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Project Proposal

RetroMath

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Introduction

What is the Project About?

Have you ever experienced the sensation where you stare at a paragraph, but the words seem to be jumping around or letters appear to look silly? What you may have experienced at that point was dyslexia. A reading disability which causes children and maybe even adults to have difficulty read and understanding words and sentences. Take a moment and think how it would feel to look at writing on paper and not be able to decipher it; now imagine this condition with math, where you visually see a mathematical expression but cannot interpret it. This condition is known as dyscalculia and is the focal point of our project. Affecting roughly 6% of people, scientist say the “math soup” disability is more common than a person would think. As a third-year student, I have experienced this condition in math exams, where the question given begins looking like the numbers are floating around and the symbols and letters seem to laugh at you. We have decided to create a basic math game to help learners understand math, and at the same time help with the condition known as dyscalculia. Math is a problem-solving game. Its like the gym for your mind, as such math’s can be used to also help the elderly exercise their mind and strengthen it.

QUESTIONAIRE

Parent:

*Please circle the correct answer where necessary.

1. What grade is your child currently in? 4 / 5 / 6 / 7

2. Is your child currently attending tuitions for maths? YES / NO

3. Has there been any signs of improvement? YES / NO

4. Does your child regularly play video games? YES/NO

   4.1 If so what type of game is it?

   _____

   4.2 On Average for how long?

   _____

5. Does your child suffer with any learning disabilities? YES/NO

   5.1 If so what disability(ies) is it? -

   _____

The gathered statistics from the questionnaire handed out to the learners of Woodview Primary School were as follows:

- Out of the total number of learners in the school, 53 had decided to participate in research.

- 39 state that they do attend tuitions.

- Of the 39 students 20 stated that the tuitions has seen some improvement in their math mark.

- 45 students regularly play video games, even on a school night.

- The average screen time for playing video games is $1\frac{1}{2}$ hours during school nights. On the weekends and holidays, we see a peak of approximately 8 hours of gameplay

- The learning difficulties where given as follows:

  ADHD – A condition where a child cannot focus on one aspect for long periods of time.

  Dyslexia – A specific learning disability that affects reading and related language-based processing skills.

  Fear of math.

  Stage Fright – A learner cannot stand in front of the class and present their oral speech or any type of presentation.

Who is the target market?

- Our target market consists of learners just entering the intermediate phase in primary school as well as those in the junior primary phase. A child's mind at a very young age is said to behave like a sponge, continuously absorbing information being thrown at them. As we progress in life, the sponge sadly reaches its limit and we are not capable of learning new concepts ever so easily.

- Although the target market is set for primary school learners. The system can also be implemented in helping the elderly who did not get a chance to learn mathematics. The game is built of the fundamental concept of bodmas. It would also act in exercising their brain to fight of Alzheimer's disease. A condition that affects the brain causing an individual to become forgetful with even the basic tasks like tying their shoes

- The game can also be used to help with ADHD, since the learners mind would think they are playing a game as opposed to writing a test or exam.

- We tend to also implement this game to help treat people with dyscalculia. As such the game can be implemented in use of stimulus therapy, meaning we present a patient with some activity to help treat their condition. The more the patient is exposed to the stimulus the better the chances of fighting the condition.

What problems are we trying to solve and how will we carry it out?

- Many children in the intermediate phase do not grasp the basic concepts of Mathematical equations and solving. It is because of this, that later during the high school phase, most pupils choose to drop out or end up repeating a grade more than once.

- We want to also help solve the problem of ADHD. I suffer with this. It causes me to lose my train of thought halfway into an activity. Getting easily distracted by the simplest of actions or sounds. Learning simple aspects could take up to a day. Getting activities tend to span hours instead of minutes. ADHD can be combatted using a series of tasks. While it can be treated with medication. The main problem lies that the brain is not doing something or carrying out some form of task. With this game we aim to be distracting the brain by tricking it into believing it is a game, and no some form of school work. The child will be relaxed and be able to learn concepts on their own.

- A batch of single-alone edition subject educational game software and game study platform has come to the fore over the past few years in our country, such as, "the students' wisdom world" which was produced by Kelihua company as one of the earliest domestic games applied to study, "learning from Lei Feng " which has been known as the best educational network game in the whole nation, "the China hero pedigree" showing history heroes, "grain strength " showing the humanitarianism, and so on. Meanwhile, a lot of small educational games that are manufactured with flash have received students' favor, the character of which is combining game with educational content naturally. For example, "The Starlit Sky Education" is one of the comparatively successful examples. It has provided school edition and family edition, and every edition has all contained series of small games made with flash, which have integrated some related knowledge. Different kinds of educational games have different effects. Competitive games, such as chess, poker puzzle games, can develop student's intelligence and take the student's reaction ability to exercise. The role games and simulation games which have realistic images and complex circumstance more like movies, can make the students

gain interactive experience, avoid their delight losing in a boring classroom, and help them to seek the fun of learning. Educational games have a positive effect on students' intelligence development. – quoted from "**The Study on the Effect of Educational Games for the Development of Students' Logic-mathematics of Multiple Intelligence**"

- So why did we choose a math game out of all the other concepts that are available. Well we intend on helping people with dyscalculia, at the same time we wish to help all individuals learn to do mathematical calculations on the fly. We tend to believe that math is not a basic concept, that the formulas we learn will not help us. "I want to be a drama student why would I need math's?" Well believe it or not you use math's in almost all your day to day activities. Going to the store to buy a few items, if you do not know calculations, the teller may not have given you the correct change and you would not know. Math's help stimulate the problem-solving aspect of the brain. Another example is cooking. If a person uses wrong measurements the food would not taste the same or the proportions would be completely off. Have you ever made spaghetti thinking this small portion I am cooking should be enough for me only but end up cooking enough spaghetti to feed the neighborhood? The food could get burnt or even undercooked. Math's is all around us, and thus if we cannot grasp fundamental concepts a lot of the basic activities, do become impossible to complete.

Where will we demonstrate our project at?

- Woodview Primary School
- Principal – Mr P Ramsurrup
- Tel: (031) – 505 2010 Cell : 084 70 55 404
- Due to the events of COVID-19 pandemic, it is highly unlikely for a demonstration of the project to take place.

Literature Review

Any games similar to ours?

- Math Miner – a game where a person must choose the correct answer to carry on leveling up

- King of Math – a game where a person is given a time limit to choose the correct answer, if the answer is right, player takes some health from the hoard of zombies approaching. If player gets the answer wrong the zombies move faster

- Escape Room – player is given a time frame and a mystery to solve. If player fails to escape the room, they are stuck. If player succeeds, they escape the room and can rejoice with their family

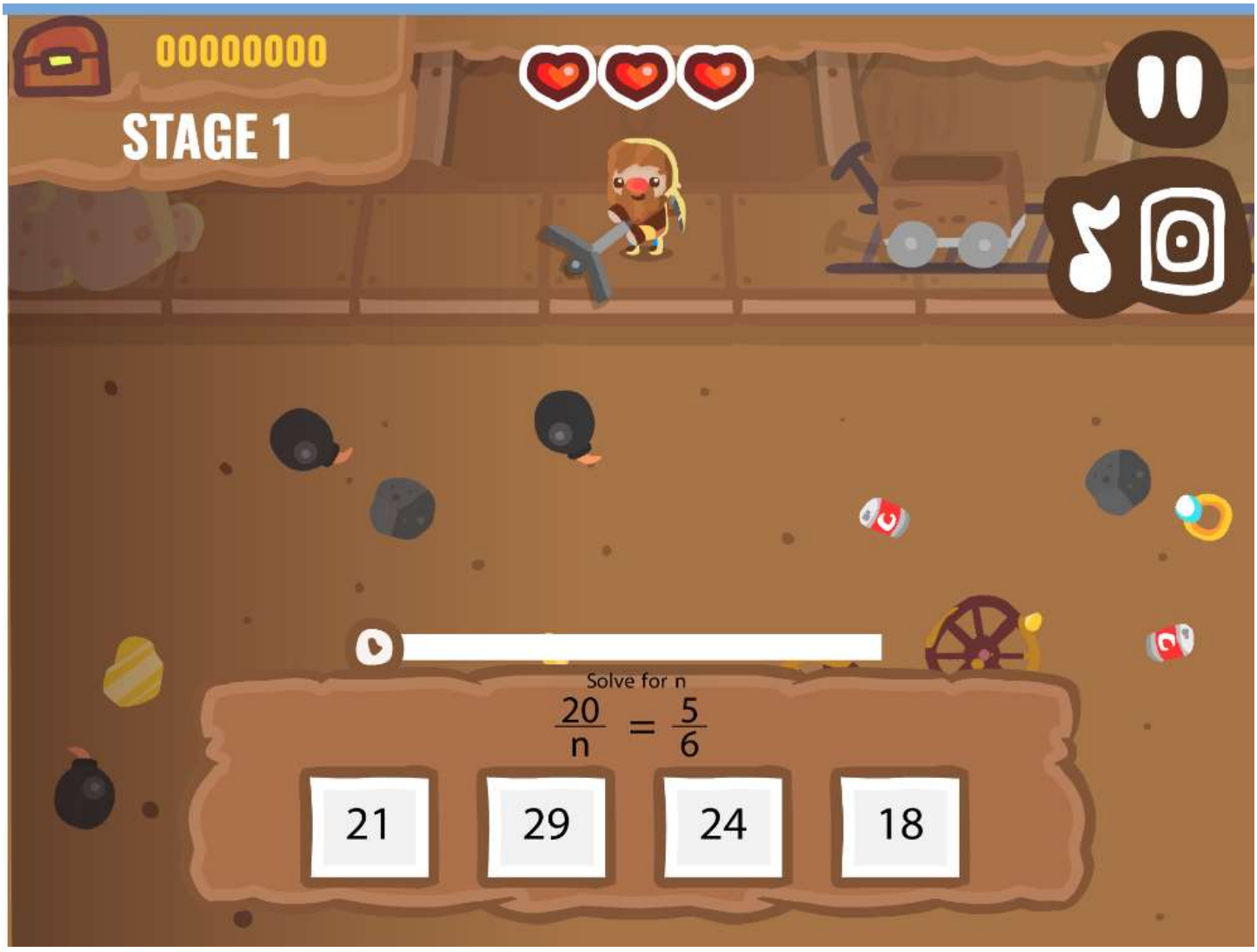
- The game is also based off a few missions in GTA where you only find out if the mission was successful after completing objectives. The main mission is in GTA IV's mission She's a keeper. The player transports Gracie from one location to the next. In the process, henchmen arrive and try to ram the car. Gracie has no health bar so the player would not know if she is in a critical state or not. At the end of the mission, we find out if Gracie had died or not.

- Another mission similar is GTA V's finale, which sees players kidnapping the final boss and taking him to the finale spot. Again, the finale boss has no health bar. Once the player reaches the final spot, 1 of 2 occurrences happen. 1) if the player drove recklessness and ended up killing the final boss, the mission is failed. 2) if the player managed to keep the final boss alive during the drive, the mission is a success

- Mystery tiles series - It is a card game which sees players answering different questions and gaining the answers towards the end of the game. An example

from the series is the Mystery tiles reducing fractions game. Each letter is given a fraction and a position, if the fraction is true, the letter is appointed a position in the sequence “x”, if it is false it is appointed another position. After answering all questions, the user is required to arrange the letters into their respective positions. Once all letters are arranged, the user will know if their answer is right or wrong

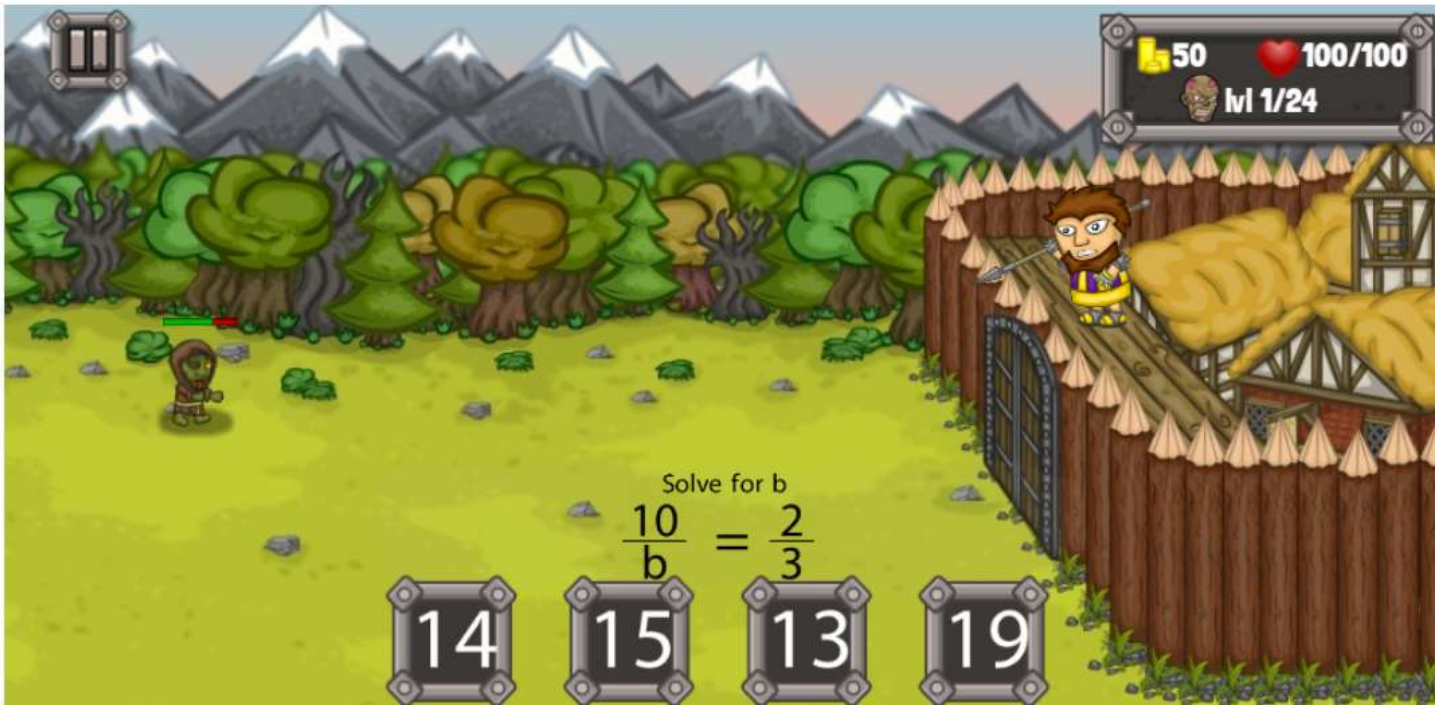
Math Miner:



Here we see players having to choose the correct answer while a miner sways his detector. Timing is crucial here, as if players answer correctly and when the detector hovers over a mine the player will lose a life

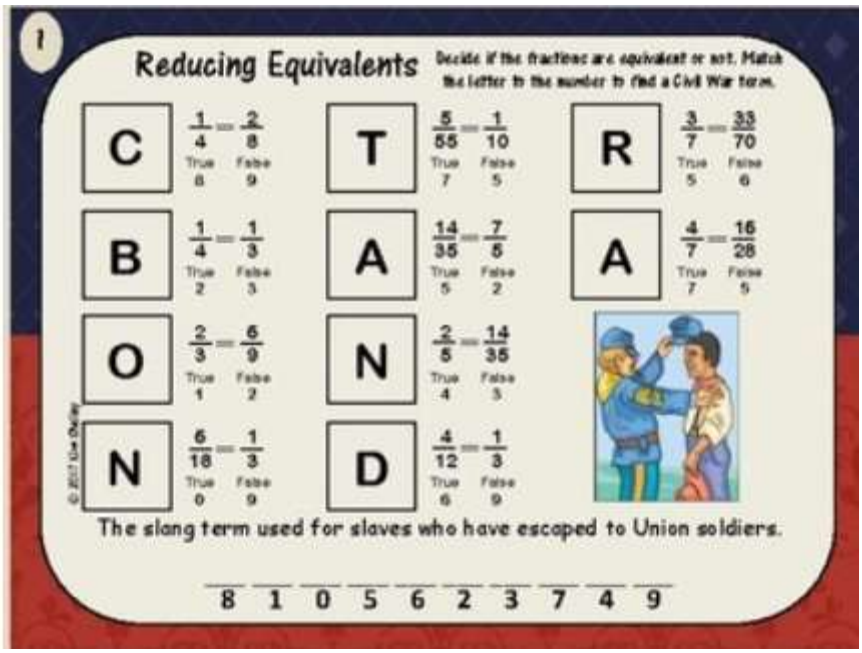
King Of Math:

This image shows the difficulty and character decision players have



This image shows the king defending his castle from a horde of zombies, if the player gets the answer right, damage is inflicted onto the zombies. The zombies also move towards the castle, so players must think fast before answering in order to save the king

Mystery tiles reducing fractions:



In this image we see the game of mystery tiles, where players have to answer true or false to gain the position of the character in the answer sequence

How will ours be different?

- While the above-mentioned games take place in a 2D environment, our game will be console based.

- Our game includes custom characters, as well as different villain's dependent on difficulty

- Unlike Escape room, our game will only inform the User at the end of the game as to whether they had successfully saved their character. This is to add suspense to the moment, as well as invoke a competitive atmosphere between peers. It tricks the player into thinking their answer is correct. When finding out your answers was not what you expected it to be, players generally play again. This is very helpful in the multiplayer format. As seen in games like Fortnite. Players always want to battle for the number 1 spot, which is generally the winner. When a person ends up failing in a game, they tend to continuously play again until they win. The use of this technique ensures that when one person finds out that another player won, they would want a rematch, meaning learners would be playing and learning for countless hours on end.

- Our game will have a feature in multiplayer where players would be able to view the statistics of their opponents. Players would be able to filter score or time to see the time of each player is ascending order, or even the score of each player.

- Our game will display a review of all the questions answered by a player. Showing them the solution and working out if they had gotten the question wrong.

- The game will also have a help feature during questions, where if a player enters help, we will display the working out for the player. In this instance the player would not be appointed any points

- We aim to use the same aspect as the mystery tiles series except that, players will only know if they had saved their character after answering all questions.

What problem are we solving and what tools will we use?

- We are trying to create a cool gaming environment where learners are free to learn at their own pace as well as compete with their friends. Since it is console based, having to create a vibrant environment and capturing the hearts of children deems it difficult

- We plan on using aspects from the console itself. Trying to change colour and fonts of text which is displayed in the console.

- The main problem we are trying to solve is dyscalculia. Incorporating a playful environment ensures that the Player is in a safe space. It's not homework nor an assignment nor an exam. It is a game. Games have this effect on people. A haven, where mistakes are made, and learning becomes enjoyable instead of having a constant worry.

- Students can learn lots of knowledge when playing games. The game **learning from Lei Feng** developed by ShengDa company is the first educational online game, the design idea of which is that education is of equal importance with entertainment, and students will be educated to do good things in the process of playing the game. Series of small Olympic games in Starlit Sky allows students to understand the rules of Olympic games competitions, to master the play skill, and to have the fully experience. World navigation knowledge, world geography and economy knowledge in NetEase games, **Fantasy Westward Journey, Voyage** are very helpful for students. In the game, in a relatively relaxed environment, the students can have a proactive learning and build-up knowledge. The game, **Fantasy Westward Journey**, adopts the way of approaching questions, which are different from the pattern of beating the monster and making a mission. Many students playing the **Fantasy Westward Journey** know that to upgrade, you must know more about Chinese history and world geography.

- The process of playing games is a constant observation and problem-solving process. In several excellent educational games, they set the problem situation at the beginning. Then, the games stimulate students motivation to

solve the problems. They also provide large amount of resources for solving problems at the same time. Thus, students can form the habits of: observe, analyze, and solving problem in depth unconsciously. They can also exercise students logical reasoning ability. In the game "**Simulate Life**", there is such a simulated circumstance: two companies sell similar goods at the competition. The student can play the role of a sales manager of anyone company. According to their company's storage capacity and market conditions simulated by computer, they make a variety of marketing decisions. These decisions will affect the market. The people who make the biggest profit will come to the final victory. Computer game is a shortcut leading to the computer world. Students will also learn the appropriate computer knowledge while playing games. In this process, students' computer technology can be improved.

Objectives

What do we intend on Implementing?

- We intend on displaying an equation to the user to solve as well as get an answer for that equation
- For the expressions we would like the length of the expression and the range of numbers used to be based on the difficulty the user enters.
- We would like to include multiple division; intend on making it such that the answer for the expression is a whole number.
- We would like the score calculation to be based of the time the user took to answer the question.
- We want to sort player attributes like the player scores and the fastest time.
- To have sound be generated at the end of the game. To make the game feel just a little user-friendly.
- We want to display the players details after some length of time. We wish to do the same for displaying questions presented to the user

Methodology

How do we plan to achieve these objectives?

- We will create a class for generating an expression and getting the answer to the expression. We plan on building our own calculator function, which will take the expression as input and calculate the final answer based on the rules of BODMAS. We will have a vector which will contain the operands +, -, *, / in them. We will generate a random number using the random operation that c++ has built in. Once a random number is generated, in some range which will be dependent on the difficulty the user chooses, an operand will be randomly selected from the vector of operands. Numbers and operands are generated until the required length of the expression is met.

- We will have control variables called upper bound limit and a lower bound limit in the expression class which will control the range of numbers generated for an expression. We will also have a control variable called expLength to control how long the expression will be, based of what difficulty the user enters

- For division we plan on creating a vector of divisors. If the previous number is a prime number, division will not occur, this will be done using a control variable which will be flagged as true once the number generated is prime. The vector of divisors will contain all numbers that our randomly generated number for division can be divided by. A random number is selected and added to our string for division. With multiple division we will use a control variable to make sure that the result of the randomly generated number divided by the randomly chosen number is not prime. If the previous operand was division and the current randomly selected operand is division. The answer for the previous operation i.e. the answer to the division of two randomly generated numbers is stored and the divisors are calculated, we will then randomly choose a number from the vector and continue with the process of generating a number, generate an operand, generate another number.

- We will get the system time from when the questions are first displayed to the user and the system time when the user answers the question. We will get the difference in time which will be the duration the user took to answer a question. Each difficulty will have a variable which will state the required time it should take to answer a question. We will develop an algorithm, that will calculate a score out of 100 for each question. As the player takes more time to answer a question, their score will decrease. If the player goes over the time limit but manages to still get the question right, they will be awarded minimal points.

- We intend on creating a template class which will contain a template function for sorting vectors. The players attributes will be stored in a struct. Each player struct will be stored in a vector. Because we wish to sort attributes such as the players score and their time we will store all the players attributes in different vectors. We chose to make the method a template method is because we would like to send it different primitive types. An example. Maybe we would like to sort out the players scores in ascending order and have their usernames be displayed also or have the player with the highest score and the time it took the player to complete the game. One can say why not just send the vector of player structs? Well the problem with this is we would have to create separate methods to sort out the different player attributes. Using a template class means we will only have 1 method to do the sorting while sending it different parameters of different types and gaining the same output. It reduces redundancy of code since each sorting function for each attribute would have the same body of code but take in parameters of different types.

- We will use the Winmm library as well as the windows.h file, which will aid us in being able to play a sound at the end of the game, when the player is presented with their score. If the player score is above a stipulated amount of correctly answered questions, a cheerful and happy sound will be played, something to congratulate the player for finishing the game with a good score. If the player does not manage to answer enough questions right, a sound will be played to encourage the user to try again, something similar to “better luck next time bud”

- We will make use of the sleeper function built-in to c++ and accessible with including the windows.h file. The sleeper function will help in creating a slow-moving environment. Where questions are not generated on the file but rather once the user is done answering the previous question, the console will be cleared, and the program is put to sleep for x number of seconds. This can be used to make it seem that the computer is generating a question to ask to the user, allowing the user to get themselves ready for the next question. The sleeper function can also be used when displaying the users score and whether they would have saved their character. This would be primarily done to invoke a feeling of suspense in the user, or to keep them on their toes.

What approach shall we use?

We have considered the bottom-up approach (inductive coding) for them problem at hand. We will deduce blocks of code based on the data we received from the questionnaire we gave out. We will analyze what section the pupils find the most difficult and base the way we generate our expression on that. From interviews with learners we deduced that it is primarily multi-operational equations that they find the most hardship in because they do not know which operation comes first and generally read the equation from left to right instead of following rules.

The Pros of using the bottom-up approach are as follows:

- We are more engaged in the learning and implementing part of the coding process. More research is done to ensure that the client gets the outcome they were hoping for.

- Each person in the group has a say in the planning and decisions are made collaboratively. Improving team communication and empowering the team members.

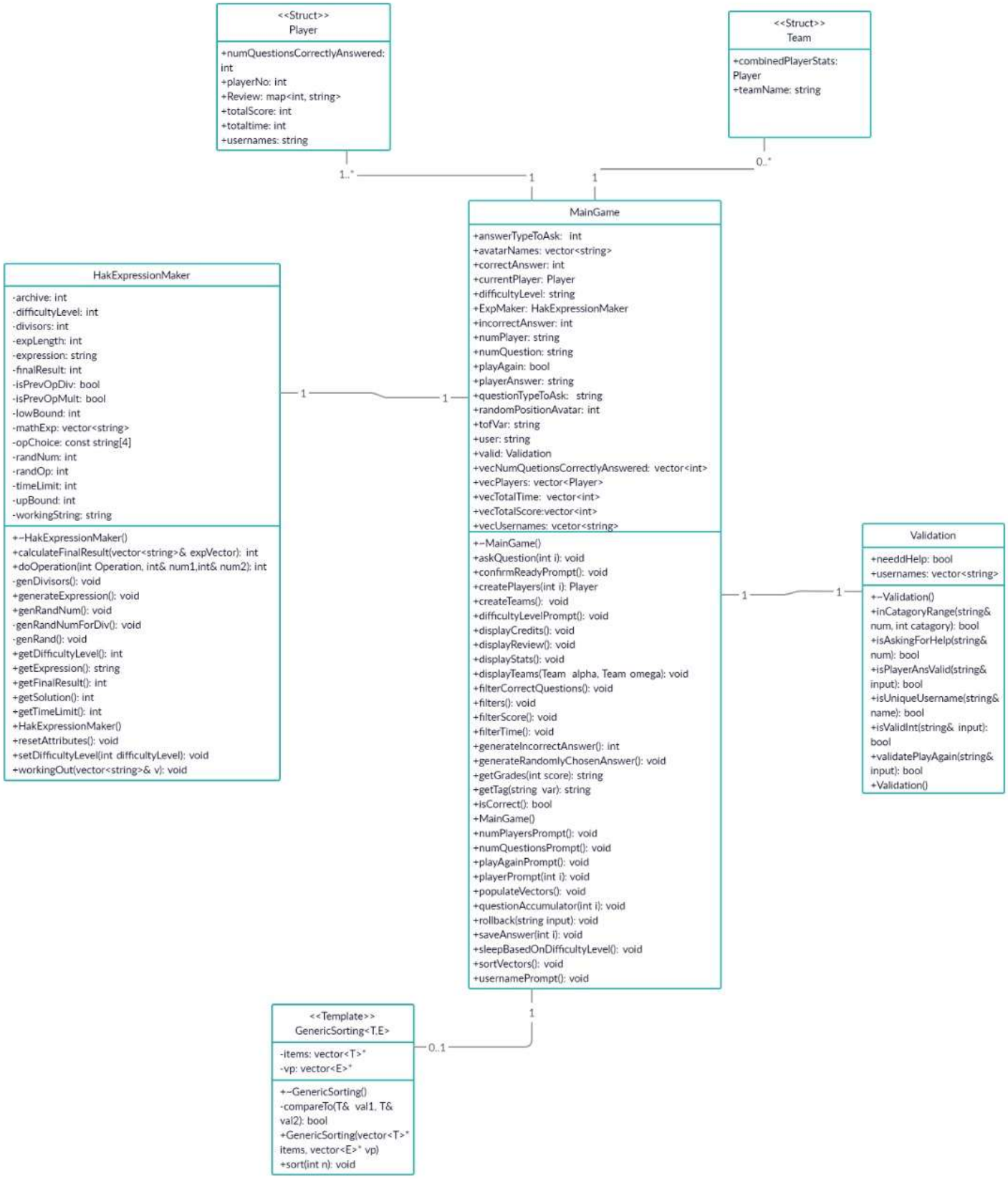
- Identifying tasks first also leads to a more detailed project plan, with a potentially more accurate schedule. Meaning we will identify what should happen next based on what we have coded so far.

The Cons of using the bottom-up approach are as follows:

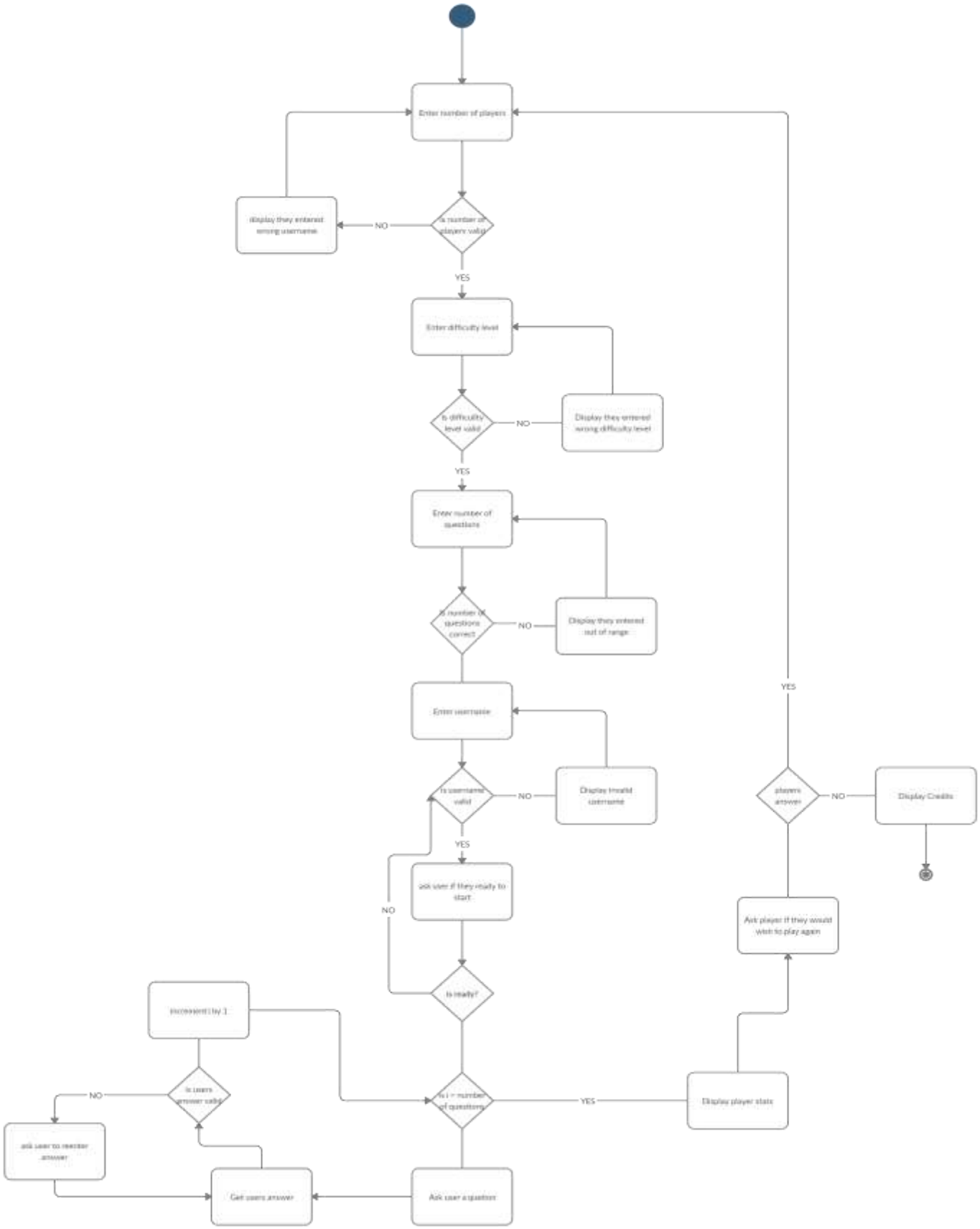
- Bottom-up planning also requires a clearly defined scope and control process, otherwise it is at risk of getting out of control. Without a defined scope we may run into issues that do not pertain to what the user wanted. Example if the client wanted a program for his car sales and we decided to implement some system that carries out advertising for the client. The client would become disappointed because we may have put in allot of work into the advertising part of the program and not met the requirements, they had given us.

Each day we will tackle a new objective. We set a time frame per day in which the objective must be complete. At the end of the day we will have an overview on the problems we encountered during the day and update our list on whether new objectives must be added, and which objectives must be removed. These are essentially our sprints as we look to try the Agile developmental process. The problem with using the Agile Approach is it focuses on processes for getting requirements and developing code and does not focus on product design. In the case of the project, our focus is to try and implement as many learning outcomes as we can. As such we may pay more attention to the processes that are required to ensure we complete all the learning outcomes that do not pertain to the product design i.e. the end game result.

UML Diagrams



UML CLASS DIAGRAM



Conclusion

We aim to create a working and fully functional game which is both educational and competitive. We hope learners have fun and continue to develop necessary skills. Developing and stimulating their problem-solving aspects of their brain, and in the process help those who suffer from dyscalculia.

We hope for there to be a Math quiz game where players have a choice to set their difficulty level, play through the game gaining math knowledge, playing against their friends as well as with their friends. Players will be given an expression and a statement about the expression and they would have to solve the expression to see if the given statement is correct. Points are calculated based on you time. The longer you wait the less points one will accumulate. We tend for this game to be incorporated with teaching dyscalculia as well as any other mathematical conditions.

References

Article title: Math Games, Math Worksheets and Practice Quizzes
Website title: Za.mathgames.com
URL: https://za.mathgames.com/

Article title: Early teens gaming online more - Study
Website title: GamesIndustry.biz
URL: https://www.gamesindustry.biz/articles/2019-01-31-early-teens-gaming-online-more-study

Article title: What Is Dyscalculia?
Website title: Understood.org
URL: https://www.understood.org/en/learning-thinking-differences/child-learning-disabilities/dyscalculia/what-is-dyscalculia

Author Jing Li
Article title: The Study on the Effect of Educational Games for the Development of Students' Logic-Mathematics of Multiple Intelligence
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Article title: Math Matters in Everyday Life - NIU - Math Matters

Website title: Northern Illinois University

URL: https://www.niu.edu/mathmatters/everyday-life/index.shtml