Undergraduate Coaches for Young Learners with Playful Computer Science

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Abstract. Growing interest in computer science (CS) has led to a shortage of qualified educators for K-12 level instruction. Many out-of-school-time computing programs are led by well-intentioned individuals with little formal training in education such as undergraduate students pursuing computing degrees. This results in environments that are often not conducive to learning for students coming from diverse cultural and educational backgrounds. This work describes an approach to address some of these challenges by using undergraduates as coaches in K-12 outreach CS activities for underrepresented students. These coaches are given essential pedagogical training with playful material that allows them to succeed as educators.

Keywords: Computer Science for Young Learners, Playfulness, Undergraduate Coaching for K-12, Underrepresented Students

1 Introduction

Learning computer science (CS) and having computational thinking skills are now considered to be basic skills necessary for young learners to be successful in our technology-driven world. In accordance with this *"CS for All"* movement, providers, schools and districts, funders, and researchers have been working toward the goal of providing quality CS education to all young learners [1]. Numerous CS workshops, computer coding classes and camps, and out-of-school-time (OST) activities have been developed and utilized for K-12 students as a result. However, there is still a significant gap for underrepresented students desiring access to quality CS learning environments [1-4]. Furthermore, current higher education systems are having difficulty providing enough well-trained CS educators for K-12 students due to the high demand for CS professionals in all areas of computing [5].

Many undergraduate students work as teachers or instructors in OST coding camps, workshops, and/or institutions with little guidance about what and how to teach coding or CS. Some undergraduates in computing programs may have enough content knowledge about CS basics and simple programming. However, the wide range of teaching experience and know-how lead the quality of student learning in these environments to be erratic and inconsistent under the best of circumstances. Furthermore, most OST programs and summer camps have been organizations with limited access to underrepresented groups.

We aim to address these challenges by including playfulness as a fundamental factor in OST program design. Including playfulness is our key contribution to improving the engagement and performance of both young learners and undergraduate coaches in OST environments. One of the overarching challenges for educators is how to teach more effectively by increasing student engagement and therefore learning. Our approach is to better engage young learners with hands-on robot activities that are both educational and playful in nature. Undergraduate students coached young learners by following structured preparation and with guidance from college faculty. They then shared their experiences in how to be a better coach, leader, and instructor with other students after the conclusion of our OST program. Coaching and teaching others also improved the ability of the undergraduates to understand and share their knowledge more effectively and efficiently.

This work provides a realistic path showing how to coach young learners by introducing CS and computational thinking skills via targeted programs for undergraduate students. In partnership with a local K-8 dual language immersion school and universities in the New England area in the United States, we have developed and offered a playful OST CS program for Latinx students in grades 4 and 5 specifically. The 8-week OST CS program has been designed to provide young learners a perspective on exploring broader CS and computational thinking concepts through a playful coding and robotics experience. Concurrently, we designed the model for our undergraduate students to be prepared to coach other young CS learners. This paper in particular focuses on how to best engage undergraduate students in the teaching and learning process as coaches in playful CS environments for young learners.

Section 2 provides background information and work on CS education in K-12 students generally, and playfulness and coaching in particular. Section 3 describes the playful CS OST program for young learners that we have offered in partnership with a local K-8 school. Section 4 provides details of how we incorporated coaches into the program while ensuring the success of the program, the coaches, and the young learners. Section 5 outlines the exploratory qualitative study used to evaluate coaching and playfulness for this program, followed by the results of that study in Section 6. Section 7 concludes the paper.

2 CS in K-12

As CS becomes interweaved with other science disciplines and education, K-12 educators are looking for ways to ensure that students are both prepared for and inspired

by CS learning. Because CS is a relatively new and evolving discipline and the current CS teacher certification system is not robust yet, teachers who do not have a CS background, or only limited CS experience, often teach CS courses in the U.S. [6]. After extensive research about teaching requirements in general, Shulman and his colleagues identified some types of knowledge for teachers to have, including content knowledge, knowledge of learners, and pedagogical content knowledge [7]. The CS Teachers Association (CSTA) certification task force report [8] provides several possible pathways to be CS teachers along with requirements in detail. However, the current education system still does not provide enough skilled CS educators for K-12 schools due to the high demand for such positions. The Pre-College computer science education survey report [9] emphasizes a balance between structured activities and student exploration for effective teaching and learning, with highlights on pedagogical techniques and activity sequences. Workforce development for CS teachers is an essential issue for successful CS education in K-12.

2.1 Playfulness

Playfulness is at once both an obvious part of learning and something that is often overlooked or dismissed in formal educational settings. Playfulness is one of the major psychological attributes affecting creativity. Research into playfulness and childhood education found that creative and intelligent adolescents demonstrated more playfulness in activities [10-11]. Liberman [10] conceptualized playfulness through investigation of the activities of young children and emphasized the attention to playfulness not only as an individual psychological concept for young people but also its relation to their sociocultural status. Chang [11] also presented that playfulness involves a significant correlation with creativity. Students are more engaged when having fun than when presented with easy but boring activities. As shown in our previous study [12], playfulness in CS activities for beginners is a crucial element to promote positive initial interest in STEM areas and careers. We considered playfulness factors such as peer work, personalization, construction, and play when we developed our weekly topics and hands-on activities. Thus, we designed all lesson plans based on developing and playing a computer or robot game.

2.2 Coaching

There are some differences between teaching and coaching. However, similarities in the role between a teacher and a coach also exist. Many schools and institutes have adopted coaching as a component of support and development. The Center for the Use of Research and Evidence in Education (CUREE) [13] encouraged coaching as a way to inlay advancement. The concept of teaching includes many different related ideas. Teaching takes place in school classrooms for students in that space. Teachers also focus on a specific subject matter, at least at any one given time, so that students can learn that topic. Teachers develop lesson plans and course/curriculum outcomes and bring them into the classroom. Coaching happens mostly for small groups or

individuals. The concept of coaching has been widely used in sport and physical education areas. However, coaching is now being adopted as a way for leadership and learning for teaching. Many coaching models emphasize the importance of care and trust through relationship building [13, 14]. The role of a coach includes multi-roles as a supporter, an initiator, an influencer sharing experience, and a subject matter expert.

This work focuses on the concept of coaching instead of teaching by leveraging coaching to better embrace individuals from underrepresented cultural backgrounds and with a variety of interests in learning. Coaching provides personalized and individual student-centered learning experiences. Coaching includes activities to support learners in expressing what they already know as well as developing new knowledge. This work also includes an exploratory qualitative study to gauge the undergraduate students' experiences as coaches during the 8-week OST program focusing on playfulness in CS learning. The research questions addressed are: 1) In what ways is coaching experience helpful or not helpful for undergraduate students? 2) How does coaching experience for an undergraduate support or not support their own learning? 3) In what ways does playfulness help or not help coaching to be more effective?

3 Playful CS Program for Young Learners

We have designed and developed an 8-week OST course for students in grades 4 and 5 to introduce general concepts of CS such as computing systems, basic networking, algorithms, and programming with *Scratch* [15] and *mBot* robot [16] exercises. By using a block-style graphical programming environment called *mBlock*, our young learners can control the *mBot* robot easily. We deployed our course as part of an OST program at a local K-8 dual language immersion school in Fall 2019 with 6 young learners and 3 undergraduate coaches. Upon completion of this 8-week course, the young learners should be able to: 1) Design and implement a sequence structure program, 2) Develop an application that uses selection and repetition structures, 3) Utilize sensors to develop a robot program, and 4) Explain how to communicate between robots and computers. Table 1 illustrates the weekly schedule for the OST program.

Playfulness in CS activities for beginners is a crucial element to promote positive initial interest and contribute to ongoing motivation in computing areas. When we designed the lesson-plans based on developing and playing a computer or robot game, we also considered playfulness factors such as peer work, personalization, construction, and play [12]. We present findings in what ways playfulness helps coaching to be more effective based on our exploratory qualitative study in Section V and Section VI. Here is a summary of playful approaches used: 1) Interaction: Personalization such as naming and decorating a robot allowed more interactions among team members as well as those between young learner and their coach. By knowing who the learners are and what they are interested in, and sharing the experience with the coaches, everyone in the classroom had an opportunity to get to know

each other and to bridge the gap between them. 2) Engagement: Playfulness had a stronger positive correlation with engagement and sustained student interest. By working with the robots, young learners can play and enjoy our classroom activities simultaneously. 3) More fun, easier teaching: We built all hands-on activities to be fun and simple in instruction by shortening the number of written words and adding images of coding. This approach took the pressure off the more formal teaching and contributed to a more positive learning environment.

Table 1. Weekly Schedule

Week	Topic & Hands-on Activities
1	Introduction to Computer and Programming: About Myself - *Sequence Structure*
2	MAZE Game – *Selection & Repetition*
3	Bounce Game – *Selection & Repetition*
4	Bounce Game (Removing Blocks)– *Function & Operators*
5	Robot Soccer Game – *Networking & Robot Programming*
6	Line Following Game – *Sensors & Uploading*
7	Robot MAZE Game - *Obstacle Detection*
8	CS Showcase – *Robot Program Demo*

4 Learning by Coaching

To accommodate individual and cultural differences of young learners, we included coaching in addition to teaching in this study. Coaching embraces a more personalized and individualized learning experience compared to formal teaching in a traditional classroom setting. Coaching facilitates young learners to show their prior knowledge and experience as well as to cultivate new knowledge.

Table 2. DIR Steps: Guidance for Undergraduate Coaches

Steps		Description	By whom
1	***D**ecision-Making*	Decide CS topics and contexts for young learners	Faculty
2	***D**raft Instructional Materials*	Draft instructional materials and activity ideas	Faculty
3	***D**evelopment*	Develop presentation material and a handout for young learners to work with	Coach
4	***R**eview and **R**evise*	Review and revise instructional materials purposefully and effectively	Faculty & Coach
5	***I**mplement*	Lead/discipline young learners guided by the instructional materials	Faculty & Coach
6	***R**eflect*	Reflect on coaching experience and/or make suggestions for improvement	Faculty & Coach
7	***R**evision*	Revise the activity materials with updates	Faculty & Coach

We designed steps to follow to establish systematic guidance for participating undergraduates in coaching young learners. Table 2 presents the overall procedure including the description and involvement for each step. Our *DIR steps* start with the faculty developing and deciding the CS topics for each session. In the second step, the faculty group develops a draft version of instructional material that includes lecture presentation slides and related hands-on activities. This draft version is then shared and discussed with undergraduate coaches. The coaches further develop the presentation material and hand-outs for young learners to work with, then both faculty and coach groups review together and revise as necessary. Then the coaches participate in running each session with the prepared materials and help young learners during the session. Afterward, there is a reflection step whereby the coach and faculty groups share their experiences, findings, and suggestions for program improvement. If some improvement is necessary, the instructional materials will be updated as appropriate. We repeated these *DIR steps* weekly, starting three weeks before the first meeting with the young learners and finishing after the last week of the OST program. The Figure. 1 presents the flow of these *DIR steps*.

There were two different categories of instructional activities during the implementation of this OST program: one for the young learners, and the other for the participating undergraduate students. In this study, we discussed the instructional activities with the participating undergraduate students.

5 Exploratory Qualitative Study

This study seeks to better understand the undergraduate students' experiences as coaches during our 8-week OST program focusing on playfulness in CS learning. The design of this research aims to determine how people construct their personal reality in their learning environment and what is perceived as real as a result. Hence, this study was designed as an exploratory qualitative study [17, 18]. Exploratory research is a type of research that develops a better understanding of an existing phenomenon and therefore gains more insight into it. Qualitative researchers investigate in depth the nature and structure of the phenomena in question [17]. As Stake [19] described, human beings "are interested in how things work in particular situations". The more we explore human affairs, the more we recognize that things work differently in different situations. Our primary interest is the undergraduate's experience in coaching and how their experience shapes their perception of teaching, so we use an exploratory qualitative study for this research design. Through the exploration of each individual's experience, we can develop a better understanding of how individual experiences contribute to their perception of coaching and learning. Using an exploratory qualitative study allows us to pursue a close-up view of the participants in an open-ended way that sheds light on their experiences beyond simply considering their collective relationships at a less granular level.

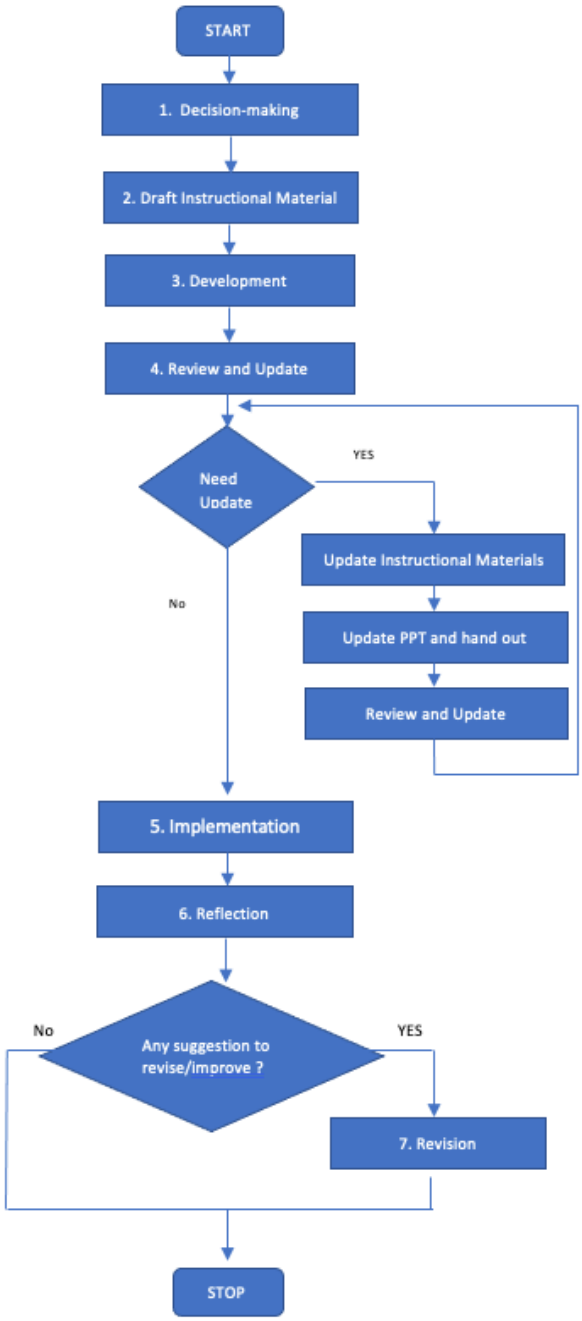

Fig. 1. Flow of DIR Steps for Undergraduate Coaches

5.1 Data Collection

For this exploratory qualitative study, we performed artifact-based interviews [20] with three undergraduate coaches after we completed an 8-week program at a local K-8 dual language immersion school. Artifact-based interviews can help us to gain a greater understanding of the realities of coaching practice by asking the three undergraduate coaches to ground their responses in particular young learner work and class artifacts. We conducted two artifact-based interviews with each coach participant. Each interview took approximately 35-45 minutes. The semi-structured interview format, which includes structures and some questionnaires, also ensures that the participants stay on topic and prompts the interviewer to clarify their views [17]. The artifacts include the first draft of presentation slides prepared by one of the faculty members, the handouts for young learners, the snapshots of block-based programming work, photos of playful activities such as decorating and naming a robot and building and playing robot games.

Three male students, majoring in computer networking, were asked to join as coaches for the OST program and participants for this project. They were conveniently selected by one of the researchers from a pool of students supported by federal work-study funds. They all came to the university directly after graduating high school. Two students are white, and one student is Latinx. We use pseudonyms to refer to each participant: Josh, Mario, and Will. Josh had some experience teaching basic programming language to his peers and younger students when he was a high school student. Mario did not have any teaching or coaching experience before this program. Will taught C programming as an instructor during a summer camp for four weeks when he was a junior in college.

5.2 Qualitative Data Analysis

All interview data were transcribed. We analyzed the data by using constant comparative analysis [21] to developp and identify underlying themes and to develop emergent themes. According to Charmaz [21], researchers develop concepts and emerging themes by analyzing and coding the data based on their personal perspectives as well as their previous and present interactions with others. Qualitative data coding is the process to interpret those data and identify patterns in the dataset. Researchers code data to develop a better understanding of the phenomenon by comparing occurrences applicable to any category and merging categories using the constant comparative analysis method. Codes are labels that assign symbolic meanings to the descriptive or inferential information compiled during a study.

The lead author translated the interview transcripts into a spreadsheet with the following columns: an index number, the name of the interviewee, the transcription of one complete thought or utterance, the codes for that thought, and any additional notes related to that thought. Index numbers were assigned to each utterance for the convenience of analysis and reference. Two authors read the entire set of transcripts, then coded and wrote some brief notes as necessary. The codes were then discussed collectively to facilitate efficiency and to ensure that they fit across the entire dataset.

Keywords were generated based on those discussions to be used in the second round of coding. Finally, the transcripts were recoded, and the dataset completed. The data were read and analyzed multiple times and a few significant themes were readily identified.

6 Findings

We analyzed our interview data and present our findings of this study based on three research questions. 1) In what ways is coaching experience helpful or not helpful for undergraduate students? 2) How does coaching experience for an undergraduate support or not support their own learning? 3) In what ways does playfulness help or not help coaching to be more effective? In the following subsections, we provide example utterances from the two interviews with each participant to support the findings. Each utterance is labeled with *(Interviewee Initial Interview Number, Utterance Number)*. For example, *(J1, 10)* is the 10th utterance of Josh's first interview.

6.1 Coaching

In what ways is coaching experience helpful or not helpful for undergraduate students? We identified the following three helpful fields/skills earned from this coaching experience.

1) Communication and Collaboration: Communication and collaboration skills are important elements in CS and engineering fields. We asked about any changes in interviewees' communication skills after participating in this program. We asked, more specifically, about three different categories of communication: communicating with more knowledgeable people (i.e., faculty in this program), with peers (i.e., other undergraduate coaches), and with young learners. All interviewees responded with positive changes in their ability to communicate in various categories. For example, the discussions with faculty and peers during the *DIR steps* reflection stage had a positive impact on the participants' communication skills, as shown in Table 3 (Communication & Collaboration). We originally assumed that current undergraduate students would feel comfortable communicating with their peers. Interestingly, however, interviewees described their participation in this project as helpful when communicating with their peer undergraduate coaches. The interviewees clearly differentiated communication with their friends and communication with other peers whom they were working with. One of the interviewees described that he never recognized the importance of communication skills in the CS field before this program. He initially said that only administrative or leadership roles require strong communication skills to manage their projects. After this program, however, he emphasized the importance and necessity of communication and collaboration techniques for any CS project.

2) Knowledge of Coaching/Teaching: The undergraduate students were exposed to the basics of pedagogical approaches to teaching and learning. Throughout this process, they began to appreciate the importance of proper teaching preparation. This includes preparing instructional materials, recognizing the state and capabilities of their learners, and ultimately delivering each lesson. The *DIR steps* helped the coaches to consider and prepare the instructional materials to be angled towards young learners. For example, they revised many instructional materials to rely more on visualization with more and larger images and less on text-heavy explanations and directions. In addition, our coaches valued the impact of using robots for young learners in CS.

Table 3. Impact on Communication and Collaboration Skills

Category	**Example Utterance**
Communication	*The year. I think I may be still use too many big words when I'm talking to a younger students- but I feel like. It's certainly improved I was able to shorten what I was saying. Similarly, to my presentations down into some more. Some sentences that were easier to digest for younger learners. Yeah. (J1, 96-98)*
	I would say that we get to interact with young students who are interested in- like- the stuff that you're interested in doing like you went to college for this right so. (W2, 289)
	I'm for I feel like in two of the three my performance significantly improved. I think in terms of communicating with faculty and in terms of communicating with students. Those are areas where I didn't have a lot of experience beforehand- in terms of communicating with like my peers. My other students. I- I don't seen that went up quite so much but that might just be because I knew and I'm still very good friends with both people who I was working with. So, I don't know- I might have seen them just friends as opposed to my students. (J1, 103-107)
Collaboration	*I feel they're more different than same mostly. Because there are more students, and the environment was much different where with a tutor- it'd be one on one- you have like a textbook and then I just teach it. This was more like a group thing. We have we have like the sheets and then we have some computers and then. So, the big takeaway is mostly just the environment and the level that you must like to interact with it. The big thing was it was more And more engaging. (M1, 372-377)*
	I kind of just viewed through the whole thing is like a team endeavor. Um- yeah- no- I didn't really think about leadership skills and I was doing it. (J1, 158)
	I really liked it. Working with the team- but not only seeing how the team works with the students. But how the students work. I like the perspective aspect that I get to see what I like. Put down notes. What I see put down notes- what I don't like. If I miss something. I feel like this like Josh or Will were telling me that this happened, and I never would have known this from me looking at them or you know that's I like I like I like. (M2, 225-230)

3) Learner Awareness: The coaches recognized that different and diverse ways of conveying knowledge are needed to support different groups of learners. They also remarked that it was a good opportunity to learn about a new group of young learners. The following utterance shows what our coaches learned: "*I learned that everyone learns a little differently. And one thing like there's not one thing that fits. Everyone- you have to kind of either give a little more attention here or take them away and then like let them like go on and like explore themselves a little bit. So, it's kind of finding the right balance between that I found." (W1, 77-78)*

6.2 Learning

How does coaching experience for an undergraduate support or not support their own learning? This question is split into three areas below.

***1) Project Operation*:** At the beginning of the project, we set an overall timeline and set up the goals for each week. We checked in on progress with the coaches weekly based on the *DIR steps*. The participants shared that their project management skills in preparing each class and working towards weekly goals have been improved through communication with and direction by the faculty. The Review, Reflect, and Revision *DIR steps* were regarded as the most helpful. Here are two example utterances: *"I felt that was certainly beneficial and that it gave us like a determined start and stop point for each week. For like when work starts when work needs to be done and have like one final go over before we continue." (J1, 140-141) "Yeah um well for me personally- I think that the reflection part after we came back were like- okay- this is how today was. I think that's the most important for kind of like building or constructing any curriculum really or any sort of project." (W1,163-164)*

2) Presentation Skills: The coaches prepared presentations, based on the faculty drafts, for each session during the program. This included thinking about presentation and activity alignment. The coaches then delivered those presentations each week. All participants described that it was helpful to be able to present their ideas in a cogent and concise manner to diverse groups and audiences. "*From being able to be in both positions both working with the students aren't like hands on and being able to like build the presentation slides. I feel like that was beneficial because you can when you're making a slide you make like a lot of little decisions on how it should look, what order they go in. And by working with the students, you can kind of get the sense of what kind of learners they are and what would work best to kind of convey that information and then also working on those with." (W2, 112-114)*

***3) Efficacy Development*:** The coaches developed confidence in their implementation abilities by revising instructional materials each week before and after the weekly session. Our coach interviewees shared their self-efficacy improvement related to teaching CS basics to young learners after our program. *"The time teaching with those students was still valuable to my learning of different skills and refining those skills." (W2, 103) "It was a good experience. It was enjoyable to kind of see something from start to finish. It wasn't kind of like coming into like a project that's like halfway through its contingency plan- we were able to say- Okay- we're going to use these robots. We're going to build these robots. We're going to build these slides and then from kind of like beginning to end. It felt pretty like complete. There wasn't really like with past projects I've worked on for like work or something. I would have loved to see like what the thing I've made is doing now- or- oh- it would have been so much easier." (W1, 127-132)*

6.3 Playfulness

In what ways does playfulness help or not help coaching to be more effective? We asked three specific questions related to playfulness and coaching: 1) How does playfulness make it easier for you to interact with young learners? 2) How do you think robot activities help students engage more? 3) In what ways does playfulness help your coaching to be more effective?

The first robot activity, before any materials were presented about programming or work, the young learners had to make a team, choose their team's name, and give a name to their robot. Then we had a robot decoration session to sustain their interest through contextualization of the robot not just as a thing but as part of their story. Personalization steps such as naming and decorating a robot offered a way to bring the young learner's story into our classroom and consequentially that improved our classroom interactions. *"And I've decorated it I've named it. And now- me and my creation can go and do this task or this thing. I think that really kind of bridges the gap of Just doing something to learn how to do something and doing something because you have sort of a connection to it- I guess." (W1, 243-244)* A coach could ask what the team wanted to call the robot and what they wanted to express through decorating the robot. Through this question, the coach could know what the young learners were interested in and what they cared for. At the same time, coaches can share their own stories and experience. *"It would ask questions of like - why did you do that. So, it was just easier for them to interact. I feel like for the students as well." (M2, 304-305) "I think the big part of relationship building to me came with a after like the lessons that included personalization. We can kind of personally as well ask what and why they're doing something." (M2, 313-314)*

All coaches described that the playful activities with robots worked positively to better engage young learners. We can clearly see how our learners and coaches enjoyed our robot work from the following utterance: *"I feel like- from our perspective- certainly- like the games and whatnot helped it feel more both to us and like fun activity and rather than just- oh- it's a boring CS class." (J2, 170) "I like to- but I just recall that it gave them like the liberty to just do what they want it. It was pretty funny." (M2, 262-263) "I feel like the- the biggest strength would have to just be the way in which its presented. Having the robots as well as like the games that you're playing and creates not only an incentive for the students to want to get there- get their work done- but also, I think it lets them see in a manner which they're familiar with like a robot moving around. How exactly what they're doing is having an impact on the real world- which I think can be difficult when you're explaining CS. I mean- oftentimes the concepts can be very verbose and theoretical for various things so I can definitely see how having a robot and just the overall style of presentation was the most effective part. Mm hmm." (J1, 130-133)*

Mario shared his thoughts that as the role of coach, he is there to support the young learners: *"Yeah- um- I feel like it definitely helped with the interaction- it kind of bridge the gap from- oh- this person is going to sit next to me and tell me what to type on the computer to oh this is someone who isn't just going to tell me what to do. This is someone who can help me create and understands the different parts of this robot and or like what I'm working on." (M2, 223-224)* We wanted all participants in our program including the coaches and young learners to have fun with playful activities. The following utterance shows our playfulness worked positively with all other improvements. *"I recommend this program for students who are interested in*

working with young CS learners. And who have a passion for looking to develop their team skills and teaching skills plus- have fun." (M1, 355-356)

7 Conclusion and Discussion

Higher education systems are having difficulty in providing enough skilled CS educators to support the number of young learners interested in the subject. Our study demonstrates one way that undergraduate students can be coaches for young CS learners by following *DIR steps* in an OST setting. The undergraduate students can work with young learners in learning basic CS concepts and act as coaches who build closer relationships with those young learners.

The COVID-19 pandemic has had an astonishing global impact on almost all activities in the world. Most educational settings had to be transferred to online urgently regardless of student grade level. Even though there were broad discussions and studies about technology use in education, it has been very challenging for educators and students to move from in-person settings to online learning and teaching. However, this challenge is also an opportunity to discuss modernization of education in the digital world. Programming with robots provides an environment to tinker with tangible objects instead of just coding in 2D space. The movement of the robot based on their code brings a vivid and immediately understandable experience to young learners. Playfulness had a stronger positive correlation with engagement and sustained student interest. The time for each session was limited, combined with the age of the young learners, so we planned to introduce very basic CS concepts and terms through simple games. Future work includes research into other types of activities that young learners find playful, engaging, and stimulating.

We do not argue that anyone can teach CS. Instead, we have shown that some basic preparation and pedagogical exposure are enough for an undergraduate student to contribute as an educator for young learners. This approach could be applicable in other STEM areas as well. In addition, developing basic pedagogical knowledge for undergraduate students could be valuable to expand their possible contribution to society in the future.

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