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Exploring Gender Differences in Teacher–Student Interactions during an Adapted Robotics Program for Children with Disabilities

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Abstract: We compared the interactions between teachers and children with disabilities enrolled in an adapted robotics program to examine potential gender differences in these interactions. We coded video recordings from instructional sections of the HB FIRST® robotics program, an adapted robotics program developed through a partnership between a pediatric rehabilitation hospital and FIRST® Canada (For Inspiration and Recognition of Science and Technology). The program consists of 6-weekly, two-hour workshops. We coded videos from four separate single-gender workshops (two all-girls, and two all-boys) involving 22 children aged 6 to 8 years-old. Results revealed that boys and girls display different styles of engagement during the robotics, and teachers' behaviour is functionally responsive to these differences. The differences in the interaction styles of boys and girls identified in this study may contribute to gender differences in students' perceived STEM competence, and ultimately interest in pursuing STEM education and careers.

Keywords: inclusion; gender; STEM; children; education

1. Introduction

Children with disabilities are pervasively under-represented in science, technology, engineering, and math (STEM) education (American Association for the Advancement of Science 2014; National Science Foundation 1996; Thurston et al. 2017). Research shows that students with disabilities are less likely than their peers without disabilities to enroll in science or math classes in high school, or to pursue postsecondary majors in STEM-related fields (American Association for the Advancement of Science 2014; Beck-Winchatz and Riccobono 2008). Youth with disabilities experience many barriers within STEM disciplines. In the classroom, teachers are often reluctant to provide accommodations to support their participation (Lindsay 2011) and students with disabilities face inequitable access to learning content (Mutch-Jones et al. 2012). Moreover, youth with disabilities often receive a lack of encouragement from parents or teachers to pursue a career in a STEM field (Alston and Hampton 2000). In the workplace, individuals with disabilities are faced with both a lack of role models in STEM careers (Lee 2011; Napper et al. 2002), and limited understanding from their employers regarding their disability. These challenges can limit the full participation of youth with disabilities in STEM disciplines.

Women and girls with disabilities are especially under-represented within STEM disciplines. Compared to boys with disabilities, significantly fewer girls with disabilities enroll in postsecondary STEM majors (Lee 2011, 2014), and they are significantly less likely to express interest, strengths, or career goals in STEM fields (Burgstahler and Chang 2007). For example, Lee (2014) reports that among students with disabilities enrolled in a 4-year university STEM major, only 14% were female, while 47% of students with disabilities in non-STEM majors were female. This gender discrepancy among individuals with disabilities mirrors the population as a whole, where women are less likely than male peers to pursue courses, postsecondary majors, or careers in STEM fields (Hango 2013; National Science Foundation 2017; Reinking and Martin 2018). Research has identified several sociocultural factors possibly contributing to gender gaps in STEM, beginning early in development. Factors such as social pressures from parents (Ing 2014), teachers (Gunderson et al. 2012) and peers (Leaper 2015), sex role stereotyping (Roger and Duffield 2000; Steele 1997), and one's self-perception (Eccles 1994; Watt 2005) have been shown to influence the decisions of women and girls to engage in STEM disciplines.

Children spend a substantial amount of time in school, and according to Expectancy–Value Theory (EVT), teachers play a fundamental role in shaping children's self-perception of ability and competence with respect to STEM, and the value they assign to educational and career choices in STEM disciplines (Eccles and Roeser 2011; Wang and Degol 2013). For example, teachers' expectations of students have been shown to influence their students' own self-expectations regarding STEM ability, and their STEM career decision-making self-efficacy (Metheny et al. 2008). Teachers have demonstrated implicit gender stereotypes in their expectations and instructional practices for male and female students, and these stereotypes contribute to gender differences in the choice to pursue STEM education and careers (Voyles et al. 2008).

Interactions between teachers and students are an important part of STEM education, and these interactions are associated with teachers' expectations of students (Jussim et al. 1996), and students' STEM learning outcomes (Liu et al. 2013). Research shows that teacher interactions with children in a robotics course are important for supporting children in the building process, and for helping them to identify and solve problems (Liu et al. 2013). Teacher–student interactions are a significant contributor to gender differences in STEM classrooms, as research demonstrates several gender differences in the type and frequency of these interactions (Duffy et al. 2001; Guzzetti and Williams 1996; Jones and Wheatley 1989; Voyles et al. 2008). Voyles et al. (2008) examined gender differences in teacher–student interactions in single-gender sections of a LEGO® robotics course. After coding videos of the teaching sessions, the authors identified multiple differences between girls and boys in their interactions with teachers. Girls in this study initiated more conversations with teachers, while teachers initiated more conversations with boys. Additionally, teachers engaged in more social interactions with girls, while they engaged in more conversation regarding cooperation with boys. Girls also received more feedback than boys from teachers, and when providing assistance, teachers more frequently did something for girls than boys. Overall, Voyles et al. argue that rather than reflecting an inherent gender bias from teachers, these differences are functional in nature, where teachers are responding to gender differences in students' behaviour.

While gender differences occur in STEM teaching behaviour among typically developing children, these differences have not been explored in the context of STEM teaching for children with disabilities. In fact, not only are gender differences overlooked, most intervention studies aimed at increasing the interest and participation of youth in STEM disciplines have included mostly male participants (Kolne and Lindsay, in review). Over the past 20 years, 13 studies have examined the effects of interventions for developing engagement of youth with disabilities in STEM and also reported the gender distribution of their sample. Of these studies, only four report a sample balanced for gender, while the remaining studies have a sample with mostly male participants (approximately 60% males or greater) (Kolne and Lindsay, in review). Given the substantial under-representation of girls with disabilities in these intervention studies, it has not previously been possible to identify gender differences in teacher–student interactions during programs aimed at increasing engagement of youth with disabilities in STEM disciplines.

The present study examines gender differences in teacher–student interactions during an adapted robotics program for children with disabilities. Robotics programs (e.g., FIRST®) are an effective and increasingly popular approach for developing the interest and skills of youth in STEM disciplines

(Adams and Cook 2013, 2017; Benitti 2012; Conti et al. 2019, 2017). We recently examined changes in STEM interest and engagement after participating in a 6-week LEGO® robotics program, as measured with the STEM activation survey (Dorph et al. 2017; Melchior et al. 2005) (assessing STEM fascination, values, competency belief, and scientific sense-making) among youth with disabilities. Based on the results of this work, we determined that there are benefits to engaging children with disabilities in robotics. In the present study, we further explore this robotics program, examining teacher–student interactions during instructional time, to identify any potential gender differences in these interactions. Specifically, we ask: are there gender differences in the interactions of teachers and students during the instructional portion of a LEGO® robotics program for youth with disabilities?

2. Materials and Methods

To examine the potential gender differences in teacher–student interactions, we coded video recordings of instructional sessions from an adapted LEGO® robotics program for children with disabilities. We used a coding scheme adapted from Voyles et al. (2008) to classify the type and function of interactions between teachers and students. This study received ethical approval from a research ethics board at a children's hospital and a university.

2.1. Description of the Robotics Program

The HB FIRST® robotics program was developed through a partnership between a pediatric rehabilitation hospital and FIRST® Canada (For Inspiration and Recognition of Science and Technology), a non-profit organization operating after-school robotics programs for children (FIRST Robotics Canada 2015). FIRST® Canada aims to engage young people in STEM fields through participation in mentor-based programs that build science, engineering, and technology skills, while developing self-confidence, communication, and leadership skills, and inspiring innovation. Through the partnership between FIRST® Robotics Canada and the pediatric hospital, an adapted, group-based version of the robotics program was created (Lindsay and Hounsell 2017; Lindsay et al. 2019). This adapted robotics program was designed to provide an opportunity for children with disabilities to develop STEM skills while working on therapy goals, and building self-confidence, independence, communication, and teamwork skills (Lindsay et al. 2019). The program consists of a six-week workshop, divided across two-hour weekly sessions, held in a classroom at a children's hospital. The program is divided into two separate age groups, with up to 10 children in any given group. The junior group is designed for children aged 6–8 years, and the intermediate group for children aged 9–14 years. There are two levels within each age group, introductory level for children just starting the program, and a more advanced, team-based version for children with more experience in the program (Lindsay et al. 2019). In response to low participation rates from girls in early iterations of the program, a group for girls exclusively was created, offered at the junior, introductory level.

Children included in the present study were recruited from the junior, introductory level group. Children in this group worked in pairs or groups of three, and each group was assisted by an adult volunteer who has knowledge of robotics or experience working with children who have a disability (Lindsay et al. 2019). There was a clinical staff member from the hospital who provided additional assistance. Each robotics session was led by a teacher, a trained student volunteer, who provided lecture-style instruction on science related concepts, introduced the building activity, and circulated the room during building and programming to provide further assistance.

The structure of weeks one to five was approximately the same, and the sixth week was dedicated to rebuilding the previous models and celebrating the completion of the workshop. In every workshop, sessions one to five started with a "build-to-express" activity, where children were given a topic and could build whatever they liked in response to that topic. After building, children exchanged ideas with their peers on what was built. This opening activity was followed by a short video showing challenges faced by today's scientists, highlighting a problem or phenomenon related to the robot being built that day. For example, on the day where children built helicopters, the video was about natural disasters and described how helicopters deliver supplies or rescue people and animals during floods. These videos were intended to relate the robot-building to a scientific concept with real-world applications. Next, the teacher leading the session provided technical instruction, in an interactive lecture-style, to introduce children to the scientific concepts relevant for the week's building task. The curriculum and lesson plan taught by the teachers was the same across sessions and workshops, and was prescribed in the HB FIRST® robotics junior program curriculum (see Lindsay et al. (2019) for details of the curriculum and lesson plans). Children then built and programed models using WeDO 2.0 while applying math and science concepts (for examples and full description of program see Lindsay et al. (2019)).

2.2. Data Collection and Analysis

We recruited children from a pediatric rehabilitation hospital, all of whom were registered for the HB FIRST® robotics program. As our intention was to examine gender differences in this study, we focused on the two girls-only workshops, and two junior level 1 workshops held in close temporal proximity to the girls-only workshops. We examined videos from a junior, introductory level, girls-only group from spring 2018 and one from fall 2018. As a comparison, we examined videos from the all-gender, junior, introductory level workshops from winter and fall 2018. While the all-gender workshop was open to children of any gender, only boys registered in the winter and fall 2018 workshops, providing two all-girl workshops and two all-boy workshops for comparison in this study. All parents of registered children in these four workshops were given an information package informing them about the study. Researchers answered any questions they had before deciding to take part. Twenty-two children and their parents across the four workshops signed a written consent form and were included in the video coding and analysis for this study.

2.2.1. Video Coding

To identify potential gender differences in teacher–student interactions during STEM instruction, we focused on the portion of the sessions where the leader of the robotics program provided lecture-style instruction on science concepts relevant to what was being built later in the session. The first author coded this section of video for sessions one to five of the included workshops. For each session, coding began after children finished the short video, and ended when children began to build the models. The coding scheme was adapted from Voyles et al. (2008), who coded video data of teacher–student interactions in a robotics course. Codes were added or removed as appropriate for our specific research question, and the nature of the robotics workshop in our study. The videos were coded according to the scheme displayed in Table 1, and one video from each group (four in total, or 20% of all included sessions) was coded by a second member of the research team to ensure reliability. The coding of 20% of the video data by a second coder is consistent with Fischer and Neumann, who suggest at minimum of 10% of video data be coded by two different individuals (Fischer and Neumann 2012). Any discrepancies were reviewed and discussed until a consensus was reached.

Table 1. Coding scheme used to code videos of student–teacher interactions during robotics instruction.

	Code	Description
Teacher speaking turn	Social	Person talk about clothing, family, outside activities, etc.
	Procedural	Talk about what will happen in class or the class rules
	Cooperative	Talk about turn-taking and being a constructive group member
	Instructional	Providing instruction on course material (further subdivided below)
	Question (rhetorical)	Question with no intent for response
	Question (gather information)	Question to elicit information from children
	Asks child to repeat	Asks child to repeat what they said
	Provide info	Statement to provide factual info
	Thinking for	Providing a hint or answer to children
	Response	An explanation in response to a question
	Summarizes	Reiterates what students have learned
	Checks for understanding	Ask students if they understand
	Giving instructions	Providing instructions to students.
	Feedback	Evaluative comment (further subdivided below)
	Indicates correctness	Indicating level of child's correctness
	Praise	Comment indicating for than correctness
	Reassuring	Reassuring the students understanding
	Repeats child	Repeating the child's statement
Child speaking turn	Social	Person talk about clothing, family, outside activities, etc.
	Procedural	Talk about what will happen in class or the class rules
	Cooperative	Talk about turn-taking and being a constructive group member
	Response	Student is responding to the teacher or another student (further subdivided below)
	Indicates correctness	Child indicates their level of understanding
	High-level	Student provides a response and elaborates or provides further information
	Low-level	Student provides a factual response
	Question	Student poses a question to the teacher or the whole class (further subdivided below)
	Repeats	Child repeats what the teacher said
	Clarifies	Child requests clarification from the teacher on something the teacher said
	Information-seeking	The child asks a question to elicit information from the teacher
	Corrects	Child corrects a statement from the teacher
	Unprompted speaking turn	Child speaks, but not a question or a response to the teacher

2.2.2. Data Analysis

Each speaking turn from either the teacher or a student was considered a unit of analysis. Coding frequencies were imported into SPSS, version 15, and we used Chi-square tests to determine whether patterns in the type and function of teacher–student speaking turns were independent of student gender. We performed a Chi-square test to examine the independence of student gender and the function of children's and the teachers' speaking turn, the type of teacher instruction, the type of feedback from teachers, the type of response from children, and the function of children's questions. For all analyses, we summed the frequencies across the workshops and sessions within each gender group. Significance was determined at the 0.05 level for all analyses.

2.3. *Participants*

Children from the HB FIRST® robotics junior, introductory level group were included in this study. These children in the junior group ranged from 6 to 8 years old. There were 22 children across the four workshops included in our study, 8 girls and 14 boys. Most children had a diagnosis of autism spectrum disorder (18), three children had a diagnosis of cerebral palsy, and one child was diagnosed with Duchenne muscular dystrophy. Five children (three girls and two boys) participated in both of the workshops included in our study, and the remaining 17 children participated in only one of the two included workshops.

Three different teachers (all females), who led the robotics sessions, were included in this study. They were student volunteers with extensive experience in robotics and programming, trained on teaching the HB FIRST® robotics program. The first teacher taught all sessions in the all-boys winter

2018 workshop, and session 1 of the all-girls spring 2018 workshop, and the second teacher taught sessions 2–4 of the all-girls spring 2018 workshop. The third teacher taught all five sessions of both the all-boys and all-girls fall 2018 sessions.

3. Results

We conducted Chi-square analyses to test the independence of students' gender in the robotics workshops and the type and functions of speaking turns from both the teacher and children in the program. The Chi-square analysis testing the independence of student gender and the function of the teachers speaking turns was nonsignificant, indicating that students' gender in the workshop is independent from the function of teachers' speaking turns, $\chi^2(4, N = 744) = 7.39$, $p = 0.116$, Cramer's V = 0.10 (see Table 2). However, there was a significant association between student gender and the function of children's speaking turn, $\chi^2(4, N = 262) = 13.40$, $p = 0.009$, Cramer's V = 0.226, and the effect size indicates a medium effect (see Table 3). Specifically, the boys used most of their speaking turns for a response to the teacher (74.4%), while the girls' speaking turns were distributed across social and procedural speaking turns (8.1%), responses to the teacher (56.9%), questions (16.8%), and unprompted speaking turns (18.2%).

Table 2. Chi-square test of independence of gender and function of teacher speaking turn.

Function of Teacher Speaking Turn	Boys		Girls		χ^2 (df)	*p*
	N = 338	% Within Gender	*N* = 406	% Within Gender		
Social	6	1.8	11	2.7	7.39 (4)	0.116
Procedural	31	9.2	43	10.6		
Cooperative	9	2.7	2	0.5		
Instructional	199	58.9	247	60.8		
Feedback	93	27.5	103	25.4		

Table 3. Chi-square test of independence of gender and function of child speaking turn.

Function of Child Speaking Turn	Boys		Girls		χ^2 (df)	*p*
	N = 125	% Within Gender	*N* = 137	% Within Gender		
Social	3	2.4	9	6.6	13.40 (4)	0.009
Procedural	0	0	2	1.5		
Response	93	74.4	78	56.9		
Question	8	6.4	23	16.8		
Unprompted speaking turn	21	16.8	25	18.2		

With respect to the type of instructional speaking turns, a significant association was found between student gender and the type of teacher instruction, $\chi^2(8, N = 448) = 46.32$, $p = 0.000$, Cramer's V = 0.322, and the effect size indicates a large effect (see Table 4). Gender differences were identified among the types of instructional speaking turns used by teachers. The standardized residuals indicate that teachers asked the boys significantly more information-gathering questions (3.1) and fewer rhetorical questions (−2.2) than expected by chance. Conversely, the teachers asked girls significantly fewer information gathering questions (−2.6) and more rhetorical questions (2.0) than expected by chance. Significant differences by gender were also identified with respect to the type of feedback provided by teachers, $\chi^2(3, N = 196) = 13.08$, $p = 0.004$, Cramer's V = 0.258, indicating a medium effect (see Table 5). The teachers repeated more of the boys' speaking turns (46.2%) and fewer of the girls' speaking turns (24.3%) than expected by chance. Fewer boys and more girls than expected by chance received praise, reassurance, and indications of correctness. Finally, gender differences were identified among the type of response from the child and their gender $\chi^2(2, N = 168) = 6.53$, $p = 0.038$, Cramer's V = 0.197 (see Table 6), and effect size for this association indicates a small effect. Fewer boys and more girls than expected by chance provided responses that were high level (6.7% and 15.4%, respectively) and indicate correctness (7.8% and 15.4%, respectively), while more boys and fewer girls than expected by chance provided a low-level response (85.6% and 69.2%, respectively). We were unable to examine the independence of gender and the type of question asked by children with a Chi-square test, as 62.5% of cells had an expected count less than 5. Most of the questions asked were asking for clarification (55.9%, 63.6% within boys, and 52.2% within girls), followed by 23.5% of questions asking the teacher to repeat (27.3% within boys, 21.7% within girls).

Table 4. Chi-square test of independence of gender and type of instruction from teacher.

Type of Instruction	Boys		Girls		χ^2 (df)	*p*
	N = 199	% Within Gender	*N* = 249	% Within Gender		
Question (rhetorical)	2	1.0	17	6.8	46.32 (8)	0.000
Question (gather information)	89	44.7	55	22.1		
Provide info	47	23.6	90	36.1		
Thinking for	28	14.1	19	7.6		
Response	5	2.5	18	7.2		
Summarize	5	2.5	5	2.0		
Check understanding	14	7.0	33	13.3		
Give instruction	9	4.5	11	4.4		
Ask child to repeat	0	0	1	0.4		

Table 5. Chi-square test of independence of gender and type of feedback from teacher.

Type of Feedback	Boys		Girls		χ^2 (df)	*p*
	N = 93	% Within Gender	*N* = 103	% Within Gender		
Praise	8	8.6	21	20.4	13.08 (3)	0.004
Reassuring	3	3.2	7	6.8		
Repeats child	43	46.2	25	24.3		
Indicate correctness	39	41.9	50	48.5		

Table 6. Chi-square test of independence of gender and type of response from child.

Type of Feedback	Boys		Girls		χ^2 (df)	*p*
	N = 90	% Within Gender	*N* = 78	% Within Gender		
Low-level	77		54	69.2	6.53 (2)	0.038
High-level	6	6.7	12	15.4		
Indicates understanding	7	7.8	12	15.4		

4. Discussion

This study examined gender differences in teacher–student interactions among youth with disabilities in a robotics course, and provides much-needed insight into the differential experiences of boys and girls with disabilities engaging in STEM education. Research among typically-developing children has identified gender differences in teachers' communication with students, where teachers engaged in more social talk and feedback with girls and more procedural talk with boys (Voyles et al. 2008). However, in this study, we do not find an association between the function of teachers' speaking turns and students' gender in the workshop. This is a promising finding, as it suggests the way teachers provide instruction in an adapted robotics course for youth with disabilities is independent of students' gender in the course.

While we did not find an association between student gender and the function of the teachers' speaking turns, we did find gender differences in the function of children's speaking turns. Children in the all-boys workshop provided more responses to the teachers, while children in the all-girls workshop had more social and procedural speaking turns, asked more questions, and provided more unprompted speaking turns. This pattern of results suggests there are gender differences in the way boys and girls with disabilities engage in a robotics program. The fact that the majority of boys' speaking turns were responses to the teacher indicates a more passive engagement during robotics instruction, where boys primarily speak only when prompted, in direct response to a teacher's question. On the other hand, the girls display more variation in their speaking turns. The girls speak more without being prompted by the teacher and they ask more questions, suggesting a more active engagement with the teachers during instruction. The types of responses provided by children to teachers further support gender differences in level of engagement. Boys provided more low-level responses to teachers' questions, while girls provided more high-level responses and responses indicating understanding. The boys are interacting with teachers in a reactive way, providing a minimal amount of detail, only when prompted. Alternatively, girls are more interactive with teachers, expanding the discussion, and providing feedback on their level of understanding. These gender differences in interaction style are consistent with findings from typically developing children showing that, during robotics lessons, girls ask more questions and initiate more conversation in STEM classrooms (Kucuk and Sisman 2017; Lee 1993; Voyles et al. 2008).

When we examined the types of instruction and feedback provided by teachers, gender differences emerged that seem to align with gender differences in children's interaction style. Teachers asked the boys more questions to gather information, while they asked the girls more rhetorical questions, with no response expected. It is possible the teachers asked more questions of the boys to counter their passive role, trying to elicit more interaction during the lesson. Given that the girls were observed to be more actively engaged during the lesson, the use of rhetorical questions seems to reflect a method of confirming the understanding that the girls display in their speaking turns. Teachers also confirmed understanding through their feedback to girls, as they provided more indications of correctness, praise, and reassurance.

Overall, gender differences observed in the types of instruction and feedback used by teachers seem to be in response to the differences in the level of engagement observed between boys and girls in the robotics lesson. The speaking turns displayed by the boys suggests they are passive and reactive when interacting with teachers. They are unlikely to have a speaking turn without being prompted, and they provide minimal detail when they are directly prompted to provide a speaking turn. Accordingly, in the all-boys workshop, the teachers provided more prompts to gather information and feedback to elicit further speaking turns. On the other hand, the speaking turns used by the girls indicate interactive engagement in the robotics lesson, providing more unprompted contributions to the lesson, and high-level responses to teacher questions. Thus, the teachers in the all-girls workshop were less likely to prompt speaking turns, and instead they provide confirmation of the girls' understanding. These findings are consistent with research showing that, rather than reflecting gender bias, gender differences in teacher–student interaction reflect a functional response from the teachers to differences in the behaviours of boys and girls (Altermatt et al. 1998; Voyles et al. 2008; Younger et al. 1999).

4.1. Limitations

There are some limitations to consider with respect to the design and interpretation of this study. First, we have dichotomized gender for our analysis, but research has shown there is overlap between gender groups, and variation within gender in the interactions of students and teachers (Brickhouse et al. 2000; Lansford and Parker 1999; Younger et al. 1999). Given that we did not examine variation within gender, nor did we identify the contributions of individual students, it is difficult to determine if the student behaviours are representative of the entire gender group. Additionally, the individual teachers varied both across and within workshops, so we cannot assess the extent to which differences in teachers' behaviour resulted from idiosyncrasies in the instruction style of the teachers. We have only considered single-gender groups in this study, limiting the generalizability of our findings. Specifically, we are unable to comment on differences between boys and girls in their interactions with teachers in the context of a mixed-gender classroom. Furthermore, while we have focused on student–teacher interaction during the instructional portion of the robotics program, these interactions could also be explored within the building and programming portions of the program to capture a more robust depiction of the student–teacher interactions. Finally, we do not include a STEM-related outcome in this analysis, so we are unable to determine the effects of gender differences identified on STEM knowledge, skills, or interest.

4.2. Implications

The gender differences in student–teacher interactions found in this study have important implications for engaging children with disabilities in STEM education. According to the EVT, teachers have an important role in shaping their students' self-perceived competence and ability in STEM, and their STEM educational and career choices. More specifically, teachers' interactions with students have been shown to influence students' STEM learning outcomes (Liu et al. 2013), and the development of STEM interest (Jussim et al. 1996). Thus, the differences in the interaction styles of boys and girls identified in this study may contribute to gender differences in students' perceived STEM competence, and ultimately interest in pursuing STEM education and careers. It is important that STEM educators are aware of the potential for gender differences in their students' interaction and engagement styles during STEM instruction, so that they can create a learning environment that encourages consistency in the student–teacher interactions across gender. Future studies to examine the effects of student–teacher interactions on STEM outcomes are necessary, so that the best interaction style can be facilitated for all children.

5. Conclusions

This was the first study to examine gender differences in the student-teacher interactions during STEM instruction among children with disabilities. We found that boys and girls differ in their level of engagement with teachers, and that the teachers' behaviour seems to functionally respond to these differences. Children in the all-boys workshop demonstrated passive engagement, providing mostly low-level responses to the teachers' many prompts for participation, while the girls werewe more interactive during instruction, providing speaking turns without being prompted by the teacher, and more high-level responses to teacher questions. In response, teachers ask fewer questions of the girls to elicit speaking turns, instead they provide feedback through indicate correctness, praise, and reassurance. To further clarify gender differences among children with disabilities in an adapted robotics program, future research should examine student–teacher interactions within a mixed-gender program, considering the variation of student behaviour within gender, and systematically controlling for differences across program teachers.

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