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Parental Engagement with Children in Computational Thinking (CT) Workshops for Mathematics Education

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ABSTRACT

This study explored the nature of engagement of parents with their children in computational thinking (CT) activities in mathematics education. It specifically investigated the ways that parents interacted during CT workshops, as well as the role, benefits and challenges of parental engagement with their children. This study utilized qualitative methodologies to investigate the dynamics of parental engagement with their children, with a specific focus on interactions between parents and children during CT activities. The research methods that were used to collect data from the field were observations, interviews, and reflection forms from eight pairs of parents and children in CT workshops. All parents expressed that the CT activities enhanced their understanding of mathematical topics and motivated them to collaborate with their children, and also CT workshops enhanced children's understanding of mathematical concepts during these workshops. The sampling was restricted to parents of a certain private primary school. Thus, for future studies, the researchers recommended conducting CT workshops for more than one school and doing one activity each day instead of all three activities in one session. Also to offer specific CT tools to conduct studies in depth.

الكلمات المفتاحية:

التفكير الحسابي **(CT)**
تعليم الرياضيات
مشاركة الوالدين

ملخص

استكشفت الدراسة الحالية طبيعة مشاركة الآباء مع أطفالهم في أنشطة التفكير الحسابي في تعليم الرياضيات. وبحثت بشكل خاص في الطرق التي يتفاعل بها الآباء أثناء ورش عمل التفكير الحسابي، فضلاً عن دور وفوائد وتحديات مشاركة الوالدين مع أطفالهم. استخدمت هذه الدراسة مناهج نوعية للتحقيق في ديناميكيات مشاركة الوالدين مع أطفالهم، مع التركيز بشكل خاص على التفاعلات بين الآباء والأطفال أثناء أنشطة التفكير الحسابي. كانت طرق البحث المستخدمة لجمع البيانات من الميدان عبارة عن ملاحظات ومقابلات من ثمانية أزواج من الآباء والأطفال في ورش عمل التفكير الحسابي. أعرب جميع الآباء عن أن أنشطة التفكير الحسابي عززت فهمهم للموضوعات الرياضية وحفزتهم على التعاون مع أطفالهم، كما عززت ورش عمل التفكير الحسابي فهم الأطفال للمفاهيم الرياضية خلال هذه الورش. اقتصرت العينة على أولياء أمور مدرسة ابتدائية. أوصى الباحثون بإجراء ورش عمل التفكير الحسابي لأكثر من مدرسة، والقيام بنشاط واحد كل يوم بدلاً من الأنشطة الثلاثة في جلسة واحدة. أيضًا لتقديم أدوات تفكير حسابي محددة لإجراء دراسات متعمقة.

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1 Introduction

Parents have an important role in supporting their children in their academic journey. Parental engagement in school is a beneficial way to assist children's learning, and it helps to examine and enhance positive learning relationships between parents and children. (Zuod, 2019). Simultaneously including computational thinking (CT) in mathematics instruction can be advantageous, as CT encompasses an advanced range of abilities. The idea of CT originated in the 1950s, and the first usage of the term CT was by Papert (1980). According to Wing (2006), it is asserted that in the middle of the 21st Century, CT would be considered one of the fundamental abilities utilized by students.

This research aims to examine parental engagement in CT activities with their children, as well as the benefits and challenges of parental involvement in CT activities. Also, it seeks to understand the views of parents regarding their involvement in CT activities in the domain of mathematics education. It involves conducting workshops for parents working with their children in elementary school. This research seeks to study the role of parents in supporting their children in learning mathematics through CT activities. Thus, this study is unique as it focuses on the role of parents in doing CT activities in mathematics education in children's classrooms. The workshops are centered around CT activities in mathematics education, which were developed by Namukasa (2017) and Gadanidis (2017). Grover and Pea (2013) see the use of "computational thinking in the instruction of school mathematics" as a potentially successful method for teaching mathematics. This approach has the potential to increase student involvement, decrease feelings of intimidation, and boost accessibility to the subject.

Marshal et al. (2010) noticed that parents play some major roles in supporting their children in their learning of mathematics which encourages parental engagement in their children's learning, and stresses the essential role of parents in their children's learning (Betts & Son, 2024). However, in some cases, parents do not support their children in mathematics learning (Marshal et al., 2010). This study aimed to involve parents with their children in their mathematics learning as Silver et al. (2024) found positive mathematics performance for students when parents engage with them in their learning. Furthermore, Masek et al. (2024) mentioned that mathematics is a difficult subject so there is a need for parents to interfere to make it more familiar for their children. Consequently, with changing curriculum, there is an increasing demand to build capability among parents to reinforce their children's learning when teachers are teaching students employing new techniques or teaching more advanced content. Thus, the CT workshop which was conducted in this study is an example to incorporate parents with their children in mathematics learning by using apps and robots.

1.1 Contribution and Involvement of Parents

Academic research on parental contributions and involvement in students' learning encompasses a broad spectrum of subjects. The topics covered are parental engagement in teaching their children, the advantages of parental contributions and involvement, the significance of parental involvement, and different styles of parental involvement. The researchers chose to examine parental engagement as a component of the study within the framework of CT activities. Curzon (2014), Gadanidis et al. (2017), Farris and Sengupta (2014), Kotsopoulos et al. (2017), and Namukasa et al. (2017) investigated the implementation of CT tasks in classroom teaching. Their study centered around investigating the integration of CT and mathematical reasoning in K-8 educational environments. However, none of these studies expressly highlighted the importance of parental participation concerning children's CT activities. Thus, Zuod and Namukasa (2023) noticed the usage of CT tools and activities improved mathematics learning by increasing engagement, effectiveness, and accessibility, especially in advanced mathematics. A recent study conducted by Silver et al. (2024) emphasized the increasing attention given to the influence of parents' mathematical discussions on their children's mathematical capacity. They discovered a positive correlation between parents' mathematical conversations and their children's mathematical skills.

1.2 The Role of Parents in Teaching their Children

According to Civil et al. (2008), parents consistently educate their children using the same ways that they were taught during their childhood. Many parents face challenges when they support children who are learning in untraditional ways. As development of curriculum and teaching procedures, there is a need to improve the skills of parents by using parental guides, such as "Doing Mathematics with Your Child, Kindergarten to Grade 6 (2014)", which are given to parents by school board offices in Canada. Studies in mathematics education have found that parents pass on their fear of mathematics to their children by openly admitting their lack of skill in the subject or by asserting that mathematics is difficult or not applicable in real-world situations (Ontario Ministry of Education, 2014).

Epstein (1987) stated that recent research completed in the past two decades suggested that children derive academic advantages when their parents provide motivation and assistance in their education. The extent of support that parents provide to their children varies depending on cultural standards, socio-economic status, and other household characteristics. For example, families with academically successful students would have given priority and emphasized outstanding performance and accomplishments in their children starting from a young age. Liang (2013) focused primarily on how the different attributes of families affect their children's mathematics education. Liang (2013) examined the level of involvement of Chinese immigrant families in their children's mathematics education. The study conducted by Liang (2013) revealed that families can have an impact on children's mathematics education, irrespective of their direct involvement with schools or interaction with teachers.

Sometimes, teachers offer additional exercises to students who need to improve and enhance their skills. However, this requires more effort from students. Parents may choose to participate in tutoring activities for their children, although this choice depends on the financial income of the family. Nevertheless, it is important to realize that engaging in these activities may influence students' time that could otherwise be dedicated to other household responsibilities. In addition, parents and educators can employ social media as a method of consistent communication regarding the intellectual advancement of children, both inside the school environment and at home. However, some parents may not view social media as a handy medium for such objectives. Civil et al. (2008) mentioned that immigrant families face a difference between their ambitions for their children's education and the actual circumstances. This is because they frequently fail to consider the potential barriers and advantages that students experience due to cultural differences, social inequities, and linguistic diversity. Hence, Hinojosa and Bonner (2024) recollected. Further empirical study should be undertaken to investigate programs that enhance parents' comprehension of mathematics beyond the conventional educational setting.

1.3 The Benefits Of Parental/Guardian Involvement

Hoover-Dempsey, Walker, Jones, and Reed (2002) found a positive association between parental participation and improved academic performance in children and adolescents. Van Voorhis et al. (2013) classified family participation in promoting students' mathematical learning into four distinct categories: family involvement in school events, family involvement in students' academic activities at home, parental assistance in children's home-based tasks, and family engagement at home without any direct contact with the school. For example, focusing on educational activities for children at home, in partnership with their parents, improves their mathematical ability and understanding of mathematical principles (Civil et al., 2008). The school plays a vital role in fostering family engagement by actively facilitating the involvement of students' families and emphasizing parents' participation in the learning process. Liang (2013) asserted that parents possess the capacity to provide instructors for their children. Sopiah (2021) stated that there is a strong relationship between parenting methods and self-efficacy about student academic achievement. Further, Eden et al. (2024) mentioned that the active act of parental engagement in their children's learning improves students' academic performance and improves the social-emotional development of children.

According to Hoover-Dempsey et al. (2002), there is a correlation between parental participation and enhanced academic performance in children. Van Voorhis et al. (2013) categorized family involvement in supporting students' mathematics learning into four categories: family engagement in school activities, family engagement in school activities brought home by students, parental support of home activities for their children, and family engagement at home without school contact. For instance, directing attention toward educational activities for children at home in collaboration with their parents enhances their proficiency in mathematics education (Civil et al., 2008). Thus, the school has a role in promoting family engagement by actively supporting and focusing on parents' participation in the learning process.

1.4 Integration of CT into Mathematics Education

According to Wing (2006), CT refers to the processes of defining a problem and describing its solution in a manner that can be efficiently executed by a computer, whether it is operated by a human or a machine (p.7). Kalelioğlu et al. (2016) defined CT as a cognitive process that involves identifying problems and devising computational processes and algorithms to solve them. KALELİOĞLU et al. (2016) further suggested that a crucial aspect of the thought process is identifying suitable models for defining the problem and determining its solutions. Furthermore, Sanford and Naidu (2016) asserted that the utilization of digital computers for mathematical modeling in contemporary times is intricately linked to the expansion of knowledge frontiers across many fields of study, and CT skills are more likely to excel in problem-solving across several domains (Denning, 2017).

Resnick (1995) stated that CT has a substantial impact on both individuals' computer usage and their cognitive processes in understanding and interpreting the world (p. 31). When students engage in CT, they can develop a profound understanding of abstract concepts by encouraging the application of real-world scenarios to their thought processes. Sanford and Naidu (2016) argued that incorporating CT concepts into our daily lives is essential for enhancing the quality of life in contemporary society. However, Brennan and Resnick (2012) mentioned that students faced some difficulties when they were working on CT activities, especially at the beginning of the activities. Nonetheless, Wing (2006) argued that CT will be an important skill in the 21st century. Sanford and Naidu (2016) argued that CT exercises have broader implications beyond the classroom, proposing that both students and parents can utilize them.

2 Methodology

This is a qualitative study. Qualitative research methods provide researchers with an opportunity to get a more comprehensive insight and knowledge of their participants and the complexity of the research subject (Creswell, 2015). Specifically, this research employs a case study methodology. The data for this study was collected from CT parent-child workshops held at a private school in Canada. Children in Grades 3 to 6, along with their parents, were asked to take part in CT workshops that were separated into two sessions. For more clarification, see Tables 1 & 2 below:

Table 1. *Description of Participants in the Workshop*

(Parent-Child) and Teachers	Gender	Grade	First/Second session	Interviewed (Yes or No)
Pair 1	Mom, Boy	3	First session	Interviewed
Pair 2	Mom, 2 Boys	4	First session	Interviewed
Pair 3	Dad, Boy	6	Second session	Interviewed
Pair 4	Dad, Girl	5	Second session	Interviewed
Pair 5	Mom, Girl	3	First session	Interviewed
Pair 6	Mom, Boy	4	First session	Interviewed

Pair 7	Mom, Boy	4	First session	Interviewed
Pair 8	Grandma, 2 Boys	5	Second session	Not Interviewed

Table 2. *Outline of the workshop*

Workshops /Content	Day	Time	Activity	Resources
Workshop 1	Day 1 Grades 3 & 4	1 hour 15 minutes	1. Symmetry activity 2. Sphero	http://researchideas.ca/sym/s2/
Workshop 2	Day 2 Grades 5 & 6	1 hour 15 minutes	3. Scratch program	https://scratch.mit.edu/projects

Observation data would enable researchers to accurately comprehend and analyze the reported case. As a result, researchers collected data through firsthand observation in a social and interactive setting, and they documented thorough observations during and after the workshop. They also conducted an interactive interview. Parents were interviewed to evaluate their level of commitment and preparedness to participate. Students were surveyed regarding their involvement and personal encounters in CT activities. Following the completion of the program, parents were requested to fill out reflection sheets.

3 Findings

In this section, a detailed account of the participants' learning, engagement, and interactions during the CT activities is provided. This was done by analyzing observations, reflection forms, and interviews. The report included a description of how participants learned mathematics and CT, how they collaborated, the level of engagement displayed during the session, as well as their perspectives and suggestions.

3.1 Learning of Math and CT

Parents provided feedback on the workshop regarding the arithmetic concepts taught, the coding skills acquired, the combined study of math and coding, and the instructional approach to math. For instance, Pair 1 (mom) stated that this session enjoyably enhanced mathematical concepts by teaching them how to do math. It involved a combination of playing and studying at the same time. Pair 2 (mom) emphasized the advantages of learning mathematical concepts, highlighting that this exercise is an exceptional means of acquiring math skills. Pair 3 (dad) stated that to design a square, one must understand that all of its edges have the same length and that all of its angles are equal. This knowledge is interconnected with various other concepts. "I am highly intrigued by the concept of robots as it greatly captivates my son," Pair 4 (dad) instructed: "Regarding the triangle, please draw a triangle and a hexagon." Pair 5 (mom) described the workshop as "highly captivating." Pair 6 (mom) remarked that understanding the concept is the main point. Once you grasp the concept and understand its functionality, it becomes easier, possibly due to its novelty. Pair 7 (mom) indicated that the exercises in the workshop offer a comprehension of the principles, while Pair 8 (grandma) conveyed that the method is innovative.

Parents from pairings 1 to 8 felt it beneficial for improving their comprehension of mathematical concepts. They displayed a positive attitude towards the subject. During researchers' observation, parents enthusiastically engaged in CT activities and actively sought to gain new knowledge from them.

3.2 Parents' Engagement During the Session

Parents engagement. While observing children during the workshop, It was noticed that the amount of involvement differed among pairs. Specifically, pairings 1, 2, 3, 4, 5, 6, and 7 exhibited a high level of engagement with their parents during the activities. However, Pair 8 showed a low level of engagement with their parent, when the grandmother exhibited a negative attitude, all the pairs were working together and supporting one other in their tasks. For example, she ignored the activities of her grandkids. She did not get involved with her grandkids. In addition, the degree of parental involvement with their children was modest for Pair 1, Pair 5, and Pair 6, with parents mainly monitoring their children's activities. The amount of parental involvement with their children was found to be high in Pair 2, Pair 3, Pair 4, and Pair 7, as they displayed rigorous compliance with instructions and active participation in their children's activities. The parent of Pair 8 had limited engagement since it was noted that the grandchildren were dutifully following the instructions and participating in the activities without any assistance from their grandma. As a result, the degree of participation within each pair varied, ranging from minimal to significant.

Figures 1. *Parents actively participated with their children during the Sphero Activity 1 workshop*

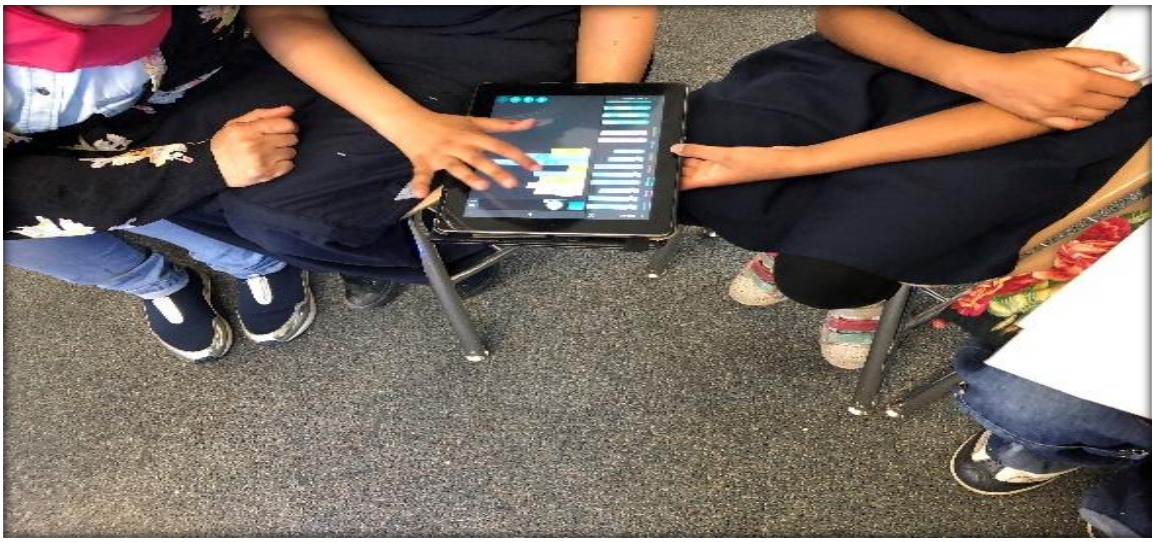

Figure 2. *Parents actively participated with their children during the Sphero Activity 2 workshop*.

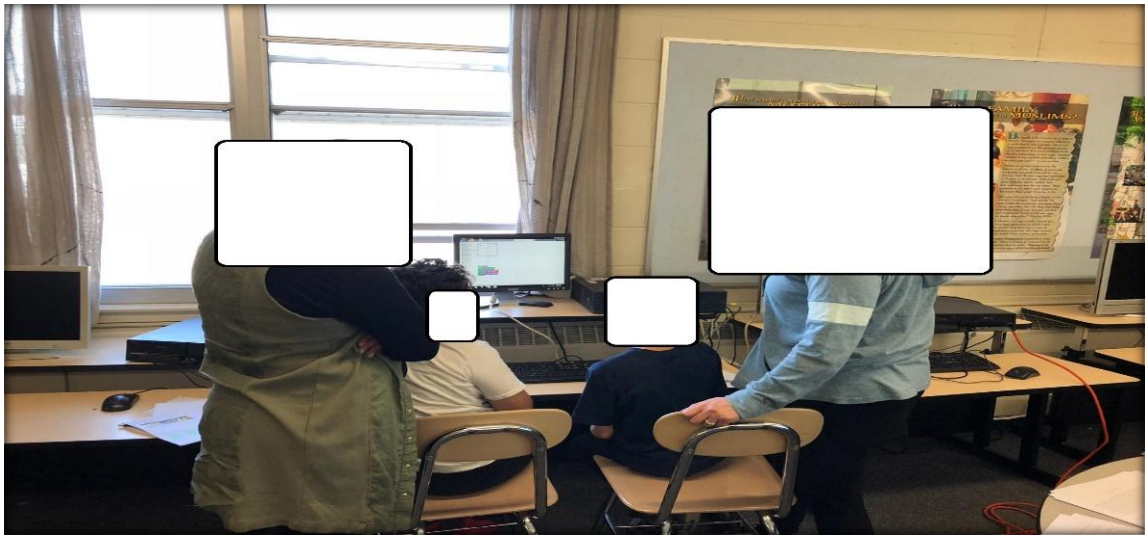

Figure 3. *Parental involvement with their children during the session, namely in the Symmetry activity.*

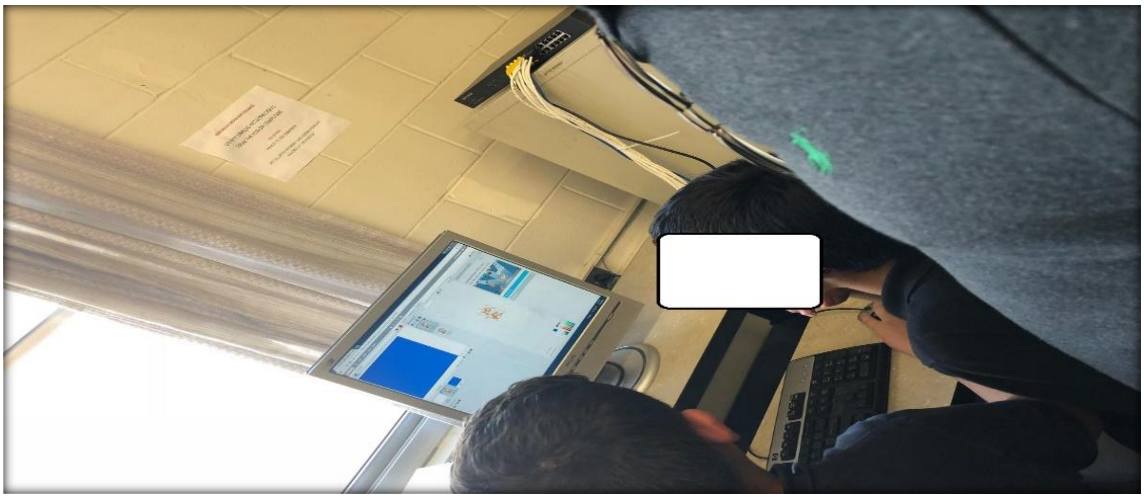

Figure 4. *Parents actively participated with their children during the Scratch activity workshop.*

Experience Working with Parents

Students conveyed their perspectives on engaging in mathematics with their parents and articulated the reasoning behind these perspectives. All pairings, except for two students, namely Boy 2 from Pair 2 and Boy 2 from Pair 8, appreciated working with their parents. Their responses are inconsistent, as they have alternated between confirming and refusing. For instance, Pair 1 (boy) enjoyed collaborating with his parent as they provided guidance and encouragement, helping him improve and succeed. "I enjoy engaging in mathematical activities with my mother," Pair 2 consists of two boys. Boy 1 expressed that it enhances enjoyment, whereas Boy 2 argued that it involves tasks he is unwilling to perform, but ultimately agreed that it is enjoyable. It is conceivable that this pertains to the nature of the activity, but it cannot be verified. Boy 2 in Pair 2 exhibited inconsistency in his comments on the reflection form, as previously noted. He explicitly expressed a preference for working independently, without the involvement of his parents. Pair 3 (Boy) expressed his appreciation for collaborating with his parents since they provide him with much assistance and support. Pair 4 (girl) expressed her appreciation for working with her parents, stating that they assist her. Pair 5 (girl) expressed her appreciation for it, stating that "they provide me with significant assistance." Pair 6 (boy) enjoyed collaborating with his parents due to their ability to provide clear explanations that aided his comprehension. Additionally, he found the experience to be more enjoyable. Pair 7 (boy) expressed his enjoyment of collaborating with his parents due to their

extensive knowledge and ability to impart new information to him. In Pair 8, consisting of two boys, Boy 1 expressed his belief that "she can assist me," but Boy 2 disagreed, stating that "no, they instruct me to perform tasks that I am unwilling to do."

It was also found that when participants were paired as a child and parent, they collaborated and worked together. Additionally, researchers observed that the primary responsibility of parents was to closely monitor the progress of their children's work. They made significant progress in certain locations and made a sincere effort to acquire a deep understanding of the new mathematical concepts.

Action and interaction for parents.

Parents contemplated their behaviors and engagements with their children while collaborating with them in the program. Based on our observations and the feedback provided in reflection questionnaires and interviews, it became evident that the primary objective of the majority of parents was to monitor their children's progress in the workshop. For instance, Pair 1 (mom) expressed that she preferred to observe most of the time and intervene when she deems it necessary or appropriate. She also mentioned that she finds it pleasurable to collaborate with others. Pair 2 (mom) expressed her appreciation for observing and engaging with her children, stating, "I enjoy watching them and attempting to interact with them through observation. I also appreciate their willingness to teach me how to do things." Pair 3 (father) expressed a preference for collaborating with his child to identify areas where they may require assistance. Pair 4 (dad) believed that the coding technique stimulates the child's thinking in several ways. Parent 5 (mother) expressed her satisfaction, saying, "I enjoy collaborating with my child because it allows us to learn together." Pair 6 (mom) liked it saying, "I discovered enjoyable methods to educate the children in mathematics." Pair 7 (mom) described it as "interesting," while Pair 8 (grandma) expressed that she found it enjoyable and liked it. I observed their actions without actively participating. During the sessions, I saw that the primary responsibility of parents, as determined by three methods (observation, reflection forms, and interviews), was to monitor their children. Additionally, the parents expressed satisfaction in collaborating with their children. During our observation, we witnessed several manifestations of parent-child dynamics, including collaborative efforts and interventions such as providing guidance and participating in coding activities.

3.3 Participants' Views and Suggestions on the Sessions

Views. The parents' perspectives are closely aligned with those of the youngsters. Pair 1 (mom) reported that she acquired new knowledge and encouraged the recipient to continue their efforts. She found the program commendable and felt the need to increase involvement with them and provide them with more resources. The mother also expressed her thoughts on the workshop, stating that she was impressed and excited by its effectiveness in teaching the children saying ‘’I am simultaneously enjoying quality time with the children while also imparting knowledge to them’’. Pair 2 (the mother) viewed the activity as both intriguing and beneficial for the youngsters stating, ‘’I aspire to consistently engage in this activity, as it is both enjoyable and particularly beneficial for children who are in the process of learning. It has proven to be a positive and advantageous experience’’. Pair 3 (dad) stated that the activity provided an opportunity to learn about a new mathematical concept and described it as a beneficial experiment for them stating, ‘’I observed the children to be deeply involved and enthusiastic about it’’. Pair 4 (dad) expressed excitement for the session, stating that it is highly stimulating and beneficial for both children and parents. Additionally, he discovered that this session motivated him to actively interact with his children, stating, "It is highly fascinating." Pair 5 (mom) expressed enthusiasm for learning new things. In addition, she stated, "I will acquire knowledge and then we will proceed to acquire new knowledge." Pair 6 (mom) expressed her belief that the new technology is quite beneficial for the children. Regarding the workshop, she stated that everything was acceptable. Pair 7 (mom) was surprised, stating "I was surprised about how fast it went and all the codes it had." Furthermore, she stressed the significance of learning if her son is acquainted with the assignment or not, stating "I prefer to be aware of my son's familiarity with the work." Regarding the class, she expressed her appreciation by stating, "I enjoy the workshop" and emphasized the importance of learning how to integrate mathematics with tablet technology to

enhance our understanding, maybe referring to parents. Mom also discovered that this training motivated her to actively interact with her children. Pair 8 (grandma) expressed their enjoyment and positive attitude towards the activity stating, ‘’When I observed pairs, I noticed that they were collaborating effectively. In general, parents expressed positive feedback on their collaboration with their children during CT workshops’’.

Suggestions

The parents' suggestions aligned with the students' ideas to enhance the workshop. Proposed recommendations encompassed an extension of time, an increase in activities, and a more comprehensive level of information. However, there were differences in the preferences of parents. Parents provided feedback on the methods of teaching mathematics and suggested including CT activities in the mathematics curriculum. For instance, Pair 1 (mom) stated, "I found the workshop to be impressive and successful," while also declaring, "I have a dislike for group activities. I prefer to receive individualized attention". Pair 2 (mom) proposed "additional methods to incorporate, more ways, more engagement that you can include." Pair 3 (dad) proposed allocating additional time to concentrate on specific subjects. Pair 4 (dad) proposed that if the parents are informed about the specifics, they would be satisfied with coming here. The experience is quite pleasant. Pair 5 (mom) found the experience satisfactory but suggested incorporating other technological devices to enhance the enjoyment. In addition, she suggested incorporating these materials into the school curriculum to ensure that students have a positive learning experience.

Pair 6 (mom) proposed that working individually would be more advantageous, as they did not enjoy working in groups but were content with the outcome. Furthermore, she indicated that if one does not wish to collaborate, there are alternative options available, ‘’There are many methods available to you. Engaging with your children does not necessarily have to occur exclusively in a workshop setting’’. The mother intended to convey that it is unnecessary to wait for a workshop to interact with youngsters. Pair 7 (mom) proposed modifying the mathematics curriculum to make it more engaging and include activities of this nature in the curriculum. Additionally, she expressed the desire for the workshop to be outstanding, comprehensible, exciting, and not dull. The parents have made several suggestions in response to the situation. These include increasing the time of the workshop, providing additional materials, sharing detailed information, integrating one-on-one activities between parents and children, integrating CT into the mathematics curriculum, and finding new ways to involve parents in their children's learning.

4 Discussions

This section presents the results of a study that categorizes parental involvement in CT activities in mathematics education. The categorization is based on a qualitative analysis of data collected during CT workshops, and the following theme was extracted from the findings of the data that the researchers collected.

4.1 The Theme: Parental Engagement in Children's CT Activities

The primary objective of the study was to investigate the extent of parental involvement in their children's CT activities. This included examining the parental engagement with their children in CT activities, benefits and challenges, and the views and suggestions of participants. The following sub-themes were extracted from the observation, reflection forms, and interview obtained from each parent-child pair: act and interact, the benefits and challenges of parents’ engagement, Participants' views and feedback on parent engagement, and Participants' suggestions on the design of the workshop., and then more details in each sub-theme separately.

Act and Interact

This sub-theme focused on parental engagement with their children during CT workshops. Engaging children's families in their mathematics education can enhance their comprehension, regardless of any direct affiliation with schools or interactions with teachers (Liang, 2013).

Working together. During the two sessions, the researchers noticed that all parents were fully engaged in observing and working with their children. All parents stated that they refrained from

directly assisting their children at each stage of the activity, but parents closely monitored their children and occasionally offered them guidance. In Pair 1, the mother said: "Typically, I obtain satisfaction from observing and then interfering when I think it essential." In Pair 2, the mother stated that she was actively engaged with her children. She expressed satisfaction with their desire to teach her how to do things, whereas the grandmother in Pair 8 expressed her enjoyment in working with her children. This statement supports Epstein's (1987) claim that parents who offer assistance and encouragement to their children can give them a reasonable benefit in developing mathematical capabilities.

Some parents supported their children when they considered it necessary. In Pair 3, the boy stated that his father helped him when he made mistakes or needed help. The father mentioned that he tried to support his child and understand the teaching methods used in school, stating, ‘Occasionally, when he veers [commits an error], I redirect him to ensure he performs the task correctly.’’ The girl in Pair 4 conveyed her dependence on her father to guarantee the precision of her actions. She stated that her parents aided her in obtaining coding abilities. She stated that her father supported her and that she had an enjoyable experience while also gaining a significant amount of knowledge. In Pair 5, the mother observed her daughter and assisted whenever the girl required it. According to her, her daughter exhibited significant shyness and hesitated to seek assistance in class, prompting her to provide support. The youngster stated that her mother assisted her with coding, namely with the implementation of angles in the code.

Furthermore, several parents reported that the CT workshops were advantageous as they facilitated their acquisition of CT skills and aided in their understanding of certain mathematical concepts. Parents who possess a comprehensive understanding of contemporary math teaching methods can provide more efficient assistance to their children in both math assignments and activities that need quantitative abilities and abstract thinking. According to Civil et al. (2008), parents typically employ the same instructional methods with their children that were used with them throughout their childhood. This elucidates the reason why numerous parents encounter difficulties in assisting their children when they acquire knowledge through unusual methods or engage with significantly more complex subject matter than what they are accustomed to. Given the constantly evolving curriculum and teaching approaches, there is an increasing necessity to assist parents in becoming more engaged in their children's education.

During the two workshops, the researchers noticed that certain parents acquired knowledge of CT exercises and subsequently assisted their children. As an illustration, the mother in Pair 6 made an effort to familiarize herself with CT activities and "enhance the child's comprehension, focus on tasks, and demonstrate the significance of learning." She stated that engaging with her son was enjoyable and that he was also experiencing enjoyment. In Pair 7, the mother observed her son's attempt to instruct her in coding. He provided her with a detailed explanation of the coding process, including its implications. He also mentioned that his parents seek his assistance when they need support, stating, "They instructed me to assist them if they make any mistakes during the workshop." In addition, the youngster mentioned that his mother assists him when he is unsure about certain things, but for the most part, he completes his tasks independently.

The results collected in this study through participant self-reports indicated that parents' involvement in CT workshops was perceived by the participants as advantageous for both children and parents. Children received assistance from their parents, while parents received assistance from their children. Furthermore, parents acquired novel mathematical principles, while children engaged in educational activities aligned with their school curriculum. Parents expressed enjoyment and acquired knowledge in the areas of mathematics, coding, innovative learning techniques, and collaborative learning with their parents.

The majority of children reported receiving substantial assistance from their parents at home when they encountered challenges in maths. As an illustration, the son in the first pair expressed that the assistance provided by others is quite beneficial to him and that they also encourage him. In Pair 4, the girl also said that her parents assisted, while in Pair 5, the girl stated that her parents offered substantial support. The son in Pair 8 also mentioned that his mother could assist him. The son in

Pair 7 stated that he generally does not receive or require assistance, expressing that his mother aids him at home, but for the most part, he handles tasks independently.

Conversely, parents reported that they engaged and assisted their children during CT workshops. As an illustration, the mother in Pair 1 stated, "I typically enjoy observing and intervening when I believe it is necessary or when I feel compelled to do so." The mother in Pair 2 expressed her intention to engage with her children by employing observation. Several parents expressed their want to be informed about their children's performance and requirements. The mother in Pair 2 expressed her appreciation for their desire to teach her, while the father in Pair 3 mentioned his preference for collaborating with his child to identify areas where they may require assistance.

The findings encompassed several forms of interaction, including parents providing assistance to their children when necessary, offering support to timid children who hesitate to seek aid in a classroom setting, and children helping their parents comprehend information before the parents, in turn, assisted the children. This implies that parents should provide greater assistance to their children and foster an environment where they feel encouraged to seek clarification when they encounter confusion. Epstein (1987) highlighted that research undertaken over two decades has consistently shown that children achieve academic success when their parents provide inspiration and support in their homework. Hence, it is crucial to educate parents about the advantages of actively participating in their children's educational development.

This finding about the engagement of parents with their children validates Epstein's statement (1987) that parental involvement is crucial in determining children's academic performance and is a fundamental factor in their scholastic achievements. Recently, Swirbul and Melzi, (2024) mentioned that there is still a need to focus on the relationship between parents and their children in mathematics learning as they are called “family math” encouraging parents to be more involved in daily mathematics with their children learning. In addition, children must be aware that their parents possess a genuine curiosity about their academic pursuits and the methods by which they acquire knowledge. This fosters an environment in which children feel comfortable approaching their parents with questions and engaging in conversations about their educational accomplishments and worries.

The Reflection of Working Together. All parents expressed their satisfaction in collaborating with their children, while the majority of children, excluding two individuals, reported a positive experience in engaging with their parents. One of the kids in Pair 2 expressed that it enhanced enjoyment, whereas the other son stated that it involved tasks he was unwilling to perform. The remarks made by the second offspring in Pair 2 indicated that a pupil may not derive pleasure from one endeavor yet find contentment in engaging in another. The second son showed a preference for working independently rather than collaborating with his parents and, on the whole, expressed a high level of admiration for the workshops.

Scott (2015) stated that the students in question are anticipated to improve their interest and performance in mathematics as a result of their parents' engagement and active participation in the mathematics workshop delivered as a component of this study. Multiple parents noted that their children were completely absorbed in CT activities. For example, the father in Pair 3 stated that the experiment had a positive impact on their family, " I witnessed the children displaying a profound level of engagement and enthusiasm towards it. "Most parents stated that the seminars acted as a catalyst for more engagement in their children's lives. For example, the daughter in Pair 4 found that the workshops inspired her to work together with her parents, and her father mentioned that the workshops motivated him to take part in his children's educational pursuits, saying, "I relish sitting with my daughter and actively participating in these activities." Nevertheless, the mother in Pair 6 believed that there were alternative ways to collaborate with her kid, rather than the current approach, " An alternative approach would be to actively interact with your children. It doesn't need to be in the workshop. "

The Engagement and the Attitude of Participants. The predominant forms of parental involvement during CT activities were passive observation and active learning from their children in coding robots, apps, and games. As previously stated, a significant number of parents need further supervision at the start of the workshops due to their insufficient familiarity with the CT exercises. After comprehending the workshop's requirements, the participants grew more at ease collaborating

with their children and acquiring knowledge together to program mathematical objects in the math coding application, manipulate characters in a visual programming language, and operate a robot to simulate various curricular and mathematical concepts.

Researchers define high engagement as the consistent and effective collaboration between the child and parent. Medium engagement, on the other hand, refers to occasional collaboration with intermittent periods of disengagement. Low engagement is characterized by a significant gap between the few instances of collaboration between the child and parent. The level of parental engagement with their children varied among individuals, ranging from minimal to considerable. The elevation was substantial for Pairs 2, 3, 4, and 7, while it was negligible for Pair 8. The two grandsons in Pair 8 diligently followed the workshop instructions and implemented them throughout CT exercises. However, their grandma opted not to actively engage with them and, at times, seemed to divert her attention away from the youngsters. Parental involvement with their children was moderate for Pairs 1, 5, and 6, as they mostly watched their children's participation in CT activities.

Most of the participants displayed a positive attitude towards CT activities, as evidenced by their conduct, self-reported reflections, and interview replies. They expressed enjoyment and satisfaction from participating in these activities. The grandmother displayed a neutral demeanor in Pair 8. Overall, most parents and children reported that CT sessions were advantageous and captivating. The grandmother's casual participation in her grandchildren's CT activities can be ascribed to her status as a grandparent rather than a parent or guardian, as well as her generation's limited exposure to digital technologies in an educational context.

From the findings of this study, acting and interacting of parents with their children benefits their mathematics learning. This is in line with Betts and Son (2024), who mentioned that essential children's learning starts from their parents, and parents have a main role in their children's learning. Thus, there is a need to investigate the varied ways that parents recognize their math-related parenting roles, and also, use their math skills, and manage their power and time (Betts & Son, 2024).

4.2 The Benefits and Challenges of Parent Engagement

The parents faced challenges in distributing electronic devices, and researchers observed a language barrier among numerous parents who appeared to have recently immigrated to Canada. The participants faced difficulty in comprehending the instructions or utilizing readily comprehensible instructions. Several parents reported encountering difficulties in sharing gadgets with others due to a shortage of available devices. Consequently, we had to allocate one gadget for each pair of individuals to share during the exercises. Parents, such as those in Pair 1, reported unease with collaborating in small groups and suggested offering them supplementary devices in the future. Overall, the participants exhibited engaged interaction with their peers during the small group activities.

Children helped parents, who are not fluent in English, understand precise terms used during workshops while explaining the core of CT exercises. The young individual in Pair 7 seized the chance to educate his parents in the English language whenever it arose. As a result, parents not only gained knowledge of mathematical principles but also improved their proficiency in the English language. The partnership between parents and children during CT workshops has proven to be beneficial in various ways, such as developing CT skills, acquiring awareness of the English language for mathematical ideas, and promoting collaborative participation in mathematical problem-solving and coding. Therefore, it is imperative for both educators and school administrators to consistently promote and support such interactions.

Both parents and children faced challenges during CT activities. For instance, the father in Pair 4 discovered that his daughter has a penchant for engaging in educational pursuits that he was previously unaware of. Additionally, Pair 5 attempted to write code that exceeded the specified requirements of the task provided during the session. As an illustration, they attempted to program a triangle but encountered challenges with the angles of turns for the path they were instructing the robot to follow. Despite the difficulties, they persisted and ultimately managed to comprehend how to utilize the exterior angle, instead of the more commonly employed interior angle, in coding a

triangle. Furthermore, certain students attempted to utilize code that employed multiple motion and appearance coding blocks in Scratch and the coding app for the robot in their activities. They were perplexed when attempting to use multiple coding blocks within the constrained timeframe of the workshop. This is in line with Brennan and Resnick (2012), who mentioned that when students worked on CT activities, they encountered difficulties understanding the activities, especially, when participants began working on the activities, but after understanding the activities, participants appeared working smoothly in CT activities.

Parents mostly expressed their appreciation for the knowledge gained from CT and mathematics workshops, particularly in terms of acquiring new insights into technology applications, coding, critical thinking, and the collaborative learning experience between parents and children. Additionally, they found the workshops to be an enjoyable and engaging approach to teaching mathematics. As an illustration, the mother in Pair 1 reported, "I acquired new knowledge," while the mother in Pair 5 stated, "Then we engage in the process of acquiring fresh information." The mother in Pair 6 expressed that the new technology is beneficial for the children, while the mother in Pair 7 was astonished by its speed and the multitude of codes it possessed. The father in Pair 4 stated that the coding technique "stimulates the child's cognitive flexibility." The mother in Pair 5 expressed her preference for working with her child, stating that it allows them to learn together. Likewise, the mother in Pair 6 expressed that she found pleasurable techniques to educate the children in arithmetic.

Most of the student participants also engaged in discussions with their parents about gaining new knowledge during CT sessions. As an illustration, the youngster in Pair 5 expressed his intention by saying, "I will acquire knowledge and subsequently engage in the acquisition of new knowledge. I thoroughly enjoy participating and interacting. " The youngster in Pair 7 expressed his enjoyment of working with his parents due to their extensive knowledge and ability to teach him new things. His mother mentioned the importance of understanding how to integrate mathematics with technology, namely tablets, to enhance their development. Parents and children also expressed their appreciation for the advantages of participating in CT activities, which fostered contact and participation, ultimately strengthening their bond. The mother conveyed her affection for working together with her children in Pair 2. This fosters a stronger bond and enhances their closeness.

According to the self-reported data from the participants, the benefits of parents' engagement in CT activities appeared to be more significant than the challenges that participants experienced throughout the CT workshops. This is in line with Eden et al. (2024), who mentioned that parental engagement in their children's learning is boosting the multiple needs of students, and also the effectiveness of parent involvement reinforces their children's academic achievement and more involvement in school activities.

4.3 Participants' Views and Feedback on Parent Engagement

Views. The majority of participants expressed a favorable opinion on CT activities. For instance, in Pair 1, the mother expressed her positive opinion by stating that it was "an effective program" and "a fruitful workshop." One student in Pair 2 expressed their enthusiasm by exclaiming, "This is remarkable, I truly admire it," while their sibling commented, "It was quite captivating, I experienced a surge of excitement." Their mother conveyed that the CT workshops were enjoyable and advantageous, and she derived value from them. The boy in Pair 3 also characterized them as "pleasurable and advantageous." The mother in Pair 5 expressed her enjoyment of the activity, stating that she found it enjoyable enough to engage in daily. The mother in Pair 7 expressed her satisfaction, stating, "This is excellent, as it is intelligent, interesting, and not at all boring."

The remarks support the findings of Vallera and Bodzin (2017), who suggest that combining technology with authentic project-based learning, using real-life examples, could improve children's comprehension of complex and abstract concepts. This discovery validates the potential of integrating CT exercises into mathematics instruction and as a component of the mathematics curriculum.

Feedback. Upon conclusion of the study, the majority of parents expressed satisfaction with their decision to partake in CT workshops and reported deriving pleasure from their engagement in

their children's CT endeavors. According to some parents, the CT workshops not only taught them new mathematical concepts but also improved their bond with their children. For example, one mother in Pair 2 stated, "I thoroughly enjoy collaborating with my children." This strengthens the relationship and brings it closer.

Several parents expressed their satisfaction with the utilization of CT activities for math learning, stating that both they and their children were thoroughly enjoying the experience. In Pair 1, the mother expressed her admiration, enthusiasm, and appreciation for the simple and effective method of teaching the children, stating, " I am simultaneously enjoying quality time with the children while imparting knowledge to them. I find it pleasurable to collaborate." The mother in Pair 2 expressed that engaging in this activity with children is enjoyable, particularly while they are in the process of acquiring new knowledge stating, "The content proved to be both intriguing and beneficial for the students. I aspire to perpetually engage in this endeavor. " The paternal figure in Pair 4 expressed his enthusiasm, stating, "I find it highly intriguing...I am exceedingly pleased that I decided to be present at this location." The product is immensely pleasurable and offers substantial advantages for both youngsters and their parents. The mother in Pair 5 expressed her belief that children should have a positive and enjoyable experience while learning, rather than developing a dislike for mathematics. The statements provided support Wing's (2006) claim that "computational thinking will be a necessary skill utilized by people globally in the 21st century" (p. 2). The comments also validate the proposal put forth by Sanford and Naidu (2016) that CT activities, which are more recent types of learning activities, should be accessible to parents as well.

Most of the participants conveyed their contentment with the workshops. For example, the youngster in Pair 3 conveyed his pleasure in working together with his parents, while the boy in Pair 6 just mentioned that he found it pleasurable. In addition, the mother in Pair 6 shared her positive impression of the experience, stating that everything was excellent, and she was impressed. The mother in Pair 7 expressed her preference for being aware of her son's understanding of the task. She also mentioned finding workshops to be intriguing. In addition, her kid stated, "I derive great enjoyment from it and it enhances my knowledge."

4.4 Participants' Suggestions on the Design of the Workshop

Attendees provided numerous recommendations to enhance the design of CT activities and the overall sessions. Several individuals believed that increasing their engagement in workshops, particularly with their preferred activities, would provide the most favorable outcomes. For example, the young kid in Pair 1 suggested that future seminars should include additional activities with the Sphero robot. The child in Pair 3 indicated a desire for "more active involvement with the Sphero," while his father suggested dedicating "extra time to particular subjects." In Pair 2, the two boys recommended augmenting the duration allocated to CT activities, whilst their mother suggested investigating more approaches and enhancing the overall level of involvement. Several participants suggested resolving the limitations of working in small groups with other pairs who have the same equipment by proposing the inclusion of supplementary technological devices and gadgets, such as robots, in the workshops. For example, the mother in Pair 5 stated that the experience was mostly favorable, but recommended that adding more technologies may potentially improve satisfaction. The suggestions put up by other participants related to altering the mathematics curriculum offered to students in schools. For example, the mother in Pair 7 proposed integrating CT activities into the mathematics curriculum to increase its attractiveness. The recommendations made by the participants of the workshop are comparable to those discussed by Yadav et al. (2016), who suggested integrating CT into the curriculum of all subjects. The objective is to transition students from simply being familiar with technology to utilizing computational tools to solve problems (Yadav et al., 2016, p. 565). Barr et al. (2011) Additionally, it is crucial to ensure that all children are given the opportunity to develop CT abilities and use them in diverse contexts in the coming years.

5 Conclusion

In summary, the study centered around the topic of parental engagement and explored several subthemes, including the actions and interactions involved, the advantages and difficulties associated

with parents' engagement, and the perspectives and feedback of the participants regarding parents' involvement. This study investigated the extent to which students engage with their parents during CT activities, as well as the advantages and difficulties of parents' engagement with their children during CT activities, and gathered the perspectives and feedback of parents after participating in these activities.

The findings demonstrated that parents were actively engaged and effectively collaborating with their children. All parents stated that they refrained from assisting their children at each stage of the activity. They observed their offspring. For example, the mother in Pair 2 stated that she was "carefully observing and actively trying to interact with my children through observation". Additionally, some parents did offer help to their children when it was needed. As an illustration, the boy in Pair 3 expressed, "My father provided assistance by identifying any errors or misunderstandings in my work and guiding me on how to rectify them." In response, his father stated, "I made an effort to support them and gain insight into their educational instruction. I sent him back to rectify the mistake."

Furthermore, several parents discovered the CT workshops were advantageous since the CT exercises facilitated their acquisition of CT skills and comprehension of certain mathematical principles. All parents expressed their satisfaction in collaborating with their children, while the majority of children save for two, reported a positive experience in engaging with their parents. One of the kids in Pair 2 expressed that it enhanced enjoyment, whereas the other son stated that it involved tasks he was unwilling to perform. The remarks made by the second offspring in Pair 2 indicated that a pupil may have a dislike for a particular activity yet find contentment in engaging in a different one. The second son likewise expressed a preference for working independently rather than with his parents, but he stated that he was generally "very impressed" with the workshops.

Upon the conclusion of the study, the majority of parents expressed satisfaction with their decision to partake in CT workshops and reported deriving pleasure from their active engagement in their children's educational endeavors. Several parents reported that the CT workshops not only facilitated their acquisition of new mathematical concepts but also enhanced their relationship with their children. As illustrated by the following statement by the mother in Pair 2, "I thoroughly enjoy collaborating with my children." Thus, "This strengthens the relationship," stated the boy in Pair 3, while adding, "I derive satisfaction from collaborating with my parents."

In general, the advantages of parents actively participating in CT activities with their children, as indicated by the data provided by the participants themselves, seemed to be greater than the frustration and confusion observed by the researchers at the start of each workshop. This frustration and confusion arose from the participants' difficulties in understanding the instructions for coding robots, screen characters, and visualizations used to simulate mathematical concepts.

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