



**Video Games as a Learning Tool:
Math Games with Tynker Unit Plan**



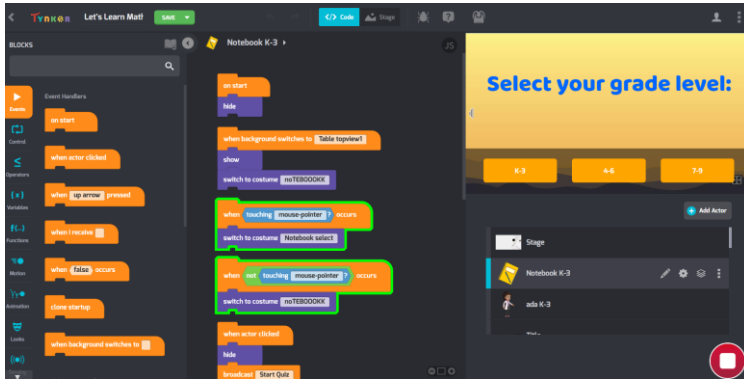
Jozelle Sumat

**EDTC 400: Advanced Studies in Educational
Technology and Media
Faculty of Education, University of Regina**

Table of Contents²

Overview & Rationale.....	3
The Making Process.....	4
1. Discovery.....	4
2. Interpretation.....	5
3. Ideation.....	6
4. Experimentation.....	7
5. Evolution.....	7
Resources.....	8
Unit Plan.....	9
Unit Overview.....	9
Learning Outcomes.....	10
Lesson One.....	11
Lesson Two.....	13
Lesson Three.....	15

Overview & Rationale³

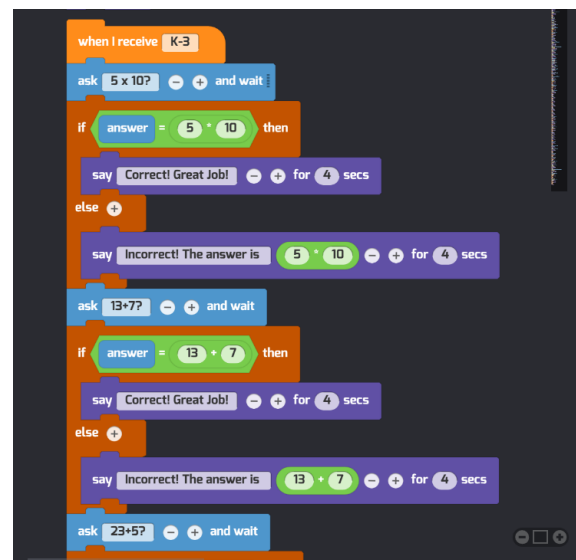


Using video games in a classroom as a tool for learning has always been surrounded by controversies. Although some video games are at the least educational, one must only generalize some as non-educational. For instance, racing games teach map recognition and memorization, and puzzle games teach pattern recognition. To give context, video game genres come in many

forms, and every genre has educational value. However, only some students wish to learn via video games, so it is merely an alternative learning tool. On the bright side, students should learn different educational tools to help them find various learning opportunities. Students may not need these tools, but exposing them to some, such as video games, will diversify their learning.

Moreover, if there is one thing that every individual from every age group must learn, it is coding. Coding exists in everyday life. From smartphones to computers, people's gadgets function because of the codes behind them. While it is a fact that coding is complex, one can simplify their learning using code-block software like Tynker. As stated, Tynker is a code-block software which varies in different complexities. Younger users or those without experience may learn coding through their code-block feature. Meanwhile, experienced individuals may like to improve their knowledge of Tynker's features, such as robotics, JavaScript, HTML, and more. Overall, Tynker has much to offer, suitable for all age groups.

In this project, I have decided to relate it to mathematics. Upon entering the mathematics education career path, I always aim to create ways to make mathematics learning more fun. Since I love video games and have a soft spot for coding, I decided to combine the two and create a game where students use code blocks to learn math. This game that I made consists of three levels: K-3, 4-6, and 7-9. However, this project is created for grades 10-12. Therefore, this game will serve as a tool to determine if students of grades 10 to 12 know the essential skills they need upon entering their grade levels. This project also aims to teach students how code-block software like Tynker works. Ultimately, students will create games and math questions for their classmates to play.



The Making Process

1. Discovery

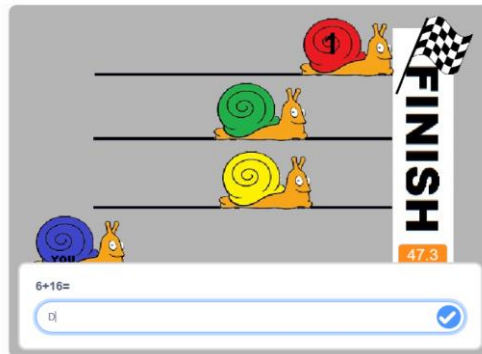
Video games and mathematics inspired me to create a project based on those two. Since my goal is to make my future math classroom more fun, I want to create something that gives me joy and introduce it to my students, hoping that math will be enjoyable for them. My initial idea is to create a horse racing game where students will answer as many equations as possible to get to first place. Games like [Nitro Type](#) and [Typer Shark](#) inspired me to create a game where students catch up with time and test their math speed.

To create this game, I decided to make it using Tynker. Since I'm not too fond of Scratch's interface. I searched for different software. I came across [Stencyl](#) and [Blockly](#) and finally settled for [Tynker](#). Tynker is the most user-friendly among the three, so I decided it is a safe pick for this project. The challenge for this project is learning a new code-block software since Scratch is different from Tynker. Another challenge is creating a game. Many aspects make up a game, such as:

- ❖ The different levels,
- ❖ the different math questions that will make up the whole game,
- ❖ scores and how will I assess the scores, and
- ❖ Is there a game like this that already exists?

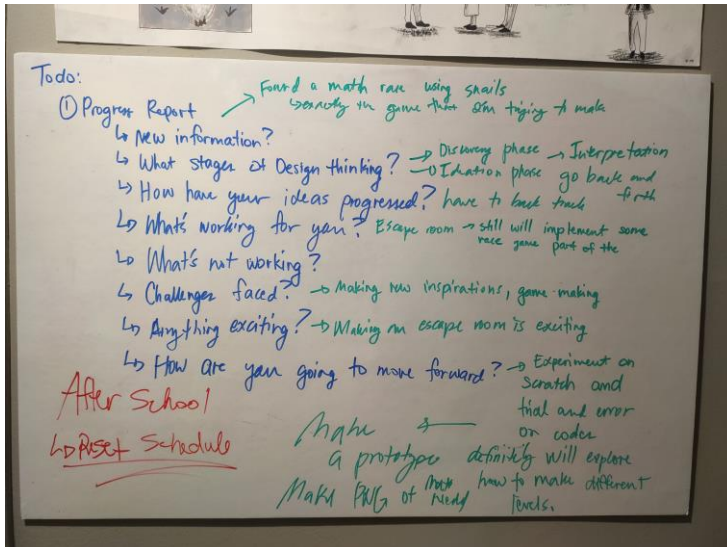
Then it hit me, math racing games already exist in Scratch. Upon discovering this, I searched for more video game inspirations. I remember playing escape room games where players gathered tools and clues to unlock the door. To make this game math related, every clue the player find will have a corresponding math question. Players must answer correctly to retrieve the clues that will open the door. I have progressed in this idea as far as having interactives in the room that will lead to the next room. The prototype of my math escape doors can be found [here](#). The math race game that I mentioned can be found [here](#).

I looked for ideas for my final project from the math scratch games during reading week. I searched for a math racing game, hoping to find inspiration and ideas for the code. To my surprise, I found a game that looked just like what I imagined my finished game would look like. Instead of using horses, they used snails!



Upon making progress in my escape doors math game, I found it challenging to have many interactives that follow the same code. This results in a game lagging and failing to progress. Once again, the escape door math game will not work. However, it can work with more advanced software, but that is different here.

The Making Process



Again, I started looking for inspiration for this third attempt. I decided to keep it simple and make an after-school tutoring game. I figured I was too ambitious to create a game inspired by the games I had played when I was not making it for myself but for my future class. Moreover, I also played many educational games in my childhood.

2. Interpretation

I remember signing up for Saturday math classes back in the Philippines. I remember finding it extremely useful. Becoming a mathe-

matics teacher is complicated, and becoming a math student has the same difficulty. This project made me realize how much students learn in one grade level. For some students, the time spent sitting in a classroom and learning is often insufficient. This inspired me to create after-school tutoring because students need much time to grasp new information, especially further math information.



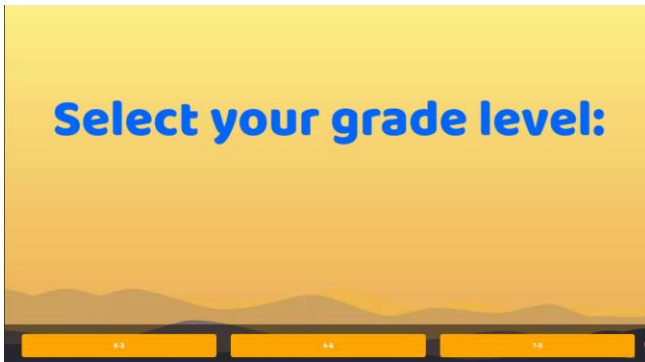
While working on the afterschool tutoring game, I added a character to act as the tutor. Tynker offers many assets. I chose one of the assets that look like a teacher the most. Her name in Tynker is Ada, so I just kept the name. While working on Ada, I often imagine myself as her as I create the dialogues. Therefore, I made Ada's conversations what I imagined I would say to my future students. I concluded that I am creating this project for my prospective students, so I wanted to make it so it looks like I am the one who is tutoring them. Moreover, while creating dialogues for Ada, I figured this game could be applied to any subject area.

It is interesting how I ended up doing this game. The first and second ideas for a game did not work because: First, a game already exists that does exactly what I imagined the final product to be; Second, the game is too complex that the software itself gave up. However, the main idea remained the same. I wanted to make a game which features mathematics. With this, my idea for a mathematics game could be interpreted in many ways. I just had to find the most appropriate and efficient way to create one.

The Making Process

3. Ideation

To make accurate grade-level questions, I consulted the outcomes and indicators from [SK Curriculum](#). Of course, the game will not cover every outcome, but I will cover the important ones and/or related to the next grade level. This way, if a student playing the game wishes to try the higher levels, they will understand what topics the questions cover.

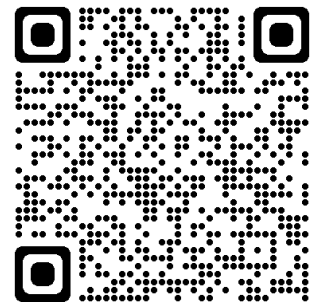
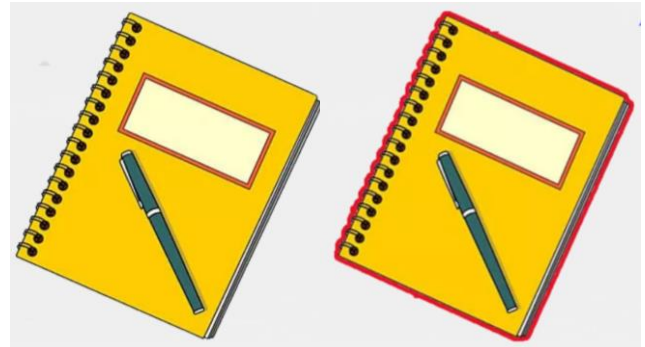


Moreover, even though the first two games did not make it, I made sure to use some of their features for this game. For instance, the first game has three difficulties. Instead of questions becoming more complex, the levels are based on grade levels. The easiest level is the "K-3," which covers topics taught in grades kinder, grade 1, grade 2, and grade 3. The second level is "4-6," which covers topics taught in grades 4 to 6. Lastly, the third level is "7-9," which covers topics from grades 7 to 9. The question varies from students typing the answer, and a multiple choice question.

I really liked the idea of interactives in the second game. So, for the third game, I decided to make the notebook glow whenever the mouse pointer touched it. It works perfectly since it is the only interactive object in the game.

As stated in the interpretation, one idea that came up to me is having the tutor, Ada, make occasional comments (reminders) whenever students get the wrong answer. This makes the game not robotic, and students understand why they got the answer wrong. I wanted to include scores in the game, but this would only generate competition since the game's goal is to assess students. Moreover, some topics are just hard to cover without demonstration. So, I added QR codes that lead to different math charts like areas and volume, place value charts, and more. I also added dialogues for Ada that tell students to refer to the charts whenever they get a question wrong.

Moreover, even though the first two games did not make it, I made sure to use some of their features for this game. For instance, the first game has three difficulties. Instead of questions becoming more complex, the levels are based on grade levels. The easiest level is the "K-3," which covers topics taught in grades kinder, grade 1, grade 2, and grade 3. The second level is "4-6," which covers topics taught in grades 4 to 6. Lastly, the third level is "7-9," which covers topics from grades 7 to 9. The question varies from students typing the answer, and a multiple choice question.



The Making Process⁷

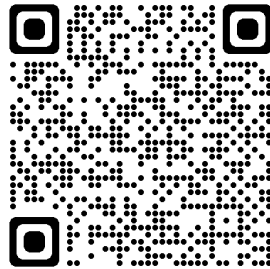
4. Experimentation

Here is my prototype:

- ❖ The finished game: [Tynker](#)
- ❖ Notebook interaction: [Tynker](#)

All the features of this game are suggested in the ideation stage.

You can also access it with this QR code. However, Tynker is not mobile-friendly.



I received feedback/questions from the Makerfaire about detecting if a student made a specific error on a question. This is excellent feedback since I have yet to explore it. The tutor's feedbacks are for general errors. For instance, when students make an error on place values, the tutor will discuss how place values work. I also suggested that specific detection could work if the tutor is an AI (Artificial Intelligence). Tynker offers some AI detections, but I did not entirely explore it, mainly because I already have a solid plan on how to do feedback from the tutor. However, I would love to explore Tynker's AI feature someday.

Makerfaire handout can be found [here](#).

5. Evolution

Doing this project was such a great experience. It re-ignited my passion for coding and excitement for mathematics. Before making this game, I needed to learn how to generate QR codes. I just found out it is straightforward to create a QR code. We know something new every day.

As for moving forward, this project will be the key feature of this unit plan. I plan to use it to assess students on where they stand regarding math skills or as an assessment by making students create their own game and set of questions to be answered by other students.

The Making Process

Resources used in the game:

ROOMS:

Study Table Top View: [Minimal Office desk table top view with office supply and coffee cup on a white table with copy space, White color workplace composition, flat lay 1884561 Stock Photo at Vecteezy](#)

Classroom: [Classroom Images - Free Download on Freepik](#)

ITEMS:

Notebook: [Notebook Cover Clipart Hd PNG, Yellow Box Frame Cover Notebook Clipart, Notebook, Clipart, Yellow Notebook PNG Image For Free Download \(pngtree.com\)](#)

Paper: [Printable Graph Paper Templates for Word \(vertex42.com\)](#)

Dice: [Dice PNG Free Images with Transparent Background - \(674 Free Downloads\) \(vecteezy.com\)](#)

Box: [Box PNG Free Download | PNG Mart](#)

Geometry Worksheet: [Geometry Reference Sheet \(with Formulas\) - EEWeb](#)

Unit conversion Chart: [Metric Chart For Kids | Download Free Printables \(playosmo.com\)](#)

Odd and Even chart: [Odd and Even Numbers Chart 1-100 | guruparents](#)

Place value chart: [Decimal Place Value Chart \(math-salamanders.com\)](#)

Mean, median, mode chart: [Mean/Median/Mode Chart - TCR7773 | Teacher Created Resources](#)

Order of operations chart: [Pemdas Chart Teaching Resources | TPT \(teacherspayteachers.com\)](#)

Types of angles chart: [Free Printable angles anchor chart for classroom\[PDF\] - Number Dyslexia](#)

Perfect Squares chart: [Square 1 to 30 | Values of Squares from 1 to 30 \[PDF Download\] \(cuemath.com\)](#)

Unit Plan

9

Title of the Unit: Math Games with Tynker Unit Plan

Subject: Mathematics 9

Grade Level: 9

Time Frame: 3 Lectures (60 minutes each)

Unit Overview:

This unit plan aims to further grade 9s' understanding of powers with integral bases and whole number exponents, rational numbers, and square roots. This unit plan will also expose students to different learning pedagogies, such as learning through video games and coding. Students will explore a code block software called Tynker. They will learn the function of Tynker, such as creating a game and coding questions. Using Tynker, students will assess their learning of the said topics by creating a quiz game to create questions based on the three topics. By creating questions, teachers will assess students' ability to follow instructions and expand their knowledge of powers and exponents, rational numbers, and square roots. Furthermore, students can answer other students' quizzes and assess their learning by documenting their experiences.

The logical sequence of this unit is as follows:

This unit plan will consist of three lessons. The first lesson will be an introductory lesson about how Tynker works. Teachers will introduce Tynker to the class via PowerPoint. Students will learn how to create an account, create a project, start and end a game, add pictures, add costumes, add a background, and code dialogues. Students will have the rest of the class time to explore Tynker, ensuring they know how it works. An exit slip will be given to the students, asking questions about what they learned today. This file will be attached to the first lesson plan.

The second lesson is where teachers will introduce the students' project. This project will also be their summative assessment for this unit. Students will create a game with at least ten questions varying from powers and exponents, square roots, and rational numbers. Students are NOT allowed to focus on one topic. For example, it is not permitted for a student to create ten questions about powers and exponents. Moreover, students are required to have at least three questions for each topic and are required to have at least ONE word problem for each topic. Students must also document their questions and the answer key for their questions. This is to avoid students creating difficult questions to which they do not know the answer. After introducing the project, the class will have the rest of the time to work on it. Students should have at least some questions done to be coded in Tynker.

For the third and last lesson, students will have 20 mins of the class to polish their projects. Then, they will have 30 minutes to try other students' projects. For the last 10 mins, students will answer another exit slip via a Google form, asking about their learning in the project, the difficulty of creating questions (especially the word problems), how many projects they tried from their classmates, and what their experience was while answering other's quizzes.

Learning Outcomes:

Mathematics 9

Outcome(s):

N9.1 - Demonstrate (concretely, pictorially, and symbolically) understanding of powers with integral bases (excluding base 0) and whole number exponents including:

- ❖ representing using powers
- ❖ evaluating powers
- ❖ powers with an exponent of zero
- ❖ solving situational questions.

N9.2 - Demonstrate understanding of rational numbers including:

- ❖ comparing and ordering
- ❖ relating to other types of numbers
- ❖ solving situational questions.

N9.3 - Extend understanding of square roots to include the square root of positive rational numbers.

Cross-Curricular:

English Language Arts 9

Outcome(s):

CC9.5a - Create and present a variety of visual and multimedia presentations to best represent message for an intended audience and purpose.

Indicator(s):

- (a) - Explore ideas and express understanding using various visual and other representational techniques (e.g., storyboarding, scripting, concept mapping).
- (k) - Experiment with the use of technology in communicating for a range of purposes with a variety of audiences.

CC9.5b - Create and present a variety of visual and multimedia presentations including addressing various audiences for one proposal.

Indicator(s):

- (a) - Explore ideas and express understanding using various visual and other representational techniques (e.g., storyboarding, scripting, concept mapping).
- (k) – Experiment with the use of technology in communicating for a range of purposes with a variety of audiences

Lesson 1: Introduction to Tynker

Lesson Objectives:

This introductory class will teach students how to use Tynker. After this class, students should have a Tynker account and be registered in the teacher's classroom in Tynker. Moreover, students should be able to create a project, start and end a game, add pictures, add costumes, add backgrounds, and code dialogues.

Assessment:

1. Formative assessment: Exit slip with questions about what students learned today and some reminder questions about exponents and powers, square roots, and rational numbers.
2. Show of fingers 1-5: 1 finger means students have zero clue what they learned and teachers need to elaborate more, and 5 fingers represent students fully understanding the lecture.

Materials:

1. Tech devices: Chromebooks, Laptops, Ipad, Mobile phones (Students may run into some issues when using mobile devices)
2. Exit slips can be found [here](#).

Resources:

1. PowerPoint presentation on the Tynker tutorial can be found [here](#).
2. Tynker tutorials can be found [here](#).
3. "Tynker Workshop: Basics You Need to Know" can be found [here](#).

Lesson 1: Introduction to Tynker

Procedure:

SET (ENGAGEMENT):

TIME: 30 minutes

Teachers will set up the PowerPoint presentation about Tynker (which can be found in the "[Resources](#)" list). The first slide on the PowerPoint will ask, "What is coding?" Students do not need to raise their hands to answer. Teachers will record any answers that students come up with on the PowerPoint.

After collecting enough answers from the students, teachers will continue with the PowerPoint. Teachers will thoroughly discuss Tynker—what it is, why it is essential to learn to code, and so on. Next, students will grab a Chromebook or any devices that they have. Next, teachers will begin the live demonstration on creating an account on Tynker. After each student has finished creating their accounts, teachers will demonstrate how to create a project, add actors, add costumes, add backgrounds, and code dialogues.

While demonstrating how to code dialogues, teachers must explain the difference between dialogues requiring a typed answer and dialogues requiring choices. Lastly, teachers will demonstrate to students how to share and publish their projects after finishing them.

After the demonstration, teachers will ask students to show of hands if they understand how Tynker works. If some students need clarification on what they learned, teachers may elaborate more.

DEVELOPMENT:

TIME: 20 minutes

Students will have 20 minutes to explore Tynker, ensuring they fully know how it works. They will have a chance to create any project of their choice, showcasing their newly acquired skills.

LEARNING CLOSURE:

TIME: 10 minutes

Teachers will ask students again to show hands regarding their confidence in navigating Tynker. Then, to end the class, teachers will give each student an exit slip (which can be found in the "[Materials](#)" list). The question in the exit slip contains things about their opinion regarding Tynker, about creating projects with Tynker, and some reminder questions from their previous lectures about powers and exponents, square roots, and rational numbers. These math questions are hints for their upcoming project regarding the use of Tynker.

Unit Plan

Lesson 2: Introduction to Tynker Project

Lesson Objectives:

This second lesson will introduce students to their project regarding Tynker, which is also their summative assessment. Then, students will create a quiz game where they will make at least ten math questions on topics such as powers and exponents, square roots, and rational numbers. By the end of this lesson, students should have some questions written down with answer keys and have coded some questions in their Tynker project.

Assessment:

1. Formative assessment: Students' exit slip for this lesson is to make math questions with answer keys.
2. Show of fingers 1-5: 1 finger means students have zero clue what they learned and teachers need to elaborate more, and 5 fingers represent students fully understanding the lecture.

Materials:

1. Tech devices: Chromebooks, Laptops, Ipad, Mobile phones (Students may run into some issues when using mobile devices)
2. Pen and paper: If students wish to write their math questions with answer keys on a paper, first before coding it in Tynker

Resources:

1. Project description handouts can be found [here](#).
2. PowerPoint presentation on the Tynker tutorial can be found [here](#).
3. Tynker tutorials can be found [here](#).
4. "Tynker Workshop: Basics You Need to Know" can be found [here](#).

Unit Plan

14

Lesson 2: Introduction to Tynker Project

Procedure:

SET (ENGAGEMENT):

TIME: 10 minutes

Teachers will give each student handouts for their projects (which can be found in the "[Resources](#)" list). Next, teachers will introduce the Tynker project they will be doing. Next, students will create a quiz game with at least ten questions regarding powers and exponents, square roots, and rational numbers. Students are NOT allowed to focus on one topic. Students MUST create at least three (3) questions regarding each topic. Students MUST also create ONE word problem in every three topics. Students can make as many questions as they want, but it should be at least ten with answer keys to be handed in physically or online (the Google form exit slip on the third lesson will cover this topic). After explaining the project, teachers will ask students to show their hands to assess if they need to elaborate more. If everyone is on the same page, students may begin their project.

DEVELOPMENT:

TIME: 45 minutes

Students will have 45 minutes as a work period. Students can walk around the class and ask their classmates about their doubts.

LEARNING CLOSURE:

TIME: 5 minutes

Teachers will ask students again to show their hands regarding their confidence in the project. Finally, teachers will walk around the class and check every student's progress on the project. Students should have at least some questions done to be coded in Tynker. If students use their time wisely, they may even finish some coding during work.

Lesson 3: Project Showcase

Lesson Objectives:

The third and final class is a project showcase. Students will invite their classmates to try their quiz game. Students should be able to explain their steps in creating the project. Additionally, they will assess their classmates' work and give feedback. Upon submitting the work, students will fill out a Google form with questions about self-assessment, peer assessment, etc.

Assessment:

1. Formative assessment: Google form exit slip.
2. Show of fingers 1-5: 1 finger means students have zero clue what they learned and teachers need to elaborate more, and 5 fingers represent students fully understanding the lecture.
3. Summative assessment: Students' Tynker project will determine their understanding of powers and exponents, square roots, and rational numbers. Additionally, teachers will assess students' Tynker project as a design project.

Materials:

1. Tech devices: Chromebooks, Laptops, Ipad, Mobile phones (Students may run into some issues when using mobile devices)
2. Google exit slips can be found [here](#).

Resources:

1. PowerPoint presentation on the Tynker tutorial can be found [here](#).
2. Tynker tutorials can be found [here](#).
3. "Tynker Workshop: Basics You Need to Know" can be found [here](#).
4. Tynker design project rubric can be found [here](#).

Unit Plan

16

Lesson 3: Project Showcase

Procedure:

SET (ENGAGEMENT):

TIME: 5 minutes

Teachers will discuss what the final lesson will entail. Teachers will ask students to show their hands regarding their feelings about the project.

DEVELOPMENT:

TIME: 45 minutes

(20 mins): Students will have 20 minutes to polish their projects.

(25 mins): Students will walk around the classroom and play their classmates' quiz games. Teachers MUST remind students that they are assessing their classmates' games.

LEARNING CLOSURE:

TIME: 10 minutes

Teachers will introduce the Google form exit slip to students. However, students have until 11:59 PM to submit the form. In the Google form, students will answer questions regarding their takeaways from Tynker, the difficulty of creating questions (especially the word problems), assessment of their peers, self-assessment, etc.