THE EDUCATION FUND 40 YEARS

FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

2024
2025

# Ideas with IMPACT

STEM

## Sustainable City Planning

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ASSURANT®

# Sustainable City Planning

**STEM**

Science, Technology, Engineering, and Math

Special Education & General Education

*"We are all one. Only egos, beliefs, and fears separate us." Nikola Tesla*


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Project Conducted at Thomas Jefferson Biscayne Gardens K-8 Academy / School Code: 6281

Current Work Location: Mae M. Walters Elementary School / School Code: 5711


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# Background

## The Purpose of My Project

I developed this project to give my students a unique opportunity to learn about sustainable city planning. I conducted this project during the School Year of 2023-2024 at Thomas Jefferson Biscayne Gardens K-8 Academy with my Grade 8 special education students during access science, math, and health classes and my STEAM (Science, Technology, Engineering, Art, and Math) Club Project Grades 3 and 4 general education students during Club classes. Thomas Jefferson Biscayne Gardens (TJBG) K-8 Academy is a public school in Miami-Dade County Public Schools, Miami, Florida, United States of America.

## The Source of My Idea

The source of my idea was to use different technological equipment I acquired through Education Fund Innovator Grants to build a miniature sustainable city to help my students understand the concept of a sustainable city. My idea focused on using technological resources such as Finch the Robot, Tinkercad, and a 3D printer to provide my students with firsthand experience in planning a sustainable city.

## Educators Can Expect from this Workshop

By attending this workshop, educators can expect to learn how to:

1. Develop innovative classroom projects to increase firsthand experiences for their students.
2. How to adapt this project to the classes they teach and their specific students' needs.
3. How to network with coworkers, parents, and businesses to create a sense of community and maximize the project's success.
4. Increase their students' interest in the subject area and level of engagement.
5. Facilitate and stimulate students' critical thinking to apply in their lives and future careers.

6. Correlate social science concepts to scientific and technological concepts and ideas to boost students' critical thinking skills.
7. Use the Finchblox code system to move Finch the Robot
8. 3D printing, graphic design, building, painting, blueprint paper, and assembling activities.
9. Create interactive PowerPoints.
10. Informal assessment creation.

## My Project Demographics

I conducted this project at Thomas Jefferson Biscayne Gardens (TJBG) K-8 Academy, a public school in Miami-Dade County Public Schools, Miami, Florida, United States of America. TJBG K-8 is at 525 NW 147th Street, Miami, FL, USA, 33168. Thomas Jefferson Middle School merged with Biscayne Gardens Elementary to be renamed Thomas Jefferson Biscayne Gardens K-8 Academy. According to online data from https://publicschoolreview.com, when I conducted my project at TJBG K-8 in the School Year of 2023-2024, school-wide data was as follows:

**Students at the Elementary Level Grades Prekindergarten-5**

- Grades: **Prekindergarten-5**
- Enrollment: **377 students**
- Student: Teacher Ratio: **13:1**
- Minority Enrollment: **99%**
- Overall Testing Rank: **Top 50%**
- Math Proficiency: **50-54% (Top 50%)**
- Reading Proficiency: **55-59% (Top 50%)**
- Science Proficiency: **45-49% (Bottom 50%)**
- Source: **National Center for Education Statistics (NCES), FL Dept. of Education**

Serving 377 students in grades Prekindergarten-5, Biscayne Gardens Elementary School ranks in the top 50% of all schools in Florida for overall test scores (math proficiency is in the top 50%, and reading proficiency is in the top 50%).

The percentage of students achieving proficiency in math is 50-54% (approximately equal to the Florida state average of 52%). The percentage of

students achieving reading/language arts proficiency is 55-59% (higher than the Florida state average of 52%).

The student-to-teacher ratio of 13:1 is lower than the Florida state level of 16:1.

Minority enrollment is 99% of the student body (majority Black), higher than the Florida state average of 64% (majority Hispanic and Black).

**Students at the Secondary Level Grades 6-8**

- Grades: **6-8**
- Enrollment: **398 students**
- Student: Teacher Ratio: **14:1**
- Minority Enrollment: **99%**
- Overall Testing Rank: **Bottom 50%**
- Math Proficiency: **40% (Bottom 50%)**
- Reading Proficiency: **36% (Bottom 50%)**
- Science Proficiency: **40-44% (Bottom 50%)**
- Source: **National Center for Education Statistics (NCES), FL Dept. of Education**

Serving 398 students in grades 6-8, Thomas Jefferson Middle School ranks in the bottom 50% of all schools in Florida for overall test scores (math proficiency is in the bottom 50%, and reading proficiency is in the bottom 50%).

The percentage of students achieving proficiency in math is 40% (lower than the Florida state average of 52%), and the percentage of students achieving proficiency in reading/language arts is 36% (lower than the Florida state average of 52%).

The student-to-teacher ratio 14:1 is lower than the Florida state level 16:1.

Minority enrollment is 99% of the student body (majority Black), higher than the Florida state average of 64% (majority Hispanic and Black).

## Overview of Participant Classes

I conducted this project in 7 classes: special education access science, math, and health (Grade 8 Homeroom and Secondary Room) and STEAM Club Project (Grades 3 & 4 Club Class). A total of 72 students participated in this project.

## Different Ways to Conduct the Project

I created customized activities according to the students' unique learning needs and the subject areas in which I conducted the lessons, such as access science, math, and health. The STEAM Project Club students' activities focused more on technology and coding.

## Different Levels of Participation

Due to the diversity of students participating in this project, I customized lesson plans to fit the special education modified curriculum and the general education standard curriculum. I used the Florida Standards and Access Points. Students participated at different levels: participatory, supported, and independent.

## Benefits and Academic Achievement for My Students

The benefits of participating in this project included learning the concept of a sustainable city, creating 3D designs on Tinkercad, using Creality slicer software to format the 3D designs previously created on Tinkercad, using a SainSmart 3D Ender Pro 3D Printer to 3D print the sliced designs, painting miniature models, and building a miniature of a sustainable city.

As a result of this firsthand experience project, the students improved their academic achievement and classroom engagement. The students showed a great interest in Finch Robot, 3D printing, and Tinkercad.

## Media Release Forms

I used Miami-Dade County Public Schools (MDCPS) Media Release Form #7489. Some parents used the English version, others used the Creole version, and others used the Spanish version. It is essential to explain to parents the purpose of Form #7489 and provide the appropriate language version they need.

English Version

MIAMI-DADE COUNTY PUBLIC SCHOOLS
MEDIA RELEASE PARENTAL CONSENT FORM

(Date)

Dear Parent:

Please be advised that during the year your child may be photographed, videotaped, or interviewed at various school sponsored events. With your consent, the photograph, video or interview may be reproduced and released for use in the media, i.e., newspapers, brochures, videos, television, the internet, and Miami-Dade County Public Schools websites and social media platforms such as Facebook, Twitter, etc.

Please indicate your preference below:

(Student's Name) (Student's ID)

☐ Yes. My child's photograph/video/interview **may** be reproduced and released for use in the media.

☐ No. My child's photograph/video/interview **may not** be reproduced and released for use in the media.

(Signature) (Date)

Return the signed form to:

CONTACT PERSON: _____

SCHOOL NAME: _____

SCHOOL TELEPHONE: _____

Spanish Version

ESCUELAS PÚBLICAS DEL CONDADO MIAMI-DADE
FORMULARIO DE CONSENTIMIENTO PATERNO A LOS MEDIOS DE COMUNICACIÓN

(Fecha)

Estimados padre/madre o tutor:

Por la presente le advertimos que durante el curso escolar, posiblemente a su niño/a se le tome una fotografía, se le haga una grabación de video o se le entrevista en diversos eventos auspiciados por la escuela. Con su consentimiento, se podrá reproducir y publicar la fotografía, video o entrevista para ser entregada a los medios de comunicación, p. ej., periódicos, folletos, videos, televisión, o para su uso a través de la internet y de las páginas web de las Escuelas Públicas del Condado Miami-Dade y en plataformas de medios sociales como Facebook, Twitter, etc.

Por favor, indique su preferencia a continuación:

(Nombre del estudiante) (Número de identificación del estudiante)

☐ Sí. La fotografía/video/entrevista de mi hijo/hija **puede** ser reproducida y publicada para ser utilizada por los medios de comunicación.

☐ No. La fotografía/video/entrevista de mi hijo/hija **no puede** ser reproducida ni publicada para ser utilizada por los medios de comunicación.

(Firma) (Fecha)

Devuelva este formulario a:

PERSONA DE CONTACTO: _____

NOMBRE DE LA ESCUELA: _____

TELÉFONO DE LA ESCUELA: _____

Creole Version

LEKÒL LETA MIAMI-DADE COUNTY
FÒM KONSANTIMAN PARAN POU PIBLIKASYON NAN MEDYA

(Dat)

Chè Paren:

Sèvoupèl o ap avèrti w, pandan ane a nou kapab pran foto pitit ou a, enregistre li nan vidèyo, oubyen fè entèvyou avèk li nan diòs evènman lekòl la ap parenne. Si ou bay konsentiman ou, nou ka reprodui oubyen pèmèt foto, vidèyo oubyen entèvyou yo nan medya tankou, jounal, brochi, vidèyo, televizyon, Entèrnèt, ak sit Entèrnèt Lekòl Leta Miami-Dade County ak platform medya sosyal tankou Facebook, Twitter, elèt.

Sèvoupèl chwazi preferans ou anba a:

(Non Elèv la) (Nimèro idantifikasyon Elèv la)

☐ Wi. Nou **ka** reprodui e pèmèt foto/vidèyo/entèvyou pitit mwen an pou itilize yo nan medya.

☐ Non. Nou **pa ka** reprodui e pèmèt foto/vidèyo/entèvyou pitit mwen an pou itilize yo nan medya.

(Siyatè) (Dat)

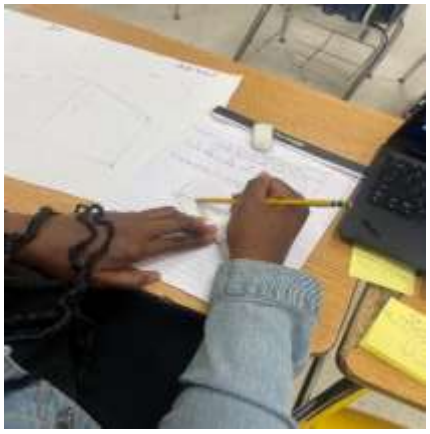
Byen fèm se a e retourne li bay:

MOUN POU W KONTAKTE: _____

NON LEKÒL LA: _____

TELEFÒN LEKÒL LA: _____

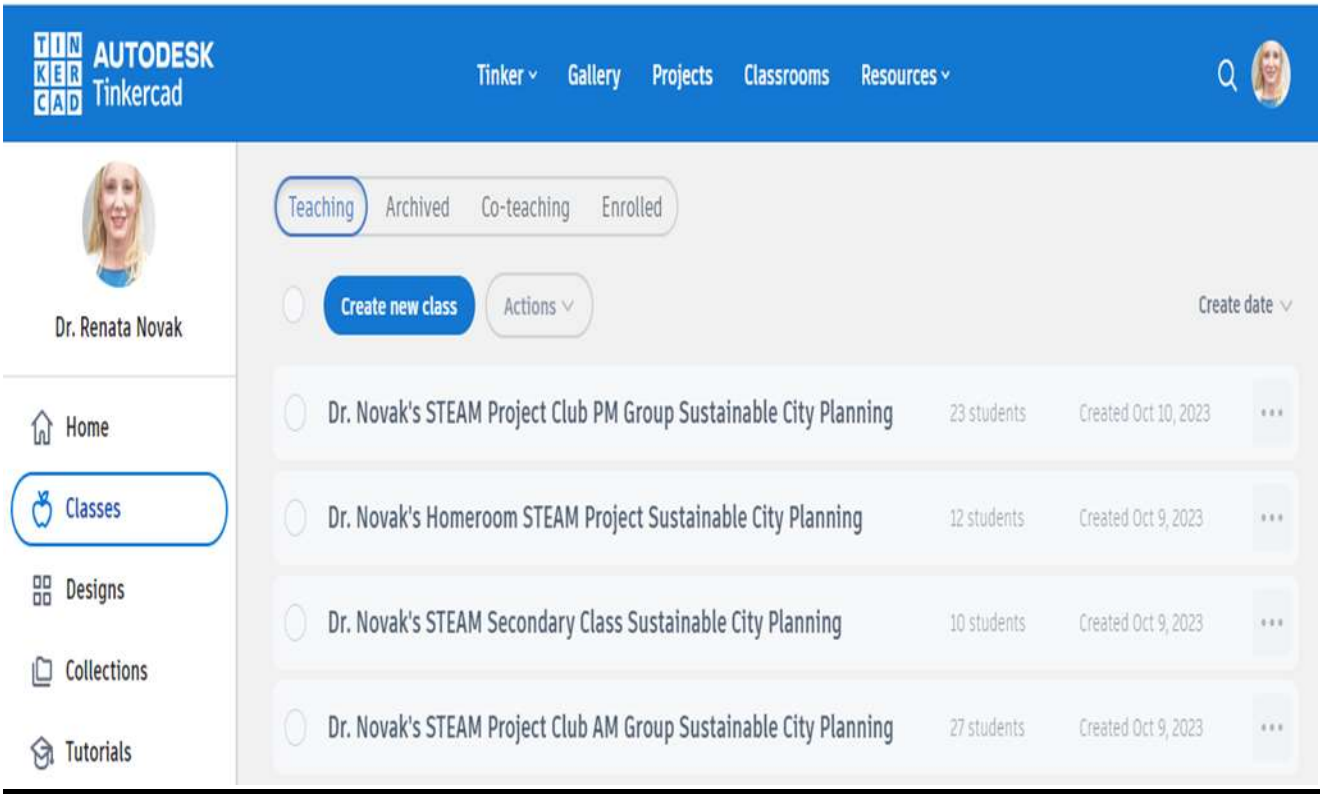
## Pictures of Students' Engagement in the Project



## Equipment and Materials

**Finch Robot Classroom Flock** Set of 5 Robots

Tinkercad Free Software Website: **tinkercad.com**




**SainSmart 3D Ender Pro 3D Printer, Auto Leveler, and Filament**

**SainSmart 3D Ender Pro 3D Printer**

**Creality Auto Leveler**

**Filament**

**Creality Slicer Software**

**Blueprint Paper**

**Big white paper, markers, paint, paintbrushes, writing journals, and school laptop computers.**

## Goal and Objectives

The main goal of this project is for students to learn how to take responsibility for their learning by identifying needs and setting goals. The main objective is for students to identify a solution for a given real-life problem by learning through firsthand experiences. Other objectives are understanding, planning, and conducting a scientific investigation using technology to create a miniature sustainable city. See the Florida Standards and Access Points section for further information.

## Florida Standards and Access Points

- Social Studies -SS.4.G.1 The World in Spatial Terms SS.4.G.1.3 Explain how weather impacts Florida. Access Point SS.4.G.1.AP.3 Recognize the effect of weather in Florida.
- Technology - G.K12.5.3.3a Technology - Know: Identify appropriate technology to achieve a project goal.
- Science, Computer Science & Engineering-SC.K2.CS-CS.2.3 Solve real-life issues in science and engineering using computational thinking. Access Point SC.8.N.1.In.1 Identify a problem from the eighth-grade curriculum, use reference materials to gather information, carry out an experiment, collect and record data, and report results. SC.68.CS-CS.1.1 Examine connections between mathematics and computer science elements, including binary numbers, logic, sets, and functions.
- Visual Arts -VA.68.S.2.3 Use visual thinking and problem-solving skills in a sketchbook or journal to identify, practice, develop ideas, and resolve challenges in the creative process. Access Point VA.68.S.2.In.b Re-create sequentially ordered procedures to incorporate in a new world of visual art

## DPGT & IPEGS Goal Inclusion and Impact

**Growth Target:** Describe what you expect to learn and the anticipated impact on your students' learning. My goal is to create learning opportunities for my special education students to increase their level of understanding of the contents of math, science, and health, to reflect an improvement of 10% to 20% in their informal assessments, teacher observations, weekly assignments, and I-Ready Math End of the Year Diagnostic (EOYD) data collection. By June 2024, 80% to 100% of my math, science, and health students will increase their understanding of the content by 10% to 20% to be reflected in their informal assessments, teacher observations, weekly assessments, and i-Ready Math (EOYD), in 4 out of 5 trials.

**Reflection and Outcome Impact:** Describe how your deliberate practice growth target has been achieved and the impact on your professional growth and your student(s) learning. I won an Innovator Grant from the Education Fund Miami to conduct a STEAM (Science, Technology, Engineering, Art, and Math) Sustainable City Planning project with all my access math, science, and health classes. This project was an excellent opportunity for firsthand activities using Finch the Robot,

a SainSmart 3D printer, blueprint paper, and Tinkercad. This helped my students understand how to apply math and science concepts to real life. According to teacher observation and informal assessments, 80% of my students showed 20% improvement in their math and science skills. My students are in the special education modified curriculum. Most students presented learning gains according to their I-Ready Diagnostics for the School Year 2023-2024. On I-Ready Math, one of my students had a 126% annual percent progress (annual stretch growth), which moved him up 2 grade levels in math. Seven of my students had an annual stretch growth higher than 19% on I-Ready Math. I was a Disseminator at the Ed Fund 2023 IDEA EXPO, presenting the results of the STEM Project I conducted during the last school year of 2022-2023. I hosted an Arts4All Visual Artist Residency, and my students presented their work at the Miami History Museum. All my students won 1st place blue at the 2023 Youth Fair Miami. I have also attended several Professional Development Sessions, such as AI, Beacon 2024: ESE for All Educators, and other PDs listed in the hard copy folder for my IPEGS 23-24.

## Project Timeline

By October 2023, students will learn what a sustainable city is and start learning how to use coding to program Finch the Robot to draw the blueprint of a sustainable city. By December 2023, students will use a previously acquired 3D printer and filaments to create miniature buildings and structures. By February 2024, students will paint miniature objects to arrange them to make a miniature of a sustainable city. Lastly, students will fill out a reflection and complete a survey of the project.

## Students' Activities

The students learned the concept of a sustainable city, how to use the Finchblox code system to make Finch the Robot move to draw designs, to use Tinkercad to develop their designs further, to use architect blueprint paper to draw their designs, to create GCode to 3D print models, to paint the models and assemble them on the miniature city base. Examples of classroom activities used were as follows:

• Interactive PowerPoint presentation on sustainable city concepts.

• Using a school computer, logging in to Finchblox, going to mode 2, and creating codes by changing measurements and tiles while observing the codes' effect on the Robot movements and designs on sizeable white paper.

• Log into Tinkercad and develop the shape for a part of the sustainable city.

• Using 3D printer slicer software to create a GCode,

• 3D printing the model.

• Painting the model.

• Assembling the models on top of the miniature city base.

• Discuss with the class sustainable city concepts

• Complete informal assessment of the project

## Sample Lesson Plan

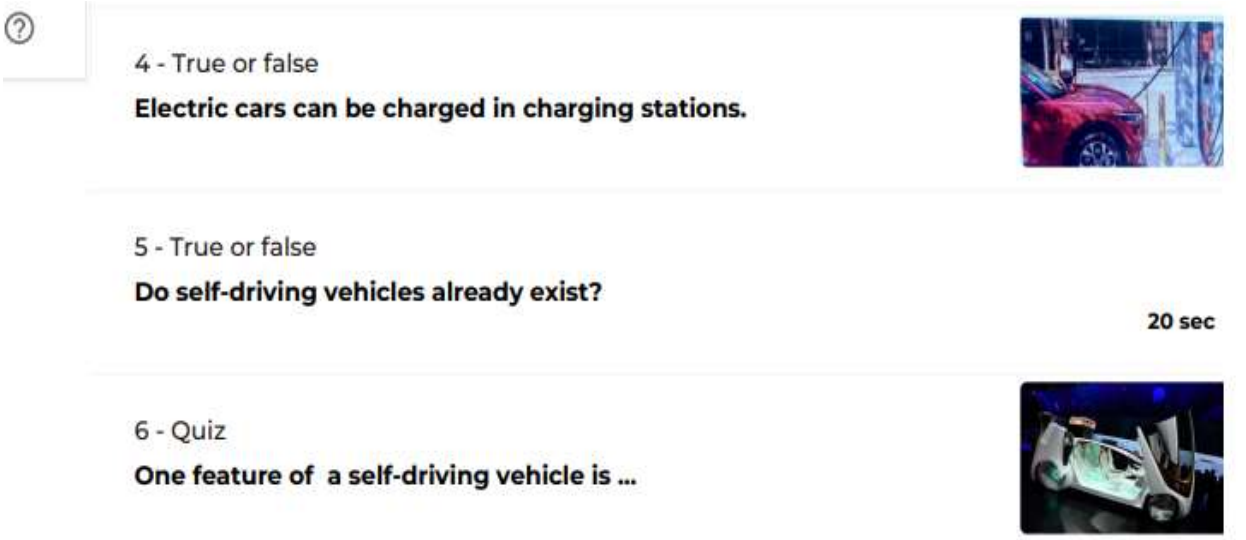
Sample Lesson Plan

Standard-Driven Activity Title: Sustainable City Planning

| STEAM 1.0 (Science) | STEAM 2.0 (Technology) | STEAM 3.0 (Engineering) | STEAM 4.0 (Art) | STEAM 5.0 (Math) |
|---|---|---|---|---|
| SC.K2.CS-CS.2.3 Solve real-life issues in science and engineering using computational thinking.<br>Access Point SC.8.N.1.In.1 Identify a problem from the eighth-grade curriculum, use reference materials to gather information, carry out an experiment, collect and record data, and report results.<br>The students will identify the 5 components of a sustainable city (1. the implementation of green infrastructure,<br>2. use of urban farming,<br>3. operations on renewable energy sources, waste management,<br>*4. efficient public transportation,*<br>5. water conservation.) | G.K12.5.3.3a Technology - Know: Identify appropriate technology to achieve a project goal.<br>SC.68.CS-CS.1.1 Examine connections between mathematics and computer science elements, including binary numbers, logic, sets, and functions.<br>The students will use Tinkercad to identify how to create 3D designs for sustainable city buildings and structures.<br>The students will use Finch the Robot to recreate the 3D designs they created on Tinkercad and Finchblox Code to create a code that moves Finch the Robot to draw their 3D designs on a big white paper. | SC.K2.CS-CS.2.3 Solve real-life issues in science and engineering using computational thinking.<br>The students will use the Creality software to adjust the size of the 3D designs they created on Tinkercad. | Visual Arts -VA.68.S.2.3 Use visual thinking and problem-solving skills in a sketchbook or journal to identify, practice, develop ideas, and resolve challenges in the creative process. Access Point VA.68.S.2.In.b Re-create sequentially ordered procedures to incorporate in a new world of visual art.<br>The students will use blueprint paper to draw the designs they created on Tinkercad. | MA.8.DP.1.1<br>Given a set of real-world bivariate numerical data, construct a scatter plot or a line graph as appropriate for the context.<br>Access Point #: MA.8.DP.1.AP.3<br>Given a scatter plot with a linear association, use tools to draw or place a line of fit.<br>The students will use their journals to construct a scatter plot and make annotations on the calculations for the distance Finch, the Robot, needs to be programmed to recreate their Tinkercad 3D design. |

# Data Collection

## Kahoot Quiz Sample Questions



7 - Quiz

**Self-driving cars have features are ... (mark all that apply)**

8 - True or false

**Adaptive cruise control is an existing self-driving technology.**

9 - Quiz

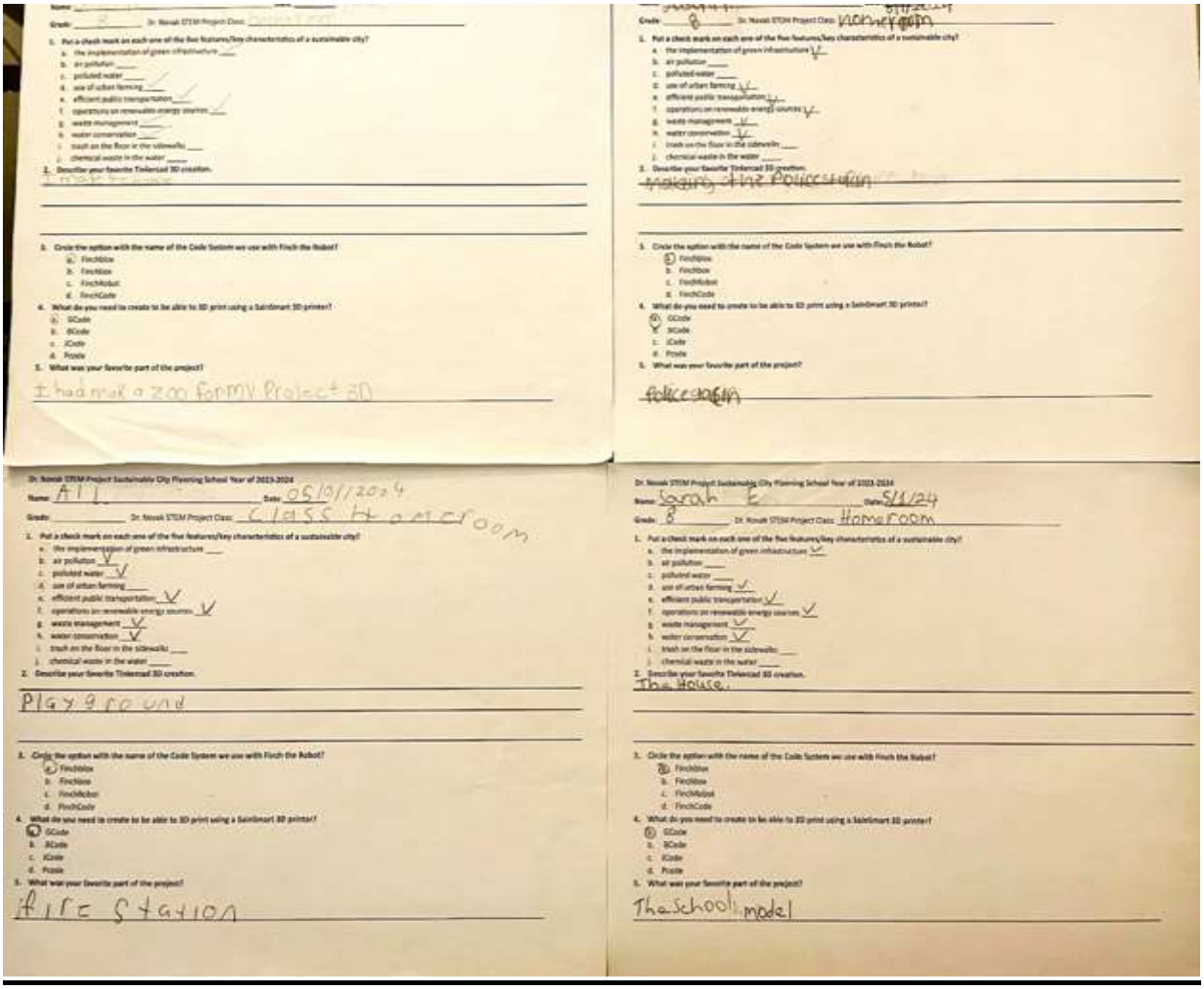
**Which one is not a key component of a sustainable city?**

**20 sec**

10 - True or false

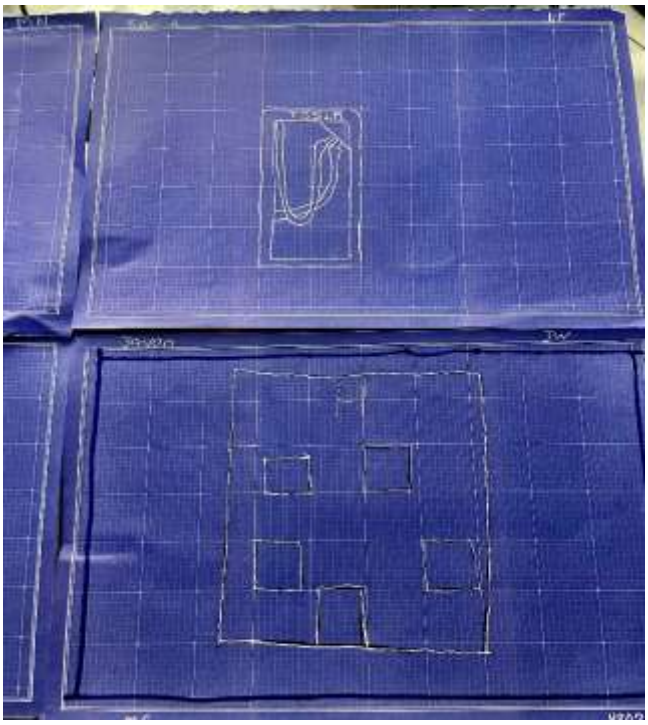
**Part of Ford's mission is to become the world's most trusted company.**

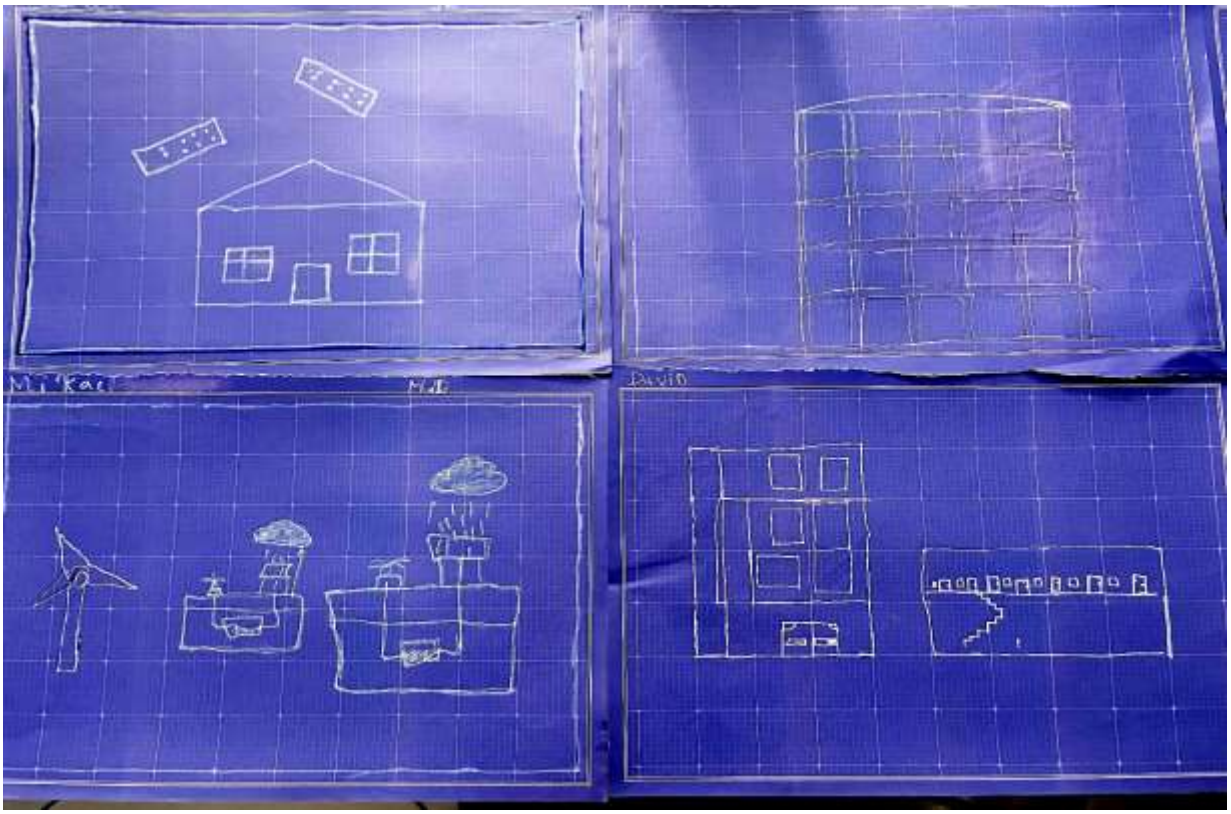
## Final Test/ Reflection/ Survey Sample

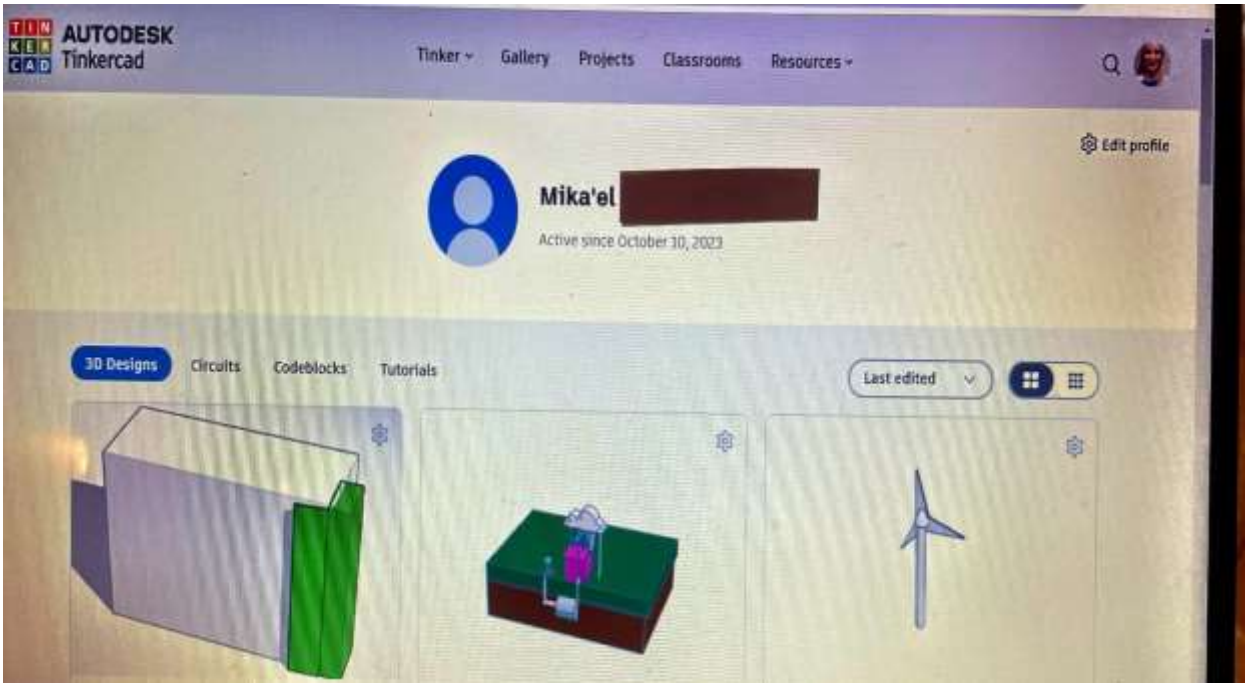


## Student Product and Work Samples

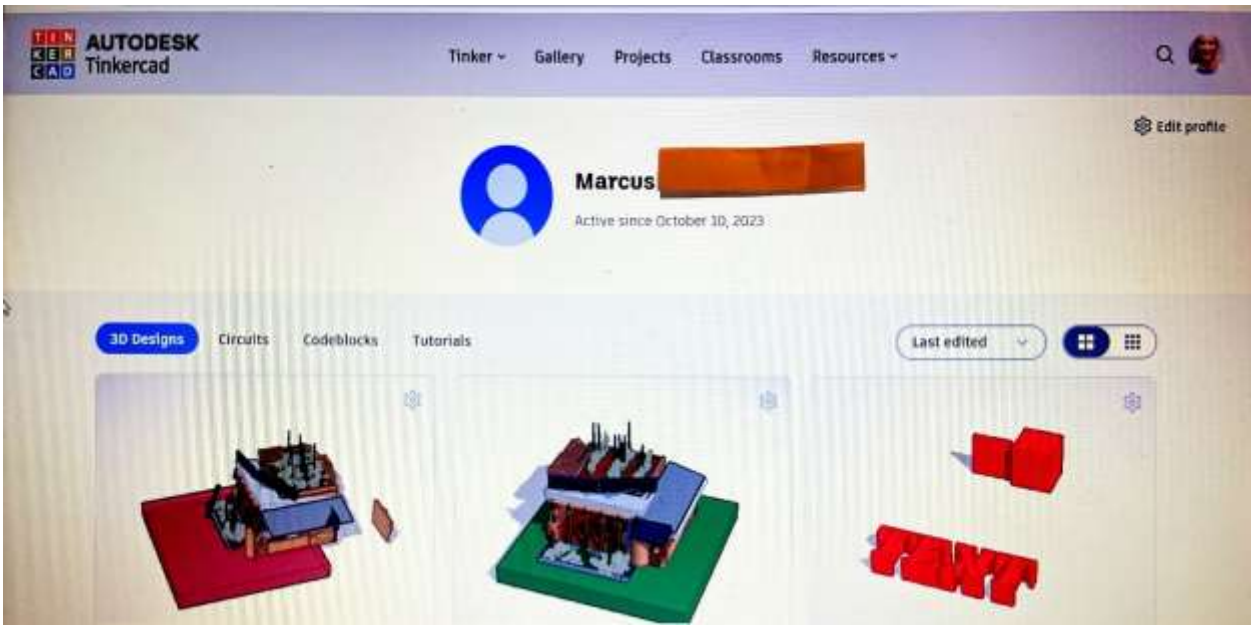
WORD WALL




David


AUTODESK
Tinkercad
Tinker
Gallery
Projects
Classrooms
Resources
Edit profile
Mika'el [redacted]
Active since October 30, 2023
3D Designs
Circuits
Codeblocks
Tutorials
Last edited

View in 3D
3D Desi[redacted]
Sarah E
Tinker this
Download
Share to Classroom
Copy link
Design is visible only to the student.
Change visibility to share
Edited April 17, 2024
Created April 17, 2024




## Cost and How to Adapt This Project for Your Students

I already had a SainSmart 3D Ender Pro 3D Printer from a prior Ed Fund Innovator Grant, and I received an Innovator grant from the Education Fund for $1,000. Therefore, I could buy the Finch Robot Classroom Set of 5 Robots. However, you can adapt what you learned in this workshop and use less materials. You can use only one Finch Robot and assign small groups, taking turns to share it.

• Finch the Robot from BrainBird Technologies- can be bought through Stemnity Educational site or directly via BirdBrain Technologies website - 1 robot approximately cost $150

• Tinkercad – tinkercad.com – free/ No Cost

• SainSmart 3D Printer Ender Pro with software and lament- approximate cost $236

• Blueprint paper – approximate cost $6

• Non-toxic paint -approximate cost $8

You can also adapt this project by using the Tinkercad idea, which is free of cost and allowed to be used by MDCPS teachers. If you are not a MDCPS teacher, you can check if your school district allows using Tinkercad for academic activities

## References and Resource


- https://www.merriamwebster.com/dictionary/sustainable
- https://www.tinkercad.com
- https://www.climaterealityproject.org/blog/five-sustainable-cities-making-difference-planet
- www.amazon.com
- https://www.cpalms.org
- https://www.sainsmart.com/
- https://www.birdbraintechnologies.com/
- Freethink Channel- Is Copenhagen the World's Most Sustainable City?

  https://www.youtube.com/watch?v=pUbHGI-kHsU&t=40s
- https://www.unesco.org/en/sustainable-development