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The Impact of Social Justice Aligned Performance Tasks on the Awareness of Civic Responsibility in Adolescents: A STEM Perspective

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Abstract

This action research explores the impact of social justice aligned performance tasks on the awareness of civic responsibility of adolescents. The primary question of this STEM education action research is what impact does integrating social justice aligned performance tasks in computer science and college-preparatory math courses have on the awareness of civic responsibility by adolescents? This action research uses a mixed methods approach to identify the changes in a pre- and post-survey and a thematic analysis of student reflections. The findings suggest social justice aligned performance tasks result in an increase in their awareness of community and social justice issues and real-world connections. Furthermore, more research is needed on social justice-aligned performance tasks in STEM courses, such as in higher level math and computer science at the secondary level or other topics in the field of STEM. This can lead to a higher need for more research on the impact of this work on the awareness of civic responsibility in adolescents. Lastly, more research, such as individual interviews or focus groups could help illuminate what students' perceptions are of the issues and of their ability to make an impact on such issues.

Introduction

There are multiple issues plaguing society today, such as people experiencing homelessness, prejudice, discrimination, and this directly impacts how one may see their place in the world. One group that is particularly affected by these issues is adolescents because they are experiencing many changes (physical, biological, and cognitive) and can be largely influenced by experiences, community, and culture (Jimenez et al., 2023; Jaworska & MacQueen, 2015). Adolescence is a transformative period in the development of the self-identity and empowerment of individuals by engaging in tackling issues in their community that can be a powerful tool. Civic responsibility is key in creating thriving communities and understanding how to foster developmental processes in order to maintain them into adulthood (Metzger et al. 2020).

This study aims to measure the impact of the social justice aligned performance tasks on the awareness of civic responsibility. This study will be guided by the question: *How do social justice aligned performance tasks impact*

the awareness of civic responsibility in adolescents? A STEM perspective. The study will measure the awareness of civic responsibility in adolescents, ages 14 - 18, as they undergo social justice aligned performance tasks in Science Technology Engineering and Mathematics (STEM) courses, specifically involving statistics, algebra, and computer science. Flanagan and Levine (2019) argue that "young people are most likely to become civically engaged when they are in settings, such as faith-based institutions, workplaces, schools, and community organizations, where they become knowledgeable about issues and about how to take action on them, where they are asked by someone to join an organization or attend a meeting, or where normative pressures encourage them to participate in civic affairs" (165). This further supports the idea that schools can offer the setting and experiences for students to engage in critical thinking, solve issues in their community, and make a difference in the world. We will demonstrate that students will gain an understanding of how STEM can be used to analyze issues impacting their community as they engage in the social justice aligned performance tasks. Students will reflect and gain confidence in finding solutions and an awareness of civic responsibility to enact solutions to make positive changes in the real world.

For this study, the researchers adopted the school-site created definition of civic responsibility which is defined as:

- The student's ability to exhibit a commitment to service of their community.
- Demonstrate strong citizenship in response to their school, community, and beyond.
- Ability to show awareness of critical issues at home and abroad.

This definition was adopted because the participants were familiar with this definition, allowing any changes to be more clearly seen.

In addition, social justice aligned performance tasks will be defined as instructional tasks or assessments that will allow students to tackle the unfair and inequitable issues that directly impact them in their community. This definition is supported by the framework proposed by McArthur (2015), which states "Assessment for social justice is a two-pronged concept: it refers both to the justice of assessment within higher education, and to the role of assessment in nurturing the forms of learning that will promote greater social justice within society as a whole" (p.1). The performance tasks in this study were designed to include elements of justice to encourage students to promote the advancement of their society. These definitions will provide the foundation for this study to evaluate the shifts in awareness of civic responsibility in participants as they engage in the social justice aligned performance tasks.

Theoretical Framework

This study is grounded in research on the following themes: social justice and performance tasks, social justice and STEM education, and civic responsibility in STEM courses.

Social Justice and Performance Tasks

Performance tasks support critical thinking, engagement, and problem solving, especially when rooted in social

justice issues. According to Bell (2011), social justice is a society in which all members have meaningful access to essential needs and an equitable share of resources. It also requires full and equal participation of all people in social institutions committed to advancing a broad range of equitable social goals. This suggests a social justice lens can bring meaning to performance tasks because it emphasizes the role that individuals can play in solving these challenges. Defined Learning (2015) defines performance tasks as "any learning activity or assessment that presents a situation that calls for learners to apply their learning in context to demonstrate their knowledge, understanding and proficiency" (para. 1). This indicates implementation of performance tasks provides the opportunity for students to demonstrate their learning within their own context.

Barnes and Urbankowski (2014) further add that performance tasks "challenge students to apply their knowledge and skills to realistic problems to create products or performances" (p. 17). This further reinforces that performance tasks allow students to tackle problems in their community. These findings indicate social justice aligned performance tasks can transform the way educators plan assessments and experiences for their learners.

Social Justice Aligned Performance Tasks and STEM Education

STEM courses have a unique opportunity to bring context and ingenuity to solving social justice issues. Nicol et al. (2019) argue that issues like climate change and homelessness require critical perspectives across multiple disciplines, including STEM fields, beyond the traditional focus in Social Science and English Language Arts courses. Multilevel analysis studies revealed STEM students exhibit a negative relationship with social agency outcomes and find the importance of working for social change as less important to their career goals (Garibay, 2015). This illustrates and highlights the need to bridge STEM instruction with solving societal challenges to help adolescents feel empowered and be active members of their community.

Statistics in math and computer science courses taught through a social justice lens allows students to impact society significantly by exploring new possibilities for equity and engendering creativity in students, while providing the tools to shift from consumers of technology to creators of technology (Mishra & Yadav, 2013; Vakil, 2018). Gutstein and Peterson (2013) claim the role of critical math teachers is to, "position teaching and learning mathematics in the service of humanity and nature" (pg. xii).

Civic Responsibility in STEM Courses

As STEM educators develop their lessons and find more ways to develop civically responsible students, it is important to consider the impact on students and their self-perception of civic responsibility. This action research will present the impact of developing such self-perception of civic responsibility and engagement involving statistics and computer science. Evans and Prilleltensky (2005) argue that building awareness for the needs of the community enables individuals to identify and pose solutions to social issues their communities encounter. When young people engage in this process, they feel empowered and develop empathy towards their community to become agents of change.

Method

Consent and Recruitment

Participants of this study attend an urban public school in a large metropolitan school district and are enrolled in the action researchers STEM courses, specifically Computer Science and a fourth-year, college-preparatory math course called Transition to College Math and Statistics (TCMS). The students are predominantly Hispanic/Latino and African American and include a diverse range of learners, including students with special needs, emerging bilinguals, gifted, and foster youth. Upon California State University Dominguez Hills (CSUDH) Institutional Review Board (IRB) approval (IRB-FY2024-53), students and guardians were given forms to review and provide consent and an assent permission form for those students who would be participating in this action research. Students returned the forms in a sealed envelope and were assigned unique identification numbers to prevent the researchers from linking responses to participants. The action researchers distributed 71 sets of forms, and 68 students returned the forms. Out of the 68 students, 34 students consented to participate in the action research.

Implementation

The researchers developed and co-taught two units with social-justice aligned performance tasks as the culminating task for 9-12th grade students concurrently enrolled in TCMS and computer science. Students engaged in the interdisciplinary units without impacting their school schedule and used school issued Chromebooks to complete their performance tasks. Most of the instruction and completion of the social justice-aligned performance tasks took place at the school site during the learners designated scheduled class time for each course. The teachers joined classes toward the end of the units in order for project teams to work together during multiple class periods to construct their final product. The first performance task took approximately six weeks to complete, and the second performance task took one week to complete.

The performance tasks will serve as the intervention for the study in aims of increasing the awareness of civic responsibility in the students. The performance tasks followed an inquiry-based structure of exploration, understanding, and response. The unit design of the performance tasks encouraged students to first wonder, ask questions, and make meaningful connections to the issue, which led to an authentic and sustained inquiry of the task. The conclusion of the performance tasks asked students to take action in the form of a public product. The mathematics components of the performance tasks were adapted from *High School Mathematics Lessons to Explore, Understand, and Respond to Social Injustice* (Harper, 2020; Ortiz, 2020), which served as the channel through which students could explore and understand the social justice issue. The computer science component used *Unit 1 - Problem Solving and Computing and Unit 2 - Web Development ('23-'24)* where students developed the research and digital production creation skills to build the public product (Code.org, n.d.-a, Code.org, n.d.-b).

In the first performance task, the Fair Housing Wage Performance Task, students engaged in completing a multi-page website that tackles the critical issue of fair housing wage inequities. In the math course, students determined and explored the cost of housing and wages of realistic families and used representations of linear relationships to model and analyze while justifying an efficient solution to address the inequitable housing wages in their

community (Harper, 2020). In Computer Science, students used HTML and CSS coding to effectively program and style a multi-page website to share, communicate, and advocate for issues related to housing inequities (Code.org, n.d.-a, Code.org, n.d.-b). Students were tasked to use their mathematical data and findings from their math class to explain and engage their audience involving the issues at hand. In the second task, students used segmented bar graphs from the math course to explore and define the meaning of wealth distribution, by dividing the population of the United States into five equal portions to examine the division of wealth (Ortiz, 2020). In Computer Science, students completed the adapted unit on the problem-solving process to create a product sketch of their choice: i.e. a game, website, or app to educate their audience of such issues (Code.org, n.d.-a). The second performance task was optional for students due to lack of time as the semester was going to end.

Data Collection

This study incorporated a mixed methods data collection, by combining pre and post surveys as well as students' written reflections to gain a comprehensive understanding of the impact on students' awareness of their civic responsibility. Participants responded to a pre and post survey designed to measure students' self-perceived levels of awareness of civic responsibility. This allowed the researchers to determine what participants knew before and after having participated in this action research. A 16-item Likert-scale survey with four themes was adapted from the Measuring Civic Readiness: *A Review of Survey Scales, published by the National Center for Education Evaluation and Regional Assistance at the Institute of Education Sciences* (Tedeschi et al., 2021). The Likert-scale survey developed for this action research included four themes that asked students to self-assess their agreement with a belief or civic behavior skill using a numerical value scale of 1 to 5. In 3 of the 4 themes students rated how much they disagree or agree with a given statement and expressed their agreement using the following descriptors: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. The last theme listed skills and asked students to rate how well they could perform each skill. The scale used for this theme was the following: 1 = Definitely Can't, 2 = I Probably Can't, 3 = I Am Unsure If I Can, 4 = I Probably Can, 5 = I Definitely Can. The full list of survey items grouped by the four themes are presented (see Table 1).

Table 1. Survey Items Grouped by the Four Themes

Item #	Survey Statement
Civic Efficacy 1.0	
(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.)	
1	I can change my world for the better by getting involved in my community.
2	I can make my community a better place by helping others in need.
3	There are things I can do to make the world a better place.
Civic Efficacy 2.0	
(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.)	
1	I can make a positive difference in my community.
2	Even though I'm a teenager, there are ways for me to get involved in my community.
3	I can use what I know to solve"real-life" problems in my community.
Social Responsibility Personal Beliefs	

Item #	Survey Statement
(1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree.)	
1	I am responsible for protecting our planet.
2	I have a responsibility to improve my community.
3	I often think about ways that I can make the world a better place.
4	I have a responsibility to help others in my neighborhood.
Civic Behaviors Participation Skills *(1 = Definitely Can't, 2 = I Probably Can't, 3 = I Am Unsure If I Can, 4 = I Probably Can, 5 = I Definitely Can)*	
1	Create a plan to address a problem
2	Get other people to care about a problem
3	Express my views to others in-person in writing
4	Contact someone in a leadership position about a problem
5	Listen to conflicting viewpoints and identify where they agree and disagree
6	Summarize what another person said to make sure I understood

These specific survey scales selected from the Measuring Civic Readiness: *A Review of Survey Scales, published by the National Center for Education Evaluation and Regional Assistance at the Institute of Education Sciences* used to gather information on how students may recognize and understand their role in contributing to the well-being and improvement of their community, society, and government (Ballard, et al., 2015; Syversten et al, 2015, as cited in Tedeschi et al., 2021). Questions such as, "Even though I'm a teenager, there are ways for me to get involved in my community." or "I often think about ways that I can make the world a better place." would require students to reflect on their positions and beliefs about exercising their civic duty or obligation to their community. Likewise, asking students to rate skills by expressing their views or listening to others would allow us to analyze how these types of performance tasks could build their confidence or awareness of skills that are often utilized when tackling actual problems or social issues in the real world (Syversten et al., 2015, as cited in Tedeschi et al., 2021).

In addition to survey questions, students shared three written reflections based on their school-wide "Presentation of Learning" free-response questions about the Fair Housing Wage performance task. Every year the students at the school site engaged in a reflection of their learning presentation, highlighting an interdisciplinary project they participated in that academic school year. Students presented how their project connects to at least one school-wide learner outcome and then were required to respond to reflection questions pertaining to that learner outcome. The questions selected from the Presentation of Learning for this action research corresponds with the civic responsibility student learner outcome at the school site. The school-wide Presentation of Learning serves as a student-centered opportunity for learners to showcase their knowledge, skills, and interdisciplinary projects through authentic, real-world presentations to a public audience (where professionals are invited to serve as panelists for the event). To support this process, students are provided with reflection questions that support them to articulate and summarize their learning and connect academic content and personal experiences to the school-wide learner outcomes.

Since civic responsibility is a school-wide initiative while we strive to develop it in our students, we recognized the Presentation of Learning questions as an opportunity to collect authentic responses about how the social justice aligned performance task made them think differently of the impact on their community. It was important that students felt comfortable when providing qualitative data and students' familiarity with the prompts as well as the routine of reflecting about the assignment aligned directly with that goal of the performance task. The action researchers believed it to be a low stakes means to gain more insight to the connections students made from the performance tasks. The three reflection questions for school-wide presentations of learning are listed (see Table 2).

Table 2. Written Reflection Prompts from School-Wide Presentation of Learning

Item #	Free Response Question
1	What was the Essential Question/Focus of this assignment?
2	What is the most interesting thing about this assignment?
3	How did this class help you think differently about your community?

When collecting student responses, each student was assigned a randomly generated unique number so student identities would remain anonymous to the researcher/teachers during the span of this action research. A master spreadsheet linking unique identifiers to each student was then printed, then deleted off the action researcher devices, and stored in a secure location until the end of the action research. Students entered their randomly generated unique number when responding to both surveys and reflections questions so responses could only be linked to their unique identifier after the conclusion of the school year. All 34 participating students enrolled in both courses completed the 16 question Likert-scale survey before and after participating in the performance tasks using a web-based software tool called Qualtrics provided by CSUDH. Similarly, students entered 3 written reflections from their school-wide Presentation of Learning in Qualtrics with their unique identifier after participating in the performance tasks. At the conclusion of school year and action research, the researchers opened the returned sealed envelopes containing consent forms and associated each signed consent form with the unique identifier to identify the data that would be used in the analysis of this action research to be presented here. Any data that did not have signed consent was removed before any analysis was performed.

Data Analysis

All data collected were analyzed within Qualtrics and Microsoft Excel within a secure Dropbox folder supported by CSUDH. The data will be stored for a year and then deleted. Average responses between the pre survey and post survey of each theme were compared and the variability of the average responses among the themes analyzed using error bars computed with their standard deviation (see Figure 1 and 2). The frequency and students' change of response ratings of items from the pre to post survey were also compared and analyzed among the quantitative data.

The qualitative written response data was analyzed following the Grounded Theory Methodology (Glaser & Strauss, 1967). Each researcher started with an open coding process, doing a line-by-line coding of student written

responses. Researchers created descriptive codes that captured each piece's core idea or meaning without trying to fit them into pre-existing themes. Then each reviewed individual initial codes together and built a consensus on initial codes and definitions using an inductive coding process, allowing the data to guide the codes. This allowed for comparing new data with previous codes as they progressed in the study. Each new piece of data was compared with existing codes to see if it fitted an existing code. Thus, allowing the researchers to keep track of insights and emerging themes by writing short memos during this data analysis process.

Finally, the two researchers worked together to create axial codes and organized the initial codes from the open coding into categories and reflected on the relationship between the categories in relation to the central focus of civic responsibility and social justice performance STEM courses tasks. This allowed us to identify patterns within the context and to discuss the rationale for the declared categories found within the data. This allowed the researchers to come to a consensus on both categories and category definitions and then reviewed student responses to determine anchor examples and borderline cases for each of the final seven thematic analysis themes. Once the thematic analysis themes and definitions were clear and established, the total frequency of the seven thematic analysis themes from student responses done by Presentation of Learning Questions were identified using Microsoft Excel.

Results

Descriptive statistics were performed on the pre and post results of each survey theme. Average responses between the pre survey and post survey were compared and the variability of the average responses among the survey themes were analyzed using error bars computed with standard deviation (see Figure 1).

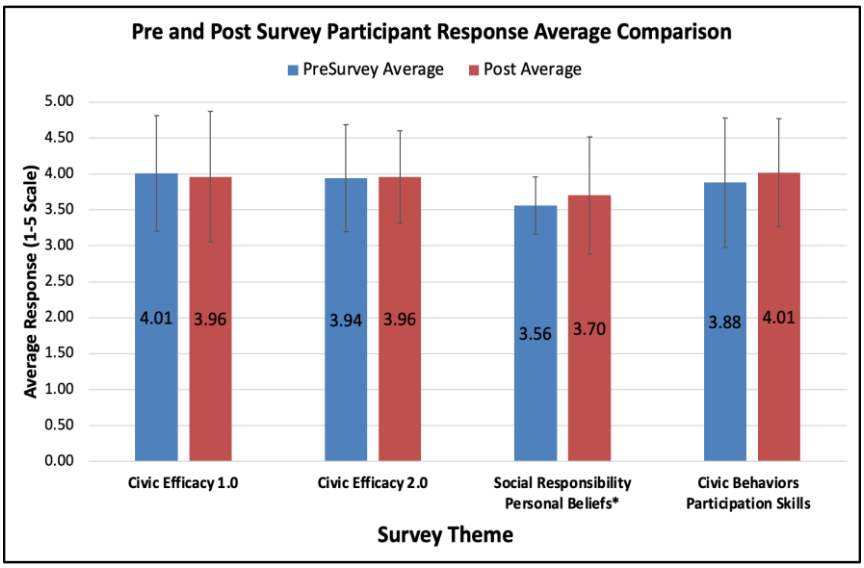

Figure 1. Pre and Post Survey Results

[*Note*: Participants responded with scores from 1 to 5 (1=Strongly Disagree, 5=Strongly Agree). Average response and standard deviation are given for (n = 34) participants completing the survey. The asterisk indicates Social Responsibility and Personal Beliefs which had 32 participants (n=32 participants).]

Though the data suggested the participants had a strong sense of civic responsibility behaviors prior to beginning the action research, it had no statistically significant changes of the overall quantitative data. A minimal increase in "Social Responsibility and Personal Beliefs" and "Civic Behaviors and Participation Skills" averages were observed and led to further analysis of the items within the survey themes.

The frequency of student agreement responses for items within the survey theme between the pre to post survey were analyzed for trends. The change in agreement responses from pre to post survey was compared. Figure 2 displays the count change in agreement statements of Item 3: "I often think about ways that I can make the world a better place" of The Social Responsibility and Personal Beliefs survey.

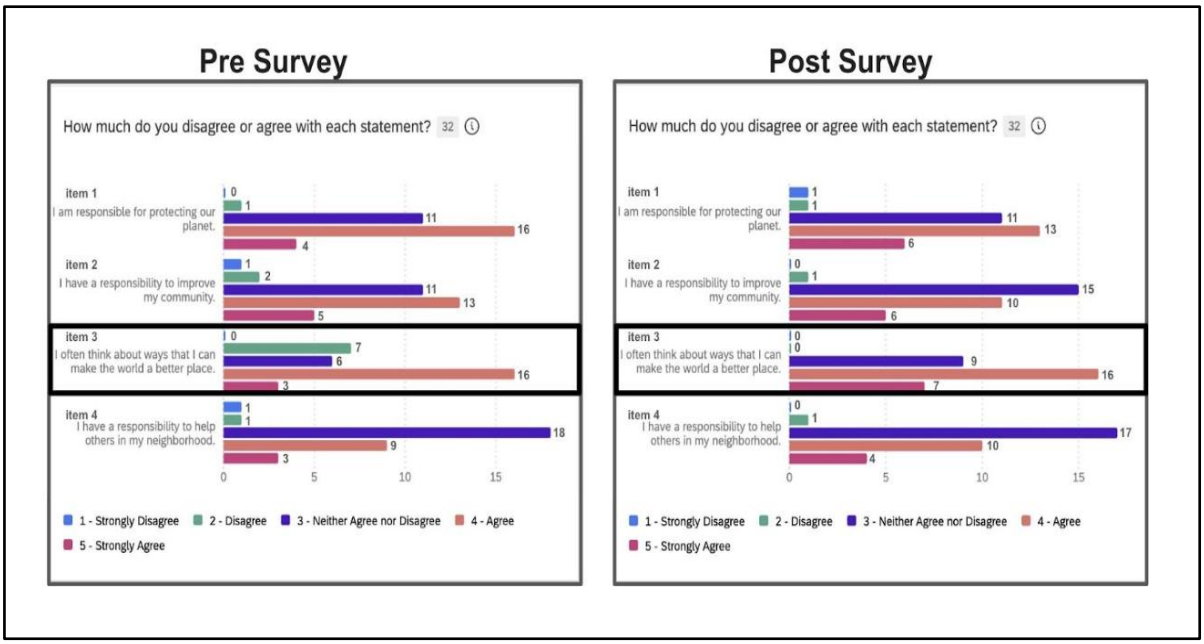

Figure 2. Pre- and Post-Survey Comparison of Social Responsibility and Personal Beliefs

[*Note*: The left image shows the pre-survey results (n= 32 participants) for the four statements within the "Social Responsibility and Personal Beliefs" theme. The right image chart shows the post-survey results (n= 32 participants) within the "Social Responsibility and Personal Beliefs" theme.]

The "disagree" category changed from a count of 7 in the pre-survey to 0 in the post-survey. The category "strongly agree" changed from a count of 4 in the pre survey to 7 in the post survey. Seven students who had previously disagreed in the post-survey, shifted to "neither agree nor disagree," "agree," or "strongly agree."

The emerging seven thematic analysis themes and definitions from the written reflection prompts (see Table 2) can be found in Table 3. The definitions for each theme were constructed by the researchers involved in this project. An anchor (clear representation of the theme) and borderline (partial representation of theme but not fully aligned) example is provided for each theme and obtained from a student's written reflection in the free response survey.

Table 3. The 7 Thematic Analysis Themes and Definition

Theme	Definition	Student Anchor Example	Student Borderline Case
TASK AND PURPOSE	*Describing the performance task in their own words.*	We focused on designing a website that tackles the issue of fair living wage inequalities all while drawing inspiration from our own experiences and using statistical and programming skills in order to analyze, explain, and propose solutions to tackle the challenges faced by people who are looking for a fair living wage.	We made a website that focused on the living wage for all families and what Fair Housing Wage.
REAL WORLD CONNECTION	*Mentioning how their learning of the math and/or computer science content connects to the real world or personal experiences*	By making a website it showed our civic responsibility by wanting to inform others on the situation. It gives insight on how hard it is to afford housing and afford other necessities at the same time. The website gives positive solutions in order to solve this problem like increasing the wage. The most interesting thing about this assignment was to find out the different incomes of various families. For our family we found their income with a table chart. We calculated his work schedule and how much money he would make if he added more hours to be able to afford adequate housing.	The most interesting thing about the assessments that addresses a relevant issue in the community while integrating different subjects.
CONTENT INTEREST AND ENGAGEMENT	*Expressing an interest in the math and/or computer science content they learned during the performance*	**Computer Science**: The most interesting thing about this assignment was that I learned new tech skills I learned while working on this project was that I learned to code. Coding plays a big part when it comes to making a webpage. For example, HTML is a type of coding and is used to build the structure of	**Computer Science**: The most interesting part of the assessment was learning how to decorate the page.

Theme	Definition	Student Anchor Example	Student Borderline Case
	task	the website, like changing the size of the fonts and making the paragraphs. Another thing I learned was using CSS that is used to style the webpage, like changing the color and adding pictures.	
		Math: The most interesting thing about this assignment was to find out the different incomes of various families. For our family we found their income with a table chart. We calculated his work schedule and how much money he would make if he added more hours to be able to afford adequate housing.	**Math**: The most interesting thing about this assignment was learning about how math can connect to fair housing wage.
AWARENESS OF COMMUNITY AND SOCIAL JUSTICE ISSUES	*Expressing an awareness of the issues and/or impact on families or their community*	How it made me think differently about my community was I realized that a lot of people in our community income is minimum wage and rent is really high which makes them waste their whole paycheck. Most of the people in our community live paycheck to paycheck. I realized how much adults struggle to live up during these times because rent has increased so much to the point where even people that earn a little above minimum wage can't even afford it. Most people have to have an extra job during their free time so they can afford living expenses.	This assignment lets you think about the lives of the people in your community. And what it takes to be in a stable house in your neighborhood.
EMOTIONAL IMPACT	*Expressing an emotional response, a change in attitude, or personal feeling*	I knew our community had been treated unfairly, but I hadn't realized it had also been applied to housing. When starting this assignment, I had known that housing was expensive, but I hadn't really understood to what extent people had to give up in order	This project helped me learn how much people are struggling with money. Since I don’t work or pay anything I don’t know how much people struggle to get

Theme	Definition	Student Anchor Example	Student Borderline Case
	regarding the issue or impact from issues.	to have the affordable housing. This assessment helped me think differently about my community when it comes to fair housing wages. The expectation that everyone is able to have a suitable house to live in while still being financially stable is very unrealistic in our community. The prices for housing have not only gone up but will continue to go up leaving a lot of people suffer financially. Not only is it the cost of housing that people have to worry about but what about the rest of their bills? How are those bills getting paid if housing itself is already so expensive.	and use money. So, working on this project I was able to understand what people struggle with financially.
AWARENESS OF CIVIC RESPONSIBILITY	*Expressing ideas on how they might take action in their community or make difference regarding a social or community issue*	I helped raise awareness and encourage action in the community. In the future, as a Social Worker, I plan to use this knowledge to push for policy changes that support economic fairness and affordable housing for everyone and to provide necessary resources to those in need.	The most part was learning how many factors, like government policies and the economy, affect housing affordability. It made me realize the impact we can have by addressing these issues.
DEFINING CIVIC RESPONSIBILITY	*Providing a definition and/or example of the definition of civic responsibility*	Civic Responsibility refers to the duties and obligations that citizens have to their community, society, and government. It involves actively participating in your community, respecting the rights of others around you, and contributing to the common good.	Civic responsibility is your duty as a citizen to be involved and informed about your community.

The total frequency of themes among the 102 written student responses are displayed in Figure 3 and ranked in Table 4 by the most to least number of occurrences. The most frequent theme evident is the Awareness of Community and Social Justice Issues, which had a frequency count of 46 out of 102 student written responses by the 34 participants responding to 3 questions.

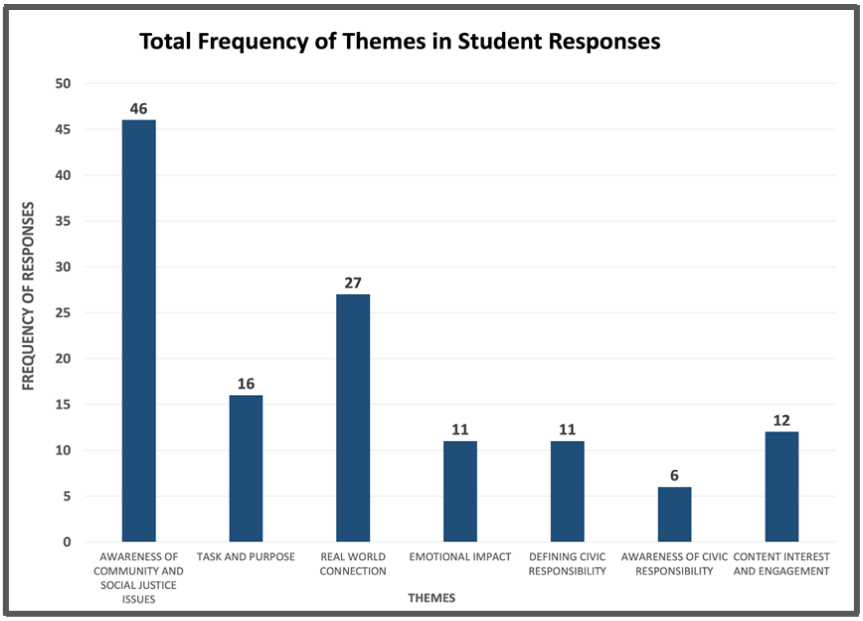

Figure 3. Total Frequency of the Seven Thematic Analysis Themes

[*Note*. Themes are ranked based on the number of times they were referenced across 102 participant responses (n =34)]

Table 4. Ranking Recurring Themes by their Frequency

Rank	Theme	Frequency
1	Awareness of Community and Social Justice Issues	46
2	Real World Connection	27
3	Task Purpose	16
4	Content Interest and Engagement	12
5	Emotional Impact	11
5	Defining Civic Responsibility	11
6	Awareness of Civic Responsibility	6

Frequencies of each thematic analysis theme per reflection question were calculated and compared as shown in Figure 4. The themes Awareness of Community and Social Justice Issues and Real-World Connection, were the most frequent themes among student responses, and occurring most is Question 3: "How did this class help you think differently about your community?" The themes Awareness of Community and Social Justice Issues, and Social Justice Issues, Defining Civic Responsibility, and Content Interest and Engagement, were the most frequent themes in Question 2: "What is the most interesting thing about this assignment?"

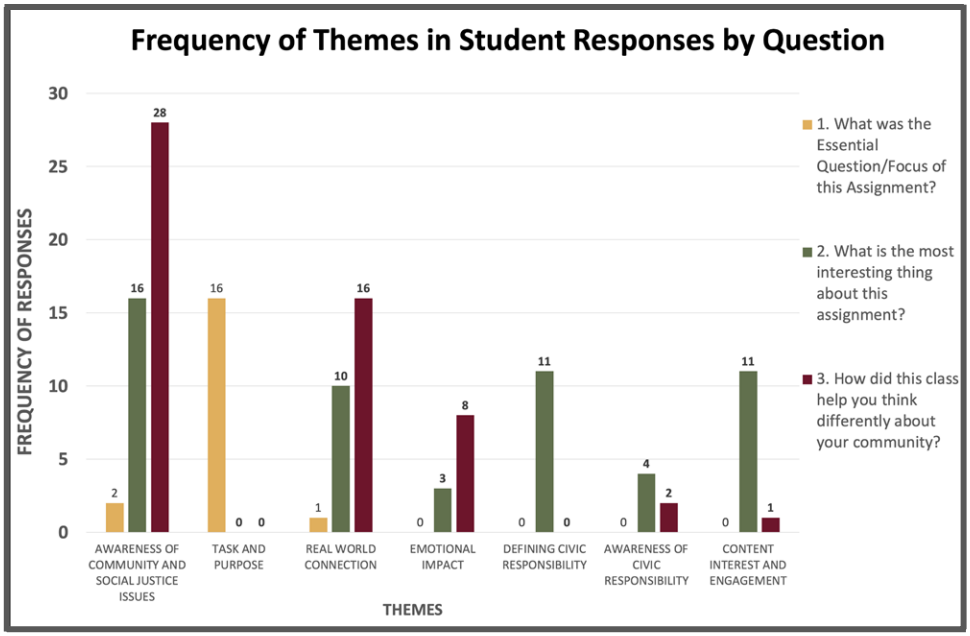

Figure 4. Frequency of Themes Per Reflection Question from Students Responses

Discussion

The descriptive statistics used to analyze the data in this action research set out to explore how social justice-aligned performance tasks in math and computer science develop adolescents' awareness of civic responsibility. The results revealed to what extent these performance tasks impacted students' awareness of civic responsibility and suggest important implications for future work on this topic. The data indicates important connections between social justice aligned performance tasks, authenticity in learning, and civic consciousness.

Quantitative Results

The quantitative data revealed insight about sustained implementation of social justice performance tasks over time of this action research. Pre- and post-survey participant average response suggest the participants had a strong sense of civic responsibility behaviors before and after the action research. Descriptive statistics performed on survey responses revealed a statistically insignificant change between pre and post surveys. This finding may be explained by the social justice themed project-based learning already established teaching approach at the school site. Given most of the participants in this research are seniors, many of the participants have had long term experience with this pedagogical approach since ninth grade. This may account for the limited impact observed in the data of Figure 1. There were no significant changes of the average ratings in the "Civic Efficacy 1.0" and "Civic Efficacy 2.0" themes, however there was a minimal increase in "Social Responsibility and Personal Beliefs" and "Civic Behaviors and Participation Skills" of .14 and .13 averaged response respectively.

In Figure 1, the data shows averages improved slightly in the Social Responsibility Personal Beliefs and Participation Skills survey themes. This leads to the belief that the performance task may have had a positive effect on students' beliefs regarding how they can take action in their community and build a stronger sense of

responsibility for their world they reside in. For example, in Figure 2, there was a count change in the agreement statements of Item 3: "I often think about ways that I can make the world a better place" of The Social Responsibility and Personal Beliefs agreement survey. Seven students who had previously disagreed in the pre-survey, shifted to "neither agree nor disagree," "agree," or "strongly agree" in the post-survey. Research has shown that social justice education actively shifts students' beliefs about their capacity to enact change in their communities (Dewey, 1997; Gallaven & Webster, 2023; Mitchell, 2008). Overall, the quantitative data shows a positive shift in their behavior skills suggesting social justice performance tasks may empower students to confront social justice issues or challenges but revealed it was limited in capturing specific ideas or shifts in perceptions among students after the performance task. This pointed to a potential need to include qualitative items or interviews to examine the depth and shifts in students' self-perceived levels of civic responsibility (rather than in general) if this study were to be replicated in the future.

Qualitative Findings

The emerging seven thematic analysis themes as presented in Table 3, were captured from each of the student reflection questions based on the school wide Presentation of Learning. As the school site utilizes a wide Presentation of Learning as a student-centered showcase of their knowledge, skills, and interdisciplinary projects through authentic, real-world presentations, students are given reflection questions to support and encourage communication of their learning and connections between their academic content and personal experiences. This study aimed to capture the insights each student made from the Fair Housing Wage Performance Task involved in Presentation of Learning.

Awareness of Community and Social Justice Issues

A major finding that emerged from this data is the heightened awareness of critical issues among the participants. This thematic analysis revealed a consistent focus on an awareness of the challenges faced by their families or local community in regard to housing wage. As shown in the ranking of recurring themes by frequency in Table 4, 46 occurrences across the 102 total student responses makes the Awareness of Community and Social Justice Issues the most recurring theme, having appeared in about 45% of the overall student responses. We concluded this to be strong evidence suggesting that social justice performance tasks build an awareness of societal issues in adolescents.

Additionally, about 24% of the responses that exhibited Awareness Community and Social Justice Issues were paired with a sentimental reaction that was described as an emotional response, exhibiting a change in attitude or personal feeling regarding the issue or impact from issues listed in Table 3. All 11 occurrences coded under Emotional Impact, as shown in Figure 3, also reflected an understanding of the social justice issue of housing affordability and wages. Although all students did not express an emotional response, the presence of the awareness of community and social justice issues did, having a 45% of responses, with a subset of those also exhibiting personal feelings or empathy, suggests that social justice performance tasks have the potential to foster informed and emotionally engaged students, moving students to empathize for others' experiences when facing

theses kind of issues. Empathy can be a key disposition and component for driving civic and social responsibility particularly when STEM is leveraged to address real-world challenges (McCurdy et al., 2020; Gutstein and Peterson 2013).

Real World Connection and STEM

Some of the students' findings were consistent with respected educational theory in problem-based learning. Figure 3 shows Real World Connection was the second major theme among the thematic analysis data, revealing students understood how math and/or computer science concepts connected to the real world or personal experiences after engaging in the Fair Housing Wage Performance Task. With 27 occurrences across the 102 student responses, the theme occurred 26.4% of the time. With 23 out of 34 participants or 67.6% of participants expressing how the STEM concepts connected to the real world at least once, suggesting Social Justice STEM Performance Tasks may captivate students with conceptualized and relevant learning, helping students understand how mathematics and computer science may operate beyond the classroom. This data supports the early theoretical and foundational work of John Dewey (1997) who argued learning is most effective when students are actively engaged in learning experiences that are centered in authentic contexts and life-based problem solving (Original work published 1938). Similarly, the results are consistent with William Heard Kilpatrick's (1918) theory, suggesting interdisciplinary learning (in our case with mathematics and/or computer science) allows students to make connections to their personal experiences and can foster their ability to see the relevance of these disciplines in their everyday lives. We concluded that the findings suggest social justice aligned performance tasks successfully engage students in their thinking about broader societal issues and support students in making connections to how STEM can be used as a valuable tool to analyze and address these issues for social change.

Awareness of Civic Responsibility

The analysis relevant to the research goal of examining how social justice aligned performance tasks impact the awareness of civic responsibility in adolescents was modest; however, findings are worth noting. Awareness of Civic Responsibility theme had the least number of occurrences among the student responses with six occurrences from six different students of the 34 participants (17.6% of the 34 participants) expressing ideas on how they might take action in their community or how they make differences regarding a social or community issue, as presented in Table 3. Additionally, 32.4 % (11 of the 34 students) were able to define civic responsibility in their own words after completing the performance task. Out of those 11 students, 8.8% (3 of the 34 participants) both defined and expressed awareness of civic responsibility. These results were deemed positive but are limited in regards to the impact on students' awareness of civic responsibility. We concluded, after engaging in social-justice performance tasks, students can develop an understanding of what civic responsibility is, but the tasks may not be enough to move students to develop a personal awareness of how they could contribute to positive change in their community or societal challenge yet. This highlighted potential areas for a deeper exploration.

It can be inferred from these results that improvements to the instructional design may improve students' awareness of their civic responsibility when engaging in social justice performance tasks. The results suggest that

while students gained awareness of social justice issues and understanding of what civic responsibility is, they may not have felt an increased sense of personal agency or confidence in their ability to effect change. This finding suggests students may benefit from more opportunities to discuss civic responsibility and its role in tackling challenges. Bird, Bowling, and Ball (2019) found that civic engagement activities accompanied with guided reflection can significantly enhance community needs awareness and civic efficacy and responsibility. Overall, this study did provide insight to the future of this study of and for awareness of civic responsibility in adolescents.

Conclusion

The quantitative data showed no statistically significant change in the students' awareness of civic responsibility. This may suggest the benefit of long-term exposure to social-justice themed curriculum at the school site. The qualitative analysis results demonstrated a clear increase in students becoming more aware of the issues in their community, a precursor of civic responsibility. The most frequent theme observed was "Awareness of Community and Social Justice Issues," indicating the social justice aligned-performance tasks made students more aware of the issues impacting their communities. This supports the findings of Flanagan and Levine (2019) that adolescents are more likely to become civically engaged if they can explore real world challenges and learn ways to take action. The second most frequent theme observed was "Real World Connection," which suggests learners saw the connection of the social justice-aligned performance tasks and the issues in their community. This finding aligns with the definition of performance tasks by Barnes and Urbankowski (2019) that these tasks allow students to apply their learning to realistic problems. Additionally, this study showed the potential of how social justice-aligned performance tasks in STEM could deepen the level in which students understand the application of STEM in the context of their community. Evans and Prilleltensky (2005) notion that building awareness of community needs can help individuals begin to understand and begin finding solutions for these needs. Social justice performance tasks can build a strong awareness of issues and increase understanding on an emotional level, potentially empowering them to confront social justice issues or challenges.

Recommendations

It is important to note this study involved a small sample size engaging in few social justice-performance tasks over the span of one semester. Replicating this study with a larger sample size over an extended period, with students new to social justice-aligned performance tasks, may yield stronger evidence and validity of the conclusions presented in this study. Furthermore, more research is needed on social justice-aligned performance tasks in STEM courses, such as in higher level math and computer science at the secondary level or other topics in the field of STEM. This can lead to a higher need for more research on the impact of this work on the awareness of civic responsibility in adolescents. Lastly, more research, such as individual interviews or focus groups could help illuminate what students' perceptions are of the issues and of their ability to make an impact on such issues.

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