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The Love Component of the Hope Wheel through Students' Mini -Project in Mathematics: Task - Based Learning (TBL)

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Abstract

This study explores the manifestation of the *Love* component within the Wheel of Hope framework during mathematics project work among secondary students. Drawing on the principles of positive psychology and affective learning, the research investigates how students express happiness, care, and connection while completing collaborative math projects. Using a qualitative observational design, data was collected through classroom observations, student reflections, and online surveys through the Google Form. The findings reveal that students frequently expressed emotional engagement characterized by joy, mutual support, appreciation for problem-solving, and satisfaction upon task completion. These behaviors exemplify the *Love* dimension of the Wheel of Hope, highlighting how affective experiences contribute to motivation and persistence in mathematics learning. The study suggests that integrating effective components into mathematics education can foster deeper learning and emotional well-being, positioning love and happiness as essential contributors to academic success and personal growth

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Introduction

Mathematics education has traditionally emphasized logical reasoning, problem-solving, and precision, often overlooking the emotional and affective dimensions that influence how students learn. In educational settings, academic emotions are considered a key factor affecting learning (Pekrun et al., 2002), and many studies have shown that the positive academic moods learners experience can promote learning (Pekrun et al., 2002; Pekrun, 2006). In the classroom, positive emotions can enhance students' motivation, creativity, and persistence, whereas negative emotions—such as anxiety or frustration—can impede learning. Within this emerging perspective, the concept of love—understood as care, connection, and joy in learning—offers a promising lens for understanding students' emotional engagement in mathematics.

The *Wheel of Hope* framework provides a holistic model for understanding human motivation and emotional resilience. It includes several interrelated components, among which *Love* represents the affective foundation for optimism, empathy, and meaningful connection (Matthews, 2021). When applied to education, this component can be seen in students' expressions of enthusiasm, cooperation, and happiness while learning or creating something new. Despite its theoretical potential, empirical studies exploring how the *Love* component manifests in classroom contexts, especially in mathematics learning, remain limited. Mathematics is often perceived as a challenging and emotionally neutral subject. According to (Boaler, 2016), many students experience moments of joy and satisfaction when solving problems, collaborating with peers, or completing creative projects. These experiences may reflect deeper affective engagement that aligns with the *Love* dimension of the Wheel of Hope. Observing and understanding these emotional expressions can help educators design learning environments that support both cognitive and emotional growth.

This study seeks to explore how the *Love* component of the Wheel of Hope is expressed by students during mathematics mini - project work. Specifically, it examines students' emotional expressions - such as happiness, care for peers, and satisfaction - during the completion of collaborative math projects. By observing these moments, the research aims to illustrate how positive emotions contribute to engagement, motivation, and a sense of connection in mathematics learning.

The research is guided by the following questions:

1. How do students express the *Love* component of the Wheel of Hope during mathematics project completion?
2. What observable behaviors or reflections indicate happiness and affection toward the learning process?
3. How might these emotional expressions enhance students' overall engagement and learning outcomes?

Through a qualitative approach grounded in classroom observation and thematic analysis, this study contributes to the growing discourse on affective education by highlighting love as a vital element of human learning. It is that love that continues to bring us a sense of harmony with the world (Baldwin, 1988; Imad, 2024)Ultimately, it seeks to affirm that emotional well - being and academic success are not opposing goals, but deeply interconnected aspects of meaningful education.

Literature Review

Teaching an educational subject effectively requires more than just content knowledge within that subject. Teaching should be grounded in clearly defined knowledge bases that were previously assumed and left unexpressed by educational policymakers - until Shulman made a strong, evidence - based argument that effective teaching requires knowledge of subject content, pedagogy, and students (Shulman, 1986; La Velle, 2022).Teachers should view teaching in two ways. In Gilbert Highet's (1966) terms, they should "think, not what you know, but what they know; not what you find hard, but what they will find hard" (p. 280). Good teaching also requires incorporating emotional intelligence and building connections with the community.

For instance, KARE givers (2015) claim they created the *Hope Wheel* during graduate school as part of their action research on emotional, social, and moral education. They chose a medicine wheel model to represent their evolving perspective and developed meaningful dialogue around each student's position on the wheel, using the graphic model as a template for personal growth.

The *Hope Wheel* in Figure 1 emphasizes respect, understanding, responsibility, and relationships. In practice-focused teacher education, similarly and by design, teachers learn to perform specific tasks such as creating a respectful learning environment, assessing students' mathematical skills, or reviewing homework (Ball & Forzani, 2009). Building strong relationships among teachers, students, and the community supports students' positive motivation.

Instructional support from teachers is essential because it provides direction and feedback that motivates students (Pianta & Hamre, 2009; Liu et al., 2025). Teachers should understand that the human brain cannot process all information; therefore, they must select material that is meaningful and aligned with students' interests. As Petersen et al. (2020) note, core concepts are typically broader, interwoven throughout the course, and more inclusive of analytical and reasoning skills for students.

Responsibility - on the part of both teachers and students - is a crucial component of the Hope Wheel, guiding effective teaching and learning. Within this framework of responsibility, teachers make independent, didactic decisions to support children and students as they strive to expand their understanding of the world (Menck, 2000; Wahlström, 2023).

The *Hope Wheel* serves as a guide for teachers to align the learning trajectory with students' cognitive and emotional intelligence. KARE Givers (2015) placed their students on the Hope Wheel relative to their life experiences, how they viewed those experiences, and the emotions that resulted from them. As Cohen et al. (2009) and Sethi & Scales (2020) noted, school climate reflects both an individual's perception of the safety, fairness, and welcoming nature of the overall school environment and a group perception of those aspects of school culture that can become a shared "reality" for a significant portion of students, faculty, and staff. The Hope Wheel - with its four core domains of *Respect, Understanding, Relationships,* and *Responsibility* - supported teachers at Glendale Sciences & Technology School in fostering positive academic growth among students.

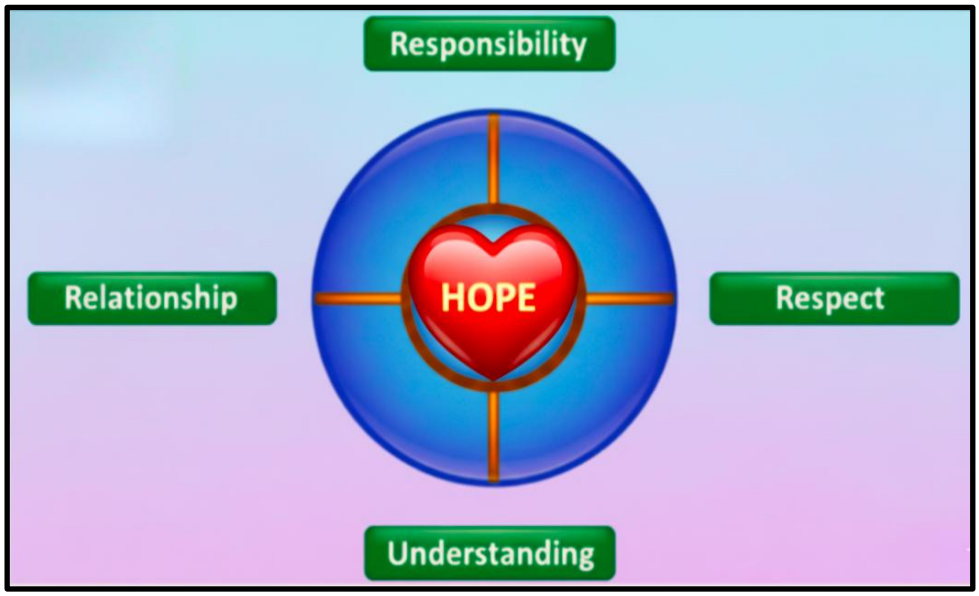

Figure 1. The Figure HOPE is Modified from KARE Givers. (2015) - Blog Post by the Teacher at Glendale Sciences & Technology School and Created during Their Graduate-School Action Research

The Hope Wheel was designed by Dr. Lou Mathews in 2019, incorporating verbs that humanize the teaching and learning of mathematics. It supplements Bloom's Taxonomy, particularly its higher-order thinking verbs. While Dr. Mathews integrates several significant components into the Hope Wheel, this paper focuses primarily on *Love*. Teaching and practicing mathematics from a love - oriented perspective involves explicitly designing mathematical tasks, courses, and programs that consciously work to alleviate aspects of the human condition through mathematical inquiry and engagement (Mathews et al., 2021). Research on love in the context of work and organizations acknowledges the difficulty of defining *love* in a way that captures the complex emotions and experiences people associate with the term (Robson & Coombe, 2020; Vincent, 2016; Sapir & Mizrahi-Shtelman, 2025).

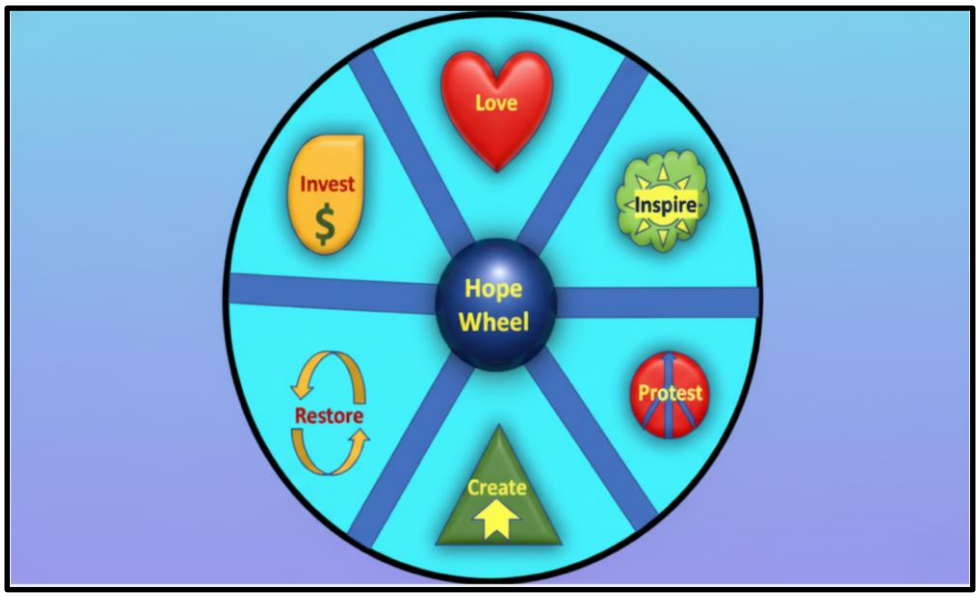

Figure 2. The Figure is Modified based on Matthews, L. (2024). *ACES Math 2025: Hope Wheel* - Planning Tool for Creating (It Supplements Higher order Thinking of Bloom's Taxonomy)

The *Hope Wheel* plays a vital role in incorporating students' cultures into the learning of mathematics. Hanushek (2016) and Williams (2024) posited that other nations, including those with similar cultural backgrounds, perform significantly better than the United States in terms of global educational achievements. By aligning mathematics teaching with students' emotional intelligence and cultural backgrounds - specifically by integrating empathy and love - students may achieve stronger academic performance.

Young people often say, "I like math class because of the teacher," since effective math teachers know how to present the subject matter developmentally, create a learning atmosphere conducive to understanding through empathy, maintain high expectations for all students regardless of gender, race, or language background, and use a variety of assessment methods and teaching styles to address math anxiety and enhance student engagement (Chernoff & Stone, 2014; Dowker et al., 2016; Schoenfeld, 2022; Furner, 2024). Teaching and learning with empathy is thus a significant component of Dr. Lou Mathews' *Hope Wheel*.

The *Hope Wheel - Pedagogy of Hope in Climate Change Education* has also been discussed by Finnegan and d'Abreu (2024). It was designed to bridge the gap between theory in educational psychology research and classroom practice by translating key elements that support a climate hope approach into practical teaching guidelines (Finnegan & d'Abreu, 2024). The model is illustrated abstractly through the visual metaphor of a wheel, where the handrails act as spokes, the guardrails as the rim, and the lenses can be layered atop the wheel to provide additional dimensions of understanding.

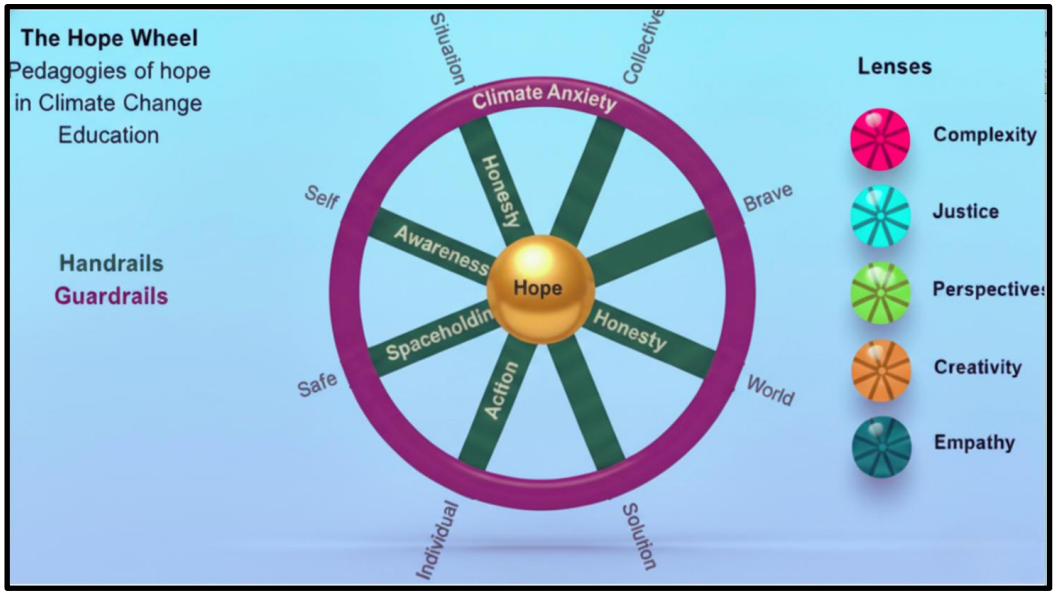

Figure 3. The Hope Wheel: Handrails (spokes), Guardrails (rim) and Lenses to Enable Hope-Based Pedagogy in Climate Change Education - Modified (Finnegan & d'Abreu, 2024)

The provided image in Figure 3 illustrates *"The Hope Wheel: Pedagogies of Hope in Climate Change Education."* According to Snyder, hope is the belief that one can achieve one's goals by finding "pathways to desired goals" and becoming "motivated to use those pathways" (Snyder et al., 2018; Matesan, 2025). At its core lies *Hope*, surrounded by seven key pedagogical elements: Honesty, Awareness, Space holding, Action, False Hope, Brave,

and a central, unlabeled segments. These components of the Hope Wheel relate to ethical principles, as Schroeder et al. (2019) note that care and honesty are essential qualities of an ethical researcher. The segments act as channels or approaches for fostering hope.

The outer ring labels represent the tensions or poles these pedagogies navigate - such as Situation/Collective (related to climate anxiety), Mis/Disinformation/Individual, and World/Solution. Additionally, five *Lenses* - based on Finnegan and d'Abreu (2024) - make visible the cross-cutting themes that relate to all components of the Hope Wheel, ensuring a holistic range of critical perspectives.

Methodology

A mathematics teacher at a technology-focused urban high school in New Jersey designed a task-based project in which students used ten geometrical figures and three mathematical operators to create an abstract art piece. The teacher divided the class into several groups, allowing students to choose their own group members based on preference. The opportunity to work with friends has been shown to be one of the reasons students prefer and enjoy group work more than working alone (Cowan, 2014; Fisher & Frey, 2012).

Students were asked to complete the project within a 40-minute class period. They were instructed to apply elements of rigid and non-rigid transformations - such as vertical or horizontal translation, reflection, rotation, and dilation. Students could rotate, translate, reflect, and/or dilate the given shapes (Baez et al., 2025). In addition, they could modify the background and change colors according to their preferences. The figure designed by the teacher is shown below: the left side presents the given geometric figures, while the right side represents the intended abstract idea. However, students were asked to display only the right side in their final work.

Participants included students from four geometry classes - Periods 2, 3, 6, and 7 - at the same high school. In total, 80 students participated, working in 28 groups, each completing the project within the 40-minute timeframe. When informed of the time limit, many students initially reacted by saying that 40 minutes was too short to complete the task. However, as Pires da Costa et al. (2024) suggest, students learn from their mistakes, driven by curiosity, and develop collaboration skills through group work. Several groups submitted their mini - projects on time, while others refined and submitted their work later the same day. Many students were surprised by what they were able to accomplish once they began working.

During classroom observations, it was evident that students were collaborating, sharing ideas, and enjoying the process. In general, students chose abstract figures that reflected their interests. For example, Period 2 – Group 3 (P2–G3) created a cat because all group members liked cats. Similarly, some students preferred dogs and selected them as their subject. For instance, a student in Period 3 – Group 1 (P3–G1) brought a dog toy, which the group used as a reference for their abstract artwork.

Students often approach mathematical tasks in deeply personal and original ways, which may differ significantly from what the teacher expects (Brousseau et al., 1986). Another interesting example came from a student in P7–

G2, who said they loved the project because it inspired their creativity and that they wished to do another one like it. The students expressed happiness and satisfaction at being able to generate their own ideas and successfully complete the task within a short period of time.

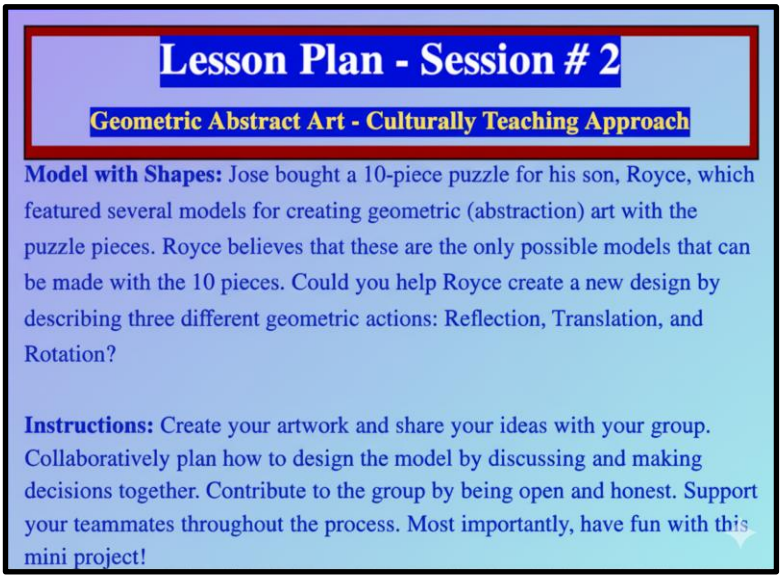

Figure 4. The Teacher Instruction for the Task - Based Learning Project Consisting of 8 Geometric Figures and Three Mathematical Operations

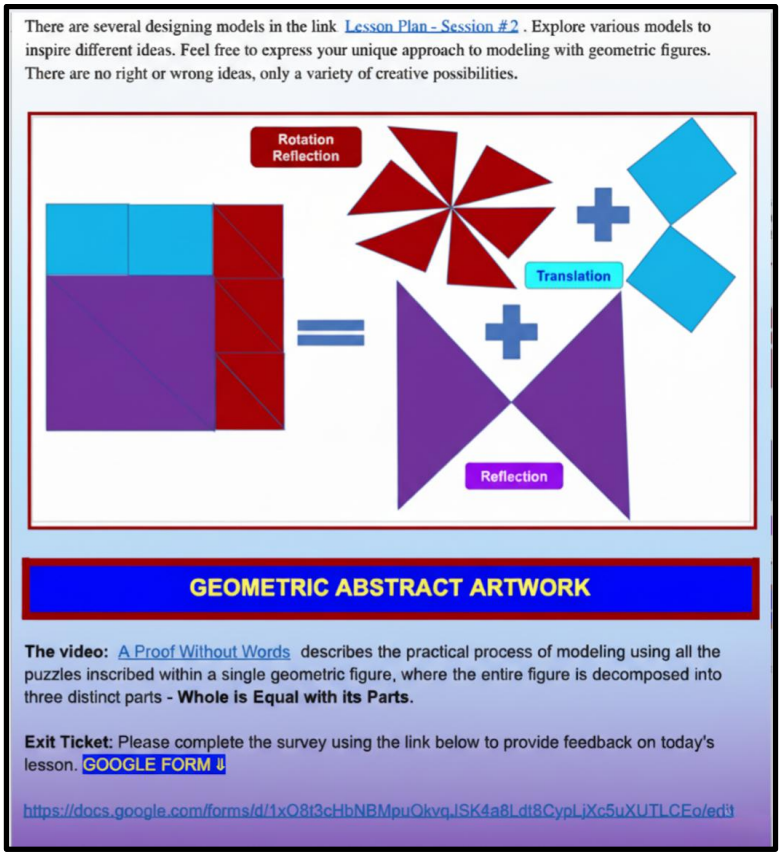

Figure 5. The Teacher Design and Exit Ticket for the Task - Based Learning Project Consisting of 8 Geometric Figures and Three Mathematical Operators

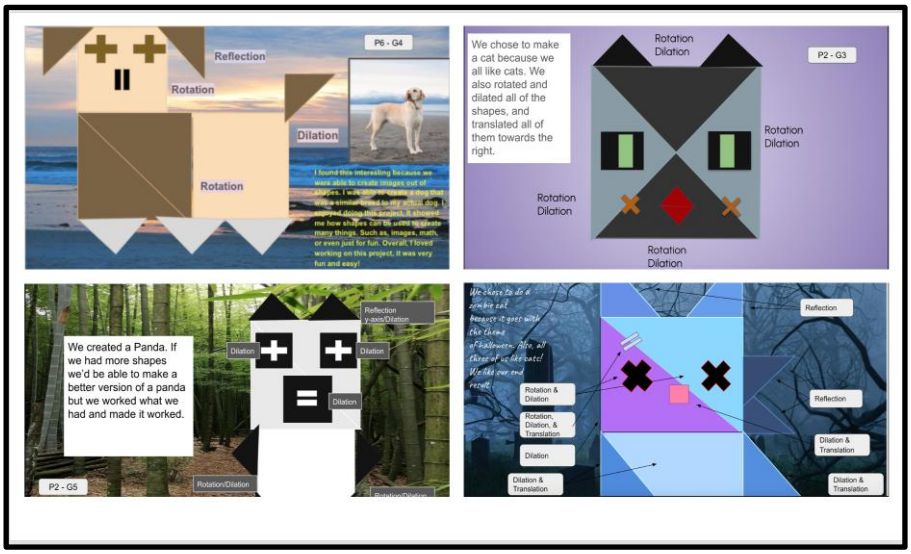

Figure 6. Projects Reflected on Task - Based Learning by Students of the Technology Focused Urban High School in New Jersey

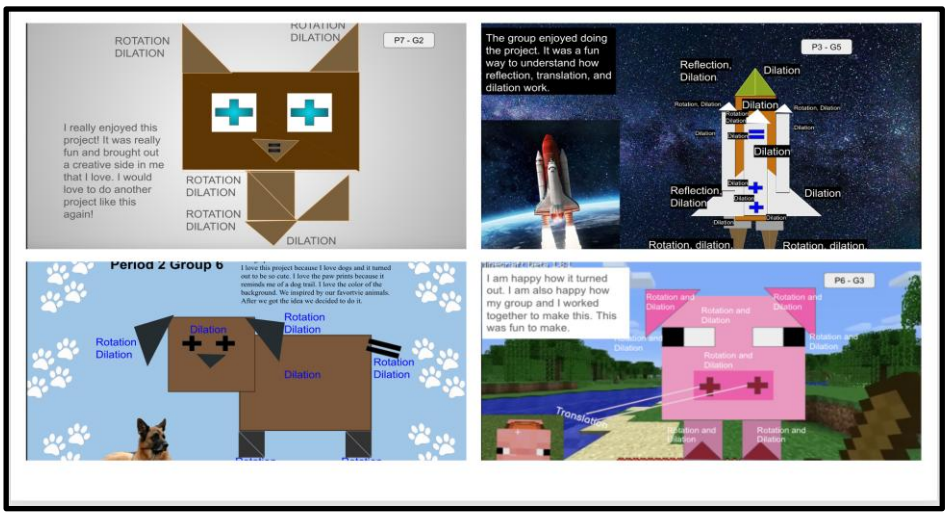

Figure 7. Projects Reflected on Task - Based Learning by Students of The Technology Focused Urban High School in New Jersey

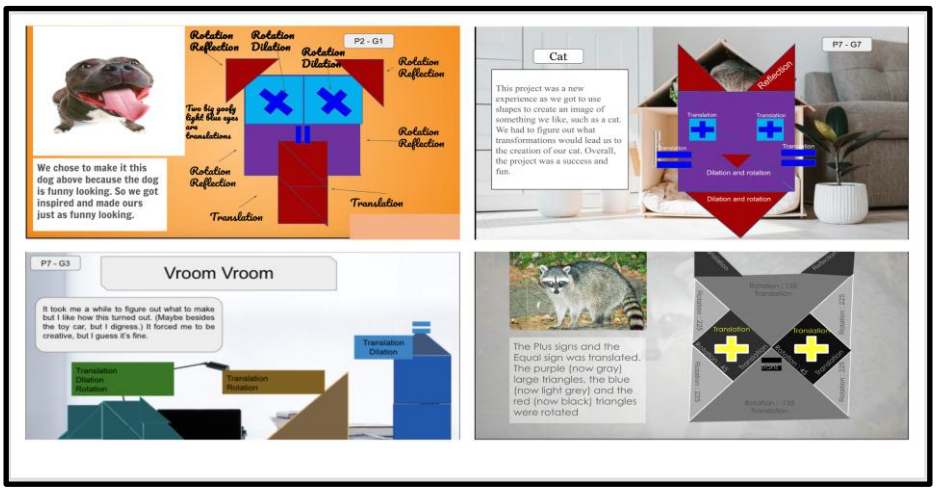

Figure 8. Projects Reflected on Task - Based Learning by Students of the Technology Focused Urban High School in New Jersey

The mathematics teacher collected all the mini projects that were ready for research and posted them on his Google Site. The next day, he showed the projects to the students, with each one appearing better than the last. The students were very excited, especially when they saw their own projects. According to Sanchez Hernandez et al. (2024), experiences of academic achievement—and subsequently sharing those achievements with peers, family members, and others outside of school—can be deeply motivating for students. One of the most humorous project titles was *Wroom Wroom*, presented by the P7–G3 group. Overall, all students were happy and proud of the artwork they had created and could now see displayed on the Google Site.

Researchers collected the students' work from the academic years 2024 and 2025, analyzed students' reflections from 2025, and reviewed survey responses from 2024. Some students wrote their reflections on behalf of their group, while others wrote in the first person. Those who used the first-person voice did so because they were more familiar with subjective writing. Regardless of format, each piece of writing represented the group's collective perspective on task-based learning and the mini-project.

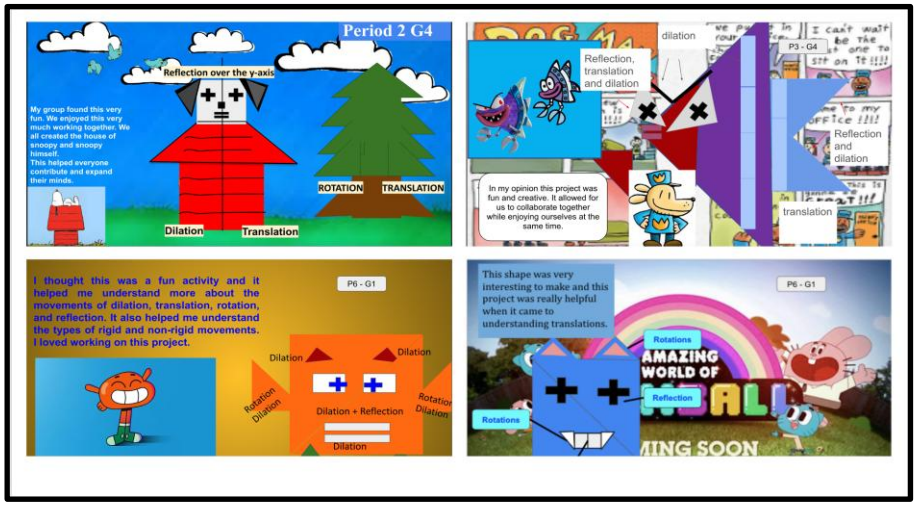

Figure 9. Projects Reflected on Task - Based Learning by Students of the Technology Focused Urban High School in New Jersey

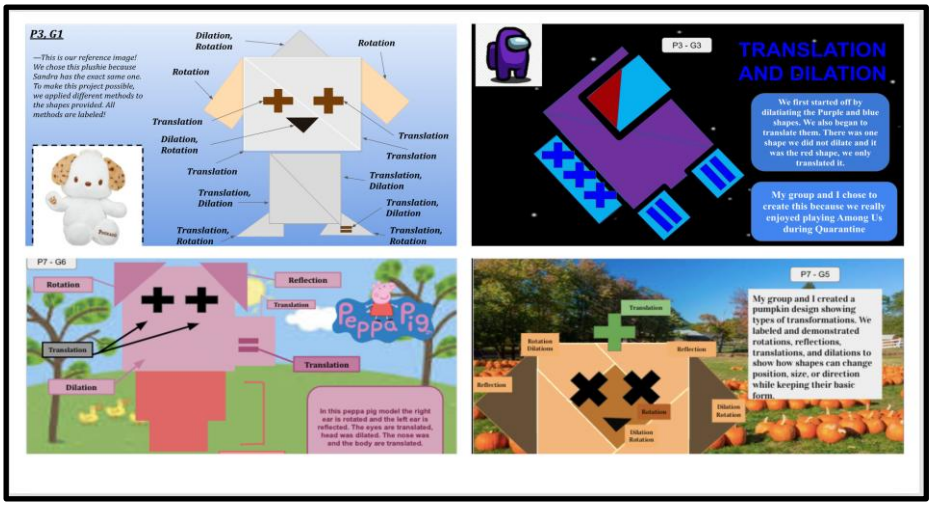

Figure 10. Projects Reflected on Task - Based Learning by Students of the Technology Focused Urban High School in New Jersey

Task-Based Learning (TBL) is an approach in which students learn by completing real-world tasks or projects rather than solely studying theoretical content. The focus is on applying knowledge to achieve a goal - for example, creating a product, solving a problem, or presenting findings. In this project, the goal was to learn geometric transformations through the lens of abstract art.

Figure 11. Several Reflections on Task - Based Learning by Students of the Technology Focused Urban High School in New Jersey

Table 1. Students Reflections on the Task - Based Learning Attached on the Mini Project, Respectively the Poster

Period - Group	Students' Reflections on Task - Based Learning Mini Projects
P2 - G1	We chose to make this dog above because the dog is funny looking. So we got inspired and made ours just as funny looking.
P2 - G2	As a group we all agree the portrait came out exactly like the image that we tried to recreate. We shape got smaller we use dilation, and rotations on triangles, and the the two cross to form the yes are translations
P2 - G3	We chose to make a cat because we all like cats. We also rotated and dilated all of the shapes, and translated all of them towards the right.
P2 - G4	My group found this very fun. We enjoyed this very much working together. We all created the house of Snoopy and Snoopy himself. This helped everyone contribute and expand their minds.

Period - Group	Students' Reflections on Task - Based Learning Mini Projects
P2 - G5	We created a Panda. If we had more shapes we'd be able to make a better version of a panda but we worked what we had and made it work.
P2 - G6	I love this project because I love dogs and it turned out to be so cute. I love the paw prints because it reminds me of a dog trail. I love the color of the background. We are inspired by our favorite animals. After we got the idea we decided to do it.
P3 - G1	This is our reference image! We chose this plushie because Sandra has the exact same one. To make this project possible, we applied different methods to the shapes provided. All methods are labeled!
P3 - G3	We first started off by dilating the purple and blue shapes. We also began to translate them. There was one shape we did not dilate, and it was the red shape, we only translated it. My group and I chose to create this because we really enjoyed playing Among Us during Quarantine
P3 - G4	In my opinion this project was fun and creative. It allowed for us to collaborate together while enjoying ourselves at the same time.
P3 - G5	The group enjoyed doing the project. It was a fun way to understand how reflection, translation, and dilation work.
P3 - G6	We chose to do zombie cat because it goes with the theme of Halloween. Also the three of us love cats! We like our end result.
P6 - G1	I thought this was a fun activity and it helped me understand more about the movements of dilation, translation, rotation, and reflection. It also helped me understand the types of rigid and non-rigid movements. I loved working on this project.
P6 - G2	I enjoyed doing this project, most of my members helped out with the background and colors and moving the shapes around to cause translations and transformations
P6 - G3	I am happy with how it turned out. I am also happy how my group and I worked together to make this. This was fun to make.
P6 - G4	I found this interesting because we were able to create images out of shapes. I was able to create a dog that was a similar breed to my dog. I enjoyed doing this project. It shows me how shapes can be used to create many things. Such as images, math, or even just for fun. Overall, I liked working with this project. It was very fun and easy.
P6 - G6	This project benefited me because I was able to understand more of reflection, translation, dilation, and rotation because I had a more creative and fun way to use them. I also picked

Period - Group	Students' Reflections on Task - Based Learning Mini Projects
	Pete the Cat because when I was younger I greatly enjoyed reading the books. I also appreciate the artstyle. Overall, I was fond of this project and the process of it.
P7 - G1	In my opinion I like this project because it uses shapes in a way to make drawings.
P7 - G2	I really enjoyed this project! It was really fun and brought out a creative side in me that I love. I would love to do another project like this again!
P7 - G3	It took me a while to figure out what to make but I like how this turned out. (Maybe besides the toy car, but I digress.) It forced me to be creative, but I guess it's fine.
P7 - G5	My group created a pumpkin design showing types of transformations. I labeled and demonstrated rotation, reflection, translation and dilation to show how shapes can change position, size, or direction while keeping their basic form.
P7 - G6	In this Peppa pig model the right ear is rotated and the left ear is reflected. The eyes are translated, the head is dilated. The nose and the body are translated**.**
P7 - G7	This project was a new experience as we got to use shapes to create an image of something we like, such as a cat. We had to figure out what transformations would lead us to the creation of our cat. Overall, the project was a success and fun.

(Source: Study field 2025)

In this case study, researchers had access to reflections of 28 mini-projects for analysis, as well as the online survey responses of 49 students. The relatively small number of student tasks allowed for a quick and accurate analysis. The researchers concluded that the themes emerging from students' reflections, as well as classroom observations during the completion of the projects, revolve around several key areas: positive emotion and enthusiasm; creativity and enjoyment; collaboration and teamwork; understanding mathematical concepts; problem solving and experimentation; and pride and accomplishment.

Table 2. Most Frequent Verbs (ranked) of Students Reflections in the Task-Based Learning (Mini - projects)

Rank	Verb	Count
1	be (is, was, were, am, been)	21
2	create / make (create, created, make, made)	17
3	enjoy / like / love (enjoy, enjoyed, like, liked, love, loved)	15
4	do / did	10

Rank	Verb	Count
5	choose / chose	6
6	use / used	6
7	work / worked / working	6
8	help / helped	5
9	understand / understood	4
10	inspire / inspired	3
11	translate / translated	3
12	dilate / dilated	3
13	rotate / rotated	3
14	reflect / reflection / reflected	3
15	show / showed / showing	2
16	start / started / began	2
17	find / found	2
18	appreciate / appreciated	2
19	decide / decided	1
20	benefit / benefited	1
21	pick / picked	1
22	figure / figured	1
23	label / labeled	1
24	demonstrate / demonstrated	1
25	show / showed	1
26	expand	1
27	contribute	1

(Source: Data modified by ChatGPT)

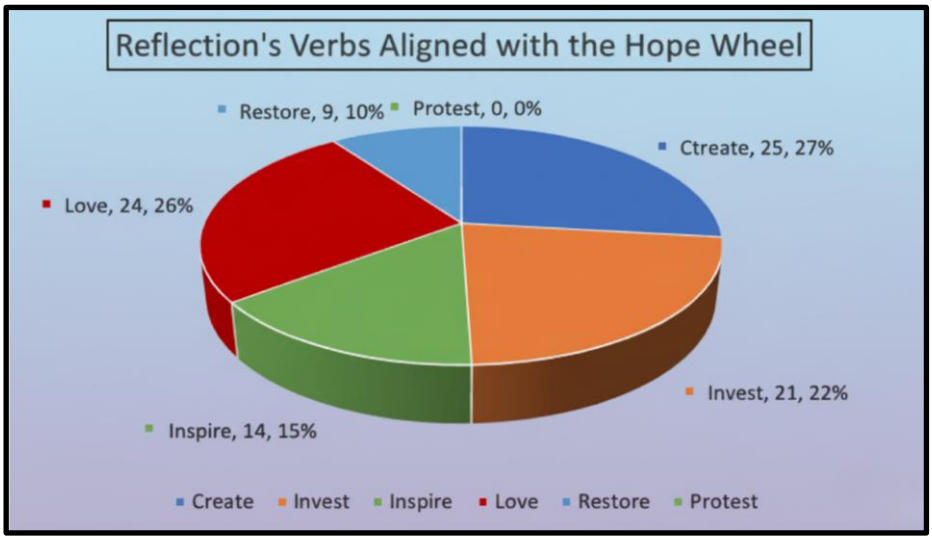

Figure 12. Students Reflection Verbs Aligned with the Hope Wheel Verbs Given by Numbers and Percentages

Table 3. Summary Totals of Verbs in Reflection with Respect to the Hope Wheel Components by Category

Category	Total Count	Representative Verbs
Create	25	be, create, translate, rotate, dilate, start, expand
Invest	21	do, choose, use, work, find, decide, contribute
Inspire	14	help, understand, reflect, inspire, show
Love	24	love, like, enjoy, appreciate
Restore	9	Reflect, understand
Protest	0	None

(Source: Modified by ChatGPT)

From these reflections, it is clear that students developed a stronger appreciation and love for mathematics through this creative project. Many realized that math is not limited to numbers and equations but can also serve as an artistic and expressive tool. By using geometric transformations such as translation, rotation, reflection, and dilation, they connected mathematical concepts to real-world creativity. This hands-on experience allowed them to see how math shapes everyday objects, animals, and even favorite characters, turning abstract ideas into something visual and enjoyable. Students expressed pride and excitement in discovering how geometry could bring their designs to life, deepening their curiosity and confidence in learning mathematics. The project demonstrated that mathematics can be both fun and meaningful, sparking enthusiasm for exploring additional mathematical concepts in the future and showing that math can be both a form of art and a discipline of logic. To protect student and school privacy, the researchers used pseudonyms or omitted real names. While the events and projects reflect actual student work, even the school name has been fictionalized as “the technology-focused urban high school in New Jersey.”

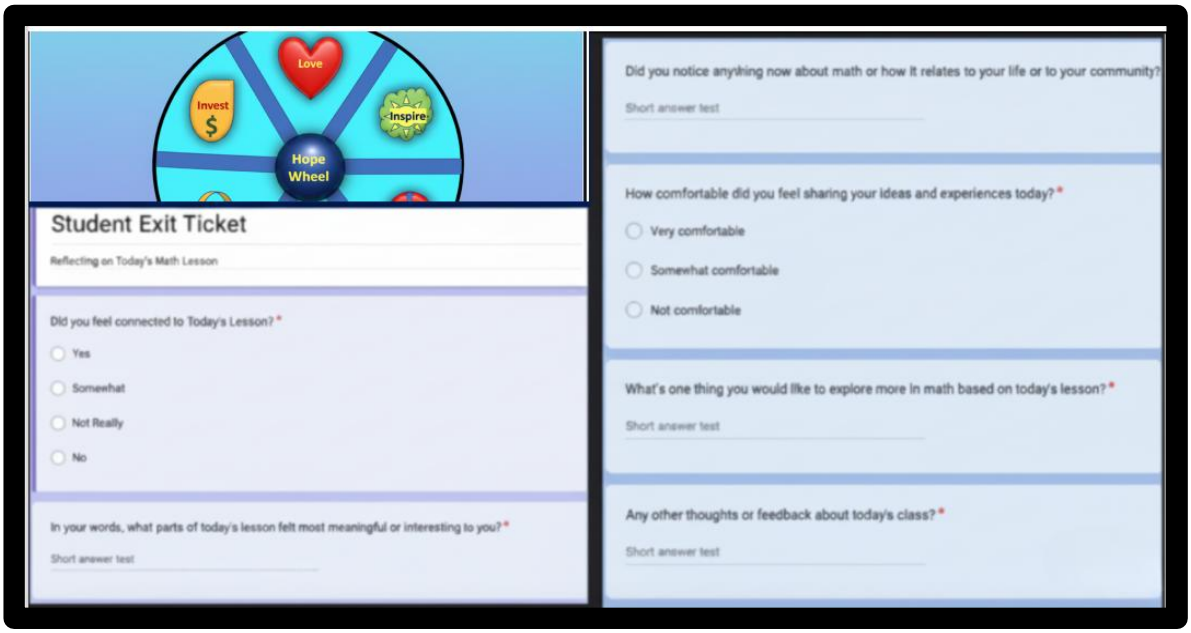

Figure 13. Questionnaire of the Online Survey - Students Exit Ticket through the Google Form in 2024

Table 4. Student Responses in the Survey through the Google Form Categorized based on 6 questions - 2024

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
11/11/2024 9:06:08	No	Learning about rotations.	No	Not comfortable	I don't know	I don't like working in groups.
11/11/2024 9:17:14	Yes	The creation of shapes & transformations	Yes because it relates to creating something out of one's mind and turn it into a masterpiece	Somewhat comfortable	Using math in art	No
11/11/2024 9:21:09	Yes	Making the figures into anything we want.	I realized how figures are used in everyday life, in order to make buildings.	Very comfortable	I don't really know a specific topic I would like the class to explore.	N/A
11/11/2024 9:23:19	Yes	The most interesting part of the project was being able to make my own design for a cat.	I noticed that in math that we were able to make more shapes with being able to tell the reflection and translation.	Very comfortable	I would like to be able to make more shapes in class to try different things.	I really enjoyed today's lesson and it was fun to be able to make shapes.

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
11/11/2024 9:24:17	Somewhat	The rotations and the translations.	I noticed many new things when I started geometry this year.	Somewhat comfortable	I would like to explore more translations based on today's lesson.	The project today was very interesting and fun.
11/11/2024 9:24:20	Yes	The designing part	No	Very comfortable	Learning a bit more on reflection	No
11/11/2024 9:24:43	Somewhat	In today's lesson I really liked how we could design our own figures.	I noticed how figures and art like this involve a lot of math in the form of translations, reflections, and rotations.	Somewhat comfortable	I would like to make more figures and designs like we did today.	Today was a fun class since we could design our own figures and drawings.
11/11/2024 9:26:25	Yes	The community amongst our peers nourished an environment of learning.	This math has already been learned for me and it relates to how everyday objects have similarities or reflections of each other.	Very comfortable	More unique shapes and relate it to more real life objects.	Overall it was really fun to learn.
11/11/2024 9:28:39	Yes	The freedom to make whatever we wanted.	N/A	Very comfortable	More teamwork	N/A
11/11/2024 9:29:15	Yes	The part where we made our rooster.	Yes, simple shapes make up our everday world.	Very comfortable	Geometry figures	I liked how hands-on todays class was with having to make our own figures.
11/11/2024 9:30:25	Yes	The lesson felt most meaningful when we began to experiment and learn the different reflections, rotations and translations for our mini project.	Math can be connected to the arts even if it seems it can't.	Very comfortable	I would like to explore more translations and reflections.	Today's class was fun and definitely helped build connections between classmates.

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
11/11/2024 9:30:32	Yes	The most meaningful and interesting part of today's lesson is how we learned to create art with geometric shapes using rotations and translations.	I noticed that math is much more involved in my life than i had originally thought.	Very comfortable	I would like to explore more dilations and reflections.	It was a very engaging class.
11/11/2024 9:30:43	Yes	I enjoyed making shapes	N/A	Very comfortable	I would like to explore dilations and reflections	N/A
11/11/2024 9:31:37	Yes	The part that felt most interesting is that you can't tell what the exact image is of the figure unless you look into it deeply and see its true identity.	I would like to explore dilation and translations.	Very comfortable	I would like to explore more abstract art like shapes.	No feedback.
11/11/2024 9:33:47	Yes	the making of the cat	no	Very comfortable	making more shapes and cats	today was very nice and easy
11/11/2024 9:33:53	Somewhat	I was able to understand the concept of the lesson.	No, because I've learned some of this in 8th grade.	Somewhat comfortable	Maybe the names of each translation.	No, i liked this mini project.
11/11/2024 9:34:41	Somewhat	The interesting part of today's lesson is learning about Rotations, Reflections, and Translations that I learned on the 8th as well.	I learned the lesson in a different way than the way I was taught.	Somewhat comfortable	How to use it in a real world problem.	No other thoughts :)
11/11/2024 9:35:47	Yes	I liked using what we learned in class in a creative way	not really	Very comfortable	how to use it in a real world problem	no

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
11/11/2024 9:36:59	Yes	I found it interesting how we were able to learn about rotations, reflections and translations while expressing their creativity.	I noticed that math is also used in art.	Very comfortable	I would like to explore reflections, translations and rotations while using art.	I think this method will allowed us to learn more since people like to express their creativity.
11/11/2024 9:37:56	Yes	The part of today's lesson that felt most meaningful was the combination of geometry and abstract art, expressing more emotion.	I noticed how we applied real-life creativity and ideas into subjects of math.	Very comfortable	One thing I would like to explore more in math based on today's lesson is creativity in math-related subjects.	No.
11/11/2024 9:49:28	Somewhat	The introduction	It helps my thinking process be quicker and smoother.	Very comfortable	Rotations	No, thank you
11/11/2024 9:51:25	Somewhat	When we were putting the parts together	I noticed how you always have to figure out different ways to figure out the problems in your life.	Somewhat comfortable	Rotations	It was a good idea to do this today because I felt comfortable.
11/11/2024 10:10:07	Yes	Understanding transformation and its purpose in different ways to use it.	I noticed that we use transformation in our everyday life to rotate, move and flip things.	Very comfortable	rotation.	N/A
11/11/2024 10:16:05	Yes	Being able to talk to my friends on what we wanted to do. Also on being able to have fun but also learn.	Yes we can make objects out of shapes.	Very comfortable	More about shapes.	No, I think it was nice and very fun.
11/11/2024 10:16:18	Yes	Making squidward	I love squidward a lot	Very comfortable	to make new groups and he can	No!

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
					put with me with new people	
11/11/2024 10:16:51	Yes	During today's lesson I was able to learn how when shapes turn it has a different wording. Sometimes its translation, dilation and ect	Yes, Shapes tend to move around just like us.	Very comfortable	Shapes, what else is there to learn about shapes in geometry.	Today's class was fun, I had fun getting creative and moving shapes.
11/11/2024 10:17:31	Yes	it made us go into our creativity side and made me find math more interesting	Not really, but It was to not think math is all about paper and symbols, but also can be used for fun.	Very comfortable	How to know when to reflect in what axis.	N/A
11/11/2024 10:18:28	Yes	That i watched this show as a little kid and really love the logo	Yes because i see how shapes connect to math	Very comfortable	How to tell a angles degree just from a picture	Not really
11/11/2024 10:18:38	Yes	What was most meaningful was how I was able to connect it to my childhood. I used to watch Spongebob when I was smaller and now through this lesson I was able to make him while also learning.	Our cartoons, houses, and most of our lives are filled with multiple shapes.	Very comfortable	It influenced me to want to learn more about the types of shapes and they are moved when being utilized.	It was very outside of the box and fun. It allowed us to explore creativity while still learning about geometry.
11/11/2024 10:19:03	Yes	making squidward was very interesting	No, not really.	Very comfortable	reflections. they seem fun	nope.
11/11/2024 10:19:13	Yes	the idea of creating something from a bunch of shapes	I noticed how I am as I made a squidward figure out of blocks and	Very comfortable	How to make very detailed figures	everyone is very nice

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
			triangles.			
11/11/2024 10:20:16	Yes	There wasn't really anything in particular that felt meaningful to me.	No	Very comfortable	There is nothing in particular	No
11/11/2024 10:20:39	Yes	The fact that we were able to get creative with translations.	Math helps make our lives more interesting.	Somewhat comfortable	How to properly translate shapes. Perfectly.	No.
11/11/2024 10:20:49	Yes	I think the most meaningful or interesting is the amount of creative liberty we had to create something and be able to incorporate mathematics.	Lately, i've been really into coding and being able to use google slides with shapes and create something really shows how math is a vital part of life and especially in coding where everything needs to be very specific. It is very similar to mathematics and it incorporates aspects of mathematics.	Very comfortable	Maybe how to determine the amount of rotation because it was a bit difficult.	I think overall this was a really fun assignment.
11/11/2024 10:21:21	Yes	I think the fact that we could make our own creative art freely was meaningful and helped me to get engaged in the lesson.	I realized how geometrical shapes are all around us and you can make art with just shapes. For example, my group and I made a Christmas tree out of only shapes and transformations.	Very comfortable	I would like to explore dilations to be able to have more free will in creating artworks utilizing only shapes.	I enjoyed the lesson because it allowed me to talk with my group mates and make our own creative artwork.
11/11/2024 10:21:21	Yes	Making the Christmas tree	no	Very comfortable	dilation	nope pretty good

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
11/11/2024 10:22:19	Somewhat	Working on the transformation of shapes to make other figures.	I noticed that there are always some types of transformation happening when making something new.	Very comfortable	Dilation and expansion	Nope
11/11/2024 10:54:14	Yes	Creating a character from a show I grew up watching and having fun with the way we move the shapes made this assignment very interesting and fun to do.	Yes, math can be used in multiple situations and in many ways. In this case we were able to use shapes to create a figure. Moving the shapes around and changing their size to create the figure required math such as transformations to complete. There are many other situations in which one could use transformations in the real world such as when one moves from one place to another or when one cuts something to give it another purpose.	Very comfortable	I would like to know more about how math can be used in the real world. Although there are types of math that one can clearly tell are useful in are lives, there are some complex topics that just don't make sense how he would use them in our daily lives.	This assignment was super fun and helped me think outside the box to complete it.
11/11/2024 13:12:07	Yes	Creating art	Yes, shapes can make anything	Very comfortable	Geometric shapes	It was very fun
11/11/2024 13:12:20	Yes	building things with shapes	I realize shapes are useful and can be used to make up many different things in our everyday life	Very comfortable	I would like to explore transformations more	I don't have any other feedback
11/11/2024 13:15:07	Yes	We were able to make so many fun	Shapes are everywhere	Very comfortable	I want to know more about shapes	Shapes are fun

Timestamp	Did you feel connected to Today's Lesson?	In your words, what parts of today's lesson felt most meaningful or interesting to you?	Did you notice anything new about math or how it relates to your life or to your community?	How comfortable did you feel sharing your ideas and experiences today?	What's one thing you would like to explore more in math based on today's lesson?	Any other thoughts or feedback about today's class?
		pictures			like circles and polygons	
11/11/2024 13:15:46	Yes	Creativity	Math can create things other than numbers	Very comfortable	Dilations	No
11/11/2024 13:16:03	Yes	Connecting with my classmates and laughing together while making this	I notice that math is everywhere and apart of everyday lives	Very comfortable	More about dilation	None
11/11/2024 13:16:29	Yes	Using shapes to create one big figure	I don't think so	Very comfortable	Hands on activities	I liked it, it's fun and easy.
11/11/2024 13:16:32	Yes	The assignments was very interesting to me	No I did not notice anything	Very comfortable	Reflections	No
11/11/2024 13:16:37	Yes	Creativity	Shapes can turn into a lot of things	Very comfortable	Dilations	No
11/11/2024 13:16:56	Yes	The part where we were able to create our own character through shapes.	Yes	Very comfortable	How to determine more on how rotating can be a big part of how an item looks.	no
11/11/2024 13:16:59	Yes	working with my friend and fixing the shapes to make something.	I found out that math is everywhere and its very cool	Very comfortable	dilation	none at all
11/11/2024 13:18:38	Yes	It was very fun	Yes `	Somewhat comfortable	dilations	no

(Source: Field study 2024)

Findings

The overall theme of the students' reflections in these slides center around creativity, collaboration, and learning through transformations in math (translation, rotation, reflection, and dilation). Here are the main ideas that emerge from the students' reflections with respect to love - Hope Wheel component:

1. Positive Emotion & Enthusiasm - Phrases like *"It was fun," "I really enjoyed this project,"* and *"I'd love to do another project like this"* show emotional engagement - a key marker of affection toward the subject.

2. Creativity and Enjoyment – Many students mention that they had fun and enjoyed expressing their creativity through the project (e.g., making animals like pandas, cats, or dogs).
3. Collaboration and Teamwork – Several reflections highlight how working in groups made the project more enjoyable and helped everyone share ideas and contribute. Children who have experience with Collaborative Reasoning achieve better solutions to a spatial reasoning problem and have more positive attitudes toward the problem-solving experience.
4. Understanding Mathematical Concepts - Students repeatedly note that the project helped them better understand geometric transformations - especially translation, reflection, rotation, and dilation.
5. Problem-Solving and Experimentation – Some reflections describe challenges (like figuring out shapes or proportions) and how they solved them creatively.
6. Pride and Accomplishment – Many express satisfaction with how their projects turned out and pride in their teamwork and final results.

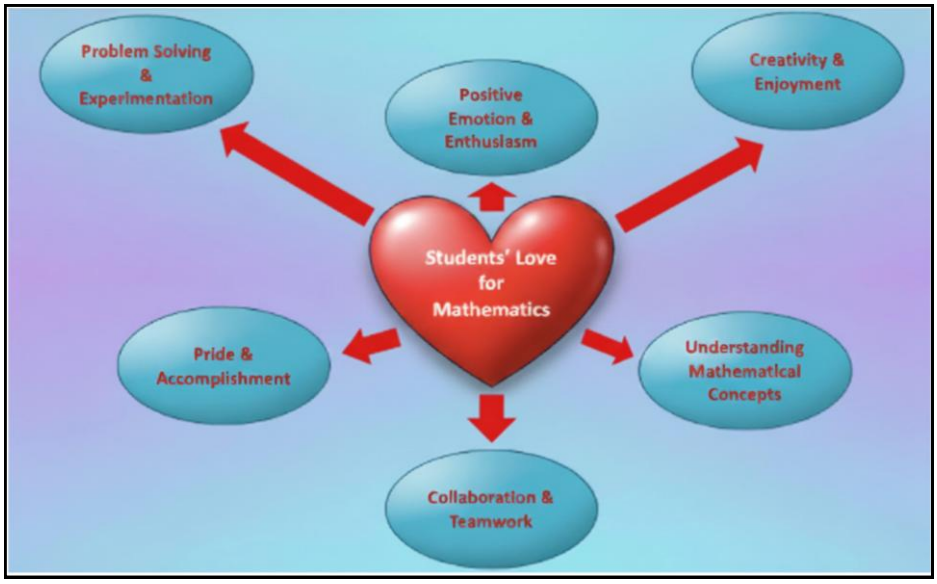

Figure 14. Describes the Direct and Indirect Key Components of Students' love for Mathematics in the Projects' Reflections at the Technology Focused Urban High School in New Jersey

The reflections and survey show that students found the project to be an engaging, creative, and collaborative way to deepen their understanding of geometric transformations, while enjoying hands - on, artistic problem-solving and feeling comfortable choosing their own pieces of abstract art. Students' reflections indicate that they were happy working with the TBL approach. Happiness in education plays a pivotal role in shaping children's present experiences, fostering engagement, and promoting overall fulfillment (Noddings, 2003; Patel, 2021). In mathematics education, love and happiness are crucial emotional foundations for effective learning. A caring and supportive teacher–student relationship (Noddings, 2003) encourages confidence, curiosity, and resilience in mathematical thinking. When learners experience mathematics as a subject of wonder rather than fear, their happiness increases and their engagement deepens. Cultivating a love for both the discipline and the learning process transforms mathematics from a source of anxiety into a pathway for intellectual joy and personal growth.

Discussion

Researchers analyzed the action of *love* (the verb of the Hope Wheel) in high school mathematics through students' reflections, observations, and an online survey conducted during task-based learning. The discussion section will focus on students' reflections from the task-based learning mini-projects conducted in October 2025. Another part will analyze students' survey responses from a similar project completed in November 2024. Additionally, the discussion will compare and contrast Bloom's Taxonomy with the Hope Wheel verbs, specifically the verb *love*. Mathews et al. (2021) identified an operational application of the Hope Wheel in mathematics lesson planning - in inductive or deductive teaching.

This tool helps teachers design instructional experiences that go beyond the verbs typically found in Bloom's Taxonomy, providing space for learners to flourish. The Hope Wheel supports practical learning and enhances higher-order thinking skills such as applying, evaluating, analyzing, and, in particular, creating.

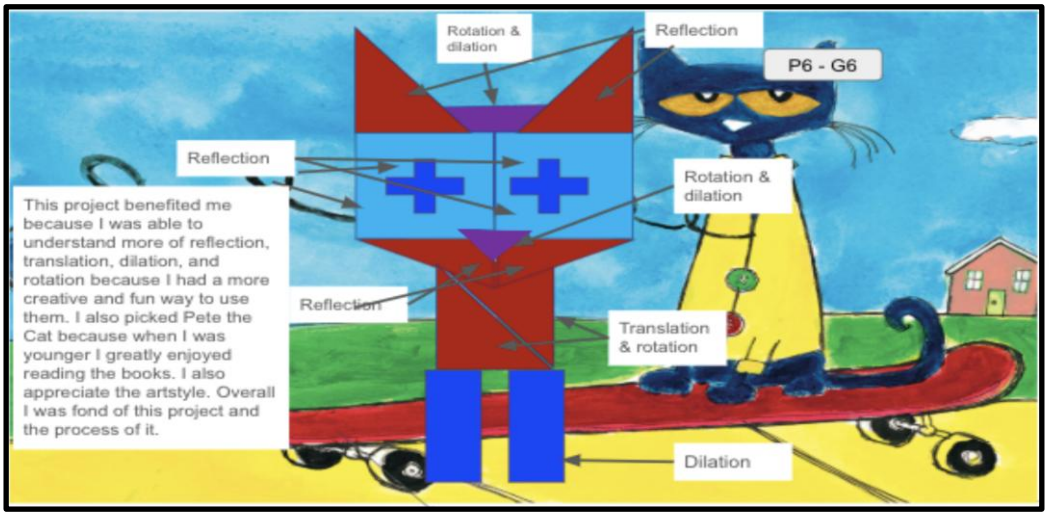

Figure 15. The project Reflected on Task - Based Learning by Students of The Technology Focused Urban High School in New Jersey

Baez et al. (2024) reported that students from a technology-focused urban high school in New Jersey utilized technological tools such as Desmos, PowerPoint, and Google Slides to successfully complete a project in their Geometry classes. This project effectively connects art and mathematics, demonstrating that math is not just about numbers and formulas but also about creativity, design, and self-expression. By using geometric transformations such as reflection, rotation, translation, and dilation, students applied mathematical concepts to create meaningful and visually appealing images inspired by *Pete the Cat*.

At the high school level, projects like this encourage a deeper appreciation for mathematics by showing how math exists in art, design, and storytelling. Understanding transformations through creative projects helps build spatial reasoning, problem-solving skills, and confidence in applying abstract concepts to real-world or imaginative contexts. Pllana et al. (2024) note that high school mathematical projects enable students to complete tasks that integrate technology with mathematical creativity. Personal reflections, such as "This project benefited me

because I was able to understand more about reflection, translation, dilation, and rotation…," demonstrate a genuine connection between learning and enjoyment. The student's personal interest in *Pete the Cat* adds a unique dimension, making math not just a subject to study but also a language for creativity and expression.

Overall, this image exemplifies how mathematics can inspire curiosity, creativity, and joy, fostering a lifelong appreciation for learning and discovery. Students are developing a positive attitude toward math because they experience it in a fun, creative, and meaningful way. Here's how this love or positive connection is reflected:

- Positive Emotion & Enthusiasm: Phrases such as "It was fun," "I really enjoyed this project," and "I'd love to do another project like this" demonstrate emotional engagement — a key marker of affection toward the subject.
- Creative Ownership: Students felt empowered to make artistic choices (choosing animals, shapes, and designs). This sense of ownership often leads to deeper interest and enjoyment in learning.
- Curiosity and Pride in Learning: Comments about learning transformations and feeling proud of the result indicate intrinsic motivation - valuing the learning process itself rather than just the grade.
- Connection Between Math and Art: By blending creativity and geometry, students began to see math as expressive and enjoyable, rather than abstract or rigid.

The reflections reveal that students are not only understanding geometric transformations but also developing a positive emotional connection to math. According to Gonsalves (2024), by engaging in reflective cycles, students appear to develop a heightened awareness of their learning processes, potentially recognizing patterns and refining their approaches over time. This can be interpreted as a budding appreciation and enjoyment of mathematics fostered through creative exploration and collaborative learning. The discussion further explores how love connects directly and indirectly with other components of the Hope Wheel—namely: Students, Inspire, Create, and Invest. In the Google Form survey, 49 students responded to six questions, as shown in Table 4. The questions were:

1. Did you feel connected to today's lesson?
2. In your words, what parts of today's lesson felt most meaningful or interesting to you?
3. Did you notice anything new about math or how it relates to your life or to your community?
4. How comfortable did you feel sharing your ideas and experiences today?
5. What's one thing you would like to explore more in math based on today's lesson?
6. Any other thoughts or feedback about today's class?

The discussion focuses on three questions: two Likert-scale questions and one open-ended question. The results of the Likert-scale questions are illustrated in Figures 17 and 18, showing that 84% of students felt connected to the task-based learning (TBL) project, while 82% felt comfortable sharing their ideas within their groups. Thus, students at different academic levels may have a negative or positive attitude toward mathematics for fundamentally different reasons (Wakhata, 2022). Students with high intrapersonal intelligence reported lower levels of connection and comfort in sharing their thoughts. According to Okwuduba et al. (2021), intrapersonal emotional intelligence positively predicts academic achievement in distance learning, but in face-to-face group work, it negatively predicts achievement. Overall, the majority of students preferred interpersonal emotional intelligence and were highly engaged in the project, with over 80% reporting a strong connection to the lesson

and comfort in freely sharing ideas within their groups.

Student feedback (based on Figure 19) reveals a strong sense of immersion and genuine enjoyment in learning geometry through creative, hands - on experiences. The opportunity to create shapes and explore geometric concepts in an active, tactile way allowed students to become fully engaged in the learning process. Students took ownership of their learning through task-based activities (mini projects) in geometry classes. In such a subject-centered classroom, the teacher's central role was to give the subject an independent voice - a capacity to express its truth apart from the teacher's own voice, in ways that students could hear and understand (Jons, 2024). This immersion transformed geometry from an abstract subject into something tangible and enjoyable, fostering deeper understanding through exploration.

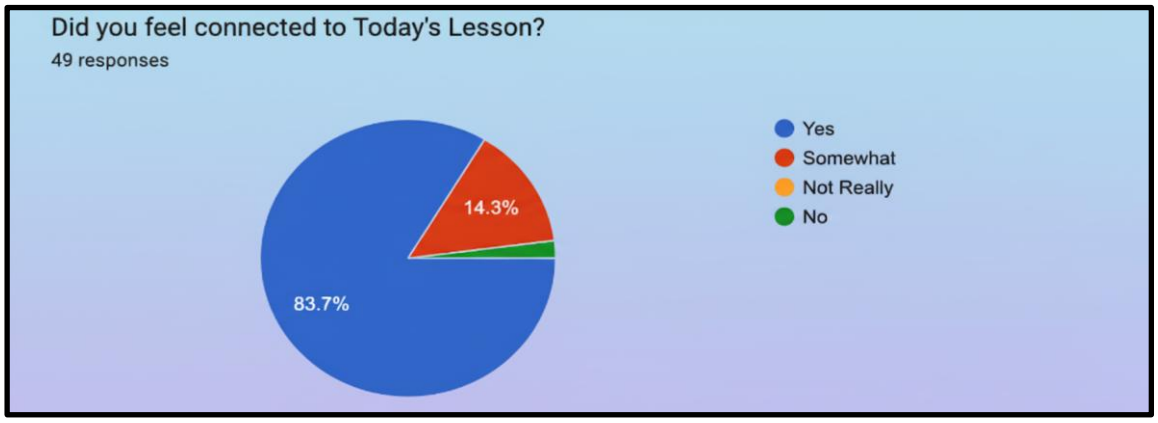

Figure 16. Responses of Students on the Question of the Google Form: Did You Feel Connected to Today's Lesson?

The feedback also demonstrates a growing love for mathematics, as students connected geometric principles with creativity and collaboration. By engaging in group activities and problem - solving together, they experienced mathematics as both a social and imaginative endeavor. This balance between creativity and rigor not only enhanced comprehension but also nurtured positive emotional connections to geometry and mathematics as a whole.

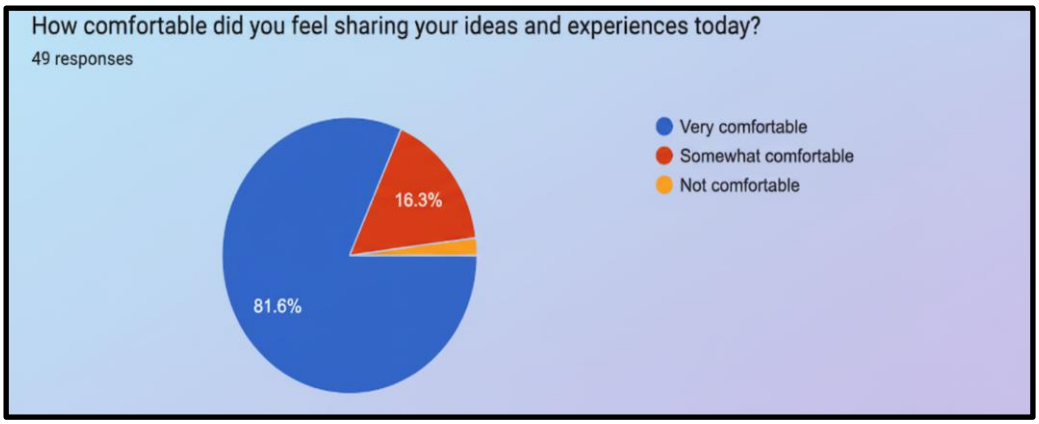

Figure 17. Responses of Students on the Question of the Google Form: How Comfortable Did You Feel Sharing Your Ideas and Experiences Today?

In essence, love is the central force that powers every part of the Hope Wheel - it is the energy that transforms students into creators, inspiration into action, and investment into lasting impact. The Hope Wheel primarily aligns with the higher-order domains of Bloom's Taxonomy - analyzing, evaluating, and creating - as it emphasizes critical reflection, innovation, empathy, and purposeful action. While foundational cognitive skills such as remembering and understanding support its development, the Hope Wheel ultimately extends beyond cognition to foster ethical reasoning, creativity, and transformative learning, engaging both the mind and the heart.

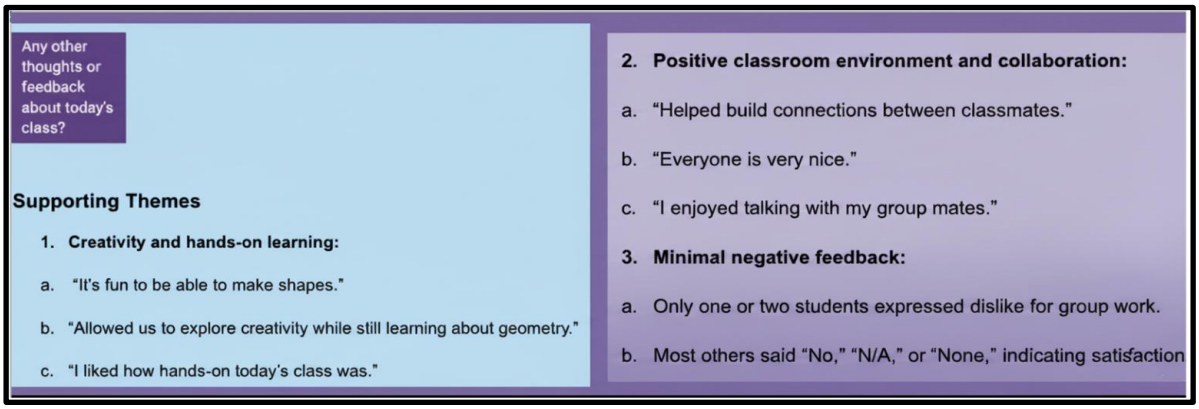

Figure 18. Summary of the Student Responses on the Survey (2024) regarding the Question 6 in the Google Form: Any Other Thoughts or Feedback about Today's Class (Lesson)?

Table 5. The Heart of the Hope Wheel

Component	How Love Connects
Students	Directly nurtures emotional and social well-being
Inspire	Fuels hope and purpose through compassion
Create	Enables meaningful, heartfelt expression
Invest	Sustains growth through care and dedication

(Source: Generated by ChatGPT)

Bloom's Taxonomy contains six verbs and two levels of thinking: lower-order thinking and higher-order thinking. Connecting Bloom's Taxonomy to the Hope Wheel verbs in high school mathematics enables teachers to design lessons that progress from the introduction of a topic to real-world applications and beyond. LaFever (2016) claims that teachers can ask students to develop projects that are personally meaningful, but they also need to provide feedback in a way that encourages refinement rather than dismissal of ideas, followed by support for learners throughout all the steps necessary to bring an idea to fruition.

Usually, lesson plans in high school mathematics integrate Bloom's Taxonomy with at least one verb from the Hope Wheel. For example, inspiration aligns with both lower-order and higher-order thinking skills. Bloom's Taxonomy has long been used as a universal framework for lesson planning and instruction. Due to its history

and popularity, it has been condensed, expanded, and reinterpreted in various ways (Forehand, 2010). Considering the verb *love* - the least directly applicable verb from the Hope Wheel - its integration with Bloom's Taxonomy appears to have significant potential. Table 6 shows that *love* is associated with levels 2–6 of Bloom's Taxonomy, based on students' reflections and online survey responses from task-based learning mini-projects in geometry classes.

Table 6. Comparing and Contrasting the Verb Love if the Hope Wheel with the Bloom Taxonomy Levels

Hope Wheel Component	Core Meaning	Bloom's Taxonomy Connection	Bloom's Level (1–6)	Comparison	Contrast
Love	Empathy, care, connection, compassion	*Understand* (empathy), *Evaluate* (values), *Create* (relationships)	2–6	Encourages perspective-taking and ethical reasoning.	Goes beyond cognition into affective/emotional intelligence—Bloom's does not fully address this.

(Source: Generated by ChatGPT)

Table 7. Comparing the Verb Love if the Hope Wheel with the Bloom Taxonomy Levels, Inductive, and Deductive Teaching

Teaching Type	How "Love" Is Expressed	Typical Bloom's Levels	Classroom Feel
Inductive	Listening, trusting, co-creating knowledge with students	Analyze → Evaluate → Create	Inquiry, collaboration, voice
Deductive	Clarity, structure, affirming relevance and care	Remember → Understand → Apply	Guidance, support, connection

(Source: modified by ChatGPT)

Students' work in completing the task-based learning project connects the verb *love* from the Hope Wheel to both inductive and deductive teaching, as well as to Bloom's Taxonomy, as shown in Figure 20 and Table 7. The mini-project was assigned after students learned the general rules for transforming geometric figures and applying these transformations to various real-world examples. There are two nearly opposite ways of teaching: the inductive and deductive methods (Sekhar & Murty, 2024). In this case, the teacher employed the deductive method while integrating the verbs of the Hope Wheel and the higher-order thinking skills of Bloom's Taxonomy.

The Hope Wheel verb "Love" can be applied at all levels of Bloom's Taxonomy, as described in Figure 20, and it can be implemented in lesson plans through both deductive and inductive teaching approaches. Analyzing the verb *love* reveals a narrower action when applying the Hope Wheel in educational settings. While "Love" may not be a directly practical verb like the others, it serves as the driving force - the reason each action occurs. Viewed

through that lens, “Love” becomes the unifying motivation behind all other actions.

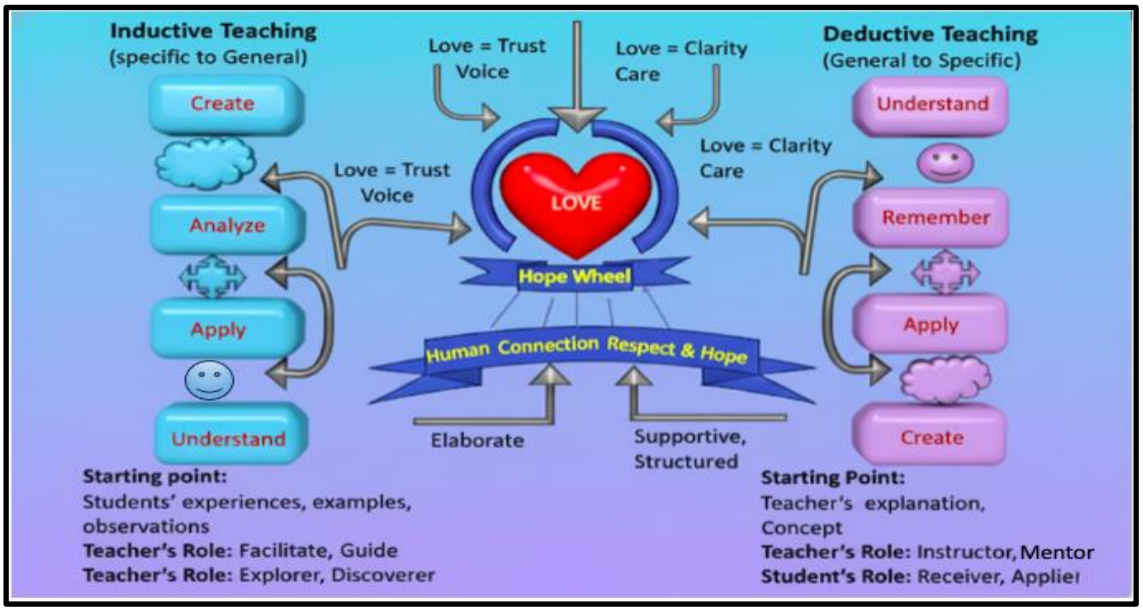

Figure 19. Bridging the Verb of the Hope Wheel - Love with Inductive, Deductive Teaching Approach, and Bloom’s Taxonomy (the Figure is Modified with PowerPoint and Gemini)

For example, we create because we love our classmates and want our community to thrive; we invest because we value inclusion and accessibility for everyone; we restore because we love preserving shared spaces for joy and safety where ideas can be exchanged; and we protest because we love justice and want safer, fairer environments. Students protested when the project was introduced by the teacher and completed it within a short time—about 40 minutes. Above all, every task is completed with love, while any act of demolition or destruction arises from the force of hate. Work completed with love is beautiful and, for some, beauty is greater than truth. According to Zeki (2009), the great German mathematician Hermann Weyl is often quoted as saying, “My work always tried to unite the truth with the beautiful, but when I had to choose the one or the other, I usually chose the beautiful.”

Conclusion

From the perspective of love, the reflections show genuine affection and an emotional connection to the learning experience. Students express joy, pride, and excitement - feelings that suggest they didn’t just complete the project but genuinely enjoyed it. They speak about having fun, being creative, and working together - all of which reflect a love for the process of learning, not just for its outcomes. Their words convey warmth toward discovery, satisfaction in teamwork, and delight in seeing math come alive through art.

The reflections reveal a growing love for learning. As Gao (2014) claims, students do have an innate love of learning - a love expressed through creativity, collaboration, pride in accomplishment, and joy in understanding something new. They show that students are not only understanding geometric transformations but are also developing a positive emotional connection to mathematics. This can be defined as a budding appreciation for, and enjoyment of, math through creative exploration and collaborative learning.

The online student survey reveals that more than 80% of students felt connected to the lesson or the mini project; over 80% also reported feeling free to share their thoughts and to contribute fully within their groups. In the final open-ended question - where students could express any thoughts not covered by the questionnaire - they shared satisfaction with their personal work and group interactions. They enjoyed spending time with friends and expressed pride in their creative work. In addition, they demonstrated deeper learning through the verbs of the Hope Wheel, particularly the verb *Love*.

Analyzing the connection between the Hope Wheel verbs and Bloom's Taxonomy, along with inductive and deductive teaching approaches, shows that the project - represented by the thick line - incorporated the verbs *create*, *love*, *invest*, *inspire*, and *restore*, which align with the higher-order thinking levels of Bloom's Taxonomy and the inductive teaching approach. Because the teacher had limited experience with the Hope Wheel, it was easier to use the inductive approach, as the verbs from the Hope Wheel naturally align with Bloom's three higher-order thinking verbs. As teachers who Love the Hope Wheel gain more experience applying its verbs, they can extend its use to a wider variety of situations and align it more effectively with the Common Core State Standards.

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