



ENG 100D, Spring 2018
Instructor: Brandon Reynante

Comic Portfolio Guide

June 7, 2018
Team Animal Fries



Team Members:

Andrew Lee, Alice Lee, Shreeman Hariharan,
Kimiko Okumura, Won Suh Kim, Siyuan Guo

Community Partners:

Mrs. Melissa Han (mhan@sandi.net) - Baker Elementary 3rd Grade Teacher
Mrs. Han's 3rd Grade Class of 2018



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Executive Summary

Our partner organization for this project is Baker Elementary School, a member of the San Diego Union School District. This school is located in the Mountain View neighborhood of San Diego, a neighborhood with a large low-income population and high crime rates. Our primary clients in the organization are Mrs. Han—a third-grade teacher at Baker Elementary—and her students.

Our team was given the challenge of redesigning Mrs. Han's third-grade classroom experience. The way our team defines redesign was left open to interpretation as it could refer to a physical change to the classroom, modification of the class structure, or method of facilitating student interaction. After learning more about Mrs. Han and her students, we learned that their main need was a strengthened art curriculum as the class did not have a structured art lesson plan. Rather, there was a strong emphasis on teaching students math and reading skills; Baker Elementary School invested heavily in math and reading learning softwares for students in preparation for annual California standardized exams. Due to the competitive nature of pursuing higher education, a stronger focus is placed on core subjects such as math, reading, and science as these subjects can easily evaluate students' aptitude for learning. This leaves out art as an area of importance in education.

When defining the problem, we met with our client multiple times and used various ethnographic methods. We conducted user-interviews and observations with Mrs. Han's classroom to gain insights of how the class is structured, what works, and what does not work in the class. After analyzing the results from our ethnographic methods, we defined the user's problem. Following this step, we generated ideas for potential solutions to our defined problem. After initially brainstorming individually, we shared our ideas with the rest of the team to build off of these ideas. By testing our three main ideas with ENG 100D students and Mrs. Han's class, we narrowed down to one solution. In the proceeding testing phase, we followed the design process closely by prototyping rapidly and testing our prototypes with Mrs. Han's class. We iterated multiple times based off of previous feedback from testing. In addition to testing, we considered how sustainable and impactful the solution would be, and modified our solution accordingly.

Based off the approach from above, we found our user problem to be a lack of a sufficient art curriculum and expertise to teach art to third graders. Through brainstorming, we found our three best solutions to be an art portfolio project, a mung bean plant growth project, and a student-led teaching activity. Testing these three ideas revealed the art portfolio project to be the most suitable one to solve the user's need as it was an interdisciplinary project based off of math and science concepts learned in class. Through testing and iterating, we determined that each art project in the portfolio would be a comic strip based off of a course concept and the students would have three different templates to choose from. Our impact analysis revealed that the comic portfolio solution is economically sustainable in terms of resources required and is feasible for implementation. All in all, the solution provides students with an outlet for creative and analytical thinking and can be used by Ms. Han in the years to come.

1. Project Management

1.1 Goals & Objectives

Our main goal for this project is to improve the classroom experience for Baker Elementary School teacher Melissa Han and her third grade students. Through human-centered design techniques, we hope to understand our stakeholders' needs and interests, and cater to them through the implementation of a curriculum or activity.

Our main objective is to produce a sustainable, interdisciplinary art and science curriculum by the end of Spring quarter, to addressing the needs of our key stakeholders, Mrs. Han and her students. Through the implementation of this curriculum, we aim to help the students improve their standardized test scores to 70% or above in order to reach the California state standards for the Smarter Balanced Assessment^[1,1].

1.2 Approach

1.2.1 Team Project Management

The planning and documentation for the project were managed largely through the use of a team Google Drive. We also had regular in-person meetings to maintain productivity and focus. Our team Gantt chart also reinforces a sense of accountability with its clear delineation of assigned tasks. In terms of maintaining communication across the team, the team heavily relied on Facebook Messenger as the mode of contact.

1.2.2 Strategies and Methods

In terms of our design challenge, we focused on a human-centered approach. We interviewed both Mrs. Han and her students individually to gain insight on what they felt was and was not working for their class from different perspectives. We also maintained contact with Mrs. Han throughout the quarter, and we have conducted multiple site visits to work with her and the students in iterating through our design. We made sure to keep this interaction constant so that the students and Mrs. Han could also provide input and ideas in creating and refining the curriculum. Using the information from each of our interviews, we continuously narrowed down the areas that required further research and iteration. We worked both individually and collaboratively in brainstorming and critiquing our project, which allowed for unique insights, and a well-rounded analysis of areas for improvement.

1.2.3 Interviews

Interviewee:

Lylah Araiza (Mrs. Han's student)

Diana H. (Mrs. Han's student)

Herbert H. (Mrs. Han's student)

Alina D.(Mrs. Han's student)

Yahul (Mrs. Han's student)

Amy Aquino (Mrs. Han's student)

Eduardo Regaldo (Mrs. Han's student)

Melissa Han (Teacher)

Location:

Baker Elementary

User Interview Questions (Students, Mrs. Han)

1. Take me through your day yesterday in class. (Students, Mrs. Han)
2. What did you do after school yesterday? (Students, Mrs. Han)
3. Tell me about a time you enjoyed teaching your students. (Mrs. Han)
4. Tell me about a time you enjoyed learning.(Students)
5. How do you feel about the material you teach? (Mrs. Han)
6. What are things that you like about Mrs. Han's teaching style? (Students)
7. What are things that you dislike about Mrs. Han's teaching style? (Students)
8. Tell me about a time you were frustrated with your students. (Mrs. Han)
9. How do you feel about the way your classroom is physically arranged? (Students, Mrs. Han)
10. How do you feel about the access to resources that your classroom has? (Mrs. Han)
11. Walk me through the most recent incident when there was a conflict between students. (Students, Mrs. Han)
12. How effective do you feel the homework is at reviewing class content? (Students)
13. What is your hobby?/What do you do at your leisure time? (Students)

1.3 Schedule

We used a Gantt chart to plan, delegate, and track progress in the project, as shown in Figure 1.3(Appendix). Meeting minutes can be found in Figure 1.4 (Appendix).

1.4 Team Profiles

	Shreeman Hariharan, Facilitator <i>Cognitive Science Major, Class of 2018</i> As the team's facilitator, I will resolve conflicts between team members and will help the group during tough design decisions. I have volunteered at the local community library which has given me experience working in a learning environment. I also have five quarters worth of design project experience.	sghariha@ucsd.edu
	Kon Lee, Team Leader/Liaison andrew.konwoo@gmail.com <i>Cognitive Science Major, Class of 2018</i> As the team leader I am responsible for organizing meetings and making sure each person has everything they need to be able to complete their tasks. I have experience working as a tutor throughout high school and worked with some of Mrs. Han's students through COMM 102C and the Town and Country Learning Center.	
	Won Suh Kim, Enabler <i>Cognitive Science Major, Class of 2018</i> As the team's enabler, my role is to support completion of tasks, especially ones that are in need of additional attention. I regularly communicate with the team leader and prioritizer to assure completion of tasks on time. I will be applying my knowledge of working with kids through my interactions with the Baker Elementary students.	w8kim@ucsd.edu
	Alice Lee, Researcher <i>Cognitive Science: HCI Major, Computer Science & Global Health minor, Class of 2019</i> As the Researcher, I will be in charge of conducting background research of our community and the design challenge. I have experience with programming in various languages and developing Web Applications, as well as practice with the human centered design process.	ayl064@ucsd.edu
	Kimiko Okumura, Prioritizer <i>Cognitive Science: Human-Computer Interaction Major, Class of 2020</i> As the Prioritizer, I am in charge of ensuring all tasks are completed efficiently and all team members are actively participating. My experience in the design process will help the team throughout this project.	kokumura@ucsd.edu



Siyuan Gao, Innovator

sig019@ucsd.edu

Cognitive Science: Human-Computer Interaction Major, Computer Science & Music Minor, Class of 2019

As the innovator, I will be responsible for creating new and different ideas and perspectives, produce radical solutions to problems, develop long term vision and dream up new ideas and insights.

1.5 Stakeholder Analysis

Stakeholders:

Mrs. Han's students (ally - high influence) - Current third-grade students of Mrs. Han's class. The students have a high stake in the project, as they will be affected daily by the changes to class design. They also have a limited amount of power through opinions, but relatively less than others, as they hold little authority. Our strategy will be to encourage the students to share opinions and histories of experiences in the classroom. Through this, we hope to gain information on current classroom practices and how best to redesign them.

Mrs. Han (ally - high influence) - Third-grade teacher seeking classroom design

Mrs. Han, similarly, has a high stake in the project, as she will need to utilize the changes we design for her classroom. She also has a good deal of power over the project, since we will want a design that is satisfactory for the needs of her and her students. We will want to encourage and influence Mrs. Han by fostering an environment of respect. We will want to listen to her ideas and seriously consider any issues she may have.

Baker Elementary (ally - low influence) - Elementary school where Mrs. Han has her classroom. The elementary has a good deal of interest in the project--they would not want students or parents to be unhappy, or be left with a disaster of a class--but somewhat low power. They are able to make executive decisions, but will likely not be involved directly with the redesign of Mrs. Han's classroom. This is because the changes we will implement are restricted to one classroom and will not affect the activities of the school as a whole. We will want to keep the elementary informed of our progress and any significant decisions.

San Diego Unified School District (indifferent - high influence) - Baker Elementary's district. The school district may not be particularly at stake for this project (although it is certainly of interest, it is too small-scale to be monitored), but they have a great deal of power. The school district has policies we must follow, and have ultimate authority over any decision. We will keep the school district satisfied by ensuring that we follow any district policies, and follow any directions given to us by the district (if applicable).

Brandon Reynante (ally - high influence) - Overseer of class

Brandon is the primary liaison between us and Mrs. Han, which means his reputation will be affected by the outcome of our efforts. He will have a significant impact even without directly being involved because he laid the foundations for the project and dictates the class structure. Our strategy for success will be to maintain a professional relationship with Brandon by completing assignments on time, giving progress reports, and following additional directions or feedback.

Parents of the students (ally - low influence) - Parents of the third-graders

The parents have a stake in the project, as it will affect their children's lives. However, parents will likely not make significant impacts on the team's decisions, as they will not be involved in the design process. Like the elementary school, we will want to keep parents informed by having them sign informed consent forms that detail our project and goals.

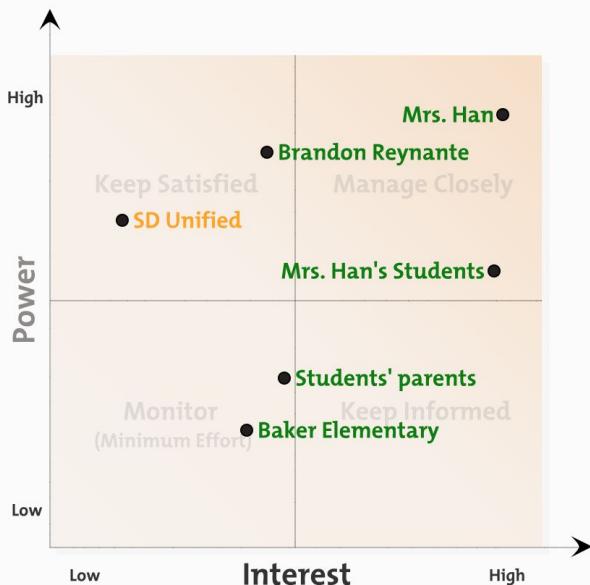


Figure 1.5 - Stakeholder Analysis Matrix

2. Problem Definition

2.1 Problem Statement

Third graders in Mrs. Han's class at Baker Elementary need more access to an interdisciplinary art curriculum because students should have the resources to explore their unique interests and strength as well as improve their math and writing at the same time. Right now their classes focus mainly on math and writing.

2.2 Background & Context

What is the problem

Mrs. Han teaches 24 students in her third-grade class at Baker Elementary School. The challenge she faces is that there is a lack of funding and expert knowledge for the arts and other subjects outside of math and reading. Through our interview, we found out that a lot of students love art and hope to have the chance to learn about art. Currently Ms' Han's third-grade class focus mainly on math and writing. This problem heavily impacts Mrs. Han and her students as they have to work with a curriculum that is not very well-rounded.



Figure 2.2.1 - Mrs. Han and her third-grade students



Figure 2.2.2 - Mrs. Han's class schedule heavily emphasizing reading and math

Context of community

Baker Elementary teaches low-income students. This is supported by 2015 data from the CA Dept. of Education, which shows that 94% of Baker students are eligible for reduced-price lunches. Data from 2011-2017 provided by the San Diego Unified school district shows that the overwhelming majority of students are Hispanic and ESL (English as a Second Language). The percentages being on average above 80% and above 60%, respectively. From this, we know our primary group of students are Hispanic immigrants who are low-income. With a lack of money, technological resources are expected to be limited in student households. The same dataset reveals that more than fourth of parents lack high school diplomas and less than 10% of them graduated college, suggesting a lack of emphasis on academic success in such households.^[2,1]

History/future scope of the problem

This problem derives from the workforce forcing education to shift too heavily towards STEM. Humanities and arts graduates are having a difficult time finding jobs that pay well, and that has forced K-12 education to focus more on STEM curriculum. The education system is quantifying students' value based off of exams and classroom performance in STEM-related education. Also, standardized testing focus mostly on math and reading. In order for students to pass the tests and get higher chance for better education, schools are putting more emphasis on math and reading class starting third grade. Although this educational trend has grown larger recently, United States only ranks 21st out of 34 according to the Organization for Economic

Cooperation and Development for science, math, and reading performance^[2,2]. In the future, the continued focus on STEM education will not greatly seem to help performance and is actually known to hinder creativity and innovation as creativity is fostered through experimentation and freedom in learning.

Underlying causes of the problem

An underlying cause of the problem is cultural in that everyone involved in students' education, which includes parents, teachers, schools, and society, measures educational success based off of financial success. Due to low job prospects for humanities graduates, parents don't encourage their children to pursue such majors; this forces schools to disregard non-STEM curriculum^[2,3].

While STEM itself does not have to hinder the creativity. In fact, science, engineering and technology today are closely associated with STEM. The problem is that the way how Baker Elementary, or Mrs. Han teaches her class focus mainly on the test and lack attractive teaching methods. Besides, we do see a lot of students in Mrs. Han's class do have great interest and talent in learning arts. Their current education system not only did not do a good job in improve students' math and writing scores, but also lack resources and access for students to other subjects of learning.

Structurally, governmental funding and standards for education revolve around math and science for the sake of encouraging technological innovation among the youth. As a result, states over time have implemented standards for measuring how well students are learning STEM concepts.

Baker Elementary School's CSR (Corporate Social Responsibility) ranking is low (3/10) due to poor performances on the CAASPP (California Assessment of Student Performance and Progress System) Math and English exam^[2,4]. Schools receive funding based off of rankings, which puts pressure on the school faculty to prepare students in Math and English rather than in the arts. Baker Elementary puts its funding mostly towards that through educational software such as ST Math, Achieve 3000, AR Reading.

Resources and capacities

Mrs. Han appears to be aware of this issue and wants to focus on producing well-rounded students. Her desire to emphasize arts and promote social intelligence allows us to dedicate time to teach art curriculums that foster teamwork.

2.3 User Profile(s)

Margaret, a Baker Elementary School third-grade teacher



2.3.1 Margaret, a Baker Elementary School third-grade teacher

Bio: Margaret is a third-grade teacher who has been at Baker Elementary for two years. She is proficient in teaching math and reading but struggles to instruct her students in areas such as science and arts. She currently emphasizes reading and math to prepare students for the annual standardized examination but would like her students to have a more well-rounded curriculum.

Group size: 1

Empathy map: (Table 2.3.1 in appendix)

Knowledge and skills: Margaret is experienced in teaching reading and math to meet state standards as she received her teaching credentials for elementary school education. She has excellent interpersonal skills and conflict resolution strategies for working with young children. She knows how to maximize use of school resources for her class lessons.

Journey map: (Table 2.3.2 in appendix)

Alisha, a third-grade student who loves science



2.3.2 Alisha, a third-grade student who loves science

Bio: Alisha is a third grade student at Baker Elementary who loves studying science. She loves going to school and learning math and reading, but her favorite part of the day is going home and reading books about dinosaurs and fossils. Whenever she has a computer, she also likes to look up new fun facts or projects she can do with science. Alisha would love to do more experiments and learn more science with her classmates.

Group size: ~10

Empathy map: (Table 2.3.3 in Appendix)

Knowledge and skills: Alisha has met the education standards from second grade a year ago and is currently learning reading and math skills for the third-grade level. Her strong suit is science and asks her teacher insightful questions out of genuine curiosity. She knows many science facts beyond what she learned in school, and she knows how to do her own online research for topics she's interested in.

Brianna, a third grade student who loves art



2.3.3 Brianna, a third grade student who loves art

Bio: Brianna is a third grade student at Baker Elementary who enjoys any time the class spends on art projects. Since art is not heavily emphasized in her class' curriculum, she loses focus on days when art is not being taught. Craft projects serve as a stress-reliever for Brianna after learning math and reading throughout the day. She also enjoys projects where she blends science and art, such as making solar system models or topographic maps with clay.

Group size: ~10

Empathy map: (table 2.3.4 in Appendix)

Knowledge and skills: Although Brianna has met the second-grade educational standards and is currently learning the third-grade material, she is more proficient in the arts as she spends time outside of class drawing and seeing art in museums and around the city. She is learning collaborative skills by interacting with her classmates when learning new concepts.

2.4 Design Requirements

Table 2.4 shows our design criterions and requirements which will serve as the objectives for the entire design process and the reference that we will trace back to anytime during the design process.

3. Concepts

3.1 Existing Solutions Analysis

Organization/Product #1: Education.com

Problem: Teachers don't have the expertise to provide art curriculum for students

Solution: A list of hundreds of pre-existing art projects and ideas, and you can filter for grade level and types of activities

Pros: Large collection of project ideas that allow teachers to pick and choose from

Cons: Teachers have to pay for membership to get access to full lesson, requires a lot of extra materials^[3.1]

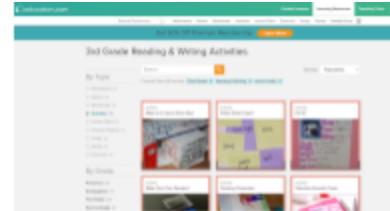


Figure 3.1.1 - Education.com Website

Organization/Product #2: Team Baker

Spaces (ENG 100D, Winter 2018)

Problem: Third-graders need the freedom to pursue their interests outside of the current rigid school curriculum.

Solution: A story-based lesson plan to prompt the students to come up with their own solutions to a problem.

Pros: Freedom for the students to come up with their own ideas and doesn't require extra materials or resources

Cons: Only a one time lesson; not a continuous learning experience and doesn't specifically help students interested in art and science^[3.2]



Figure 3.1.2 - Team Baker Spaces Lesson Plan

Organization/Product #3:

Sciencebuddies.org/online project

Problem: Third-graders don't have fun, engaging ways to explore science, technology and engineering

Solution: Uses students' answers to simple statements to recommend age-appropriate projects

Pros: Help third graders learn through interactive projects, more engaging than lecture-based learning

Cons: Some students might not have access to computers or internet^[3.3]



Figure 3.1.3 - Sciencebuddies.org website

3.2 Concept Generation

Concept #1

Name: Art Portfolio

Tagline: Throughout the school year, each student will create a portfolio of art projects related to math and science topics and showcase it at an end-of-the-year exposition.

Core Need: This idea solves the need for art curriculum integrated into Mrs. Han's syllabus. It does so in a non-intrusive way such that Mrs. Han can continue to teach science and math while allowing art to revolve around the topics being taught.

Strengths: Fun for students, non-disruptive, achieves goal of providing students with a creative outlet, done throughout the year so has the potential to be impactful

Weaknesses: Requires more funding from school, may lead to competition among students, relationship between art and science/math is not always clear

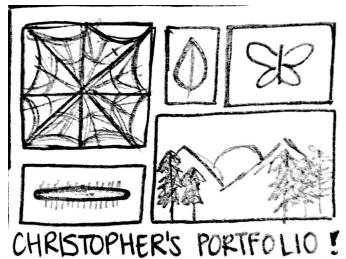


Figure 3.2.1 - Example portfolio



Figure 3.2.2 - Art Exposition

Concept #2

Name: Mung Bean Growth Log/Mung Bean Experiment

Tagline: Students grow personal mung bean plants and keep a journal to illustrate and describe each stage of development. Alternatively, can reduce the number of plants and use them to test hypotheses about effects of changing variables.

Core Need: This concept serves as an outlet for artistic expression and promotes scientific thought on a regular basis. The branching experiment concept would offer a stronger science education by teaching students how to use simple observations to test scientific hypotheses.

Strengths: Can be implemented whenever desired, low cost for project, visually engaging to students, low likelihood of non-participation because students have ownership of plants, promotes scientific thought

Weaknesses: Does not provide intensive engagement or interaction with plant, slow plant growth/failure may be discouraging to the students, may be a source of distraction in class

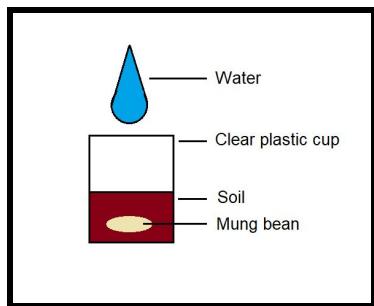


Figure 3.2.3 - Mung bean project

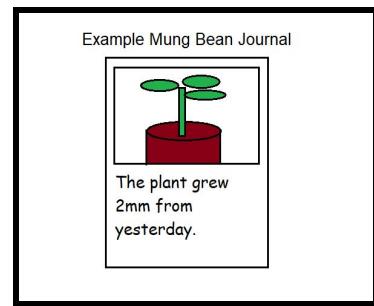


Figure 3.2.4 - Mung bean journal

Concept #3

Name: Teach the Class!

Tagline: “*Students work together in groups to teach fellow classmates a lesson that Mrs. Han wants to cover during the school year*”

Core Need: This will allow Mrs. Han to build on these lessons and focus on what the students are struggling with the most.

Strengths: Provides insight to how children learn and what visual aids work best, encourages working together, source of pride for students to be able to teach and have the respect of peers, sustainable and can be reiterated

Weaknesses: May be difficult for students to grasp concept, potentially ineffective learning for other students, lack of respect from peers when listening to lesson, might require too much investment of time from Mrs. Han

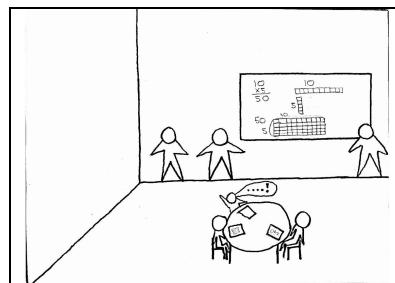


Figure 3.2.5 - Teach the Class! Concept sketch

3.3 Concept Evaluation & Selection

We surveyed a group of ENG 100D students to evaluate which concepts they found more appealing. The initial prototype testing involved a simple presentation of each idea on paper drawings (drawings in 3.2). After each presenting each idea, we asked individual members of the group to rate the concepts on a scale from 1 to 5 and write these down on paper. We tallied the scores and to find the highest-rated concept. The following table shows the results we received.

Table 3.3.1 - Prototype A/B Testing Feedback

Concept	1	2	3	4	5	Average
Art Portfolio	5	3	4	5	4	4.2
Teach the Class	4	5	2	3	3	3.4
Mung Bean Growth Log	3	3	3	4	2	3

In order to evaluate the ideas that we came up with, we asked our stakeholders to provide us with feedback on each plan. We presented the concepts and what their goals are, and we asked for positive and negative feedback on how well the idea accomplished its goal.

Art Portfolio

Table 3.3.2 - Analysis of Art Portfolio concept

<p>What's Good (+):</p> <ul style="list-style-type: none"> • More opportunities to work on projects throughout the year • Can share work and see what others worked on 	<p>What Can Be Improved (Δ):</p> <ul style="list-style-type: none"> • Come up with specific list of math and science topics that relate to art • Maybe go beyond just drawing and allow for sculptures or models.
<p>Questions (?):</p> <ul style="list-style-type: none"> • “How would you store all the art in the class?” • “How much would the art journals and supplies cost?” 	<p>Ideas (!):</p> <ul style="list-style-type: none"> • Students can have journal entries reflecting how their art projects relate to math or science topic • More artwork demo sessions throughout the school year

Mung Bean Growth Log

Table 3.3.3 - Analysis of Mung Bean Growth Log concept

<p>What's Good (+):</p> <ul style="list-style-type: none"> • Hands-on way to learn science • Low maintenance 	<p>What Can Be Improved (Δ):</p> <ul style="list-style-type: none"> • More art integration • More contextual info about what to expect and what variables to consider
<p>Questions (?):</p> <ul style="list-style-type: none"> • “How long do mung beans take to grow?” • “Is there enough classroom space to store all the plants?” 	<p>Ideas (!):</p> <ul style="list-style-type: none"> • Create an art piece at the end depicting this experiment experience • Run trials with the plants being put in different environmental conditions (change lighting, water amount, etc.)

Teach the Class

Table 3.3.4 - Analysis of Teach the Class concept

<p>What's Good (+):</p> <ul style="list-style-type: none"> • Demonstration of student's understanding of the teaching concept • Enhanced perception by letting students interacting with themselves 	<p>What Can Be Improved (Δ):</p> <ul style="list-style-type: none"> • Children might need extra resources to know enough to teach others
<p>Questions (?):</p> <ul style="list-style-type: none"> • “How long would they be teaching?” • “How to choose the students who are teaching?” 	<p>Ideas (!):</p> <ul style="list-style-type: none"> • Instead of teaching a subject, teach an art topic (e.g. Picasso, Monet)

To aid in the decision of our final concept, we used a decision matrix to evaluate all our concepts against a baseline and how they addressed our four main design requirements:

Desirability was chosen because Mrs. Han's classroom needs to be interested in working on the project. We gave this a weight of 2 since the enjoyment of students plays a strong role in how valuable the solution would be in the classroom.

Affordability was a criterion as Baker Elementary has limited funding for extra activities. We gave this a weight of 1 because our solution ideas were already generated with the intention of offering affordable solutions.

Feasibility was selected since the solution should be able to be easily adopted by Mrs. Han without changing too much about the class to get started. We gave this a weight of 3 because Mrs. Han's class is very well-structured and this solution may not be used if it is too disruptive.

Functionality was selected because the final concept that we pursue should end up teaching the students something valuable about art and science. We gave this a weight of 2 because it is partially in the class' control of how much time students spend to get the most out of the project.

Table 3.3.5 - Decision Matrix

Criteria:	Weight:	Teach the Class (Baseline)	Mung Bean Growth Log	Art Portfolio
Desirability	2	0	+1	+1
Affordability	1	0	-1	0
Feasibility	3	0	+1	+1
Functionality	2	0	+1	+1
Total		0	+2	+3
Weighted Total		0	+6	+7

We decided to move forward with our Art Portfolio idea because Mrs. Han specifically mentioned that she liked that idea; the decision matrix gives the Art Portfolio the best score, which shows that we also think it's the best idea of the three. The Art Portfolio project allows us to address our problem statement by providing the class with plenty of interdisciplinary art projects. The barriers that this idea addresses are the lack of an art curriculum and a strict class schedule that cannot be changed significantly. Another key reason why we decided to go ahead with this idea is because the project is sustainable, meaning that Mrs. Han can use this project idea again in the years to come.

4. Analysis & Testing

4.1 Overview

After narrowing down to the art portfolio idea, we created two prototypes to get a sense of specific art projects students would enjoy for their portfolios. The first prototype was a lesson plan to create a comic based off of math or science concepts from class. The second was a lesson plan for creating tessellations in order to learn geometry while making an individual art piece. We taught the lessons to the students ourselves during the first round of testing.

Using the feedback from the students and our observations after the first round of testing, we decided to focus on a more refined comic book lesson plan. During this round of testing, we wanted to see what a live implementation would look like, so Mrs. Han taught the lesson. We also added a silent independent work period because we noticed students were easily distracted by each other and were unable to complete their comics. Finally, we also included lines for the students to write a narrative and an outline their comics, since several students did not plan out their comics well. This was also added to encourage students to write and thus improve their writing ability.

4.2 Desirability & Usability

For both iterations, we tested with all the students in Mrs. Han's class. The table of participants can be found in the References section.

First Iteration

Introduction:

We created two prototypes of the art portfolio idea: a lesson plan for creating comic strips based on class lessons (Figure 4.2.1) and a lesson plan for creating tessellations (Figure 4.2.2). We were testing to see which project idea was more suitable for Mrs. Han's class in terms of desirability, feasibility, and functionality. See Figure 4.2.9 for lesson plan instructions.

Methods:

- We tested both prototypes simultaneously by splitting Mrs. Han's class into two groups. Each group went to a different room with two of our members per group
- For the comic prototype, we handed each student a paper with a six-box comic template and instructed them to create a comic based off of any science or math concept from class.
- For the tessellation prototype, we showed each student a sample tessellation created by artist MC Escher (Figure 4.2.2) and gave the students a demo on how to cut a tessellation pattern and trace it onto paper.
- After testing, each student wrote down which lesson plan they preferred and why by completing the sentence: I liked _____ better because _____.

Results:

The feedback revealed that 10 students preferred the comic activity, 10 preferred tessellations, and 4 enjoyed both. Regardless of whether the student enjoyed the tessellation activity or not, student from both ends of that spectrum noted it was too difficult.

Discussion:

From the student feedback, we realized that the comic book was the more desirable and more suitable for third graders to learn. Mrs. Han also gave us feedback that she enjoyed the comic strips because they gave the students an interdisciplinary method of reinforcing the lessons learned in class. Comic strips are more sustainable for Mrs. Han to implement in her classroom and intuitive for students to learn as it requires a minimal amount of resources and time. However, this solution does have a limitation in that it does not incorporate high levels of collaboration. In addition, many students were distracted by their neighbors.

Second Iteration

Introduction:

We refined the comic book prototype for the second iteration of testing (Figure 4.2.7). We added text lines below each box in the comic template so students can separate text from comic images and instituted a silent work time so students can better focus on the activity (Figure 4.2.8). Again, we tested for suitability of the project for Mrs. Han's class in terms of desirability, feasibility, and functionality. See Figure 4.2.10 for lesson plan instructions.

Methods:

- We tested the prototype with the whole class at once. Mrs. Han led the lesson plan this time since she better represents who would be using the final solution (Figure 4.2.9)
- We handed out a template with the text lines to each student. Mrs. Han then instructed the students to create a comic that illustrates teaching a concept they learned in her class to a second grader. After showing the students an example, Mrs. Han enforced a 15-minute silent work time.
- Afterwards, all of the students shared their comic progress with a partner. A few students shared and explained their comic on the smart board with the rest of the class.
- Students then pointed their thumbs up, down, or to the side depending on if they liked, disliked, or were not sure about the comic activity, respectively.

Results:

There was a good mix of feedback, but only about 50% of students put their thumbs up. When asked why, the students said they were unclear how to draw to teach a second grader, and it was difficult to fill in all six boxes. However, the silent work time aspect was successful as students primarily worked independently without getting distracted.

Discussion:

Although this prototype satisfies the need for interdisciplinary curriculum, the students did not seem to enjoy the activity. Once again, the only required resources are art supplies that the students already have and paper comic templates. The text lines below each box were not intuitive enough for all students to know to write captions there. In addition, some students opted out of certain portions of the assignment, such as drawing or writing. After gathering feedback, we realized that students need to have enough direction and guidelines. Moving forward, we need to find a good balance between providing enough instructions while still allowing creative expression to reduce students' frustration and make the lesson plan more desirable.

4.3 Feasibility & Suitability

Our final deliverable will be a lesson plan for the students to draw their comic strips and for Mrs. Han to compile them into a “Third Grade Survival Guide” for her next year’s students. This project is feasible because it does not require materials outside of what Mrs. Han already has access to, nor does it require any extra training. From our user testing, Mrs. Han was able to understand all the instructions and convey them to her students, and the students were able to complete their comic strips in roughly 30 minutes.

Functionality is also a key requirement for this project, and the project aims to allow students to demonstrate knowledge of prior lessons and improve their writing ability. The best way to measure this is by repeating comic topic ideas every few weeks to see if the students can demonstrate improved understanding of the topics in their comics. In addition, the project aims to improve writing ability through repetition, and that can be measured through state tests at the end of the year.

4.4 Sustainability

Ecological Sustainability

The ecological impact of the comic book project is minimal: all the supplies needed would be plain 8.5” x 11” sheets of paper and markers or crayons. See Figure 4.4.1 for the Life Cycle Assessment of the paper our solution requires and Figure 4.4.2 for a breakdown of resources and wastes at each stage of the LCA.

Economic Sustainability

The cost of this comic book project is inexpensive compared to many other art project ideas that would require out-of-class materials. The solution only requires two key materials: a comic worksheets provided by the school and coloring materials which the students already have. Each student will require several templates, and since this is a repeatable activity, the cost of materials depends on how many times Mrs. Han decides to have the students create their comic strips. To estimate the cost of materials, we researched several online stores. Please refer to table 5.1 in the appendix for the total cost of materials

Our comic book solution provides Mrs. Han's classroom financial security because they will not have to worry about spending a lot of valuable resources on the project. Since it's essentially just paper and coloring materials, this is a low-cost project that won't cause Mrs. Han to worry about supplies. As for self-sufficiency, Mrs. Han can easily recycle this project idea several times throughout the year without needing any outside help. She can think of new ideas for the students to create comics about, and all she has to do to make adjustments is to find a template that she likes online. That will allow her to make any adjustments to the number of panels or to the number of speech bubbles which enables her to tailor the project to fit her students' skill levels.

Socio-Cultural Sustainability

Our solution is culturally appropriate because it takes into account the children's interests without requiring them to obtain additional skills. There are all kinds of students in Mrs. Han's classroom, from secondary English learners and various skill levels in art and writing ability, and the project can be applied to all these types of students. The comic book will the kids to write and draw comfortably at their own skill level in a format they enjoy. We made sure to create the project entirely out of the community's feedback, so before we even began, we went to interview the students and Mrs. Han. Through our interviews we discovered that the children enjoy arts and science while Mrs. Han values creative freedom and individualism. The children's parents, the school, and Mrs. Han all valued learning as well, and we wanted to make sure our solution took into account everyone's perspectives and values. In addition, whenever we made adjustments to our project, we made sure they were backed by evidence from our interviews as well as observations from our tests. Finally, all our ideas were run through Mrs. Han, and with her feedback we were able to tailor the project to fit her classroom's needs.

The solution can easily be replicated and improved on by Mrs. Han. She just needs to provide her students with additional comic book templates and ideas for their comic strips. She has a wide variety of topics that the students learned throughout the year and can easily replicate our project. In addition, she can make the judgement call to make the comic easier or shorter. She will be able to control how many panels are in each comic strip and she can also control how much her students will be writing with the addition or removal of speech bubbles or story lines.

The comic book project promotes social justice by allowing the students access to interesting art while improving their English ability. By creating or presenting their comic strips, students can learn valuable conversational and storytelling skills. In addition, there is a broad range of topics that the students can choose from, and it allows students to write or draw about their interests and express their creativity. This creates an enriching environment for students to learn and allows students to be proud of their work.

5. Design

5.1 Overview

Through observations, secondary research, and stakeholder interviews, we determined that the classroom redesign at Baker Elementary would take an interdisciplinary approach to address a lack of art and reinforce writing skills for Mrs. Han's third grade class. The redesign is an art lesson curriculum for students to create comic strips each week for 38 weeks, based on material they learn in class. Each comic is meant to illustrate curriculum to a future third grader at Baker Elementary. The objective is for each student to create a collection of comic strips that will serve as a course guide for Mrs. Han's future third graders. As 60% of students during the 2016-2017 school year did not speak English as their first language, this comic project will allow students to practice their English writing skills. This project will not require students to purchase materials on their own as the school funding for Mrs. Han's class will cover the expenses. The total expenses are relatively low as the project only requires basic school supplies that Mrs. Han's classroom already has.

Mrs. Han will facilitate a class discussion where students recall topics they've covered since the last comic session. Then, Mrs. Han will choose a topic for the students to base the comic around. Then, the students and Mrs. Han will discuss the topic together so students will have a better understanding as to how to create the comic on the topic. Once the students are ready, they will select one comic template to use among three choices depending on how they wish to structure the particular comic. Then the students will be given 10 minutes to talk and collaborate on ideas. Then, Mrs. Han will hold a silent working period for 20 minutes. At the end, students will be able to share their comics to the class. The art lesson plan also covers how to compile a collection of comics. We provided variations on how to bind the comics depending on the materials most readily available for the class. The most cost effective way is for students to hole punch their comics and string it together with ribbon. If they have access to binders, then they can put their comics in a binder. If they have access to empty letter-size notebooks, they can paste their comics into the notebook with glue sticks. Regardless of how the book is bound, the first page will serve as a table of contents for students to detail what the various topics and corresponding page numbers are. At the end of the school year, Mrs. Han will collect all of the journals; at the start of following school year, the new third graders will have these notebooks as references to look at when learning new topics or wanting to read about past third graders' experiences in class.

5.2 Detailed Design

The art curriculum is a guide for Mrs. Han on how to incorporate art into her syllabus in an interdisciplinary fashion. The lesson plan provides three printable templates for students to use while creating comics based on the topics they learn in class. The solution will be delivered

to Mrs. Han electronically with all three comic templates and a set of written instructions on implementing the lesson plan. The instructions will be available through a Google document that Mrs. Han can edit if necessary.

Editable Lesson Plan Document:

https://docs.google.com/document/d/1pu9573OAPvfmGttspA3M3LuT0-hEfchjLFsWwTc_yU0/edit?usp=sharing

From our many rounds of user testing, we found that students need large boxes to draw, because it's more difficult for the students to draw in the smaller boxes. We also found that it's helpful to have a space for the student's name, as well as the date and title. Without these guides, students often forget to put their name and date, requiring Mrs. Han to frequently remind students. By providing the space to put their name, date, and title of the comic, we lessen the burden on Mrs. Han and create a more seamless experience for the students. The comic templates are on 8.5 x 11 in. printer paper due to high accessibility and low cost. We kept the templates vertical to fit binder or folders if they ever decide to bind the portfolios using those materials instead.

To give students creative freedom, we provided three comic templates that students can select from. The first template (Figure 5.2.1) has four panels and each panel has lines below to provide a guideline for students to write. This template follows a traditional comic format and offers an equal balance of writing and drawing. This template also allows a storybook-style approach to explaining a topic learned in class. From our user testing, we have found that some students need up to all four boxes to create comics; such students may prefer this template to effectively express their ideas. The traditional comic strip template provide students with the space to explain processes that have steps.

We also observed through our testing that some students are better at expressing ideas through drawings versus writing and had difficulty filling in all of the caption sections; therefore, we created a second template (Figure 5.2.2) for these students. This second template does not have text areas for each illustration box. This format can help students explain the same concepts that the first template could explain with a simpler explanation process due to no text below the drawings. Students could also benefit from the second template as it allows flexibility in regards to structuring captions and additional text within the panels.

The third template (Figure 5.2.3) differs from the others in that there is only one illustration box and a larger area for writing. Our user testing revealed that some students struggled to explain their topic with multiple sections as they only completed one illustration box and one text box. As opposed to a conventional comic strip, this template follows a simple story format; this may be useful for topics that only need straightforward explanations without multiple illustrations to guide them. In addition, this template acknowledges students who prefer writing over drawing.

By providing a variety of different options, we are promoting *desirability* to the wide range of students present in any third grade classroom.

Required Materials

In preparation before the first lesson, Mrs. Han will need at minimum 24 copies of each template, just in the extreme case that all 24 students want the same template. In the following weeks, she will print additional templates to ensure that she meets the minimum of 24 copies of each template. Mrs. Han can adjust accordingly if she notices one template is not being used at all. Printer paper with dimension 8.5 x 11" is readily available to Mrs. Han provided by Baker Elementary. One sheet of construction paper for each student would serve as the cover for their portfolios using the ribbon binding method. We suggest the ribbon binding method for the students because it's more interactive, it's low cost, and the materials are most accessible.

By using materials that Mrs. Han already has access to in her classroom, we have taken steps to make sure that our design is both *usable* and *feasible* for use throughout the year. Students would need access to pencils and coloring tools such as colored pencils or markers to successfully create comics each week. As each student is provided with these supplies through personal supply boxes, there will be no additional funding required from the school for the implementation of this curriculum.

As students accumulate comic strips throughout the school year, they will store the comic strips in the construction paper folder stored in their personal cubby holders. As discussed earlier in the overview section, there are three portfolio options available to students - hole punched comics bound with ribbon, binder portfolio, or notebook portfolio. We will suggest to Mrs. Han to use the ribbon binding method for reasons mentioned earlier. The ribbon binding option requires a collective classroom hole puncher and sufficient rolls of ribbon. Students already have access to scissors, which are also necessary for this portfolio option. 1-inch 3-ring binders along with a collective hole puncher are the only required materials for the binder portfolio method. As Mrs. Han's students already have access to scissors and glue sticks, 1-subject notebooks of at least 40 pages would be the only extra items that the notebook portfolio method demands.

Our solution would take approximately 60 minutes of time for each session of this project. Mrs. Han expressed the need for new interdisciplinary projects and she said there were no constraints on lesson duration. However, to ensure the lesson is easily integrated into the current school day, we decided to limit the lesson to an hour maximum. This promotes *usability* within the constraints of a regular elementary school day.

This project also does not require any specific lessons or topics for the students to learn in order to create their art. Mrs. Han is free to continue teaching the curriculum she deems necessary for her students. By making our lesson plan adaptable to Mrs. Han's curriculum, we addressed the sustainability of our solution: the projects can change along with any changes to the third grade curriculum throughout the years.

Case Scenarios

Primary Actors: Mrs. Han, students

Main Success Scenario

1. Mrs. Han prints out template on letter sized printer paper prior to the comic strip lesson.
2. Mrs. Han facilitates class discussion where students recall and discuss topics covered since the last comic strip session.
3. Students choose which template they'd like and any other supplies they want to use to create their comic strip.
4. Students create the comic strip within one hour.

Extensions

- 1a. Mrs. Han runs out of printer ink.
 - 1a1. Students draw their own boxes on easily accessible binder paper. The binder paper provides lines for them to write out their story.
- 2a. Students cannot recall topics.
 - 2a1. Mrs. Han gives more guidance on what topics they covered.
- 3a. There aren't enough templates for the students.
 - 3a1. Mrs. Han prints out more templates.
 - 3a2. Students draw their own boxes on binder paper (Reference 1a1).
- 4a. Students have trouble on coming up with a story.
 - 4a1. Mrs. Han provides individual help.
- 4b. Student have trouble drawing.
 - 4b1. Students focus on the writing portion.

Deliverables

- Templates (Figures 5.2.1-3)
 - Various templates will be sent to Mrs. Han in PDF format so they can be printed as needed.
- Digital Lesson Plans that can be edited when needed
- Printed Lesson Plans

Materials

- 3 Templates
- Construction Paper
- Writing instruments (Pencil or pen)
- Drawing supplies (Colored pencils or markers)
- Binding supplies (Ribbon + hole puncher, notebook + glue stick, binder + hole puncher)

Please refer to the appendix for the lesson plan.

6. Implementation and Impact

6.1 Implementation

After ideating the final iteration of our solution, we went to Baker Elementary to discuss the future direction of the project with Mrs. Han and her class. After our short presentation, we interviewed our primary users—the students—in small groups of three to four students. Through this process, we gained additional feedback to incorporate into our final deliverables. At this time, Mrs. Han also shared with us the teaching concept of *scaffolding*—dividing up key portions of tasks—which she plans to employ should workloads ever become overwhelming. We intend to append this idea into our instructions to provide instructors with teaching guidance. We have since provided Mrs. Han with the lesson files via email and Google Docs.

Roadmap

The implementation process and outcome of our solution are in the hands of our key stakeholders who will complete the curriculum. One of the strengths of our final solution is that it can be employed whenever deemed suitable by the instructor which means there are no specific dates or deadlines within the implementation process. We expect each implementation—new comic strip entry—to take approximately 30 minutes to an hour. Discussions and voting for deciding entries to be photocopied into the final guide is estimated to take 5-10 minutes. The actual compilation and binding of the classroom final guide is estimated to take 10-20 minutes. Assessing successful implementation is difficult because the curriculum is an exercise in self-expression and reinforcement of classroom content. This curriculum is not meant to teach students new information but improve educational efficacy through review and repetition. However, we can assume the final guide will be composed of high quality entries as judged by the whole class and Mrs. Han. Therefore, if the final result contains at least one entry from the majority of students, the solution will be deemed successful.

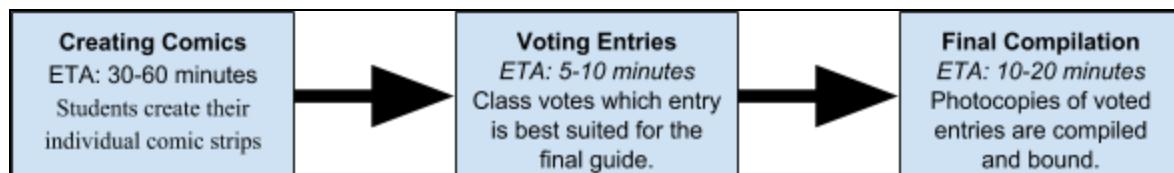


Figure 6.1.1. Implementation Roadmap Diagram

Resource Assessment (Appendix Table 6.1.2)

Distribution will be a process of our design team providing Mrs. Han with the lesson files and Mrs. Han presenting the files to her students. The implementing organization for our solution is Mrs. Han's third grade class, the funder is the San Diego Union School District, and the external party is Google—providing cloud storage.

Our solution will be incorporated into Mrs. Han's existing lesson plans which makes lack of participation a non-issue. However, because our assessment of success is so closely tied to the user experience, it is not sufficient for users to simply attend class and participate. To be successful, we would like the students to actively engage in the curriculum and be motivated by it. To this end, our best strategy has always been to make our key stakeholders feel involved in the process through regular communication. Mrs. Han has expressed that we have succeeded in making our users feel invested in the success of our project by tailoring our product to their needs and specifications through rigorous feedback loops. We have not extended this level of engagement to Baker's principal because we recognize that we were operating under Mrs. Han's authority, which is limited to her classroom and its operations.

Stakeholder Engagement Strategy

Because our design is an art curriculum to be implemented in class, we plan to engage the students and Mrs. Han through each project session that Mrs. Han holds in class. Other stakeholders besides the students and Mrs. Han include the students' parents and the Baker Elementary community. In order to also engage these stakeholders and give them an opportunity to interact with our design, we plan for the students' final art portfolios to be displayed at an "art expo" for their parents, other students, and other teachers to see. In terms of any incentives for or against participating in the art projects, we allowed the curriculum to be easily adaptable for any students. The students have the choice of focusing on writing, on the art, or both areas equally.

6.2 Failure Analysis (*Appendix Figure 6.2*)

As far as failures were concerned, our main focus was to prevent students from not enjoying the project because that was the sole problem we could be meaningfully address through the design process. Issues concerning funding are outside our design scope, but art curriculum mandates art supplies so we made a point of utilizing drawing capabilities of writing instruments, which can be procured extremely cost-effectively.

Because each individual student is unique, we could not take any overly specific actions to mitigate potential failures. Instead, we placed great emphasis on user input during the iterative design process to best characterize the class as a whole, and made our solution flexible in a way that Mrs. Han can manipulate. As the teacher of the class, she is the primary expert on what her students are motivated by and enjoy most, so relinquishing a degree of control over the implementation process to her is what we expect to mitigate failure best.

6.3 Monitoring & Evaluation Plan

The solution to the lack of interdisciplinary art curriculum involves a lesson plan for a creating a comic strip portfolio. The breadth of impact that we aim to leave should only affect ways in which students learn and not the overall classroom structure. Quantitatively, the people

impacted ranges from Mrs. Han's students to the San Diego Union School District which would amount to thousands. We expect this impact to be derived from improved standardized test scores in English, but this impact will be mitigated with every degree of separation from the immediate class. Therefore, we expect significant observable impact will only be made at Baker Elementary third grade level which only consists of about one hundred students.

In terms of impacting students' learning, the portfolio lesson plan covers multiple subject areas; they will practice their writing and artistic skills when creating comics with just a template that they are given. When expanding on the material they learned in class for the comic, they will recall their knowledge of core math, science, and reading concepts. This interdisciplinary aspect allows students to improve their proficiency in different subjects, thus revealing the breadth of impact this solution can create. However, we do not intend to affect the current class structure with much breadth. The reason behind this decision is how Mrs. Han's class is currently designed to meet the California education requirements for third grade and has limited funding from the school. Changing the course structure by significantly changing the schedule or syllabus may interfere with Mrs. Han's efforts of meeting her annual goals for her class.

We hope to leave a deep impact through our solution in terms of how much the students will learn from creating the comic portfolios. The comic portfolio lesson plan would ideally fill the void in art curriculum to a large degree. We see this solution offering students a creative outlet to express themselves throughout the school year, making this solution a pervasive one in their lives. By the end of the school year, the students would have had a great deal of exposure to interdisciplinary art that would be enough to hopefully inspire them to create more art on their own or in future classes. By implementing this interdisciplinary art curriculum, we hope that students would have more opportunities throughout the school year to draw and write, thus increasing their interest in schoolwork due to the fun factor of creating comics. This sense of enjoyment in schoolwork through comic creation would drive these students to perform better in reading and writing, and moreover increasing their sense of confidence in their learning abilities.

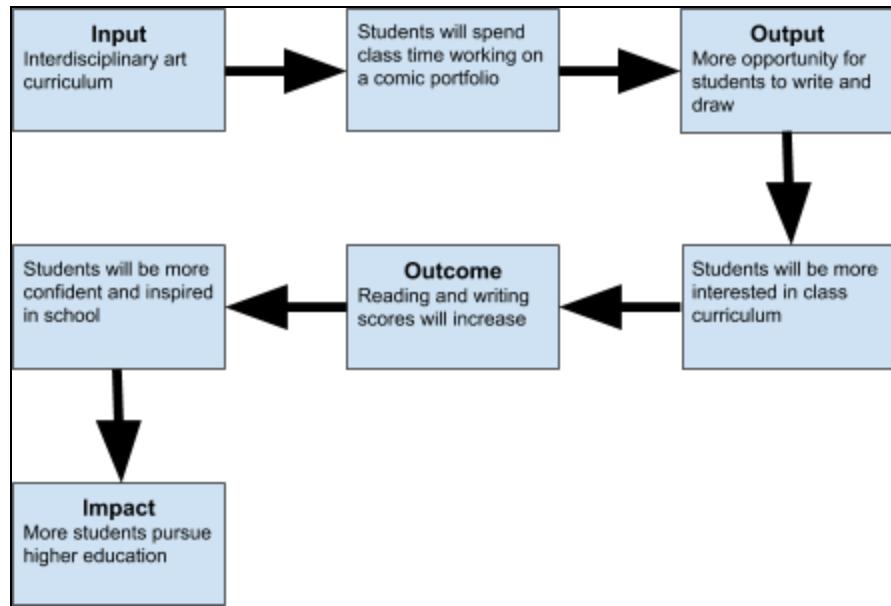


Figure 6.3.1. Theory of Change Diagram

Table 6.3.2 Monitoring and Evaluation

	Objectives	Indicators	Baseline	Target	Data Source	Frequency
Inputs	Interdisciplinary art curriculum	% of topics used for comic creation	0%	70%	List of topics that Mrs. Han has used each week for the comics	Weekly
Outputs	Opportunities to draw and write	# of times conducted	0	38 (# of school weeks)	Mrs. Han's weekly class activity schedule	Weekly
Outcomes	Reading/writing scores increase	% of students achieving Level 2 on the CAASPP in language arts and math	0%	70% for English and math	caaspp.cde.ca.gov	Yearly
Impacts	More students go on to higher education	% of students from each school year who attend college in the future	0%	60%	Surveys given to former students of Mrs. Han	Yearly

6.4 Ethical Analysis

Our solution attempts to promote social justice by empowering students to take ownership of their own education. By demonstrating their knowledge through art, Mrs. Han and her classroom are able to create a collaborative learning environment. The obvious beneficiaries from our solution are Mrs. Han and her current students, as well as any future iterations of Mrs.

Han's classroom. Sustainability was a significant concern when creating our comic book solution, so we made sure that Mrs. Han will be able to implement this idea with next year's students as well. The school indirectly benefits from our solution if it is successful in helping the students learn by receiving better state testing scores, which would result in increased funding.

Our comic book solution is currently tailored for Mrs. Han's class, so other third graders in other classrooms will be unable to participate in creating the comic book. This could cause some jealousy and an unbalanced learning experience for other students. We had the opportunity to work with Mrs. Han's classroom, but for those students who were unable to partner with a UCSD team, they would be left out and not be able to experience a co-designed project. Other teachers also missed out on this opportunity to have a UCSD team create a solution for their classroom, so there is an unbalanced privilege there as well. The best way to address these issues is to relinquish ownership of the lesson materials to Mrs. Han. This way, if the solution performs for Mrs. Han as expected, she has the choice to share the curriculum with other teachers freely. To this end, we will grant Mrs. Han ownership rights to the Google Doc files.

7. Conclusion

The main goal of our project was to work with Mrs. Han and her students to develop a method for improving their classroom experience while helping them review class material. To this end, we made multiple trips to Baker Elementary to observe the community and conduct interviews so we could gain insight on their problems. Through these methods, we identified their problem as a lack of interdisciplinary curriculum—specifically, art—through which to enrich their curriculum.

Through individual and group brainstorming sessions, we ideated three potential solutions: art portfolio project based off of science and math science, students teaching classroom lessons to each other, and a mung bean planting project with a plant growth-tracking journal. After testing the individual performance of these concepts, we identified the art portfolio idea as being the most desirable, affordable, feasible, and functional.

Through many rounds of testing with Mrs. Han's class, we collected feedback to guide us in selecting the most ideal portfolio content for providing an interdisciplinary approach to learning. Specifically, we concentrated our efforts on developing our comic book concept, which was the most successful component of the original art portfolio. We predicted this curriculum would allow for development of English skills through repetition and review of class material, all while maintaining a high level of engagement through art.

During our iterating process, we were able to test our prototype to clarify its strengths and weaknesses. One key insight we discovered was how hectic it can be to get all the students to focus, which we addressed through the implementation a quiet working time. In addition, we realized the need to strike a balance in our instructions so they can provide sufficient guidance without impeding their creative expression.

Ultimately, the implementation of our solution is in the hands of the users. Students will create one entry per work session and at the end of the project term, they will submit their best entries on an individual basis. After the last session, photocopies of the submissions will be compiled into the final guide for the next third grade class.

By applying themselves through our project, students' English and other reviewed subjects should improve through repetition of learning. This should result in higher standardized test scores for the school district, which will impact the community as more students go on to higher education.

Although our solution addresses our community's current need for interdisciplinary art, there are several ways our solution can be improved upon. First, our solution only addresses art due to budget and time constraints, but Mrs. Han's students also expressed a desire for science curriculum. Given more time, we would have attempted to include science into our project as well. Another way we could have improved our solution is by improving the ability to measure its ability to teach the students. We would like to be able to see how effective the comics were in improving the students' reading and writing ability so that we could make adjustments accordingly, but that can only be done with better data collection.

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Appendix

ENG 100D Spring 2018

Team Animal Fries

Mrs. Han's Classroom Re-design

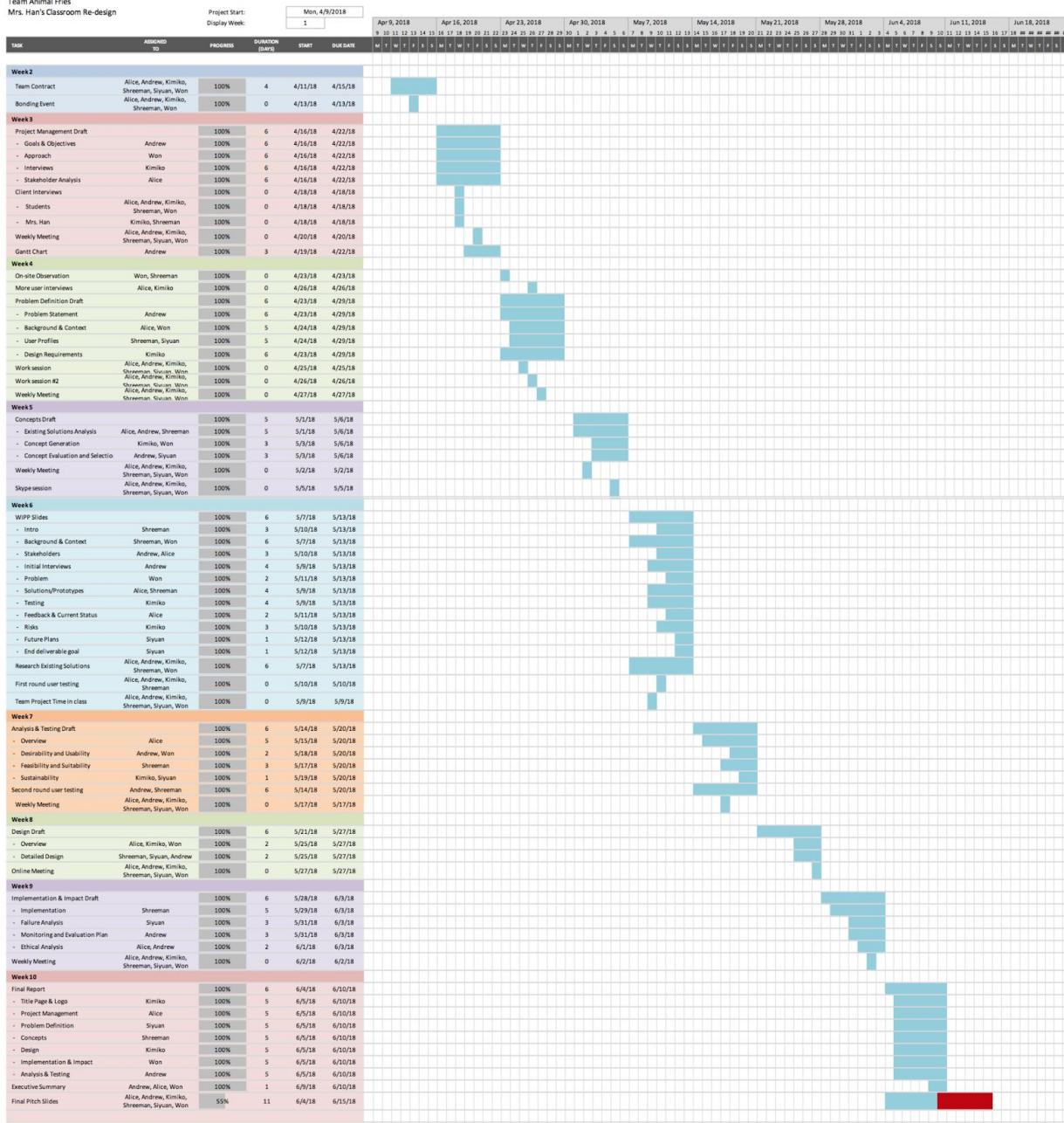


Figure 1.3 - Gantt Chart

Frozen Yogurt Bonding - 4/13/18

Attendance: Shreeman, Andrew, Alice, Kimiko, Won, Thao

Discussion Items:

1. Personal Introductions

Action Items:

1. Everyone fill out when2meet to determine weekly meeting times
 2. Everyone look at the team contract and sign.
-

Onsite Visit - 4/18/18

Attendance: Siyuan, Alice, Kimiko, Shreeman, Won, Andrew

Discussion Items:

1. Introduce team to Ms. Han's class

Action Items:

1. Perform interviews with Ms. Han's students
 2. Perform interview with Ms. Han
-

Work Session Week 3 - 4/18/18

Attendance: Thao, Alice, Kimiko, Andrew, Shreeman, Won (Remote), Siyuan (Remote)

Discussion Items:

1. Discuss everyone's team roles
2. Create survey for third grade students
3. Takeaways from interviews:
 - a. Students want more art and science
4. Possible solutions:
 - a. Science & Art projects (Art in Action format with curated lesson plans)
 - b. Channel for communication between Ms. Han and experts in the fields of art and science
5. Create Gantt Chart

Action Items:

1. Work on Project Management Draft
 2. Andrew reach out to Ms. Han to ask:
 - a. Do the students have science fairs?
 - b. What materials do you have in your classroom?
 - c. Science lesson plan: what science lessons can we potentially combine with art?
 - d. How many students have trouble with English?
-

Team Meeting Week 3 - 4/20/18

Attendance: Alice, Siyuan, Shreeman, Kimiko, Andrew

Discussion Items:

1. Identify how to create the survey
2. Discuss adequacy of interviews done so far

Action Items:

1. Review Project Management Draft and submit
 2. Identify key problems
 3. Brainstorm solutions (in document)
 4. Plan next week's tasks
 - a. Send Ms. Han's students a survey
 - b. Potentially sit-in on one of Ms. Han's lessons
 - c. Look into Problem Definition document
-

Onsite Visit - 4/23/18

Attendance: Won, Shreeman

Discussion Items:

1. Ask Ms. Han about what the morning routine on Mondays at class are
2. Decide what aspects of the class to focus on during the observation

Action Items:

1. Take notes on students' and Ms. Han's interactions
 2. Document the actions through pictures
 3. Do not interfere with the students' or Ms. Han's actions to prevent any confounding factors affecting how they behave
-

Work Session Week 4 - 4/25/18

Attendance: Siyuan, Shreeman, Andrew

Discussion Items:

1. What is the underlying problem for Ms. Han's class
2. How do we address this issue with our project?
3. Find supporting evidence for our problem

Action Items:

1. Work on Problem Definition Draft

Work Session Week 4, #2 - 4/26/18

Attendance: Alice, Andrew, Won, Shreeman, Kimiko

Discussion Items:

1. Ms. Han's feedback
2. Potential solutions:
 - a. Students create pitches and make teams to work on those
 - i. Problems with this:
 1. Questions have to be fairly open ended for a research project. Can students come up with these kinds of questions on their own?
 2. Students might all be interested in just one idea
 3. How to split into teams? Too many kids in one team doesn't work. Too many projects requires a lot of materials.
 - b. Combine art and science through fun craft projects
 - c. Students implement a project in an artistic manner but make it about a scientific concept.

Action Items:

1. Work on Problem Definition Draft:
 - a. Consolidate background research into the Background & Context section
 - b. User profiles
 - c. Design requirements table
-

Team Meeting Week 4 - 4/27/18

Attendance: Siyuan, Alice, Shreeman, Kimiko

Discussion Items:

1. Leftover things to do
 - a. Need Ms. Han's feedback to finish problem statement and background/context
 - b. Need Brandon's clarification for journey maps
 - c. Start brainstorming ideas for design solution
 - d. Revise + submit the problem definition document

Action Items:

1. Finish design requirements and user profiles

Team Meeting Week 5 - 5/2/18

Attendance: Kimiko, Won, Shreeman

Discussion Items:

1. Talk about the three concepts that the attendees came up with
2. Figure out how to reorganize Google Drive team folder
3. Weigh the pros and cons of attendees' ideas and new ideas created during the meeting

Action Items:

1. Add a concept to the concept draft, we will pick best 3: Task Owner-Everyone
 2. Assign roles for the concept document due at the end of the week
 3. Come up with ideas for the existing solutions analysis
-

Team Skype Session - 5/5/18

Attendance: Kimiko, Andrew, Alice, Siyuan, Shreeman, Won

Discussion Items:

1. Share the solution ideas that each team member generated individually
2. Share the existing solutions that each team member generated individually
3. Decide on updated design requirements

Action Items:

1. Add the ideas that were voted on to the concepts draft document
 2. Perform testing and analysis of prototypes created from ideation stage
 3. Vote on final idea out of the final three
-

Team Project Time (in-class) - 5/9/18

Attendance: Alice, Kimiko, Siyuan, Andrew, Shreeman, Won

Discussion Items:

1. Planning for on site user testing
 - a. Schedule
 - i. 30 for each project
 - b. Need feedback on:
 - i. Portfolio format [for next week's testing]
 1. Hang up
 2. Bind in a book
 3. Binder of the whole class's work
 - ii. Different project topics [for tomorrow, 5/10]
 1. Comic strip about an artist's life/solar system
 2. Tessellations (math & art)
 2. New idea:
 - a. Comics journal for the year
 - i. Each week or whenever they learn a new topic, they draw a comic about that experience and add it to their portfolio

Action Items:

1. Need to write outline of the test plan for 5/10
 - a. Alice & Kimiko
 - b. Andrew & Shreeman
-

Team Meeting - 5/17/18

Attendance: Kimiko, Won, Andrew, Siyuan, Alice, Shreeman

Discussion Items:

1. Work on presentation
2. Shifting our idea from multiple disciplines (Math, Science, English) to English through Comic Book idea
 - a. Quality of all the mini-lessons would go down, plus they have ST Math and Engineering class every few weeks, so we decided to focus more on English because many students are English Second Language students
 - b. New California Common Core doesn't enforce Science and Technical subjects until 6th grade

Action Items:

1. Let Ms. Han know what plan we want to test for tomorrow
 - a. Ask her to pick one or two lessons for the students to use when making their comics
 - b. Start off with silent time for 10 minutes
 - c. Ask her for her feedback
 - d. Ask the students to present their stories and the topic they drew their comics about
 - e. Ask the students for their feedback
 - i. Did they like it? Did they have fun?
 - ii. Would they want to continue doing this the whole year?
2. Presentation order
 - a. *Intro/Hook* : Shreeman
 - b. *Background/Context* : Shreeman
 - c. *Stakeholders* : Andrew
 - d. *Initial Interviews*: Andrew
 - e. *Problem* : Won
 - f. *Solutions/Prototypes* : Siyuan & Shreeman
 - g. *Round 1 of testing comic* : Kimiko
 - h. *Round 1 of testing tessellations* : Andrew
 - i. *Feedback & Current Status*: Alice
 - j. *Risks* : Kimiko
 - k. *Future plans* : Siyuan
 - l. *End deliverable goal* : Siyuan

Team Project Time - 5/25/18

Attendance: Alice, Kimiko, Siyuan, Shreeman

Discussion Items:

1. Finalize the solution idea based off of second round of user testing
2. Second testing round
 - a. It was hard for the students to draw and write explanations for the concepts
 - b. Students had fun coming up with ideas to teach the second graders but weren't sure how to actually draw them out
 - c. Had fun with drawing, but the things they were drawing were irrelevant?
3. Ideas
 - a. Half class draws, other half writes. Then exchange and have the other half write about the others' pictures and have the others draw based on what others wrote
 - b. Relay comic across groups of students
 - c. Guide - provide them with a table of content
 - d. Writing about fun memories or about themselves + pictures/comics
 - i. An "extended comic" throughout the year
 - ii. Pick from different templates: one panel with lines or few panels with speech bubbles
 - iii. Start - about me
 - iv. Throughout the year - entries about what happened that year
 - v. End - what I learned this year/what changed in me

Action Items:

1. Work on the design document based off of the final idea
2. Create a lesson plan prototype, bill of materials, and diagrams for the design document
3. Visit Baker Elementary to get feedback on the final solution idea from Ms. Han and students

Online Meeting - 5/27/18

Attendance: Alice, Andrew, Kimiko, Siyuan, Shreeman, Won

Discussion Items:

1. Need to create an instructions guide for Ms. Han
 - a. Written instructions along with each of the templates
2. Final design
 - a. Survival guide for incoming third graders
 - i. Create comics/art projects each week based on concepts learned in class
 - ii. Collect each piece throughout the year to create an art portfolio
 - iii. Allow students to pick which template they want to use

Action Items:

1. Work on Design Draft

Online Meeting - 6/2/18

Attendance: Alice, Andrew, Kimiko, Siyuan, Shreeman, Won

Discussion Items:

1. Positive feedback from Ms. Han about final design
2. Maybe let the students take the portfolios home instead of having them passed down to the next year's class

Action Items:

1. Finish Implementation and Impact draft
-

Team Project Time - 6/4/18

Attendance: Alice, Kimiko, Shreeman, Andrew, Won

Discussion Items:

1. Assign drafts to every person for review
 - a. Title page - Kimi
 - i. Animal Fries Logo - Kimi
 - b. Project Management - Alice
 - c. Problem Definition - Siyuan
 - d. Concepts - Shreeman
 - e. Design - Kimi
 - f. Implementation & Impact - Won
 - g. Analysis and Testing - Andrew
 - h. Executive Summary - Everyone
 - i. Appendix - Everyone
 - j. Reference - Everyone

Action Items:

1. Everyone to update project sections using Brandon's feedback
 2. Add citations for every reference and interview
-

Team Work Session - 6/6/18

Attendance: Alice, Kimiko, Shreeman, Siyuan, Andrew, Won

Discussion Items:

1. Remaining requirements for the final report
 - a. Executive summary
 - b. Conclusion
 - c. Appendix
 - d. Reference
2. Discuss and distribute tasks for the final presentation creation

Action Items:

1. Revise final report

Figure 1.4 Meeting Minutes

Table 2.3.1 - Margaret, a Baker Elementary School third-grade teacher “Empathy Map”

<i>say</i>	<ul style="list-style-type: none"> - “Good effort! Better luck next time.” - “Alright students, we’re going to have math time now.” - “Would anyone like to share what their answer is?” - “Any questions? Is everyone having a fun time?” 	<i>do</i>	<ul style="list-style-type: none"> - Explains tasks to students - Appoints students to perform logistical tasks such as distributing papers and supplies - Calmly handles conflict - Does not pressure students to talk or interact
<i>think</i>	<ul style="list-style-type: none"> - She should handle conflict between students peacefully - Students should learn a variety of subjects in order to have a meaningful educational experience - The school has limited funding - Arts is somewhat pushed aside by the school curriculum 	<i>feel</i>	<ul style="list-style-type: none"> - Experiences contentment when her students are getting along and participating - Feels sorry for her students when talking about the lack of creative learning - Does not feel upset when students misbehave or get angry as she tries to be understanding

Table 2.3.2 - Journey Map:

8:15am - 9:00am Morning meetings Margaret starts “Am I Ready?” time to get her students settled in. She starts the Morning Gathering by having her students answer engaging questions.	9:00am - 10:00am Math Margaret has her students answer math questions on the SMART board and then play with geometric blocks in groups.	10:00am - 10:25am Shared reading She has students take turns reading aloud a book that the entire class is currently reading.	10:25am - 11:20am Computer lab She takes her students to the computer lab to work on ST Math, AR Reading, or Achieve 3000 learning tools.
11:20am - 12:00pm Lunch Margaret excuses the students for lunchtime and then brings the students back to the classroom after lunch in a single-file line.	12:00pm - 2:20pm Reading activities She first goes through a read aloud session, followed by independent reading, and lastly, guided reading.	2:20pm - 2:30pm HW and cleanup She reviews with the students what the assigned homework is and then has the students clean up the classroom.	2:30pm Dismissal She allows the students to retrieve their backpacks from hooks outside the classroom and finish class for the day.

Table 2.3.3 - Alisha, a third-grade student who loves science “Empathy map”

<i>say</i>	<ul style="list-style-type: none"> - “I love doing experiments” - “I wish we could go to science museums” - “I learned about fossils by myself at home” - “I like science experiments” 	<i>do</i>	<ul style="list-style-type: none"> - Performs really well in science activities - Helps out her peers who struggle with science projects - Expands her science knowledge outside of class through books and tv shows
<i>think</i>	<ul style="list-style-type: none"> - Firmly believes that science is her favorite subject - Would like to have more time for science curriculum 	<i>feel</i>	<ul style="list-style-type: none"> - Gets excited when time for learning science approaches - Feels interested and curious when learning new concepts

Table 2.3.4 - Brianna, a third grade student who loves art “Empathy map”

<i>say</i>	<ul style="list-style-type: none"> - “Art time in class is my favorite part of school” - “I wish we had more time to do crafts in class” 	<i>do</i>	<ul style="list-style-type: none"> - Express their sense of creativity really well during art time - Prefer to spend a lot of time on art projects in class - Creates art projects in her freetime
<i>think</i>	<ul style="list-style-type: none"> - Misses 2nd grade art class - Thinks there should be more time for art in class - Thinks very creatively 	<i>feel</i>	<ul style="list-style-type: none"> - Feels joy when art time approaches - May experience boredom during math and reading lessons

Table 2.4 - Design Requirements:

<i>Criterion</i>	<i>Requirement</i>
Functionality	The duration the solution requires must be less than an hour a day so as not to interfere with the rest of Mrs. Han's class schedule.
Desirability	The number of students interested should be the majority of the class because otherwise the curriculum will not have fulfilled its purpose in providing a way for them to pursue their interests.
Usability	The ease-of-use rating on a 10 point Likert scale must be at least a 7 because Mrs. Han should have a solution that is easy to teach her class.
Affordability	The cost of implementation need to be approved by Mrs. Han before implementation because we lack the authority to address school finances.
Feasibility	At least 80% of the required materials must be readily available in Mrs. Han's classroom so Mrs. Han does not have to exert extraneous effort.
Sustainability	The number of times the idea can be implemented must be at least once per school year because Mrs. Han should not require significant resources to utilize it.
Socio-cultural sustainability	The content of the curriculum must be available in languages easily understood by 100% of the students because students' cultural backgrounds should not interfere with the impact of the project.

Table 4.1.1 - Analysis & Testing Summary

Test Iteration	Criterion	Metric	Target Value	Resultant Value	Method
Round 1	Desirability	Proportion of students who enjoyed the activity (%)	> 50%	50%	User feedback
	Affordability	Cost of additional materials required (\$)	\$0	\$0	User testing & research
	Feasibility	Time spent on lesson (minutes)	15 ~ 30 min	20 min	User testing
	Functionality	Rating on 10-point Likert Scale	> 6	8	User feedback
	Sustainability	Rating on 10-point Likert Scale	> 6	9	User feedback + research
Round 2	Desirability	Proportion of students who enjoyed the activity (%)	> 50%	50%	User feedback
	Affordability	Cost of additional materials required (\$)	\$0	\$0	User testing & research
	Feasibility	Time spent on lesson (minutes)	15 ~ 30 min	25 min	User testing
	Functionality	Rating on 10-point Likert Scale	> 6	8	User feedback
	Sustainability	Rating on 10-point Likert Scale	> 6	9	User feedback + research

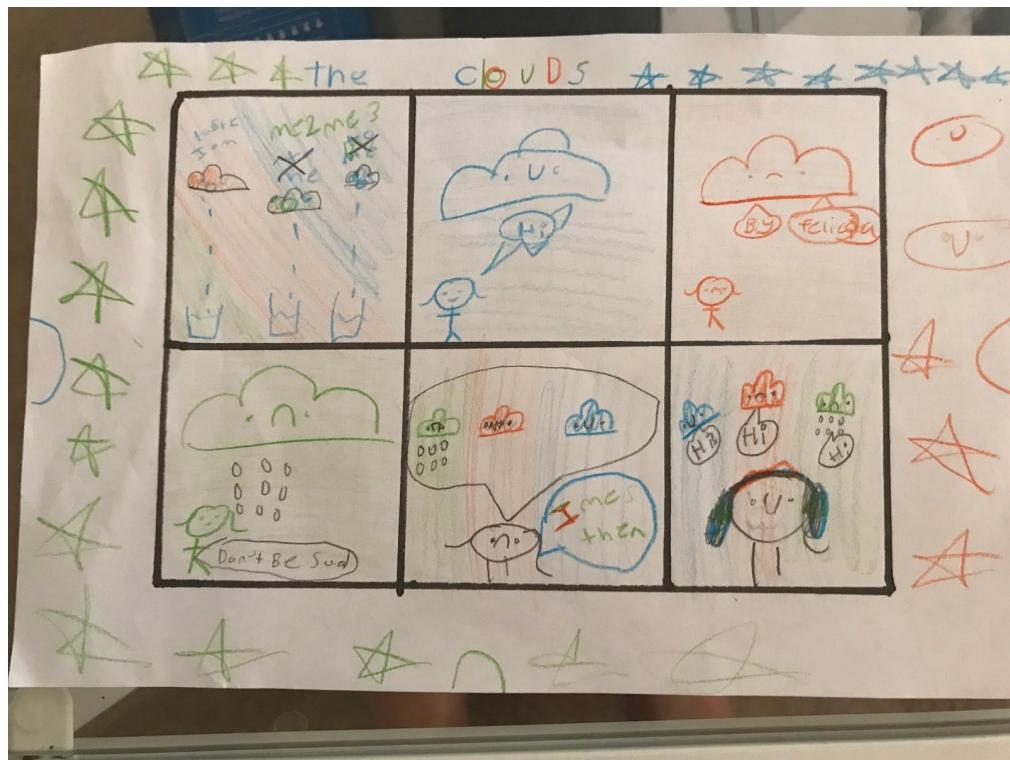


Figure 4.2.1 - Comic Book Prototype

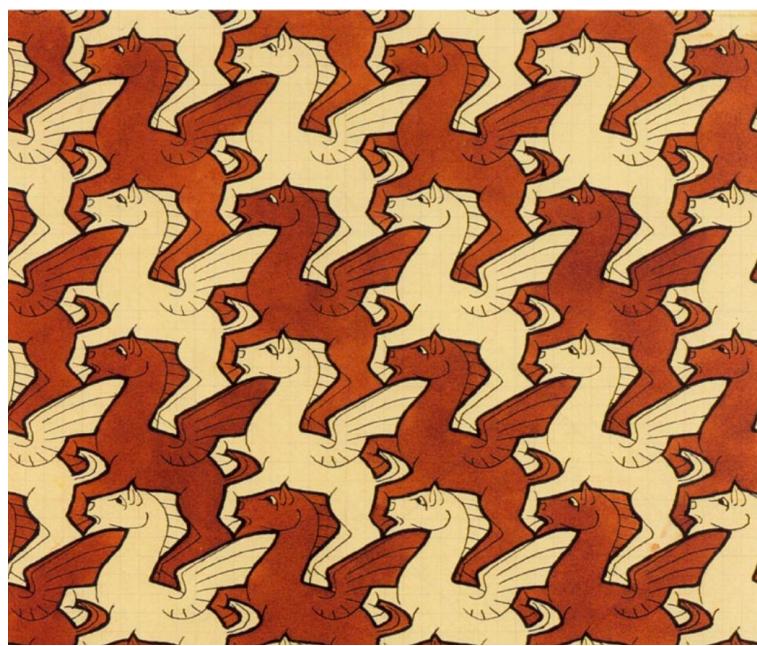


Figure 4.2.2 - Tessellation Prototype



Figure 4.2.3 - Tessellation User Testing



Figure 4.2.4 - Example tessellation from user testing



Figure 4.2.5 - Comic book user testing.

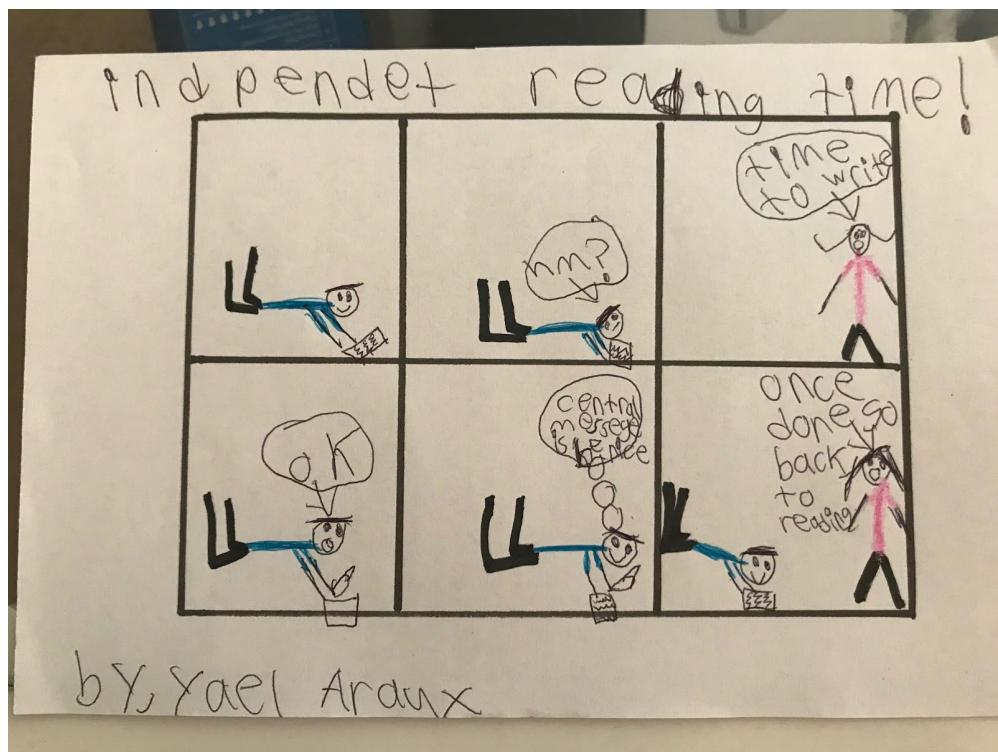


Figure 4.2.6 - Example comic from user testing



Figure 4.2.7 - Testing comic book idea round 2

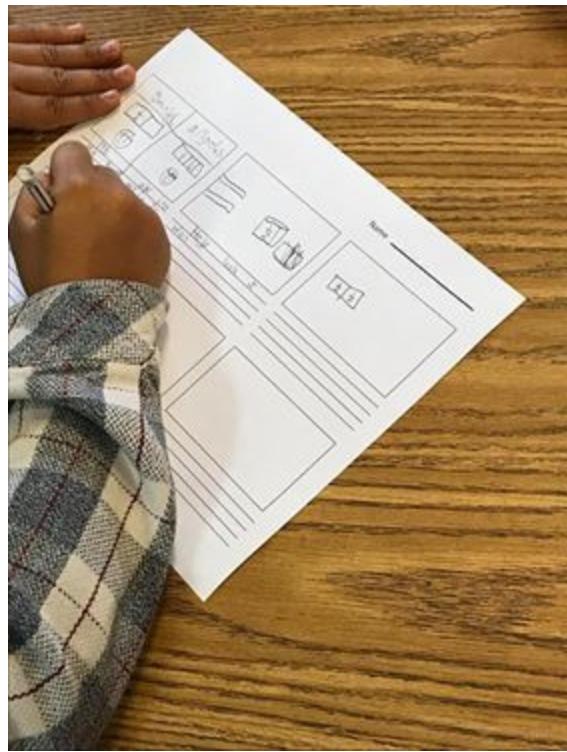


Figure 4.2.8 - Example comic from testing round 2

For the comics:

1. Discuss a lesson that students learned in the last month
2. Hand out comic book templates and instruct students to grab their coloring supplies.
3. Students will be given 20 minutes to complete their comics based on the lessons they discussed.

For the tessellations:

1. Teach students about MC Escher and discuss tessellations
2. Teach students how to create their tessellation templates
 - a. Students will cut two shapes on adjacent sides of a 3x3 index card
 - b. Helpers will tape the shapes onto their opposing sides to make them stick out.
3. Show how tessellations can be traced to create repeating patterns
4. Students are given 20 minutes to create their tessellations.

Figure 4.2.9 - Lesson Plan for testing Round 1

Comic book Instructions:

1. Mrs. Han will discuss lessons or topics that the students learned in the last month
2. Mrs. Han will instruct students to create comics silently
3. After creating their comics, Mrs. Han will instruct partners to share their comics with each other and to the rest of the class
4. After discussion, Mrs. Han will ask students to provide feedback about the activity (thumbs up to indicate that they liked it vs thumbs down)

Figure 4.2.10 - Lesson Plan for testing Round 2

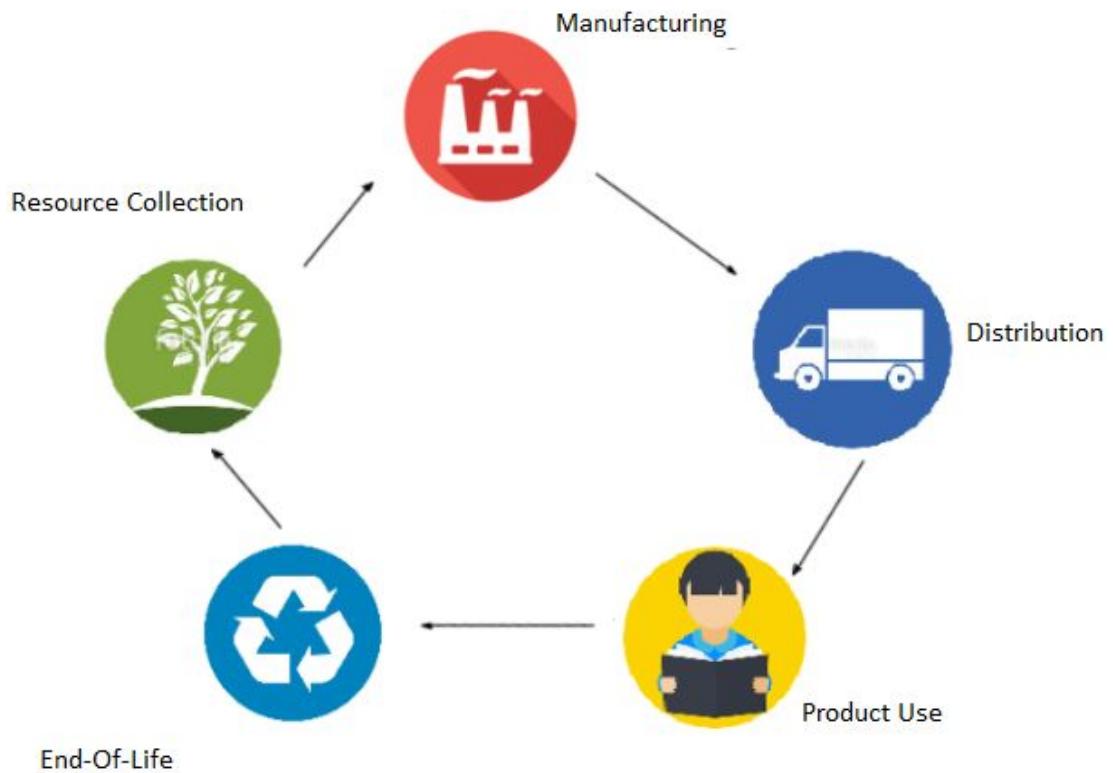


Figure 4.4.1 - Project Life Cycle Assessment

Table 4.4.2 - Table of resources and wastes at each stage of the LCA

Stage	Resources	Wastes
Resource Collection	Trees (Paper) Paraffin Wax (Crayons) Fossil Fuels (Machinery)	Carbon Monoxide
Manufacturing	Fossil Fuels & Electricity	Air Pollution Water Pollution
Distribution	Fossil Fuels	Carbon Monoxide
Product Use	Paper Coloring tools	Recyclable paper
End-Of-Life	Recyclable paper	Carbon Monoxide

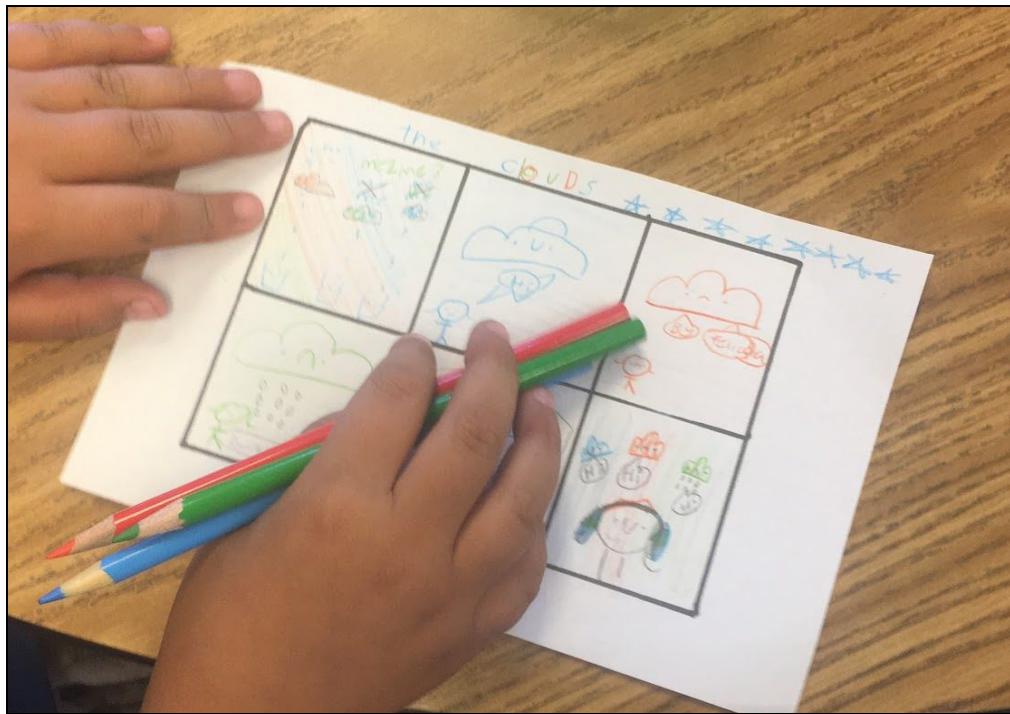


Figure 5.1.1 - Example comic project

5.2: Curriculum Cost Table Based on Yearly Basis

Item	Vendor	Reference	Quantity	Unit Cost	Subtotal Cost
Printer Paper	Staples	https://www.staples.com/Staples-Copy-Paper-8-1-2-x-11-Case/product_135848	1	\$31.99	\$31.99
Printer Toner	Staples	https://www.inkcartridges.com/product-share-oem-laser-mxc30ntboem-25911	1	\$36.99	\$36.99
Color Pencils 50 Count	Amazon	https://www.amazon.com/Crayola-Colored-Pencils-Count-Coloring/dp/B00000J0S3	5	\$8.98	\$44.90
Hole Puncher	Amazon	https://www.amazon.com/Swingline-Precision-Capacity-Adjustable-74037/dp/B0006HUPHU	1	\$4.22	\$4.22
Regular Pencils	Amazon	https://tinyurl.com/y8cggy4oz	1	\$4.99	\$4.99
Binders w/ prong	Amazon	https://tinyurl.com/ybp8sfsw	4	\$12.99	\$51.96
Spiral Notebooks (Pack of 24)	Amazon	https://tinyurl.com/ycw5sc6k	1	\$29.92	\$29.92
Ribbon	Michaels	http://www.michaels.com/500yd.-textured-curling-ribbon-by-celebrate-it/M10118263.html?dwvar_M10118263_color=Royal&dwvar_M10118263_size=500%20yd#start=8	1	\$2.99	\$2.99
Manila Folders (100 count)	Amazon	https://tinyurl.com/y8fvhnlw	1	\$8.29	\$8.29
Scissors (Pack of 10)	Amazon	https://tinyurl.com/y945qrcw	1	\$14.99	\$14.99
				Total	\$231.24

Figure 5.2.1 - First Template

Name:	Date:
Title:	

Figure 5.2.2 - Second Template

Name:

Date:

Title:

Figure 5.2.3 Third Template

COMIC STRIP CURRICULUM

Comic Strip (1 hour)

Materials for one comic strip session

- 24 copies of templates 1, 2, and 3
- Writing pencils
- Colored pencils

Intro - 10 minutes

Review last week's lesson topics.

Brainstorming - 10 minutes

Let students brainstorm with each other about which lesson to cover, how to portray it, and which templates would be most suitable.

Silent Working Time - 20 minutes

Have students choose their templates and gather supplies to their work areas. Start a silent drawing/writing period.

Wrap-up - 5 minutes

Check on the students' progress and start wrapping up the activity. Students should store the comics into their individual folders.

Portfolio Making Session (1 hour)

Materials for portfolio making session

- 24 sheets of construction paper
- Writing pencils
- Colored pencils
- Ribbon method:
 - Spool of ribbon, scissors, 3-ring hole punchers to share
- Notebook method:
 - Spiral notebook with A4-size sheets, glue stick
- Binder method:
 - 3-ring binder, 3-ring hole punchers to share

Intro - 10 minutes

Introduce the three different methods for compiling portfolios - ribbon, notebook, binder.

Students Select Binding Method - 5 minutes

Hand out construction paper for the portfolio cover. Have students pick preferred method of binding and gather proper materials for the method.

Portfolio Binding - 20 minutes

- Ribbon method:
 - Have students place the comics in the order that they would like them to be in the portfolio. Have students hole-punch each comic and the construction paper on the left side of the paper. They should each cut three 6-inch strings of ribbon. Then, they should align the comics with the construction paper cover on top and tie a piece of ribbon through each of the three holes.
- Notebook method:
 - Have students place the comics in the order that they would like them to be in the portfolio. Students should then apply glue to the backside of the construction paper and paste it to the first page in the notebook. Students should glue the backside of each comic and paste the comic to a new page in the notebook.
- Binder method:
 - Have students place the comics in the order that they would like them to be in the portfolio. Have students hole-punch each comic and the construction paper on the left side of the paper. They should place each page in the desired order into the binder with the exception that the construction paper cover should be on top.

Cover Decoration - 20 minutes

Have students create covers using the construction paper that highlights their portfolio. The cover should also have a thoughtful message written to future students.

Wrap-up - 5 minutes

Wrap up the activity and collect all student portfolios.

Scaffolding

If the class has difficulty finishing in time, don't worry!

This would be a great opportunity to try *scaffolding*!



Break the assignment down into separate parts: drawing, writing, coloring, etc. Dedicate sessions to completing individual components! This can mitigate stress and let students really get their creative energies flowing!

Table 6.1.2. Resource Assessment

Distribution	Activities	Capabilities	Responsibilities				Still Needed?
			Design Team	Implementing Org	Funder	External	
Google Doc, Email (.pdf)	Physical space	Space procurement + cost		●	●		
		Cleaning + general maintenance		●	●		
	General Education	Determining necessary curriculum		●	●		
		Formulating lesson plans		●			
		Teaching lesson plans		●			
	Follow-ups	Feedback discussion		●			
	Performance tracking	Feedback loop		●			
		Test scores		●	●		
	Informational materials	Written instructions	●				
		Comic templates	●				
		Distribution	●	●		●	
	Physical resources	Writing supplies		●	●		
		Drawing supplies		●	●		
		Paper		●	●		
		Binding supplies		●	●		

Table 6.2. Failure Mode and Effects Analysis (FMEA)

Failure Mode	Effects	Severity	Occurrence	Detection	Risk Score	Action
Students grow tired of comics	Class lacks motivation to continue comic project	5	5	4	100	Add fun art projects in addition to comics
Class runs out of supplies (markers, pencils, etc)	Students cannot create their comics	10	2	2	40	Request funding from the school administration or seek assistance from the community for supplies
Students don't demonstrate improved writing	Students do not benefit from this lesson plan completely	5	4	4	80	Offer supplementary writing exercises to help students work on their writing skills
Next year's students are disinterested in the comic book	The next year's students may lose interest in creating their own comics	3	4	8	96	Frame the comic project as a personal comic book rather than one for future students
Mrs. Han loses their comics/comics get damaged	Class cannot compile comics into a book	10	2	10	200	Continue creating comics but without creating a portfolio. Students can bring them home after they are made.