

**Teachers of Today Make a Better Tomorrow: Teachers' Values in Teaching Robotics to  
Pre-K Students Experiencing Homelessness**

A thesis submitted by

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### **Abstract**

The Coding as a Palette of Virtues metaphor introduces a pedagogical approach for teaching coding and computational thinking that integrates the cultivation of character strengths along with technical knowledge and skills (Bers, 2022). Previous research has used the Palette of Virtues to understand how children explore and develop these virtues, but little is known as to how teachers personally resonate with and model these virtues in the classroom. The present study employed a mixed methods design to measure and understand the extent to which teachers in a preschool for homeless children personally experienced and intentionally promoted these virtues in their practice as they were implementing a robotics curriculum. Results of the study revealed that while all ten virtues were relevant to the entire group of teachers, individual teachers placed higher emphasis on different virtues. Additionally, the results revealed patterns of overlap between and among virtues (e.g., experiencing two or more virtues simultaneously). These findings suggest that specific virtues can be leveraged to encourage the expression of other virtues in the palette. Furthermore, they offer insight into the extent teachers experience each virtue and provide possible approaches for educators to integrate socioemotional learning into computer science education for young children.

*Keywords:* values, socioemotional learning, teaching methods, computational thinking, robotics, early learning

**Dedication**

For my dad, the greatest source of inspiration in my life.

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## Chapter One: Introduction

Computer programming and computational thinking (CT) are powerful tools in our constantly evolving digital world. As one of the most increasingly sought after skills, learning to program enables individuals to think critically while solving the problems of today in creative and novel ways. Given that programming and data science related jobs are projected to grow 36 percent from 2021 to 2031 (U. S. Bureau of Labor Statistics [BLS], 2022), there has been an increasing demand to teach CT skills in K-12 education. CT encompasses a set of problem solving and analytical thinking skills that involves breaking down a solution into sequential steps that can be performed by a computer or human (Bers et al., 2022). Although CT is most often used in the field of computer science (CS), CT skills can strengthen development in other domains of thinking (Wing, 2006). Jeanette Wing posited that engaging in CT includes processes such as abstract thinking, heuristics, pattern recognition, and conceptualization (Wing 2006; Wing 2011). Therefore, CT skills share similarities in other areas that involve logical thinking and are relevant in a variety of contexts beyond computer programming, such as solving a math problem, storytelling, or planning and organizing your schedule for the day. (Bers, 2010; Bers, 2021).

With the rising number of computer science (CS) initiatives to provide CS education for K-12 students, there has also been an increase in research examining effective strategies for integrating and teaching CT in classrooms (Gerosa et al., 2022; Peel et al., 2022). Despite the growing body of research on teaching strategies for promoting CT in early childhood through high school, few studies have examined how CS tools can be utilized to foster learning in other domains, including social-emotional development. Given that early childhood is a critical developmental period for young children to gain social skills, teaching coding provides educators



with an opportunity to engage children in CT while promoting socioemotional and character development through creative, play-based experiences. For example, developmentally appropriate programming tools that are designed to strengthen social skills, such as the KIBO robotics kit – a tangible programming tool in which children must work together to construct and program a robot – promotes collaboration and social development in the classroom while equipping children with the necessary social scripts to problem solve, share, and work as a team (Bers et al., 2022). Research on collaboration and the use of KIBO robotics in a kindergarten classroom demonstrated that a combination of unstructured pedagogy and a “learn-by-doing” approach fostered greater collaboration amongst peers compared to more structured teaching approaches (Lee et al., 2013). Combined with teaching pedagogy, integrative curricula that connect social emotional learning with academic learning promotes prosocial behavior while enhancing the overall development of an individual at a young age.

Along with a need to examine effective teaching practices to foster CT skills in early childhood, there is also a critical need to address the lack of CS learning opportunities in low-income schools and marginalized communities (Vakhil, 2018). Research assessing K-12 students' barriers to accessing CS opportunities found that Black students, regardless of income, were less likely than white or Hispanic students to report access to CS opportunities, while lower income students altogether were less likely to report access to CS learning opportunities (Wang et al., 2016). As a field, computer science is overwhelmingly dominated by white and Asian, middle- to upper-class, cisgender men (Buzetto-More et al., 2010). Therefore, it is morally imperative that CS opportunities are made accessible and inclusive to historically underrepresented students, especially those that identify as Black, Hispanic, or low socioeconomic status. Investing in CS education in early childhood within these communities

equips young children with the necessary CT and problem-solving skills that fill the gaps in their learning and prevents them from falling behind in school. Principals and superintendents of schools with predominantly underrepresented populations reported that lack of funding to outsource and adequately train teachers in computer science was a significant barrier to providing CS opportunities (Wang et al., 2016). This finding provides more support as to why high quality, integrative curricula and pedagogy are necessary for exposing students from historically underserved backgrounds to CS, especially at an early age.

## **Chapter Two: Literature Review**

The Coding as a Palette of Virtues metaphor proposes a pedagogical approach for teaching coding and computational thinking that integrates the cultivation of character strengths along with technical knowledge and skills (Bers, 2022). Like an artist who uses a palette of paint as a tool for their work, the Palette of Virtues is a tool for teachers to promote young children's social-emotional learning in the classroom. Bers uses the metaphor to lay out a dynamic approach for teaching and learning human values while equipping children of the 21st century with the necessary critical thinking and problem-solving skills to navigate an ever-growing digital world. The Palette of Virtues introduces an opportunity for children to actively engage in a dual process that fosters both computational thinking and socioemotional learning by exploring the socioemotional, moral, and ethical dimensions of learning to code.

Developed within the Coding as Another Language (CAL) pedagogy, the Palette of Virtues was designed as a developmentally appropriate tool to promote prosocial behavior and character development in young children learning how to program (Bers, 2022). The CAL pedagogy is implemented within the CAL curricula, which includes *CAL-ScratchJr*, an app-based programming language that introduces powerful ideas from computer science by teaching

young learners how to code and *CAL-KIBO*, a tangible programming language that teaches young children to use robotics (Bers, 2022). While learning to program prepares children for the future of new technologies, Bers emphasizes that we cannot rely on mastery of such skills alone to drive innovation. Students need both the technical knowledge and moral ground to navigate the complexities of our ever-evolving technological globe and advance social justice.

Leveraging the principles of computer science, the CAL pedagogy intentionally teaches children about moral values and ethics through the Palette of Virtues metaphor. Currently, the palette proposes ten virtues: *curiosity, open-mindedness, perseverance, patience, optimism, honesty, fairness, generosity, gratitude, forgiveness* (Bers, 2022). Children are encouraged to “paint” from their palette by developing, exploring, and practicing these virtues through creative play and personalized computational projects, which Bers coins as “the coding playground” (Bers, 2012). The coding playground builds upon the work of Seymour Papert, who developed the LOGO programming language for young children to create art using code (Papert, 1980). Through LOGO, Papert constructed an environment where children could learn the language of LOGO through free exploration, creativity, and personal expression. Bers expands upon this with the coding playground, an environment where children play with code while freely exploring their imagination and creativity. Like the physical playground, children learn to work together, help one another, manage their frustrations, and take risks to achieve their goals, while adults provide scaffolded opportunities to enhance children’s learning and understanding without direct instruction (Bers, 2012). Classroom environments that offer appropriate challenges and scaffolded approaches to learning while normalizing mistakes are associated with improvements in students’ learning (Elliot & Dweck, 1988; Turner et al., 2002; Orkin et al., 2018). In the

coding playground, children acquire coding skills to create meaningful computational projects through a play-based approach while exploring the ten virtues throughout the learning process.

Teachers play a crucial role in modeling and reinforcing these values in the coding playground. While the CAL pedagogy lays out a novel approach that fuses moral education with technical knowledge, teachers are responsible for setting the precedent and displaying these virtues in the classroom. The Palette of Virtues is only as meaningful as the teachers who intentionally promote and put these values into practice. Bers uses the metaphor of a painter choosing different colors for her art to describe how educators choose certain values to incorporate into their lesson (Bers, 2022). The addition of new colors, or virtues, forms a complex palette for teachers and students to create unique, meaningful experiences throughout the creative process of coding. The integration and promotion of these virtues in the coding playground is a dynamic, dyadic teacher-child process – teachers provide young learners with a palette and help them create meaning of each virtue, while children are the artists who learn how to apply such values throughout the learning process of coding.

### **Palette of Virtues**

The Palette of Virtues metaphor was designed with the intention of understanding how young children learn human values through learning to program (Bers, 2022). However, little is understood as to how teachers personally experience and purposefully promote such values in the classroom. Given the pivotal role educators play in creating meaningful experiences for children to learn technical skills, explore moral values, and develop character strengths, it is imperative to examine how teachers personally resonate with these virtues and apply them in their own practice. The ten virtues (*curiosity, open-mindedness, perseverance, patience, optimism, honesty, fairness, generosity, gratitude, forgiveness*), along with their definitions and

examples of them in practice—both in the coding playground and wider literature—are provided in detail below.

### *Curiosity*

Broadly speaking, curiosity is defined as a desire for specific information in the absence of extrinsic reward (Markey & Lowenstein, 2014; Lowenstein, 1994). Other scholars have described curiosity as an epistemic feeling driven by the value of knowledge that depends on the existence of unknown knowledge (Gordon, 1987). Although there are slight variations in the definition, a common understanding about curiosity has remained uniform across researchers and philosophers historically (Lowenstein, 1994). Early thinkers such as Aristotle and Cicero viewed curiosity as an intrinsically motivated desire for knowledge, while Cicero believed that curiosity was seen as a passion and Kant referring to it as an “appetite for knowledge” (Lowenstein, 1994; Posnock, 1991).

In the coding playground, Bers describes curiosity as novelty seeking, or a strong desire to know or learn something (Bers, 2022). For example, in a first-grade classroom that implemented the CAL-ScratchJr curriculum, the teacher intentionally evoked curiosity in her coding playground by asking questions, exploring ideas, and experimenting with those ideas to reach a new discovery (Bers, 2022). The teacher understood that she is a keeper and promoter of curiosity and has a responsibility to not only discuss it, but model curiosity through deliberate action (Bers, 2022). Although first graders are naturally curious, the teacher recognized that some children may lose their inquisitive nature over time. By reinforcing curiosity in her coding playground, she hoped that their desire to seek out new knowledge was retained (Bers, 2022).

Research examining the impact of curiosity on teacher-student relationships found that teachers who were curious and displayed genuine interest in their students' academic success,

feelings, and lives outside of the classroom were more likely to have students who were more responsive and willing to engage with them and the course content (Anorim Neto et al., 2022). Having a positive relationship with and feeling valued by an adult in an authority position, such as a teacher, can foster students' confidence and resilience in the classroom and is crucial in the overall development of young individuals (Anorim Neto et al., 2022).

### ***Open-mindedness***

Open-mindedness has gained widespread recognition as an intellectual or epistemic virtue (Baehr 2020; Riggs 2010). Generally speaking, open-mindedness is an attitude in which there is an awareness of one's own fallibility. The individual has the ability to transcend a default cognitive standpoint by considering novel ideas and revising one's own beliefs and opinions in light of these ideas (Baehr 2020; Riggs 2010), To be open-minded is to be willing to entertain new ideas and acknowledge them with serious consideration (Kwong, 2016).

In the coding playground, Bers describes open-mindedness as flexibility in considering different perspectives and the quality of willingness to consider ideas, opinions, and feelings that are new or different from one's own (Bers, 2022). For example, in a classroom that implemented CAL-ScratchJr, one student attempted to recreate an epic battle from *Pokémon*. The student programmed one of his ScratchJr characters to attack the other but ran into a timing issue in which the avoiding character begins to move well before the attacking character (Bers, 2022). The student's teacher noticed his frustration and suggested a different method to program the characters by using the *send* and *receive* message programming blocks. The student decided to try out this method and debugged his program using the suggested blocks. After some trial and error, his new program remedied the timing problem. (Bers, 2022). By offering guidance and

positive feedback, the teacher was able to tap into the student's personal motivation and flexibility to try new solutions (Bers, 2022).

Research has shown that open-mindedness is an important characteristic of a teacher's ability to reflect and be a critical thinker (Cui, 2022). In teaching, teachers and students from diverse socio-cultural backgrounds may have different or conflicting viewpoints (Cui, 2022). Therefore, it is crucial for teachers and students alike to learn how to cope and adapt in the face of differentiating opinions and ideas (Cui, 2022). As a miniature of the social world, the classroom context is an important environment for teachers and students to be open to different or opposing perspectives so that they can learn to raise awareness and receptiveness in the academic context and outside world (Cui, 2022).

### ***Perseverance***

Most literature defines and refers to perseverance in the context of grit—perseverance and passion for long-term goals (Duckworth et al., 2007). Perseverance has also been linked to psychological resilience—the ability to maintain persistence towards existential purposes in the face of adversity or stressful situations (Sisto et al., 2019). Although a singular definition for perseverance does not exist within the literature, elements of grit and psychological resilience encompass the essence of perseverance.

In the coding playground, Bers refers to perseverance as determination and persistence in pursuing goals despite difficulty or adversity, having grit, and believing that one can improve (Bers, 2022). For example, during the CAL-ScratchJr curriculum in a second-grade classroom, a student was encouraged by his teacher to create a story with ScratchJr (Bers, 2022). The student had an idea for a long story, so his teacher suggested using multiple tablets so that the student could have a story with more than four pages. Despite the challenges the student faced in

learning how to program a story with multiple tablets, he continued steadfastly, working on his project each day. The entire project took two full weeks to complete. By placing perseverance at the forefront of her coding playground, the teacher helped her student develop persistence through longer, more difficult projects that were personally meaningful (Bers, 2022).

Kraft & Duckworth (2014) examined how grit, or perseverance and passion for long-term goals, predicted effectiveness and retention of novice teachers. In their study, they found that sustained passion and perseverance in activities prior to entering the teaching profession led to higher retention rates throughout the school year and improved their students' academic performance (Kraft & Duckworth, 2014). Their findings suggest that teachers' personality traits, such as grit, can influence both their effectiveness and retention in the school setting (Kraft & Duckworth, 2014).

### *Patience*

There are a variety of conceptions of patience, such as the capacity to wait, endure, persevere, and tolerate. The most basic or common notion of patience is that it is an individual's capacity to wait calmly despite delays or disruptions (Vigani, 2016). Many scholars regard patience as a virtuous act and way of relating to the world. For example, impatience may allow one to be more productive when dealing with a toddler who takes over an hour to feed herself breakfast, but exercising patience and taking the time to acknowledge this moment with your child who will grow in the blink of an eye holds meaning that is beyond instrumental value (Vigani, 2016). Although patience can also be regarded as a means to a desired end, the practice of patience is good in itself.

In the coding playground, patience is defined as the ability to accept or tolerate delay, trouble, or suffering without frustration (Bers, 2022). For example, in a kindergarten classroom



learning KIBO, a teacher paired up two students to play with the robot together: one who picked up KIBO fairly quickly and the other who was learning slowly. As the girls took turns scanning the programming blocks with KIBO, the novice student struggled to scan a longer, more complex program. Frustrated by how slowly her classmate was taking to scan, the student snatched KIBO out of the girl's hands. Cries and shouting ensued between the girls, and their teacher rushed over to the scene. After learning what happened, the teacher used this moment as an opportunity to teach the girls patience. The teacher asked the more skilled student if she played a sport, to which the student nodded. The teacher then probed the student to recall what it was like to first learn tennis, and the young girl remembered the embarrassment she felt when everyone could return the ball over the net, except her. Like learning a new sport, the teacher reminded her that some students take longer to learn KIBO, but that they will eventually get there. With this newfound awareness, the student waited patiently while her classmate carefully scanned the blocks. When her classmate struggled to scan a block, the student offered support by suggesting different scanning techniques. Through this powerful conversation, the teacher was able to reinforce not only the child's patience, but empathy towards her fellow classmate.

Research examining the effectiveness of an educational intervention focused on teaching patience found that students who were assigned to the program demonstrated more patient choice-making than students who were assigned to the control group, which persisted almost three years after the implementation of the program (Alan & Ertac, 2018). The program utilized a structured curriculum delivered by children's own teachers who were trained in the pedagogy. Teachers reported that students who practiced more patient decision-making were less likely to demonstrate problematic or disruptive behavior in the classroom (Alan & Ertac, 2018). These findings have implications for promoting the positive development of the whole child and

demonstrate that effective pedagogy and teacher training focused on cultivating patience can improve children's decision-making skills.

### ***Optimism***

Anthropologist Lionel Tiger provides a broad definition of optimism in his (1979) book *Optimism: The Biology of Hope*. Tiger proposed that optimism is a mood or attitude associated with an expectation about the future that is perceived as socially desirable, to an individual's advantage, or pleasure (Tiger, 1979). Through his definition, Tiger extracted that there is no objective optimism because what is considered optimism is dependent on the individual's perception of what they deem as desirable (Tiger, 1979).

In the coding playground, Bers defines optimism as confidence and hopefulness about the future or a successful outcome (Bers, 2022). For example, in a classroom learning ScratchJr, a student became increasingly frustrated and discouraged that they were not understanding how to use the programming blocks. His teacher noticed and provided her student with extra help, words of encouragement, and hope that they could learn ScratchJr (M. U. Bers, 2022). The teacher believed that her student would achieve success, and by reinforcing optimism and a "growth mindset" in her coding playground, the student was able to successfully use the blocks and gained confidence in their coding ability.

Research examining academic optimism in individual teachers found that teachers' sense of academic optimism was strongly associated with student-centered teaching, prosocial behavior, and dispositional optimism (Ngidi, 2011). These findings imply that having a strong sense of academic optimism is not only beneficial to the educator, but their students as well. Teachers with academic optimism believe in the success of their students, which in turn affects their practices to be more student focused (Ngidi, 2011).

### *Honesty*

Broadly speaking, honesty is defined as a match between what an individual communicates and what they believe to be true (Fleeson et al., 2022). Honesty is widely considered as a character trait and moral virtue amongst researchers and virtue scholars (Fleeson et al., 2022; Wilson, 2018). Behaviors and attributes related to honesty include truthfulness—the disposition to tell the truth; loyalty—being disposed to keep reasonable promises; respect of property, including intellectual property; compliance—the disposition to adhere to rules; and forthrightness—being disposed to give a transparent presentation of the facts (Wilson, 2018).

Within the CAL pedagogy, honesty is described as the quality of being an individual with integrity, uprightness, rectitude, and honor (Bers, 2022). For example, in the coding playground, students in a second-grade classroom used KIBO to create their final coding projects. The teacher asked the students to plan their projects in their design journals. While brainstorming, one student struggled to come up with ideas for her project. She looked over at another classmate's journal, which was brimming with colorful ideas, and decided to copy her classmate. Consequently, the student hit a roadblock when she was unsure how to translate the copied ideas into code and decides to copy her classmate again by duplicating her program. The student caught her copying her program and immediately called their teacher. The teacher asked if she copied her classmate's program and reassured her that she was not in trouble, but that it was important to tell the truth. The student confessed and explained the reason for her dishonesty. The teacher thanked the young girl for her honesty and suggested that she ask a friend to help brainstorm a new idea. By confronting his student, the teacher placed honesty at the forefront of their coding playground, which encouraged his student to take the high road and speak truthfully (Bers, 2022).

Research exploring the influence of moral stories and instruction on promoting honesty in 3- to 7-year-olds found that stories that emphasize the positive consequences of honesty, such as the apocryphal story “George Washington and the Cherry Tree,” significantly increased children’s truth-telling (Lee et al., 2014). In another study examining the effectiveness of a class-wide teaching intervention aimed at developing life skills in preschools, results demonstrated decreased problem behavior and improvements in instruction-following, produced by pedagogy aimed at modeling target skills and arranging opportunities for children to practice these skills (Hanley et al., 2013; Sauter et al., 2019). Taken together, these findings offer an avenue for teaching honesty and highlight the importance of developmentally appropriate tools, such as moral stories, and the crucial role teachers play in implementing these tools, modeling honesty, and providing opportunities for children to practice truthfulness in the classroom.

### *Fairness*

Broadly speaking, fairness is described as a desire to treat others equally, without bias, and is often conveyed by the idea of justice (Kraft Todd et al., 2022). The terms justice and fairness are often used interchangeably across the wider literature, with the latter term being predominantly used in research on individual decision-making and behavior (Kraft Todd et al., 2022). Aspects of fairness can include impartiality—equal treatment of all parties, charity—considering the needs of others, or reciprocity—obligations between individuals (Kraft Todd et al., 2022).

In the coding playground, fairness is defined as justice or impartial treatment without favoritism (Bers, 2022). For example, in a kindergarten classroom learning KIBO, four students were grouped together and struggled to share KIBO equally. The students shouted over one other and snatched KIBO out of each other’s hands, which caught the attention of their teacher. The

teacher asked her students how they would feel if they never had a chance to scan KIBO, in which each student admitted that they would feel sad. In this moment, the teacher provided an opportunity for the children to brainstorm ideas for how they could share KIBO equally. The students decided they should take turns, and the teacher helped them write a turn-taking schedule so they would know when it was time to switch jobs (e.g., scanning KIBO, pressing KIBO's start button). By reinforcing the importance of fairness in the classroom, this teacher helped her students not only find a solution, but also provided an opportunity for her students to practice a core CS concept: algorithms. In an algorithm, order matters in sequence, which the children practiced by following a schedule for taking turns (Bers, 2022).

Research focused on teaching anti-bias curriculum in the classroom suggests that teachers' internalized dialogue—such as reflecting and recognizing unique aspects of one's own culture—is a crucial step towards one's ability to practice and teach anti-bias in the classroom (Lin et al., 2008). Furthermore, providing teachers with opportunities to solve real-world problems, observe demonstrations of anti-bias lessons, role-play anti-bias in their classroom, and learn more about related pedagogical approaches equips teachers with the necessary skills to model anti-bias in their own practice (Lin et al., 2008).

### ***Generosity***

Broadly speaking, generosity is described as a prosocial behavior that benefits others (Allen, 2018). More specifically, generosity is the practice of freely giving one's time, resources, talents, and dedication for the welfare of others or the greater good (Collett & Morrissey, 2007). Generosity is an altruistically motivated act in which the ultimate goal is to enhance the well-being of others (Collett & Morrissey, 2007).

In the coding playground, Bers describes generosity as helping oneself and others, giving and receiving, and the quality of being kind (Bers, 2022). For example, in a kindergarten classroom exploring CAL-KIBO, the teacher saw an opportunity for her students to help each other fix their programs. Rather than solving the problem herself, the teacher asked a student who had the necessary skills—both technically and socio-emotionally—to help debug another classmate's program. The teacher saw the importance of setting up situations for her students to help each other and intentionally promoted generosity by asking her children to help someone outside of their group (Bers, 2022).

With the exception of Bers (2022), a limited body of research uses the term “generosity” to describe related behavior in educational settings. In fact, most of the research uses altruism—a related form of generosity—to describe such behavior. Given the similarities and overlap of the two terms, the following section uses altruism to describe practices related to generosity in the classroom setting. Research on altruism—behavior motivated by concern for others—posits that increasing awareness of altruism and greed, empathetic orientation – making individuals aware of their own feelings and other people's feelings, developing the classroom as a cohesive community, and increasing self-perceived competencies can increase altruistic and generous behavior (Robinson & Curry, 2005). Therefore, teachers are invaluable in the process of reinforcing generosity by helping students recognize what it is and increasing their capacity for generosity.

### ***Gratitude***

There is surprisingly little consistency in what gratitude means amongst scholars. Existing literature on gratitude has conceptualized it as a virtue, emotion, moral sentiment, a skill, and attitude (Navarro & Tudge, 2022). In broad terms, gratitude encompasses an

appreciation of others, a focus on what an individual has, feelings of awe when encountering beauty, behaviors to express gratitude, an appreciation rising from an understanding that life is short, focus on the positive in the present moment, and positive social comparisons (Navarro & Tudge, 2020).

In the coding playground, Bers describes gratitude as being aware of good things, a readiness to show appreciation, and the quality of being thankful (Bers, 2022). For example, the CAL pedagogy trained teachers to become aware of and recognize the good things that happen in the coding process, even when the achieved outcome does not go as planned (Bers, 2022). In a classroom using ScratchJr, a student was unable to finish her project to completion. Despite this, her teacher showed gratitude towards the student for the parts of her project that she dedicated time to and was able to complete. By explicitly showing gratitude towards her work, the student felt proud of the creation she had made.

In a study exploring the role of gratitude in enhancing teacher-student relationships, researchers found that teachers who displayed more gratitude in the classroom reported that the classroom ran more smoothly and there was a greater sense of cohesiveness amongst the teacher and students (Howells, 2014). Furthermore, teachers reported greater emphasis on relationships with students rather than “getting things done” (Howells, 2014). We see this in the coding playground, where socioemotional development and students’ character strengths are prioritized over learning of technical skills.

### ***Forgiveness***

Scholars across several fields, including psychology, philosophy, development, and education have largely conceptualized forgiveness as a virtue. Broadly speaking, forgiveness is described as a willingness to abandon feelings of resentment, negative judgment, and indifferent

behavior towards the individual who committed wrongdoing, while expressing feelings of compassion, generosity, and perhaps love towards one who caused harm (Neng Lin, Enright, & Klatt, 2011). Forgiveness is a layered virtue involving the cultivation of multiple virtues and therefore requires a degree of moral reasoning. That is, when an individual forgives, they must consider how to respond to an act of unjust treatment (Neng Lin, Enright, & Klatt, 2011).

Within the CAL pedagogy, forgiveness is defined as an act of pardoning and accepting, giving a second chance to the individual(s) who did us wrongdoing and ourselves (Bers, 2022). In the coding playground, two kindergarten students were tasked with creating a program based on the book *There Was an Old Lady Who Swallowed a Fly* using KIBO. The two students argued as to how they would convey the old lady and the animals she swallowed with the programming blocks. Eventually, one of the students decided to collect all the blocks and hide them behind their back, preventing the other student from reaching them. Noticing their bickering, the teacher walked over and asked his students to explain what happened. Afterwards, the teacher gave the children two options: continue being angry with one another or apologize and find a way to program KIBO so everyone is happy. The students chose the latter, which prompted the girl who hid the blocks from her classmate to apologize. After being forgiven by her classmate, she suggested they combine both of their ideas into their program, which resulted in an end product both girls were excited by. By placing forgiveness at the forefront of his coding playground, the teacher was able to guide his students to acknowledge their wrongdoings, make amends, and persevere through their coding project.

Interventions focused on teaching forgiveness in counseling and clinical contexts have helped individuals restore their emotional health following the experience of unjust treatment from others (Neng Lin, Enright, & Klatt, 2011). Researchers posit that forgiveness education can



also be used as a form of character education in the context of schools. One program developed by Knutson & Enright (2002) uses a pedagogical approach for teaching six-year-old children about forgiveness. The curriculum was implemented by teachers who received training and ongoing support from researchers to better their understanding of the nuances of forgiveness and how to implement each component of the curriculum (Knutson & Enright, 2002). Within this program, educators play a crucial role in the delivery of forgiveness education and their participation is not only meaningful to their students' socioemotional development, but their own practices as well. Forgiveness education allows educators to direct attention to identifying best practices, effective classroom activities, and appropriate forms of character education that push the field forward and promote the holistic development of children and adolescents (Neng Lin, Enright, & Klatt, 2011).

### **Chapter Three: Study Aim and Objectives**

As highlighted in the previous examples, teachers play an integral role in promoting the Palette of Virtues in the classroom. For teachers who value the holistic development of their students, the CAL pedagogy offers a roadmap for cultivating both academic and character strengths. The explicit attention to these ten virtues provides a unique opportunity for teachers to foster students' socioemotional learning while gaining technical knowledge and skills related to coding and robotics.

The current study was largely inspired by my experiences as an E-P Fellow at the Eliot-Pearson Children's School (EPCS), in which I implemented the CAL curricula in the 5–7-year-old classroom during the 2021-2022 school year. EPCS is a laboratory school affiliated with the Eliot-Pearson Department of Child Study and Human Development at Tufts University and serves children ages 2.9-7 years old. New to both coding and teaching, I initially struggled with

implementing many aspects of the curriculum and grew worried as to how I was going to organically integrate the Palette of Virtues into the lessons. As I went through this arduous process, I noticed that not only was the palette relevant to the children's learning, but my own as well. Finding ways to make the experience of coding fun and meaningful for my students led to personal experiences with each virtue, some more than others. This awareness invoked my own curiosity to understand how teachers personally experience these virtues, and how those experiences influence the modeling and reinforcement of them in their teaching.

### **Present Study**

The current study examines the implementation of the CAL-KIBO curriculum in classrooms at Horizons for Homeless Children preschool center. The purpose of this study was to understand how teachers personally experience and intentionally promote the Palette of Virtues in their classroom. Therefore, my research questions were as follows:

RQ1: Are there specific virtues that teachers personally experienced while implementing CAL-KIBO?

RQ2: Are teachers intentional about promoting these virtues in their own teaching of CAL-KIBO?

RQ3: Did teachers observe their students displaying these virtues while implementing CAL-KIBO?

RQ4: What is the relevance of CAL-KIBO to the teachers and students at Horizons for Homeless Children?

## **Chapter Four: Methodology**

The current study is embedded within a larger evaluation study of the Coding as Another Language (CAL) KIBO Pre-K Curriculum, a tangible robotics curriculum using the KIBO

robotics kit for children ages 3-5 (Bers, 2019). Examining the data of the larger study provided an opportunity to examine the relevance of the Palette of Virtues to teachers while implementing CAL-KIBO. A mixed methods research design was used for the purpose of garnering in-depth, contextualized data that capture the virtues teachers most experienced and how they were intentionally promoted in their teaching of KIBO. This study was approved by the Tufts University Institutional Review Board (IRB).

### **Participants**

Participants included 8 teachers across four classrooms at Horizons for Homeless Children in Boston, MA who were enrolled in the *CAL KIBO pre-K study*, a larger study evaluating the use of a tangible robotics curriculum in a preschool center. Horizons for Homeless Children is a preschool site serving children experiencing various degrees of housing insecurity. Each classroom consisted of 18 children and three teachers, including one bilingual teacher fluent in English and Spanish. Teachers were required to have led or co-taught at least half of the CAL-KIBO lessons to participate in the current study. Of the eight participants, six identified as female. Regarding teachers' years of experience, three participants reported having 10-14 years of teaching experience, two participants reported 4-9 of teaching experience, one participant reported more than 15 years of teaching experience, and one participant reported fewer than 4 years of experience. One participant did not report years of experience teaching. Six participants taught in classrooms serving 4–5-year-olds. One participant began teaching in a 4–5-year-old classroom at the start of the school year but was switched to teaching in the 2.9-4-year-old classroom halfway through the year. In reporting the demographics of teachers, I chose to count her as having taught 2.9-4-year-olds (Table 1).

**Table 1.** Demographics of Teachers at Horizons

<b>Individual-level variables</b>	<i>N</i>
<b>Gender</b>	8
Female	6
Male	2
<b>Years of Teaching Experience</b>	
Less than 4 years	1
4 - 9 years	2
10 - 14 years	3
15+ years	1
Unknown	1
<b>Age Group Taught</b>	
2.9 - 4 years old	2
4 - 5 years old	6

Prior to curriculum implementation, classroom teachers received training on the CAL pedagogy and CAL-KIBO curriculum, which involved attending a full-day, hybrid professional development training facilitated by members of DevTech Research Group of Tufts University, Dr. Marina Bers, PI. Members of DevTech facilitated the training online via Zoom while teachers gathered in-person and joined the Zoom call from their meeting room. The agenda of the training included introductions, discussion regarding coding in early childhood, hands-on instruction with the KIBO robotics kit, overview of the curriculum, and an in-depth review of the lesson activities. After receiving training, teachers were provided with ongoing support from research members of DevTech, which included weekly emails and video tutorials for all CAL-KIBO lessons, on-demand coaching, and additional in-person support from school administrators and staff who had also received training on the curriculum.

### **Protocol**

As mentioned, the current study is embedded within an evaluation study of the Coding as Another Language (CAL) KIBO PreK curriculum. The curriculum consists of 30, 30-minute lessons. Lessons are structured based on the Creative Curriculum and include whole group

activities, small group or center activities, songs, games, and opportunities for creative expression (*Research Foundation: The Creative Curriculum*®, 2010).

At the end of the CAL KIBO pre-K study, teachers were asked to partake in a 30-min to 1-hour interview conducted by a DevTech research member via Zoom. Interviews were recorded for transcribing purposes, in which participants provided their verbal assent prior to the interview being recorded. Following the interview, teachers were asked to complete a Qualtrics survey with questions similar to the post-curriculum interview and asked to rate the extent to which they personally experienced each of the ten virtues.

### **Measures**

The following two measures were developed for the current study in order to assess the extent to which each virtue was relevant to teachers while implementing CAL-KIBO.

*Horizon's KIBO Post-Curriculum Teacher Interview.* Following the end of implementation of CAL-KIBO, teachers were asked to participate in an interview conducted via Zoom by a researcher at DevTech. Teachers were asked to reflect on their experiences with KIBO, teaching KIBO in their classrooms, and student outcomes after implementing KIBO. Teachers were asked to reflect on their experiences with KIBO, teaching KIBO in their classrooms, and student outcomes after implementing KIBO. To capture the relevancy of the virtues, teachers were asked to reflect on their personal experiences with the Palette of Virtues, provide examples of times they experienced any of the virtues listed on the palette, and describe how they were intentional about promoting these virtues in their teaching of KIBO. In addition, teachers were asked to describe instances in which they observed their students demonstrate behaviors related to the virtues during CAL-KIBO. It is important to note that I added this

question halfway through conducting the interviews, so data on student demonstrations of each virtue can only be described by partial data (see Appendix A\*\*).

*Horizon's KIBO Post-Curriculum Teacher Survey.* Teachers were asked to complete a 15- to 30-min online survey via Qualtrics. The survey asked similar questions to that of the post-curriculum interview. In addition, teachers were asked to rate the extent to which they personally experienced each of the ten virtues and those that they saw their students demonstrate on a 0-100 sliding scale (see Appendix B\*\*).

## **Chapter Five: Analysis**

### **Quantitative Data Analysis**

Analyses using quantitative data from the CAL-KIBO pre-K study were conducted in R Version 4.2.2 ([www.R-project.org](http://www.R-project.org)) using R Studio version 2022.12.0+353 ([www.rstudio.com](http://www.rstudio.com)). Of the eight teachers included in the study, two teachers were missing quantitative data from the post-implementation survey. Therefore, six teachers were included in the final quantitative analysis of the post-implementation survey data. To explore the first research question—"Are there specific virtues that teachers personally experienced while implementing CAL-KIBO?"—I conducted frequency counts of each virtue that teachers experienced based on the rating they provided for themselves on a 0-100 scale (0 = Never Experienced, 100 = Always Experienced). I then obtained means of each virtue to examine the relevance of the virtues across the six teachers.

To explore the third research question—"Did teachers observe their students displaying these virtues while implementing CAL-KIBO?"—I calculated frequency counts of each virtue based on the rating teachers reported for their students on the 0-100 scale. To examine which virtues teachers saw displayed the most in their students, I obtained the means of each virtue.

Results from the quantitative analysis were used to supplement findings from the qualitative analysis using the post-implementation teacher interviews.

### **Qualitative Data Analysis**

Qualitative data on open-ended items pertaining to the virtues were extracted from the post-implementation survey to highlight the ways in which teachers personally experienced each virtue and how that influenced the intentional promotion of those virtues in the classroom. Data from the post-implementation interviews were auto transcribed via Zoom and then manually cleaned by student researchers at DevTech.

Using the cleaned transcripts, I identified excerpts describing teachers' personal experiences with the virtues, intentional promotion of these virtues, and specific instances in which they observed their students' displaying virtues. Then, I aggregated these excerpts into coherent narratives using the first-person words of each teacher. Qualitative data from the post-implementation surveys were matched to each teacher and then aggregated under their narrative. The rationale for this strategy was to connect teachers' experiences and promotion of the virtues with their observations of students demonstrating these virtues into a succinct, narrative context. In addition, this strategy allowed me to focus the scope of my analysis, which helped me explore the following three research questions: 1) "Are there specific virtues that teachers personally experienced while implementing CAL-KIBO?" 2) "Are teachers intentional about promoting these virtues in their own teaching of CAL-KIBO?" 3) "Did teachers observe their students displaying these virtues while implementing CAL-KIBO?" Using the narratives as text, I deductively coded the data using the ten virtues identified in the palette: curiosity, open-mindedness, perseverance, patience, optimism, honesty, fairness, generosity, gratitude, forgiveness. Virtues that were mentioned in the excerpts were coded in NVivo Release 1 analysis

software. I then labeled each excerpt by teacher for the purpose of aggregating teacher quotes and crafting vignettes for each virtue.

Using the cleaned transcripts, I extracted excerpts from responses to the following question on the post-implementation survey: “The children at Horizons for Homeless Children are experiencing several unique circumstances including homelessness, English language learning, developmental delays, etc. Do you have any observations that you believe would be relevant to children at Horizons but not another early childhood center?” to explore the fourth research question: “What is the relevance of CAL-KIBO to the teachers and students at Horizons for Homeless Children?” I inductively coded each excerpt, in which the following three themes emerged from the analysis: Relevancy to Spanish-speakers, Social-emotional Development, Trauma Exposure. These themes were created into codes using NVivo, in which I labeled and aggregated each excerpt under the specific theme/code mentioned. To display similarities and differences in teachers’ perceptions of the relevance of CAL-KIBO at Horizons, I clustered each excerpt thematically into a matrix.

## **Chapter Six: Results**

### **Virtues Experienced Across Teachers**

Table 2 displays the number of teachers that reported personally experiencing each virtue based on their responses to the post-implementation survey. Means indicate how often teachers experienced each virtue on a 0-100 sliding scale.

Gratitude ( $M = 71.17$ ,  $SD = 32.55$ ), optimism ( $M = 90.33$ ,  $SD = 8.73$ ), perseverance ( $M = 83.33$ ,  $SD = 23.91$ ), and patience ( $M = 84.50$ ,  $SD = 23.66$ ) were reported by all six participants as having been personally experienced during their teaching of CAL-KIBO. Open-mindedness ( $M = 92.50$ ,  $SD = 15.00$ ), forgiveness ( $M = 94.50$ ,  $SD = 11.00$ ), and fairness ( $M = 83.25$ ,  $SD = 33.50$ )



were the least reported across participants, with only four teachers reporting that they had personally experienced these virtues.

**Table 2.** Count, Means, and SDs of Virtues Experienced by Teachers

<b>Virtue</b>	Count ( <i>N</i> = 6)	Mean	SD
Gratitude	6	71.17	32.55
Generosity	5	88.20	16.80
Open-mindedness	4	92.50	15.00
Optimism	6	90.33	8.73
Perseverance	6	83.33	23.91
Patience	6	84.50	23.66
Honesty	5	85.00	22.09
Forgiveness	4	94.50	11.00
Curiosity	5	91.60	12.03
Fairness	4	83.25	33.50

### **Virtues Demonstrated Across Students**

Table 3 displays the number of teachers who reported on the post-implementation survey observing their students demonstrate behaviors related to each virtue. Means indicate how often, on average, teachers observed their students demonstrate related behaviors of each virtue on a 0-100 sliding scale.

Curiosity ( $M = 88.40$ ,  $SD = 11.17$ ), perseverance ( $M = 86.00$ ,  $SD = 15.70$ ), and optimism ( $M = 85.40$ ,  $SD = 14.89$ ) were reported by five participants as virtues they observed their students display during the implementation of CAL-KIBO and were virtues students displayed the most across virtues that were most reported. Honesty ( $M = 90.00$ ,  $SD = 10.46$ ), forgiveness ( $M = 81.25$ ,  $SD = 25.94$ ), and patience ( $M = 70.60$ ,  $SD = 31.47$ ) were the least reported virtues that teachers observed their students display.

**Table 3.** Count, Means, and SDs of Student Virtues Observed by Teachers

<b>Virtue</b>	Count ( <i>N</i> = 6)	Mean	SD
Gratitude	5	73.60	32.33
Generosity	5	81.00	18.92
Open-mindedness	5	75.20	31.76
Optimism	5	85.40	14.89
Perseverance	5	86.00	15.70
Patience	4	70.50	31.47
Honesty	4	90.00	10.46
Forgiveness	4	81.25	25.94
Curiosity	5	88.40	11.17
Fairness	5	80.60	19.13

### **Emphasis of Virtues Within Teachers**

The qualitative analysis revealed that each of the ten virtues was mentioned by at least one teacher during the post-implementation interview, indicating the relevancy of all ten virtues during the implementation of the CAL-KIBO curriculum across teachers. However, individual teachers gave more emphasis to different virtues. This was evident by the richness in detail participants provided for each virtue—some teachers described their experiences with specific virtues in passing or in a few words, while others described their experiences with those virtues in rich, lengthy detail. The following vignettes are narrative summaries and extracted excerpts illustrating teachers' overlapping and varying experiences with each virtue, the ways in which they were modeled and intentionally promoted, and examples of students demonstrating these virtues in the classroom during the implementation of CAL-KIBO.

#### ***Curiosity***

*Participant T1.* Participant T1 is a teacher in one of the kindergarten classrooms at Horizons School for Homeless Children. In reflecting on her personal experiences with the Palette of Virtues while teaching CAL-KIBO, she described that awareness of her own curiosity surrounding KIBO allowed her to enhance her teaching of the curriculum. The following excerpt describes in further detail how embracing her own curiosity for KIBO helped her identify what parts of the curriculum and KIBO fostered her students' curiosity:

*Curiosity, from the beginning of what KIBO is or what KIBO does. How KIBO came about was definitely part of my curiosity. Curiosity for yourself in what you're learning and not only what you're learning, but are you able to teach the children so that they gain the understanding and hearing their curiosity too. It's part of the curiosity and the perseverance, is looking into what you're doing and pushing through to understand that it's not about what you think, but being open to trying something new.*

This particular quote suggests the possibility that this teacher understood that the recognition of her own curiosity with KIBO allowed her to implement the curriculum in a way that cultivated the curiosity of her students. Her unwavering curiosity equipped her with the perseverance to push through the learning process of implementing a robotics curriculum and seek out new and different approaches to teaching her students. Furthermore, we see that this teacher's curiosity became a vehicle for reinforcing other virtues in her coding playground. The overlapping of virtues, such as curiosity, perseverance, and open-mindedness in this example, comes up in many teachers' experiences with the virtues and is something we see again in subsequent vignettes.

### ***Optimism***

*Participant T5.* Participant T5 is a teacher in one of the preschool classrooms at Horizons. While reflecting on her personal experiences with the virtues, she described feeling

optimistic and confident that everyone, including the teachers and students, would be where they are today in regard to the progress they've made in implementing the lessons. When asked if she was intentional about promoting the virtues, she focused on her outward optimism as a way to promote the positive learning experiences of her students while implementing CAL-KIBO. The following excerpt describes the intentional modeling and reinforcement of optimism in her coding playground while teaching CAL-KIBO:

*I would say I was very intentional, because you want a positive learning environment, and I am a stickler about that. I try to leave my crap at the door. Because when we come into the classroom the kids already go through enough, so I wanted to make sure [KIBO] was a positive learning environment... because we had some behaviors in the classroom, and pretty sure you've seen before, and we have some heavy behavior sometimes in our classroom so [we] made sure that everybody knew the expectations and that we're not giving in, and that we're you know we're slowing down to understand and to make this the most positive thing ever it's new to everyone, so we have to make it the best that we possibly can.*

By intentionally promoting optimism in her classroom, this teacher was able to create a safe, positive environment that fostered her students' engagement and provided an enriching learning experience during CAL-KIBO. Her optimism allowed her to create a positive experience for not only her students, but the other teachers who were also being exposed to KIBO for the first time. The socioemotional experience of teaching is just as important as that of learning, and the CAL pedagogy provides teachers with an opportunity to engage with the curriculum in a meaningful way that is enriching for both teacher and student.

### ***Patience***

*Participant T24.* Participant T24 is an assistant teacher in one of the kindergarten classrooms at Horizons. While reflecting on her personal experiences with the virtues, only a few were mentioned—most being described in just a couple of words. However, one virtue stood out the most during her interview: patience. Her steadfast patience for both herself and her students while implementing CAL-KIBO is described in the following excerpt:

*Yeah, patience always. Kids get very upset, especially when it's not their turn to touch KIBO, so being patient with them, explaining their emotions, and being patient with myself for not being able to explain something properly.*

Of all the teachers I had interviewed regarding their experiences and intentional promotion of the virtues, I found this quote particularly profound. The importance of teaching her students to practice patience with KIBO reinforced having patience and compassion for herself. Taking the time to help identify and explain her students' feelings promoted their socioemotional development during the process of learning to use robotics, which in turn enhanced her own socioemotional skills. The same could be said by flipping the context around—cultivating a sense of compassion and patience towards herself allowed her to develop deeper patience for her students during CAL-KIBO. Her gentleness not only reflects a strong sense of patience, but forgiveness towards herself and her students as well. Forgiveness and patience go hand-in-hand; one reinforces the other and are key to greater empathy towards oneself and others, which we see displayed in this teacher's coding playground.

*Participant T1.* In reflecting on her personal experiences with the ten virtues, this teacher described her self-patience as integral to her ability to effectively implement CAL-KIBO in her kindergarten classroom. The following excerpt describes the ways in which she practiced the art of patience and flexibility in her own teaching of CAL-KIBO:

*Having the patience to learn about what you're teaching so that you're able to implement it. And really be patient with it because it's still new, so you might not be wanting great results in it, you might have in your mind that the results to be one way and understanding it is not going to be that way.*

The importance of patience in her own teaching of KIBO suggests that her students will need a similar level of patience when learning to program. We've seen in earlier examples that things inevitably go wrong in the coding process. From disagreements in project ideas to difficulties with sharing KIBO, children will need to continuously exercise patience in the coding playground. This teacher's patience allowed her to remain flexible and impartial to the endless possibilities that KIBO offers, and suggests that she understands her students will need to be both patient and open-minded when faced with unexpected outcomes surrounding their coding projects.

### ***Perseverance***

*Participant T6.* Participant T6 is a teacher of one of the kindergarten classrooms at Horizons. When asked to reflect on his personal experiences with the Palette of Virtues, he described his perseverance and determination to ensure all of his students had the chance to learn CAL-KIBO. The following excerpt illustrates the ways in which this teacher's perseverance allowed him to foster his students' perseverance:

*I really had to persevere to keep going with [CAL-KIBO] and to keep making sure the kids had opportunity weekly to be a part of this program and perseverance was hard, because when you don't know how to make something work, some my friends in my class that are really like they shut down because they can't but once they seen others trying, they all begin to persevere, to try to get it*

This teacher understood that perseverance can be contagious in the classroom—watching your peers persevere in the face of challenges and roadblocks during the coding process encourages you to want to persist alongside them. Teachers are no exception to this, and the tenacity and determination of this teacher to provide robotics to all of his students pulsed through his coding playground. Despite the difficulties he faced with implementing CAL-KIBO on a consistent basis, this teacher was able to provide his students with the opportunity to exercise perseverance as they advanced through the curriculum and began creating longer, more complex programs using KIBO.

### ***Honesty***

*Participant T5.* In reflecting on her personal experiences with the virtues, this teacher described how her honesty allowed her to be transparent with her co-teachers throughout the process of implementing CAL-KIBO. Whether she was confused regarding the lesson plan or if she felt that she couldn't take on leading one of the lessons, she was able to communicate these moments openly and honestly with her teaching team. The following vignette describes how her honesty allowed her students to have the most enriching learning experience possible:

*Honesty, the quality of being honorable, rectitude, uprightness, integrity. Um, I would say being honest with my co-workers, so if I'm kind of like "hey this isn't for me today can you guys take charge of this." I have to be honest with them and with myself so that my children will get everything they need.*

Her ability to recognize when she was unable to teach KIBO and transparently communicate this with her teaching team allowed them to implement a more effective curriculum that would most benefit their students. Students can only deliver as much as their teachers offer them, and this

teacher's honesty with herself allowed her students to gain as much from the curriculum as possible.

*Participant T6.* In reflecting on his personal experiences with the Palette of Virtues, this teacher described his own honesty as an important virtue during the implementation of CAL-KIBO. The following vignette describes how his honesty helped greatly improve his teaching of CAL-KIBO:

*Honesty, and really communicating to my co teachers, if I really wasn't feeling up to it that day or I didn't really understand it, or maybe we should find out clarity, before we talk to the kids. Honesty and some of you know, saying that I can't do it, or I don't understand it, I would love to hear them say that I didn't understand because that gave me as a teacher angles, that really helped them.*

Being honest with his co-teachers when he didn't understand the lesson at hand allowed him to fill the gaps in his knowledge and provide the confidence he needed to implement the curriculum. His honesty also reinforced his open-mindedness and introduced him to new perspectives and ways of teaching KIBO. This reflects the possibility that his honesty and open-mindedness to new perspectives allowed his children to engage with KIBO similarly.

### ***Fairness***

*Participant T9.* Participant T9 is a teacher in one of the kindergarten classrooms at Horizons. In reflecting on the ways she personally experienced the virtues, she described the importance of fairness in her teaching of CAL-KIBO. Her emphasis and promotion of fairness while implementing CAL-KIBO is demonstrated in the following excerpt:

*I definitely wanted to make sure that the kids that were taking part all felt included. That there goes, you know the splitting of the groups and the Spanish speaking. I wanted to*



*make sure that they all got chances to have, be able to do each part as well, each job. So 'yes, you want to be the ones who put the wheels on,' 'you want to scan,' 'you scanned earlier now we're gonna let him do it,' and stuff like that. So I had to make sure that I remembered who did what, who hasn't had enough experience in what part so that they all kind of had that equal chance to do each part of KIBO.*

Prioritizing fairness in her coding playground allowed this teacher to create a learning environment that promotes inclusion and equal opportunity while learning to code. Her intentional promotion of fairness is seen through many of her efforts, including splitting the children into groups based on their primary language so that they could focus on learning KIBO instead of translating conversation. We also see this in her awareness of students who were more experienced with KIBO versus those who haven't had much exposure, which she considers when assigning the students with specific tasks during KIBO time (e.g., scanner job). By modeling fairness in her coding playground, this teacher understood that her children would need a similar level of fairness to provide everyone with an equal chance to use KIBO and understand all of its parts.

### ***Open-mindedness***

*Participant T8.* Participant T8 is a teacher in one of the preschool classrooms at Horizons. When asked whether she had personally experienced any of the ten virtues, the first that she immediately mentioned was open-mindedness. Having had no prior experience with coding or robotics, she was initially doubtful of her own ability to teach a robotics curriculum. Over time, she grew open-minded to the idea of learning alongside her students, which helped improve her teaching methods. The following excerpt illustrates the importance of open-mindedness as she was implementing CAL-KIBO:

*First one off the bat is open mindedness because they're programming and coding and you're like, "Huh? I can barely use excel, what do you want me to do?" So, being open-minded and being able to learn with your children, sometimes you know teachers think they have to know everything before they're teaching and so being able to learn as you go with your children, you have to be open minded so that definitely. [I was] very intentional. I would say okay, we have to teach this—I am a student too.*

Despite her initial qualms, this teacher was able to overcome the learning curve of coding by remaining open-minded to the curriculum and her ability to successfully implement it in the classroom. Her open-mindedness allowed her to take on the role of learner rather than expert, which enhanced her teaching of CAL-KIBO by modeling and promoting the importance of open-mindedness to her students. She understood that open-mindedness is essential in the coding playground and that her students will need to remain open-minded in their coding endeavors. A good educator is a lifelong learner, and by embracing a student-like mindset, this teacher was able to conquer the challenges of coding while instilling a willingness to learn in her coding playground.

### ***Generosity***

*Participant T6.* While reflecting on his personal experiences with the ten virtues, this teacher described his generosity towards the other teachers as crucial to creating a positive learning experience for the children. Sharing his knowledge and teaching techniques allowed him to not only create a positive environment for his students, but the teachers as well who were implementing the curriculum. The following excerpt describes the ways in which generosity enhanced his teaching of CAL-KIBO:

*Generosity, not keeping what I know to myself but also to share and to help others, so that the children that we are giving this information to have a great experience receiving the information.*

This teacher understood that his generosity towards his teaching team greatly contributed to the quality of instruction his students received. Although it is unclear whether his students witnessed these generous acts, we see that his pursuit for opportunities to help other teachers positively impacted the learning experiences of his students. When asked whether he observed his students demonstrate behaviors related to the virtues during KIBO time, he described that his students displayed generosity in a variety of ways, including helping their peers program KIBO or offering to let their peers play with KIBO before them. One instance in which he observed the generosity of his students is detailed in the following excerpt:

*Generosity, yes, by helping their friends or even letting the friends go before them using KIBO. I saw that, because a friend was crying because they had to wait. I've seen a girl say you know what you can go before me I'll be the last one.*

Her willingness to offer her turn to play with KIBO not only demonstrates her generosity, but compassion and patience towards her classmate. Generosity took precedence in her teacher's coding playground, which we see reflected in the generous acts of both students and teacher.

### ***Gratitude***

*Participant T5.* In reflecting on her personal experiences with the ten virtues, this teacher described gratitude as a virtue she experienced frequently throughout the implementation of CAL-KIBO. Her gratitude was especially evident when her students demonstrated curiosity for KIBO, which is illustrated in the following excerpt:

*Gratitude, we are definitely showing lots of gratitude towards the children who are showing um curiosity within the KIBO and with us doing that it shows that more children want to know more about it because they see how excited and stuff and thankful we are for that.*

This teacher's gratitude was sparked by her students' inquisitiveness towards KIBO. In turn, the curiosity her students displayed was being fueled by their teachers' explicit demonstrations of gratitude. Gratitude can act as a powerful catalyst for other virtues, which we see here in the overlapping of gratitude and curiosity. By leveraging gratitude in her coding playground, this teacher was able to foster her students' curiosity and engagement while creating an enriching and positive learning experience surrounding KIBO.

*Participant T6.* While reflecting on his personal experiences with the Palette of Virtues, this teacher expressed his gratitude towards the CAL-KIBO curriculum for providing his students with a new opportunity to expand their knowledge and learning experiences. The novelty and versatility of KIBO cultivated a deep sense of gratitude across both teachers and students. Moreso, the students' appreciation propelled their curiosity and exploration of the endless opportunities KIBO offers:

*Just really being thankful to the curriculum that the kids are really expanding and they're growing and learning and doing more. They're very thankful each time KIBO comes out so they're able to use it. They're able to explore with it, they're able to see what it does and they're so happy and so grateful they always say thank you and bye KIBO when I have to put it away.*

Since the curriculum was only taught once a week in each classroom, each opportunity to explore and play with KIBO sparked both the students' curiosity and gratitude. In turn, their

teacher was grateful that her students were being engaged in a novel way. Both vignettes demonstrate the ways in which teachers can leverage gratitude to foster curiosity in the coding playground, and this method can also be applied to cultivate other virtues in the palette.

### ***Forgiveness***

*Participant T6.* When asked to describe his personal experiences with the Palette of Virtues, this teacher expressed the importance of self-forgiveness in his teaching of CAL-KIBO. His self-forgiveness was especially relevant during times in which researchers from DevTech came to observe him teach, reminding him that they were not there to criticize his teaching methods or mistakes. These experiences helped him instill forgiveness in his students—both for themselves and others—while learning to program. The following excerpt illustrates his own forgiveness, as well as his students, in his coding playground:

*Forgiveness and let them know like really me showing the kids that it's okay if you mess up just got to start again and do it again. Open-mindedness and taking suggestions and you know, allowing you guys into our classroom to observe us, understanding that [it] is just an observation and you're not being judged on the way that we're teaching KIBO. And forgiveness, they always say I'm sorry if something happens, like KIBO's wheel fall off or something while they were doing something, "I'm so sorry, I'm so sorry," but I think it's just because they don't want to break their toy that they love to play with, also they hope that they didn't mess anything up.*

This teacher's forgiveness was promoted by his open-mindedness to suggestions for improving his teaching of CAL-KIBO. Keeping an open mind helped him develop a forgiving mind in the process of learning to program and implement a robotics curriculum. The relationship between these virtues is also demonstrated in his efforts to ingrain forgiveness in his students when they

made mistakes during the coding process. Mistakes are a natural and essential part of learning to code, and by normalizing them in his coding playground, his students could keep an open mind and persevere through their programming projects.

### **Relevance of CAL-KIBO Across Teachers**

The qualitative analysis revealed three themes regarding the relevance of CAL-KIBO to Horizons for Homeless Children. Table 4 documents teachers' excerpts from the post-implementation interview that were related to the following themes: Relevancy to Spanish-Speaking Students, Students' Socioemotional Development, and Students Experiencing Trauma. It is important to note that two participants were excluded from Table 4 due to missing qualitative data on the relevance of CAL-KIBO or because their response did not reflect any of the three themes identified across teachers in the analysis.

Table 4. Relevancy of CAL-KIBO Across Teachers

Participant	Spanish-speaking Students	Socio-emotional Development	Students Exposed to Trauma
T1	<p>"Some of the differences that might be there would be probably the amount of children that they have in their centers [who are] <b>Spanish speaking</b>. Some centers are not fortunate enough to have a Spanish speaking teacher in every classroom, so being able to think outside the box and implement the same curriculum in Spanish, I think that's a big difference between us and some other places."</p>	<p>"It's definitely not meant for kids and my center. You know, I don't think it's meant for them, but it's great that we're opening that door though. I think that it's great, but, as you said, we definitely have kids who have developmental delays. There's so many things happening, so focusing on KIBO is not a priority. Even for us it's not a priority for you to learn how to code. For example, it's a priority that you learn how to <b>regulate your emotions</b>. Especially at the place we are at so yeah, I don't think it was really meant for everyone."</p>	<p>"Our school and the kids we work with are just different. We don't even focus on knowing your numbers and knowing your letters. We do more work on social emotional development because of the kids with <b>trauma</b>."</p>
T3	<p>"We just translated everything. I translated on the spot. We never translated the songs, but when it came to vocabulary, or like given instructions, I would say, first in English and then in <b>Spanish</b>. Or if I was with a group that only spoke Spanish or we just, you know, do it on the spot, read the instructions myself and just quickly, you know, say them in Spanish."</p>	<p>"I haven't worked in a typical center in over 11 years, so I'm really not sure because all I know is the Horizons stuff now. Like if I was to think back to a preschool classroom that I worked with prior to Horizons, we had 20 kids in the classroom, but we didn't have any <b>behavior issues</b> really. There were some IEP developmental delays, but they were minor. Would I see KIBO working in a typical preschool classroom? Absolutely."</p>	
T5		<p>"I would say even when we deal with them our center is known for our work with <b>socioemotional growth</b> in development, so I mean it's helping, it's working, and KIBO could be used in so many different ways between storytelling and just even being a point of calming for the kids. Like it could be a point where a child needs to use KIBO to even calm down in the library or something to relax and just look and make programs. Sometimes kids need something to fidget with their hands, so making a program to help them slow down and think. They think they just calming down and showing us how to make a program, but in all reality it's calming their whole body, the sensory of it, so now that they're able to move on, even after KIBO."</p>	
T6			<p>"Being aware of their cognitive development like you said some are a little developmentally delayed due to <b>trauma</b> and everything so just keeping it at the forefront that some children here are going to present and take in things differently than those that may be a different center, so to speak, so that's that's a must."</p>
T8			
T24		<p>"I think a lot of the <b>social emotional</b> stuff, so anything related to cooperation, but other than that they learn on similar levels to other kids."</p>	

***Relevance to Spanish-speaking Students***

Of the six participants, two participants mentioned the relevance of the curriculum to students at Horizons whose primary language was Spanish. At the time of the evaluation study, CAL-KIBO was only offered in English at Horizons. As a result, both teachers described having to translate the curriculum from English to Spanish since many of their students only spoke Spanish and were just beginning to learn English. One participant described the fortune of working in a center where each classroom had at least one teacher fluent in Spanish and made implementing the curriculum in Spanish a smoother process. In contrast, another participant expressed the challenges of having to teach the curriculum twice in one sitting: once in English and again in Spanish. This participant described that lessons were translated on the spot and only key vocabulary, or instructions were translated from English to Spanish. Songs such as the *Design Process Song* or *Robots Parts Song* during lesson activities were never translated in the interest of time. In addition, students in this teacher's classroom were split into groups based on their primary language and those who were designated to the Spanish-speaking group received a quick translation of the CAL-KIBO lessons.

***Relevance to Students' Socioemotional Development***

All participants described the relevance of CAL-KIBO in relation to the development of their students, primarily their socio-emotional development. Two participants pointed out that their students' socioemotional growth was the main priority in their teaching and felt that the CAL-KIBO curriculum was not relevant to the developmental needs of children at Horizons. One participant expressed her gratitude for the opportunity to introduce her children to coding and robotics but concluded that the curriculum was not well-suited for the children in her classroom or the Horizons center overall. Furthermore, this teacher saw CAL-KIBO as an age-



appropriate tool for teaching children how to code but did not recognize its multipurpose use for supporting the socioemotional development of her students, especially those who faced significant delays in her classroom. Another participant described her students' behavioral issues as a significant barrier to implementing CAL-KIBO in her classroom and only saw the curriculum being successful in a neurotypical preschool classroom. On the other hand, one participant felt that KIBO proved beneficial in promoting the socioemotional development of his students and saw it as both a multimodal tool for promoting student literacy and emotion regulation. Moreover, this teacher saw the potential of KIBO as a self-soothing tool for students who were over-stimulated or agitated and described that the tangibility of KIBO offered a way for his students to fidget with their hands through the process of creating a program to help them slow down.

### ***Relevance to Students Experiencing Trauma***

Many of the children at Horizons have experienced traumatic stress due to housing-related hardship. As such, some teachers felt that the CAL-KIBO curriculum was not relevant to these students given the number of developmental delays they face due to trauma. One participant described that because of the socioemotional emphasis at Horizons, many of the teachers were more concerned with their students' socioemotional development than they were with their academic growth and thought that CAL-KIBO did not align with the school's socioemotional focus. Another participant expressed the importance of considering the developmental delays the children at Horizons face due to trauma in their teaching of CAL-KIBO, and to understand that these students may process information and present their knowledge of KIBO differently than students who have not been exposed to trauma at other preschool centers.

## Chapter Seven: Discussion

### **RQ1: Are there specific virtues that teachers personally experienced while implementing CAL-KIBO?**

The results from the quantitative and narrative analysis revealed that each of the ten virtues was mentioned by at least one teacher during the post-implementation survey, suggesting the relevance of the Palette of Virtues to the teachers at Horizons during the implementation of CAL-KIBO. Some teachers described their experiences with specific virtues in a few words or phrases, while others gave more emphasis to specific virtues, as evident by the in-depth detail teachers provided. This suggests that although the virtues were relevant across all teachers, some virtues were more meaningful to specific teachers, which influenced the modeling and promotion of those virtues in their coding playground. Furthermore, there is a clear pattern of overlap between and among several of the virtues, as illustrated by teachers who experienced two or more virtues simultaneously. The joining of virtues—such as patience and forgiveness or honesty and open-mindedness—in teachers' own reflections on the ways in which the Palette of Virtues manifested in their practice, is noteworthy. Such joining suggests the interconnectedness among the virtues—that some are inextricably linked for teachers in the way they teach CAL-KIBO and what they look for in their students. In other words, teachers could see that students who were patient with their classmates were also forgiving of their mistakes.

### **RQ2: Are teachers intentional about promoting these virtues in their own teaching of CAL-KIBO?**

The results from the narrative analysis revealed that many of the teachers who had personal experiences with the Palette of Virtues were more likely to promote those virtues in their coding playground. Virtues in which teachers placed higher emphasis on encouraged their

modeling and reinforcement of those virtues in their own teaching of CAL-KIBO. We see this demonstrated in several of the vignettes of the teachers at Horizons. Engaging with the virtues in a way that personally resonated with their learning and teaching of a novel robotics curriculum for young children allowed them to prioritize the promotion of these virtues in their coding playground.

**RQ3: Did teachers observe their students displaying these virtues while implementing CAL-KIBO?**

The quantitative and narrative analysis revealed that teachers observed their students displaying many of the virtues during the learning process of CAL-KIBO. The results from the quantitative analysis revealed that both teachers and students experienced and demonstrated similar virtues, but teachers practiced these virtues much more on average compared to their students. The narrative analysis revealed that teachers who personally experienced and intentionally promoted specific virtues in the classroom were more likely to identify the same virtues displayed in their students during the implementation of CAL-KIBO. Additionally, the results revealed that there were moments in which the modeling of certain virtues resulted in students demonstrating behaviors related to different virtues. This finding suggests that the virtues that students demonstrate do not have to necessarily mirror those that teachers reinforce in the coding playground. More specifically, virtues can be leveraged to encourage other virtues—such as the leveraging of gratitude to foster student curiosity—and offers another avenue for teachers to promote these virtues in the classroom.

**RQ4: What is the relevance of CAL-KIBO to the teachers and students at Horizons for Homeless Children?**

The qualitative analysis revealed three themes that captured the relevancy of CAL-KIBO to Horizons for Homeless Children: Spanish-speaking Students, Socio-emotional Development, and Exposure to Trauma. Many of the students enrolled at Horizons primarily spoke Spanish and had little exposure to curriculum taught in English. Some teachers described their frustrations with the curriculum and the challenges of having to translate CAL-KIBO from English to Spanish on the spot. Given the difficulty of not only implementing, but translating robotics lessons to young children, the teachers described that the curriculum was not relevant to the students at Horizons, especially those who face significant developmental delays. The teachers felt that the curriculum, at its core, was greatly focused on teaching young students coding and robotics and did not see the relevancy of the curriculum on students' socioemotional development. In addition, many of the students at Horizons were exposed to traumatic stress as a result of housing-related hardship, and several teachers described that, at times, the curriculum felt disconnected from its socioemotional framework and did not align with the school's core tenet of trauma-informed socio-emotional learning.

### **Limitations of Research**

It is important to note that the Palette of Virtues is a relatively novel element of the CAL pedagogy and the virtues had not been explored in a measurable way prior to the current study. Questions relating to the Palette of Virtues were not asked in teachers' surveys or interviews prior to the implementation of CAL-KIBO. Therefore, the results from this pilot study are exploratory and provide a glimpse into the ways teachers personally experience and intentionally promote these virtues in their practice of CAL-KIBO. Furthermore, several teachers were unable to be scheduled for an interview at post-implementation, resulting in the study's small sample size.

### **Implications and Future Directions**

Implications of this research shed light on the importance of teachers' values in promoting social-emotional development through a pedagogical approach of teaching programming and computational thinking in early childhood. Teachers' explicit reinforcement and modeling of such virtues influences student engagement, learning, and understanding of values in the coding playground and everyday life. Fostering character strengths in early childhood through a robotics curriculum can support both the cognitive and socioemotional growth of children by teaching the necessary technical skills to drive innovation, while also promoting their prosocial behavior and civic engagement.

Despite the limitations of this pilot study, it offers exploratory data for understanding the ways in which teachers personally experience and intentionally promote the virtues in the palette, and how this relates to the virtues students experience and demonstrate. As more schools continue to adopt K-12 computer science standards and frameworks, it is critical to understand how computer science education and technologies can be leveraged to enhance the socioemotional development of young children and cultivate character strengths. In addition, while some teachers at Horizons saw CAL-KIBO as an effective curriculum for promoting the socioemotional development of their students, several teachers did not recognize KIBO as a tool for supporting SEL. As such, directions for future research should consider improving the ways in which the virtues are explicitly embedded into the CAL curriculum. Although some virtues are weaved into the CAL-KIBO lessons, more virtues could be added and explicitly incorporated so that teachers are better prepared to focus on and promote specific virtues in a given lesson. Based on this work, I feel optimistic that future research will continue to improve the integration of socioemotional frameworks into computer science education.

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## Appendix A: Post-Implementation Teacher Interview

### **Before beginning the interview:**

*Thank you for taking the time to speak with us today about your experience with KIBO and the Coding as Another Language curriculum.*

*My name is \_\_\_\_\_ and I am a member of the DevTech research team. Today, I would like to ask you several questions to collect your perspectives on the KIBO Coding as Another Language curriculum, how teachers are prepared and supported to teach this curriculum, and how implementing this curriculum went for you and your students.*

*Please know that there is no “right” answer, and we encourage you to respond to each question. We deeply appreciate your time. Our conversation today will last no longer than one hour.*

*I am recording today’s discussion for the purpose of transcribing your comments for analysis. Please know that all responses will remain confidential. This means that your responses will only be shared with other members of the research team, and we will ensure that any information we include in our report does not identify you as the respondent. You are free to withdraw from this discussion at any time without penalty.*

*Do you have any questions for me before we begin?*

### **Questions:**

#### Logistics

1. Did you teach KIBO in your class during this project time?
2. During which days and times of the week did you teach lessons?
  - a. Probe: Was it the same day/time each week or did it change week-to-week?
  - b. Probe: What activities did this curriculum take the place of?
3. About how many children and adults were in your classroom during these lessons?
  - a. Were the children all in one group or in small groups?
  - b. Were the children in the same grouping for all lessons, or did the groups change between lessons?
4. Did you implement all 30 lessons in the curriculum?

#### Curriculum Implementation

*(if did not teach KIBO at all, only ask about challenges + changes, 4 + 8)*

1. Now that you have completed the coding curriculum, what are your thoughts about KIBO?
  - a. Probe: What were some pros and cons about KIBO for you?
  - b. Probe: What were some pros and cons about KIBO for your students?
2. *[skip if did not teach curriculum]* What are your thoughts about the KIBO Coding as Another Language curriculum?
  - a. Probe: What were some pros and cons about the curriculum for you?
  - b. Probe: What were some pros and cons about the curriculum for your students?
3. What would you say was the highlight of your experience?

4. What would you say were some of the major challenges you faced in implementing this curriculum?
5. Think back on your experience implementing the lessons. What were some teaching strategies you used that seemed to be really effective?
  - a. Probe: Were there any lessons or activities that really captured your students' interests? What were those? What did you do to maintain their interest?
6. What were some teaching strategies you used that were not effective?
  - a. Probe: Were there any lessons or activities that students didn't enjoy or didn't understand? What were those? How did you manage that?
7. How did these activities fit into the rest of your classroom curriculum?
  - a. Probe: Did you notice students talking about KIBO or making connections to KIBO lessons during other parts of the day?
8. What would you recommend changing about the curriculum?
9. If you were asked by a colleague to recommend this coding curriculum, what would you say?

#### Organizational Support

1. In what ways did you feel supported, or not so supported, throughout the curriculum?
  - a. Probe: Describe the type of support received from Tufts and school administrators.
  - b. Probe: Did you have adequate materials and technology?

#### Student Outcomes

*(skip if did not teach KIBO)*

1. The intent of this curriculum is to improve students' Computational Thinking (CT) skills and coding skills. Did you see evidence of this impact in your classrooms?
  - a. Probe: Look at this list of CT skills (show table with 7 powerful ideas + simple definition). Can you describe any specific instances of children displaying their knowledge of these skills when playing with KIBO?

Powerful Idea	Definition
Algorithms	Sequencing/order, logical organization
Modularity	Breaking up larger task into smaller parts, instructions
Control Structures	Recognizing patterns and repetition, cause and effect
Representation	symbolic representation, models
Hardware/Software	Smart objects are not magical, objects are human engineered
Design Process	Problem solving, perseverance, editing/ revision
Debugging	Identifying problems, problem solving, perseverance

2. Another focus of the study is how coding relates to language and literacy. Did you observe any evidence of impact in literacy and language?
  - b. Probe: Look at this list of complementary literacy and language skills. Can you describe any specific instances of children displaying their knowledge of these skills when playing with KIBO?

Powerful Ideas of Computational Thinking	↔	Complementary Concepts in Language & Literacy
Algorithms		Sequencing
Modularity		Phonological Awareness
Control Structures		Literary Devices
Representation		Alphabet and Letter-Sound Correspondence
Hardware/Software		Tools of Communication and Language
Design Process		Writing Process
Debugging		Editing and Audience Awareness

3. Did you observe any evidence of impact in other developmental areas, such as social-emotional learning, motor development, etc.?
  - c. Probe: Can you describe any specific instances of these connections?

- d. Probe: Please look at this list of social emotional behaviors known as positive technological development. Can you describe any specific instances of children demonstrating these behaviors when working with KIBO?

<b>Behavior</b>	<b>Definition</b>
Collaboration	the act of working together towards a shared goal
Communication	the act of initiating and participating in conversations
Content Creation	the act of making purposeful and original projects
Community Building	the act of taking actions to strengthen and promote group cohesion and comradery
Creativity	the act of participating in new and original ways
Choices of Conduct	the act of behaving in ways that promote a respectful, fair, and positive environment

- e. Probe: Please look at this list of example values and virtues. Can you describe any specific instances of children demonstrating these behaviors when working with KIBO?

<b>CURIOSITY</b>	A strong desire to know or learn something; novelty seeking.	<b>FAIRNESS</b>	Impartial and just treatment without favoritism or discrimination; justice
<b>PERSEVERANCE</b>	Persistence in a course of action in spite of difficulty or adversity; determination in pursuing goals.	<b>GENEROSITY</b>	The quality of being kind; giving and receiving, helping self and others
<b>PATIENCE</b>	The capacity to accept or tolerate delay, trouble, or suffering without getting angry or upset	<b>GRATITUDE</b>	The quality of being thankful; readiness to show appreciation; being aware of good things
<b>OPTIMISM</b>	Hopefulness and confidence about the future or a successful outcome; expecting the best.	<b>FORGIVENESS</b>	The action of pardoning and accepting, giving a second chance to self and others
<b>HONESTY</b>	The quality of being honorable; rectitude; uprightness; integrity	<b>OPEN-MINDEDNESS</b>	The quality of being willing to consider ideas, opinions and feelings that are new or different from your own; flexibility in taking different perspectives.

4. Were there other unintended outcomes you noticed in your students associated with your students' participation in this curriculum?  
 a. Probe: What were they?

Teaching Experience [ONLY FOR TEACHERS WHO WERE PRIMARY OR CO-TEACHERS ON AT LEAST HALF OF LESSONS]

(skip if did not teach KIBO)

1. We are also interested in understanding the experiences of teachers teaching coding and robotics. What was your experience teaching KIBO?
  - a. Please take another look at the list of Positive Technological Development behaviors. Can you think of times when you experienced any of these behaviors in yourself or your teaching while teaching KIBO?

<b>Behavior</b>	<b>Definition</b>
Collaboration	the act of working together towards a shared goal
Communication	the act of initiating and participating in conversations
Content Creation	the act of making purposeful and original projects
Community Building	the act of taking actions to strengthen and promote group cohesion and comradery
Creativity	the act of participating in new and original ways
Choices of Conduct	the act of behaving in ways that promote a respectful, fair, and positive environment

- b. Please take a look at this list of example values and virtues. Can you think of times when you personally experienced these values while you were teaching KIBO?

<b>CURIOSITY</b>	A strong desire to know or learn something; novelty seeking.	<b>FAIRNESS</b>	Impartial and just treatment without favoritism or discrimination; justice
<b>PERSEVERANCE</b>	Persistence in a course of action in spite of difficulty or adversity; determination in pursuing goals.	<b>GENEROSITY</b>	The quality of being kind; giving and receiving, helping self and others
<b>PATIENCE</b>	The capacity to accept or tolerate delay, trouble, or suffering without getting angry or upset	<b>GRATITUDE</b>	The quality of being thankful; readiness to show appreciation; being aware of good things
<b>OPTIMISM</b>	Hopefulness and confidence about the future or a successful outcome; expecting the best.	<b>FORGIVENESS</b>	The action of pardoning and accepting, giving a second chance to self and others
<b>HONESTY</b>	The quality of being honorable; rectitude; uprightness; integrity	<b>OPEN-MINDEDNESS</b>	The quality of being willing to consider ideas, opinions and feelings that are new or different from your own; flexibility in taking different perspectives.

- c. In what ways were you intentional about bringing these values or virtues into your own teaching of KIBO?



### Conclusions

5. Would you participate in something like this again?
  - f. Probe: If yes, how would you want your experience to be similar or different?
  - g. Probe: If no, what you recommend changing?
2. The children at Horizons for Homeless Children are experiencing several unique circumstances including homelessness, English language learning, developmental delays, etc. Do you have any observations that you believe would be relevant to children at Horizons but not another early childhood center?
6. What else would you like to share?

### **After the interview:**

*Thank you so much for your time. Are there any other questions you have about our research study, KIBO, or anything else? We are so grateful to learn from you and your experience, and we greatly appreciate your time and efforts in working with us.*

Follow up on any incomplete research activities. Ask if they would like any support or guidance in completing those activities.

**Appendix B: Post-Implementation Teacher Survey**

Start of Block: IRB

Q27 First and Last Name

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ConsentYN Thank you for your participation in our research on the Coding as Another Language (CAL) curriculum. If you have any questions regarding this survey or the entire research study, please refer back to the Tufts Institutional Review Board (IRB)-approved consent form linked [here](#).

This survey will take approximately 10-15 minutes to complete. Your survey responses are confidential, and no individual responses will be shared with your school or division.

Do you provide continued consent to participate in this study by completing this survey?

- Yes (1)
- No (I will be redirected to the end of this survey) (2)

*Skip To: End of Survey If Thank you for your participation in our research on the Coding as Another Language (CAL) curricul... = No (I will be redirected to the end of this survey)*

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Page Break

End of Block: IRB

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Start of Block: Roles

Q36 Which classroom were you primarily in for KIBO lessons?

▼ 251 (2) ... 348 (7)

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Role How often have you had the following roles during the implementation of the CAL KIBO curriculum?

	Majority of lessons (7)	Some lessons (8)	A few lessons (9)	No lessons (10)
I was the lead teacher for the lesson (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I co-taught the lesson with another teacher (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was the supporting teacher for the lesson (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was not present for the lesson (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

End of Block: Roles

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Start of Block: Implementation Feedback

CALRatingOverall Please rate your overall experience implementing the CAL curriculum.

- Needs a lot of improvement (1)
- Needs some improvement (2)
- Met my expectations (3)
- Better than expected (4)
- Couldn't be better (5)



WorkedBestCAL What has worked best in implementing Coding as Another Language?

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MostChallengingCAL What has been most challenging in implementing Coding as Another Language?

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Start of Block: Organizational Support

ResourcesRating Please rate the resources for teaching Coding as Another Language in your classroom.

	Needs a lot of improvement (1)	Needs some improvement (2)	Met my expectations (3)	Better than expected (4)	Couldn't be better (5)
Access to KIBOs (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Coding as Another Language curriculum (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Display This Question:*  
 If Please rate the resources for teaching Coding as Another Language in your classroom. = Needs a lot of improvement  
 Or Please rate the resources for teaching Coding as Another Language in your classroom. = Needs some improvement

ResourcesImprovement If you rated any resources as needing improvement, please tell us why.

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IndividualsRating Please rate the support these individuals have provided in helping you implement the Coding as Another Language curriculum.

	Needs a lot of improvement (1)	Needs some improvement (2)	Met my expectations (3)	Better than expected (4)	Couldn't be better (5)
Tufts Research Team (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Center Administrators (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*Display This Question:*

*If Please rate the support these individuals have provided in helping you implement the Coding as An... = Needs a lot of improvement*

*Or Please rate the support these individuals have provided in helping you implement the Coding as An... = Needs some improvement*

IndivImprovement If you rated the support provided by any individuals as needing improvement, please tell us why.

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EnoughTimeYN Have you had sufficient time to prepare for implementing the Coding as Another Language curriculum?

Yes (1)

No (2)

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*Display This Question:*

*If Have you had sufficient time to prepare for implementing the Coding as Another Language curriculum? = No*

WhyNotEnoughTime If you marked you have not had sufficient time to prepare for implementing the Coding as Another Language curriculum, please briefly explain why.

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**End of Block: Organizational Support**

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**Start of Block: CSEfficacy**

Q38 Please respond to these questions regarding your feelings about your own ability to teach computer science topics.

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Q39 I can explain basic programming concepts to children (e.g., algorithms and loops).

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
- 

Q40 I can plan out the logic for a computer program even if I don't know the specific programming language.

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
- 

Q41 I know where to find the resources to help students learn to code.

- Strongly disagree (1)
- Somewhat disagree (2)
- Neither agree nor disagree (3)
- Somewhat agree (4)
- Strongly agree (5)



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Q42 I can find applications for coding that are relevant for students.

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
- 

Q43 I can integrate coding into my current curriculum.

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
-

Q44 I can help students debug their code.

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
- 

Q45 I can teach KIBO to children.

- Strongly disagree (1)
  - Somewhat disagree (2)
  - Neither agree nor disagree (3)
  - Somewhat agree (4)
  - Strongly agree (5)
-

End of Block: CSEfficacy

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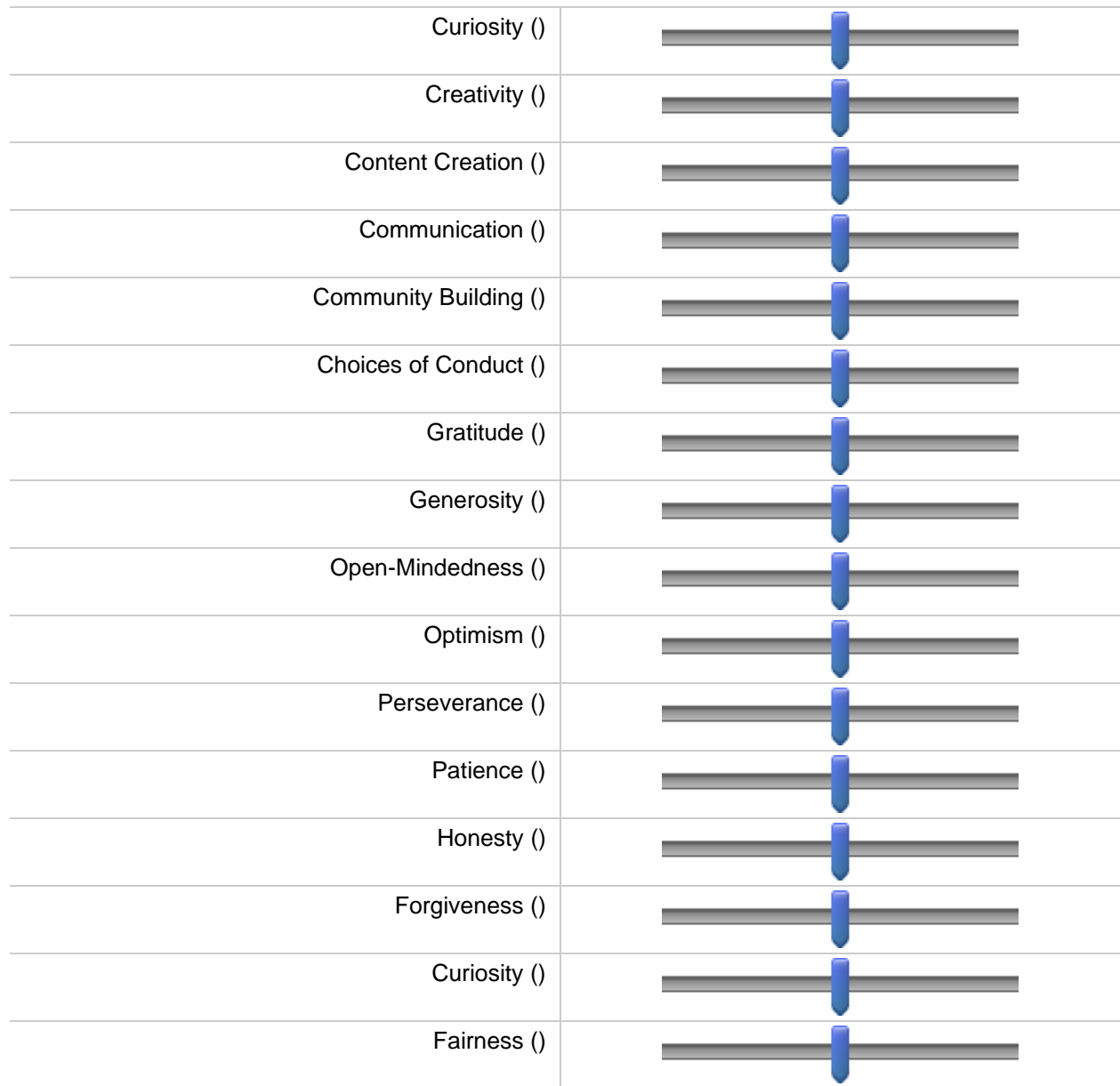
Start of Block: SelfPTDVirtues

Q31 Please take a minute to reflect on **your personal experiences** while teaching the CAL KIBO curriculum.

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SelfPTDVirtues To what extent did you experience each of the following **for yourself** while implementing the CAL KIBO curriculum?

Never Always  
0 10 20 30 40 50 60 70 80 90 100



SelfValuesStory Please provide one or two examples of a time you experienced one of the above.

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AdditionalSelfValues What additional personal values or virtues, if any, did you experience while implementing the CAL curriculum besides those mentioned above?

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End of Block: SelfPTDVirtues

Start of Block: StudentPTDVirtues

Q33 Please take a minute to reflect on **behaviors you observed in your students** while implementing the CAL KIBO curriculum.

StudentsPTDVirtues To what extent did you observe each of the following **in your students** while implementing the CAL KIBO curriculum?

Not at all Always

0 10 20 30 40 50 60 70 80 90 100

Curiosity ()	
Creativity ()	
Content Creation ()	
Communication ()	
Community Building ()	
Choices of Conduct ()	
Gratitude ()	
Generosity ()	
Open-Mindedness ()	
Optimism ()	
Perseverance ()	
Patience ()	
Honesty ()	
Forgiveness ()	
Curiosity ()	
Fairness ()	

ClassValueStory Please provide one or two examples of when you observed one of the above in your students.

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Q35 What additional personal values or virtues, if any, did you observe while implementing the CAL curriculum besides those mentioned above?

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End of Block: StudentPTDVirtues

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