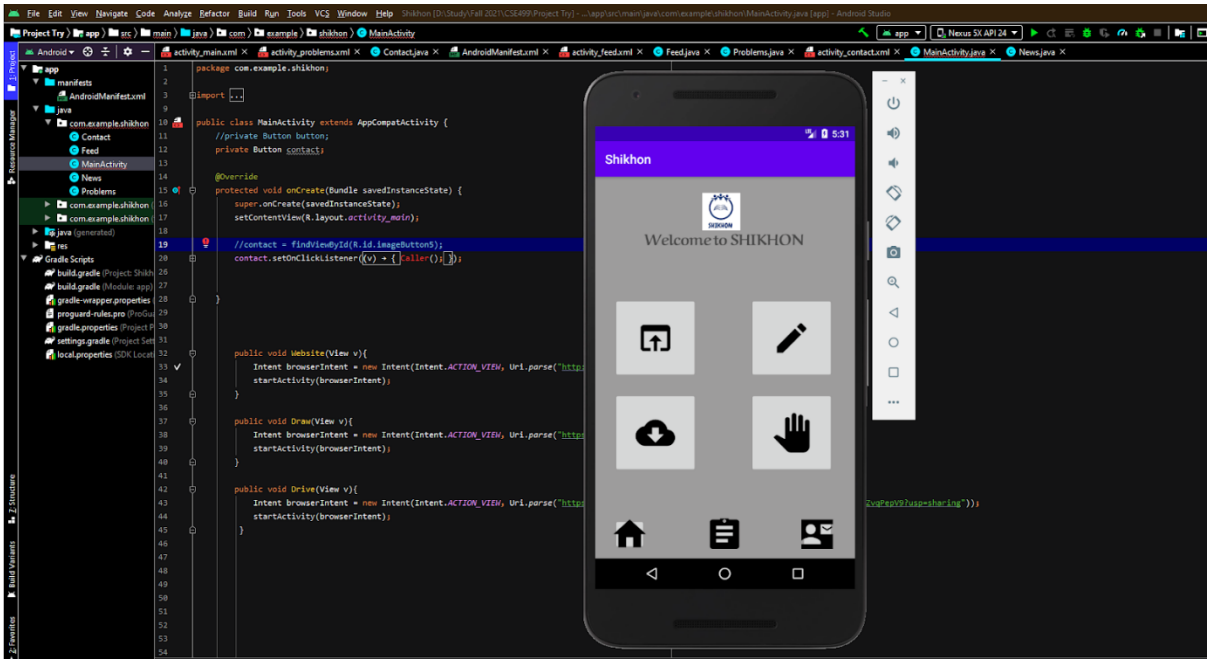


Figure 16: Android App to offer multi-platform experience and increase the usability of our system

The homepage contains,

1. Directing button (Top left) which leads to explore our website.
2. Drawing button (Top right), to create drawings
3. Download e-books button (Bottom left), to download pdf version of text books from class 5 to class 10
4. Ask for assistance button (Bottom right), to ask for help or any other assistance

The navigation buttons below,

1. Home button (Bottom left), to return to home page
2. News button (Bottom middle), to get updated about the latest educational news.
3. Contact button (Bottom right), to contact us for any queries

Basically, this app is to help the kids in their education by providing them news and updates. So, the “news button” is mostly the helpful one. After that the “Ask for assistance” option will help them clear their confusions about anything. That will work

like a feed so that everyone can share their problems and see the other's. We will be updating this app according to user needs. This is going to be the basic launch.

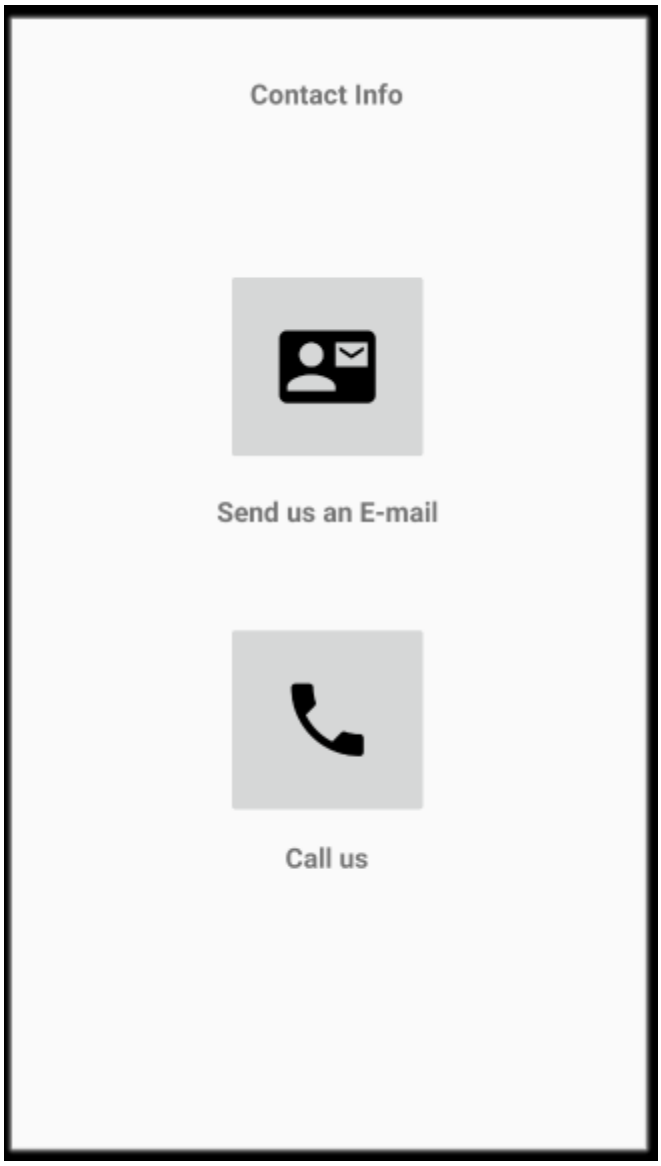


Figure 17: Contact Page of the android app

This is the contact page. Clicking on email will directly generate the user to send mail page. The default receiver is one of our group members. Also, the call button will directly call our hotline. No need to insert the email address and phone number manually.

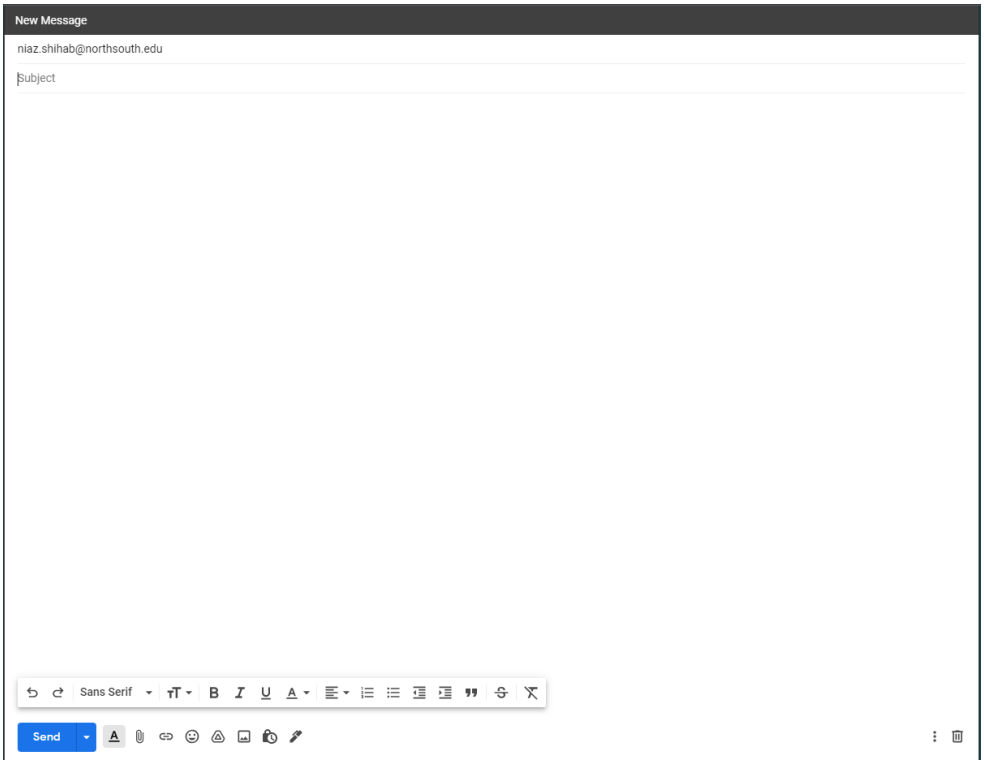


Figure 18: Direct e-mail Contact

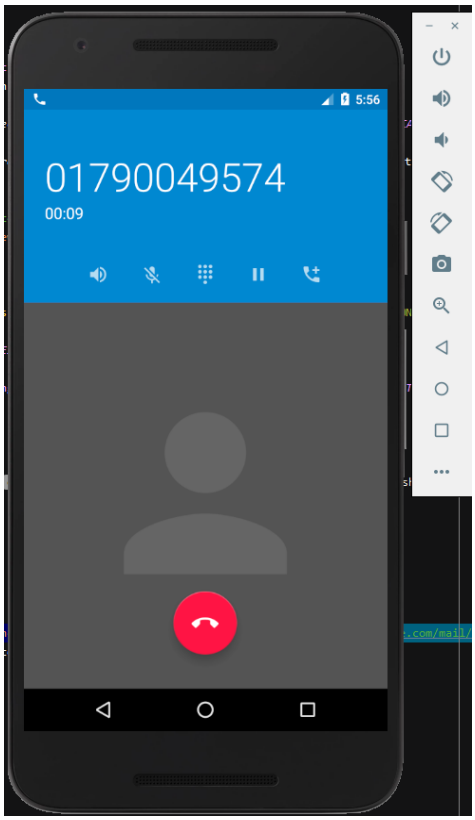


Figure 19: Direct Phone Contact

This is the comments page. We added our project to firebase which will save all the comments added in this section.

Figure 20: Comment to share user opinions and problems about any specific project

5 Conclusion and Future Work

5.1 Future Works

We wanted to add a lot of features into our project. But due to time and significant skill limitation, we had to fall short. But still we are hopeful that we have brought our project to a level where it can be further improved upon very easily. Some of these improvements need just library addition and integration work. Most of the heavy lifting code is already present. So, let's look at areas that could be improved upon in future:

- A working offline version of our project was our goal from the very beginning. We have already built the offline version of our website. But the Scratch atmosphere has some node js issues that we could not figure out so far.
- Seamless mobile and web integration is also in our vicinity. For now, we have both of the platform ready but apart from key features like database, most options don't work in unison with the others.
- We can be further trim down rendering time for the integrated programs with the help of AI integration. We have already trimmed down significant portion of waiting time. But AI integration on the platform can be more advantageous in this section in the future.
- More robust scientific simulator is our goal for future. We have already built some of the simulation programs like circuits and cells. But with the help of Scratch, we can also make a fully automated rendering program that can work as a scientific simulator. This is a big task that we are hoping to implement down the road.

5.2 Conclusion

Modern world is developing at an alarming rate. The children from other developed countries are getting necessary attention and the support necessary to develop their cognitive and problem-solving skill. They are picking up various technological knowledge at an early stage. But children from our country are lagging behind in these early developments. It is not at all their fault because we as a society are failing to provide neither the guidance nor the necessary resources that they need. So, a platform like ours could help to open up these kids to some new possibilities and help them get those early developments so that they don't lag behind the rest of the world. We have worked and will continue to work towards that goal and further improve our platform.

6 References

[1] S. Papavlasopoulou, M. N. Giannakos and L. Jaccheri, "Exploring children's learning experience in constructionism-based coding activities through design-based research," *Computers in Human Behavior,* vol. 99, pp. 415-427, 2019.

[2] A. Strawhacker and M. U. Bers, "What they learn when they learn coding: investigating cognitive domains and computer programming knowledge in young children," *Educational Technology Research and Development,* vol. 67, p. 541–575, 2019.

[3] India CSR, "BYJU'S to Empower Children with Free Learning Program," CSR India, December 2021. [Online]. Available: https://indiacsr.in/byjus-to-empower-children-with-free-learning-program/.

[4] A. Matei and C. Vrabie, "E-Learning Platforms Supporting the Educational Effectiveness of Distance Learning Programme: A Comparative Study on Administrative Sciences," *Procedia: Social and Behavioral Sciences,* vol. 93, pp. 526-530, 2013.

[5] M.-D. Shieh and H.-Y. Hsieh, "Study of Influence of Different Models of E-Learning Content Product Design on Students' Learning Motivation and Effectiveness," *Frontiers in Psychology,* 2021.

[6] R. Mahaja, K. Gupta, S. Kaur, K. T. Sidhu, U. Kaur, P. K. Goyal and S. Bedi.

[7] Sahrifuzzaman, "E-learning: 5 Bangladeshi platforms to look out for," TBS, 21 January 2021. [Online]. Available: https://www.tbsnews.net/feature/pursuit/e-learning-5-bangladeshi-platforms-look-out-189121.

[8] Prothom Alo, "Celebrate September through learning with Likee and '10 Minute School'," Prothom Alo, 19 September 2021. [Online]. Available: https://en.prothomalo.com/corporate/local/celebrate-september-through-learning-with-likee-and-10-minute-school.

[9] T. Selvan, "Case study: Making programming fun to learn for kids," 25 December 2020. [Online]. Available: https://bootcamp.uxdesign.cc/making-programming-fun-to-learn-for-kids-9-15-2a6bf22209ef. [Accessed August 2021].

[10] "Wikipedia," [Online]. Available: https://en.wikipedia.org/wiki/Solar_System.

[11] "Stardome Observatory Planetarium," [Online]. Available: https://www.stardome.org.nz/wp-content/uploads/2016/10/WEB-PDFs_solar-system-chart_2016.pdf.

[12] "Wikipedia," [Online]. Available: https://en.wikipedia.org/wiki/Earth.