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Parental Perceptions of STEM Enrichment for Young Children

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Abstract

Most pre-kindergarten and kindergarten curricula are challenging and engaging, but few are strongly grounded in STEM education. In this study, the authors examined parental perception (*N*=55) of the influences of a Saturday STEM enrichment program in one university center on pre-kindergarten and kindergarten students and their attitudes towards STEM learning. Using survey data collected from 2013 – 2016, the authors studied parental comments about benefits, drawbacks, and memorable moments they observed from their children's experiences during the program. These comments were analyzed qualitatively using NVivo and three main themes were developed. The themes were children's reactions to STEM learning, meeting the needs of young gifted learners, and learning beyond the classroom. These themes reinforced current literature in the field showing young children's need for STEM education. Sadly, few opportunities for STEM-focused programming for young children exist.

Gifted students have different needs from the cognitive aspect to the social and emotional manner (Davis, Rimm, & Siegle, 2013; Peterson, 2006; Pyetan, Oni-Grinberg, Nevo, Shofty, & Yankielowicz, 2014; Rotigel & Fello, 2004). In addition, many of these studies focus on intervention measures for students who are in elementary and beyond. Few studies have focused on the needs of pre-kindergarten and kindergarten gifted students and even fewer in the field of STEM education. In their position statement, NAGC (2006) highlighted the need for young gifted learners to be served during their early childhood education. Although most pre-kindergarten and kindergarten curricula can be challenging, and engaging for most children, few are strongly grounded in STEM education. This does not bode well for gifted young learners who are missing opportunities to develop their strengths and interests in these areas. In this paper, we examined the influences of a short-term, university-based, STEM enrichment program on the pre-kindergarten and kindergarten students and their attitudes towards STEM learning from their parents' perspectives[1].

Literature Review

Current Science Education for the Young Gifted Children

Young gifted students are often bored in regular classrooms (Siemer, 2009). They are likely to be familiar with the lesson content, teachers often pitch the lessons at general-ability students, and lessons are unlikely to contain advanced materials that will meet the needs of gifted children (Pyetan et al., 2014; Rotigel & Fello, 2004).As such, teachers often neglect and

[1]In this paper, when we refer to parents, this encompasses parents, guardians, and other adult figures responsible for the child's education, excluding teachers.

overlook these young gifted learners. This unstimulating environment is not only an issue for young gifted students in elementary schools, but also for the young children in pre-kindergarten and kindergarten. However, unlike their counterparts in elementary schools, there are few opportunities to formally identify and provide gifted services for preschool or kindergarten children (Kuo, Maker, Su, & Hu, 2010). Further, gifted services for this age group need to focus on stimulating younger children's potential and developing dispositions for learning, and this is something not recognized with one-time formal test (Kaplan & Hertzog, 2016).Recognizing the development of young children' strengths and abilities as a continuous process, and providing an integrated curriculum with interactive and responsive environment is indispensable (Cukierkorn, Karnes, Manning, Houston, & Besnoy, 2007).There is a need for early childhood teachers to focus on adapting regular classroom activities to meet young gifted students' needs to help them reach their full potential (Coleman, 2016).

The situation is more critical in the field of early science education. Gifted young learners can get benefits from science education since their exploration-prone characteristics match the inquiry-based feature of the subject. Samarapungavan, Patrick, and Mantzicopoulos (2011) studied six classes of kindergarteners' and their teachers' interaction with inquiry-based science learning and found that the kindergarteners were able to learn from the scientific investigations they conducted. Further, the knowledge gained by kindergarteners was not limited to science information, but the scientific process of inquiry as well.

Yet there is insufficient time spent on quality STEM education in the preschool compared to other domain areas such as language/literacy, social studies, and art (Early et al., 2010). Pre-school teachers who have less content knowledge in science tend to have a low self-efficacy in science education (Greenfield et al., 2009). If the teacher does not have enough knowledge and

confidence, it is inevitable that the amount of science education in an entire curriculum is less than for other subjects. The poor preschool science environment can be another factor that causes children to miss early opportunities to develop science readiness. Tu (2006), who conducted a study in 20 preschool classrooms in 13 Midwestern childcare centers, found 86.8% of the activities in the preschool classroom were unrelated to science, most materials were limited to natural items, and not all preschools had science areas. This gap in early childhood education needs to be addressed.

Needs of Young Gifted Children

Young gifted learners have some characteristics that distinguish them from other children their age. They use advanced language, understand abstract concepts and complex rules, create solutions with fast pace of thought, concentrate longer period on their interest areas, and try to organize things (McGee & Hughes, 2011; Walker, Hafenstein, & Crow-Enslow, 1999). Early science education has the potential to develop young children's language, literacy, and math readiness skills as well as content knowledge of science concepts (Gerde, Schachter, &Wasik, 2013). Eshach and Fried (2005) presented six reasons young children should be exposed early to science (a) to enjoy the nature, (b) develop positive attitudes toward science, (c) better their understanding of scientific concepts, (d) have an early acquisition of scientific terms, (e) develop skills for scientific understanding and reasoning, and (f) develop scientific thinking. Although it is important to provide all young children with access to STEM based activities, the situation is more acute with young gifted children especially in helping them to develop their potential.

It may be a common belief among educators that STEM is one of the most beneficial domains to foster interests and curiosity in young gifted children. The idea that STEM is too challenging to be integrated into early childhood setting is something that should not persist

(Coleman, 2016). Children learn best through integrated curriculum such as STEM, where they can explore with their whole senses (Moomaw & Davis, 2010). STEM does not have to be complicated, but can be used throughout preschool and kindergarten since children constantly explore their surroundings, work with tools, and try to find solutions. It is necessary for teachers to acknowledge that STEM can be nearly ubiquitous. Sharapan (2012) provided some examples of STEAM (including Art) in everyday language and how early childhood educators could use them in their classrooms. Some example listed are (a) asking children to generate hypothesis; (b) using simple tools such as rulers, magnifying glasses, scissors, not just computers or sophisticated machines; (c) finding better solutions in common situations; (d) expressing their learning in a creative manner; and (e) comparing, sorting, finding patterns in different ways. Offering play-based activities with a STEAM focus, letting children choose their activities, and providing more opportunities to play individually or in a small group allow young gifted children to build diverse perspectives (Moomaw & Davis, 2010; Sharapan, 2012).

STEM and Early Childhood Education

STEM can be successfully integrated into early childhood education (Aronin & Floyd, 2013; Flannery et al., 2013; Samarapungavan et al., 2011; Sullivan, Kazakoff, & Bers, 2013). Kindergarten students in a study by Samarapungavan et al. (2011) showed significant gains in science and scientific inquiry understanding when introduced to advanced inquiry-based instruction, such as making predictions, recording observations, and communicating the results. Sullivan et al. (2013) who examine pre-kindergarten classes in a New York magnet school, found that when young children were intensely immersed with weeklong robotics curriculum, they were able to develop their math concepts, literacy skills, and sense of aesthetics while programming and manipulating simple robotic tools.

When electronic devices such as iPads were used with developmentally appropriate apps in small mixed-ability groups in the inclusive preschool environment, their motivation and engagement were increased, fine motor skills were improved, determination skills were enhanced, and they used peer modeling as well (Aronin & Floyd, 2013). Similarly, Flannery et al. (2013) found that children, ages five through seven, were able to create and animate a story after four half-hour sessions in which they were taught a graphical program. By combining early childhood curriculum with age-appropriate STEM, young children were able to meet the challenges and stretch their potentials. The process will also allow children to experience failures, teach them to search for new solutions, and express ideas to support their decisions (Rogers, 2012).

Talent Development and Opportunities beyond Schools

Within the field of gifted education, scholars and researchers have stressed the importance of providing opportunities for students to explore and develop their potential (Gagné, 2010; Renzulli, 2012; Subotnik, Olszewski-Kubilius, & Worrell, 2011). Through the different models of talent development, researchers emphasized the influence of enrichment opportunities in fostering gifted individuals and their potential. An example can be seen through Gagné's (2010) *Differentiated Model of Giftedness and Talent 2.0* (DMGT), in which he highlighted the influence of *environmental catalysts* such as the availability of enrichment opportunities and other forms of gifted services that would influence gifted children's development. Furthermore, in this revised DMGT model, Gagné also expanded on the elements within the factor of *developmental process* that would affect gifted children's development of their gifts into talents. Among the items listed is gifted children's access to a wide range of enrichment activities. The importance of access to enrichment activities is also captured by Renzulli's four-part theory of

talent development (2012), where he highlighted the need to stimulate students' interests through providing different exploratory activities that would introduce different ideas and topics of interests to the students. Such enrichment opportunities would be essential in helping gifted children develop the disposition towards gifted behaviors and attitudes. In addition, Subotnik et al. (2011) also emphasized the need to provide all children with enrichment opportunities in the early years of their development. Subotnik and her colleagues believed that providing various enrichment opportunities to young children would fuel their development and allow them to work on increasingly challenging activities in the future.

However, not all children have the same access to enrichment opportunities. Subotnik et al. (2011) pointed out the differing enrichment opportunities available to gifted students based on their parents' access to information about gifted services as well as the financial resources needed for their children to participate in the enrichment programs. Parents who are aware of the needs of their gifted children are able to look beyond school-based learning and supplement their children's education with enrichment programs offered by private organizations or universities. Many universities offer enrichment programs on the weekends as well as during summer (Pereira, Jen, Seward, & Tay, 2016). These programs provide students the access to topics and activities not usually offered through their schools. Parents who have access to information and knowledge about talent development often view enrichment opportunities like these as a means of providing their gifted children with the challenges and choices they need.

Super Saturday is one such program. Based at a Midwest university, Super Saturday is a half-day enrichment program that runs for six consecutive Saturdays designed for students in pre-kindergarten through 8th grade. Super Saturday is among the oldest university-based enrichment programs in the United States (Pereira et al., 2016). Many of the students enrolled in the program

have siblings or even parents who were students in the program. The goal of the program is to engage students in high-level, enriching content, while promoting critical thinking skills. Students select a course of their interest from a wide array of topics, including STEM and the humanities, and attend classes on the university campus. In line with various talent development models, the aim of the program is to provide young children with access to enrichment opportunities. Thus, admission to the program is not restricted to high ability students and students do not need to prove that they are in high ability classes to gain admission to the program. Furthermore, the curriculum is designed to be two years above the child's current grade level, and to provide an appropriate level of challenge for the students. Class sizes are small (maximum of 18 for students in grades 5 to 8, 10 for students in grades pre-kindergarten to kindergarten) to help enhance the likelihood of hands-on, high-quality, individualized instruction. Under these conditions, young children are able to engage in talent development opportunities that will help to foster their interest in different topics as well as cultivate the attitudes and mindsets needed for gifted behaviors.

As an option for talent development for gifted young children, Super Saturday provides opportunities for young children to explore their interests and develop their potential. With a growing emphasis on STEM in modern education, it is important to understand how parents view STEM enrichment and its influences. The authors developed the following research questions to guide study:

1. How do parents evaluate their children's experiences in the STEM enrichment classes?
2. What do parents perceive to be influences of STEM enrichment on their children's learning?
3. What kinds of attitudes and behaviors do parents observe after their children attend STEM enrichment classes?

Method and Procedures

Participants

Parents' feedback is collected as part of program evaluation for the University-based Saturday enrichment program. On the last day of the program, a parents' feedback survey is given to all parents (see Appendix). The survey is non-identifiable and parents are encouraged to complete them on a voluntary-basis. Data from the surveys were entered into a database as part of the program evaluation procedure. Data from the database were selected based on the following inclusion criteria: (a) surveys were completed within the years 2013 to 2016, and (b) surveys were tied to the pre-kindergarten and kindergarten STEM-related classes. The data from 2013 to 2016 were selected because a new survey was developed in 2013 and has been used since that time to collect parents' feedback. Using the same survey format helped to ensure the information was collected and documented in a consistent manner. Further, the focus of this study is on pre-kindergarten and kindergarten children and their experiences in STEM-related enrichment class. With that goal in mind, only the parents' feedback from these classes was used. For example, classes identified as STEM related included *Who wants to be a scientist?, Visual Math,* and *Space Race* (see Table 1 for a complete list of classes). After going through the selection process, 55parents' responses were used for the analysis.

Data Analysis

Parents' feedback survey. The parent's feedback survey contains items, responded to using a 5-point Likert Scale ranging from "Strongly Disagree" to "Strongly Agree", as well as open-ended questions. Parents were asked to evaluate the program and its effectiveness in meeting its goals. As part of the Saturday program evaluation, means and standard deviations for Likert scale responses were calculated. The analysis was done yearly and the information was

not studied across the different courses. There are five items, items 6 -10, that are of interest to the authors. The items focused on the students' interest in the program and educational benefits that resulted from the program (See Appendix).

Open-ended responses. Responses from open-ended survey questions from the parents' feedback survey were recorded into an excel table and uploaded the information into NVivo 11 (Pro version 11.3.2.779) for analysis. The authors used the data to address the research questions and understand how parents perceived the Super Saturday influenced on their children's learning, attitudes, and behaviors concerning STEM.

The second author took the lead in developing the initial set of open codes (*n*=23). Using information from existing literature on programs for gifted young children and the data collected, the second author developed this initial coding scheme. She coded part of the data using the initial codes. After the initial coding, she met with the other authors to review the codes and the coding process. After the discussion, a new coding scheme was developed by grouping together some of the open codes to form the axial codes (Corbin & Strauss, 2008; Creswell, 2013). For example, three open codes, "enjoyment of learning; curiosity; interest" became an axial code "providing challenges and widening interests." the new coding scheme resulted in seven axial codes (see Table 2). Using the coding scheme, the first and second author coded all 55 participants' responses. The initial frequency of agreement between the two authors was 70.4%. Using coding comparison in NVivo, all three authors met and discussed any differences within the coding. This served as a check for consistency in coding (Richards, 2015). The authors discovered that the differences in coding were largely due to misinterpretation of the coding scheme and the use of NVivo's auto-coding function. The authors examined each of the coded data and removed the wrongly coded data caused by the auto-coding function. All other

differences and issues were discussed until agreement was reached. The final frequency of agreement between the two authors averaged about 84%.

Sensitivity and Credibility

Researcher role. The first and second authors worked with Super Saturday programs. The first author was a coordinator of the program and her duties included hiring teachers and selecting appropriate courses for the different grade levels. She worked with the program from 2013-2014. The second author was a teacher for Super Saturday program and taught one of the pre-kindergarten and kindergarten classes in 2013. Although both the authors worked directly with the program, they were not involved with the collection of the feedback from the parents or the entering of information into the database. Further, the survey returns are blinded and have not influence on the authors' work and research. The third author taught pre-school and elementary children for three years. The authors have all worked with young children and their parents. Strauss and Corbin (1990) highlighted the importance of field experience to a study as it helps the researchers gain insights.

Positionality. In this study, it is important to understand the needs of the gifted young learners through their parents' perception. Although the Super Saturday program did gather feedback from the pre-kindergarten and kindergarten children through a smiley face evaluation form, many of them were not suitable for analysis. This is because some children treated the form as a coloring worksheet and colored every face on the form. As such, the parents of these children are considered to be the best proxies in understanding how the children's experiences in STEM classes influenced them. The parents inform the study concerning what they observed in the learning, attitudes, and behaviors of their children. This approach helps inform the authors of the possible influences the STEM enrichment class had on pre-kindergarten and kindergarten

children's learning, attitudes, and behaviors. Hence, the authors adopted a post-positivism approach in which perspectives from multiple parents were used to inform the study (Creswell, 2013).

Results

Descriptive Results

Parents' Responses to Evaluation Questions. The parents only provided responses to five evaluation items concerning the class in which their children were participating using a Likert Scale. Different sets of data were created for the different classes and were reported separately (see Table 1). The parents' response to item 6: *My child was enthusiastic about his/her class*, showed a mean score of 4.65 (*SD*=0.55). The scores ranged from 4.33 (*SD*= 0.58) to 5.00 (*SD* =0) for the seven classes used in the study. The mean of parents' response to item 7: *My child would like to return*, was 4.67 (*SD*=0.61), and ranged from 4.50 (*SD*= 0.53) to 5.00 (*SD* =0). Parents' response to item 8: *My child learned a lot in the class*, showed a mean score of 4.56 (SD=0.63) ranged from 4.33 (*SD*= 0.82) to 5.00 (*SD* =0). The mean of parents' response to item 9: *The class my child attended was challenging for him/her*, was 4.02 (SD=0.63), and ranged from 2.67 (*SD*= 0.58) to 4.25 (*SD* =0.89). Finally, parents' response to item 10: *My child was motivated to learn in his/her class*, had a mean score of 4.65 (*SD*=0.55), and ranged from 4.61 (*SD*= 0.61) to 4.84 (*SD* =0.37). These results indicated that the parents favorably evaluated the STEM classes their children attended, as seen from mean for items 7 and 8. Further, the parents also believed that their children benefited from the STEM curriculum as the curriculum was challenging enough for their children and they were enthusiastic and motivated to learn (items 6, 9, and 10). Next, to better understand the nuances of the parents' evaluation open-ended responses were examined qualitatively.

Qualitative Results

The authors analyzed parents' responses to four open-ended survey questions:

1. What has been the greatest short-term benefit to your child from your child's participation in this program?
2. What has been the greatest short-term drawback to your child from your child's participation in this program?
3. Are there other classes or topics you would like to see offered in future sessions of the program?
4. What was the single most memorable moment your child experienced in his/her class and explain why that experience was important to him/her?

These questions helped researchers learn about children's responses to their STEM classes. Three major themes were developed from data analysis of responses to these questions: children's reactions to STEM learning, meeting the needs of young gifted learners, and learning beyond the classroom.

Theme I: Children's reactions to STEM learning

Changes in attitudes and behaviors. When analyzing the data, we found that nine parents commented on changes in their children's attitudes and behaviors. It is interesting to note how through participation in a STEM course, parents perceived children as becoming more open to new experiences and learning. These nine parents made ten references about how by attending a STEM course, their children became more interested in STEM than they were before the course. Examples of such comments include "more excited about science and learning, wanted to do experiments at home" (P52, March, 2013) and "more comfortable with math and measurement" (P23, March, 2016). Parents also noticed that their children were more opened to

new experiences. One parent reflected, “he didn't like touching new things. But during this program he touched a new material, and he really enjoyed it” (P33, March, 2014). Another parent, who was surprised to find that her child was able to able to cope with the demands of the program, commented “my child is shy and I thought that he had a hard time adjusting at first. As the class went on, his adjustment got better” (P21, March, 2016).

Enjoying and excited about learning. Pre-kindergarten and kindergarten are often children’s first encounter with formal education. Some children are able to assimilate themselves into the new environment, but others may not have the same experiences. As such, parents were often (*n*=34) glad to see their children enjoying the classes and the learning process. A parent commented on how her pre-kindergarten son was excited about learning when “prior to this class, he didn't like school” (P30, March, 2014). Thirty-four parents shared similar sentiments to this, and made 47 references to how their children showed enjoyment and excitement. “It seems like she understood learning is fun” (P15, March, 2016), “she is excited about the program” (P38, March, 2013), “my daughter loved this class … excited about learning and about not knowing what would happen next” (P32, March, 2014), “excited about math and learning and developed a positive attitude to college/school” (P22, March, 2016), and “she's looked forward to coming each week and has been excited about it” (P16, March, 2016) are examples of feedback from these parents. These comments showed parents’ perspectives that having their young children engaged in STEM courses helped the children become excited about learning and eager to participate in STEM activities.

Theme II: Meeting the needs of gifted young learners

Providing challenges and widening interests. In line with various talent development models, Super Saturday aims to provide appropriate and challenging enrichment opportunities to

young children. Thus, it is not surprising that many parents (n = 20) commented on the challenging and interesting curriculum provided by the program. In addition, Super Saturday was especially important for parents who feel that their children's current school curricula are not meeting their children's needs. Twenty parents with 23 references talked about various aspects of the curriculum that they considered supporting their children's development. Comments such as "he learned a little more in depth about animals than he does in school" (P10, March, 2016), "exposure to higher level math concepts (intro to factors)" (P28, March, 2015), and "excited about learning something not covered at school in this way" (P38, March, 2013) showed that parents considered their children's STEM courses as valuable experiences, which helped introduce new content to their children. Parents were also satisfied that their children were able to pursue their interests. These parents made comments such as "the class sparked his interest in new scientific topics" (P43, March, 2013), "enjoyed learning about topics that interest her and has been excited about it" (P16, March, 2015), and "got to learn about something that he was interested in" (P21, March, 2016). These references showed that the parents believed by participating in the program, their children not only developed their potential in their interest areas, but were also challenged with new and meaningful experiences.

Hands-on and interactive. Young children enjoyed conducting experiments and participating in activities as this allowed them to use all their senses in the learning process. Twenty parents reflected that their children had a great time with interactive experiences in this program, and they said they especially enjoyed the projects that their children brought home. A parent commented that her child "loved the tornado in the jar and keeps it in her room." (P9, March, 2016), and another parent echoed a similar idea about her daughter's experience, saying **"**she greatly enjoyed making the sun dial which was important to her, because she is excited

about creating new things" (P19, March, 2016). Parents also shared some their children's most memorable experiences from the program. A parent commented on how the teacher used glitter to teach about the spread of germs, and said "[the teacher] put glitter on a few children's hands, then had all of the children repeatedly shake hands. My daughter was astounded by how fast a germ could spread" (P4, March, 2016). Another parent shared how her child learned from a simple activity of making paper planes that "they can really go far even if you throw them gently" (P41, March, 2013). From these comments, we noticed that children enjoyed the process of creating something and were also able to grasp the learning behind the activities.

New and high quality information presented. Children in the Super Saturday program had many opportunities to engage with new words, concepts, and procedures in their STEM enrichment classes. Thirteen parents reported their children were thrilled to learn new ideas and excited to learn about new topics without dilution. Comments such as "expanded (in many cases, initial) knowledge of the basic scientific world" (P50, March, 2013), "learned new words, phrases, etc. by learning the waste cycle" (P53, March, 2016), "learn scientific issues, such as chemical changes, weather, and matter." (P2, March, 2016), and "taught them accurate terms and never dumbing down" (P4, March, 2016) showed that parents believed their children were able to learn new STEM concepts and information without simplifications.

Theme III: Learning beyond the classroom

Applying the knowledge at home and with family. Students in this age group may struggle to maintain focus for any length of time, so transferring ideas or activities into their home lives can be difficult. Sixteen parents made 18 comments that students transferred the lessons provided in the Super Saturday program to their home lives. One parent said that his child "comes home and teaches his younger brother all about what he's learned. He continues to

talk about it, and its applications, all week!" (P41, March, 2013). Parents explained how their children continue to engage in the concepts and ideas introduced through the program, and also taught other family members the content they had learned. Examples of these comments are: "she enjoyed the [field trip] and exploring the site. She wants to go with us and teach us about the animals which are there" (P38, March, 2013), "she really enjoyed how she was able to take home the projects done in class and continue to play with them at home" (P5, March 2016), "he learned about the 3 phases of matter. After he returned home, he applied this lesson to what he found around the house" (P54, March, 2013), and "she spent hours in our kitchen creating spider webs until it dried up!" (P31, March, 2014). These comments from the parents showed how the students were kept engaged by the stimulating courses and the engagement continued at home.

Thinking about the future. An important aspect of talent development is to help students discover their interests and develop their potential. An early introduction to STEM education through Saturday does not only start students in the field when they are young, but also to keep them in the field as they progress through school. Four parents referenced this need, including one who said, "I want to encourage her in STEM programs so that she has more opportunities and options when she grows older. She LOVES science and I want that to continue as she grows older and to not lose this excitement" (P32, March, 2015). Another parent also shared that the program has inspired her child, and said "learning about space and broadening her horizons! A wonderful long-term benefit was exposure to women in science and engineering and astronomy. Our little girl wants to be an astronaut!" (P37, March, 2014). It is natural for parents to have long-term goals for their children. Specifying those goals for STEM education can be a key factor in the development of gifted children.

Discussion

Gifted programs in schools for this age group are rare (Kuo et al., 2010), so often parents need to look for alternate enrichment opportunities to help their children explore and develop interest in the STEM fields. Such enrichment opportunities are especially essential for young gifted children who are beginning to explore and develop their potential. In line with various talent development models (Gagné, 2010; Renzulli, 2012), Super Saturday was designed to provide the opportunities and environment to introduce young children to new interests and topics. Without barriers, such as selection process and proof of giftedness, Super Saturday is accessible to all children. Thus, young children are able to gain access to talent development opportunities, which may initiate them onto a path towards greater challenges (Subotnik et al., 2011). Based on the parental feedback gathered, it was clear that parents appreciated the opportunities provided for their children to engage in STEM learning. They commented on their children's enthusiasm and motivation to learn as well as the benefits gained from the classes. From the parents' perspectives, such early introduction to the STEM field, not only helped their children discover new interests and explore new topics, but it has also helped some of the young children to think about their future education and careers. This finding is aligned with other research on talent development, where gifted children need to have access to learning opportunities to help them discover their interest and develop their gifted potential.

In addition, we found that these young gifted children could handle advanced science and math curriculum, which is supported by the literature (Aronin & Floyd, 2013; Samarapungavan et al., 2011; Sullivan et. al, 2013). Parents have commented on their children being able to grasp different scientific concepts and even being appreciative of the teacher not simplifying the materials based on the students' age. The use of hands-on activities has also proved to be helpful for many of the students. Students were able to understand abstract concepts through building

models and structures that helped them to visualize the concepts. Many young children learned efficiently with developmentally appropriate hands-on activities (Downing, Aldrich, & Shelly, 2006). They enjoyed doing stimulating, hands-on tasks, and often thrived in settings that may have seemed exceptionally challenging (Coleman, 2016). Parents have also highlighted how their children continue to work with the various activities they have learned in class back home. The interactive classes stimulated the children intellectually and kept them engaged (Moomaw & Davis, 2010; Sharapan, 2012).

Not only did young gifted children master difficult concepts, but they took what they learned beyond the classroom, and applied it in their daily lives. Parents reported their children exhibiting a desire to do similar activities at home. Many students taught their siblings or other family members about the concepts they learned in their classes. Gifted students enjoy learning new concepts and are always curious about things around them. When they process new knowledge or high quality information, they excitedly connect it with their present knowledge and apply it to their learning (Davis et al., 2013). Promoting transfer of knowledge can be a challenge with young children. Teachers of young students often find it challenging to teach long-lasting concepts with objectives that the students remember. With the proper classroom environment and mindset, transfer can be achieved (Sala & Gobet, 2017).

In summary, parents' feedback about their children's participation in Super Saturday showed how the provision of opportunities for young children to engage in concepts and materials that are seldom addressed within early childhood education, had helped these children to grow. Although parents were surprised by their children's abilities to grasp concepts that were often considered to be too difficult for their age, researchers in the field of gifted education have always maintained the need for enrichment opportunities to challenge and stretch young children

to discover and develop their gifted potential. Thus, findings from this study supported the need to continue in providing STEM opportunities to young gifted children to help them discover an interest and joy in exploring the STEM field.

Limitations of the Study

First, participation in the parent evaluation survey was voluntary, so not all parents responded. From 120 students who participated in the program during the four years studied, only 55 parents responded. This provided us with a small sample size that may not be representative of the population studied. It is possible that those who responded were more positive than those who chose not to respond. Second, parents who participated were likely aware of the benefits of STEM education. They are already engaging their children in enrichment opportunities that extend beyond the classroom. If the study was conducted in a traditional school setting, responses may be different. Third, findings reported here are not necessarily generalizable to other settings, as they reflect one program at one university within one community.

Call for Future Research

There are many opportunities for future research involving young gifted children in STEM education. A topic not addressed by our study was the effect of early STEM education on long-term achievement. The implementation of programming, and children's engagement in STEM-based content, could have an effect on their academic achievement in later years.

Due to the ages of the students, we decided to use parental responses in our study. The development of an instrument that could appropriately obtain data from young children would be helpful in future studies. Alternatively, some other data collection process, such as an interview

with very young Super Saturday participants, may be preferred. Finally, replication of this research in other educational settings could confirm these findings in different contexts.

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Table 1.

Parents' Responses to Program Evaluation Survey

Class Name	Number of Students Enrolled	Number of Parents Providing Feedback	6: My child was enthusiastic about his/her class Mean(SD)	7:My child would like to return Mean(SD)	8:My child learned a lot in the class Mean(SD)	9: The class my child attended was challenging for him/her Mean(SD)	10:My child was motivated to learn in his/her class Mean(SD)
Icky, Sticky, Fun	32	16	4.68 (0.58)	4.63 (0.68)	4.58 (0.61)	4.21 (0.98)	4.84 (0.37)
My Backyard: A Musical Exploration of Life in the Backyard	17	8	4.88 (0.35)	5.00 (0)	4.88 (0.35)	4.25 (0.89)	4.63 (0.52)
Space Race	11	8	4.50 (0.53)	4.50 (0.53)	4.50 (0.53)	4.00 (1.07)	4.63 (0.52)
Visual Math	31	11	4.50 (0.55)	4.83 (0.41)	4.33 (0.82)	3.50 (1.05)	4.83 (0.41)
Who Wants to be a Scientist?	8	6	4.61 (0.50)	4.83 (0.38)	4.56 (0.70)	3.56 (0.92)	4.61 (0.61)
Funky Physics	12	3	5.00 (0)	5.00 (0)	5.00 (0)	4.00 (0.10)	4.67 (0.58)
Aquatic Biology	9	3	4.33 (0.58)	4.67 (0.58)	4.67 (0.58)	2.67 (0.58)	4.67 (0.58)

Table 2

Examples of Open, Axial and Selective Coding and Frequency of Use

Examples of Open Coding	Axial Coding	Selective Coding	Number of parents supporting the axial code	Number of references for the Axial Code
More comfortable with math and measurement; prior to this class he didn't like school; became adventurous	Changes in attitudes and behaviors	Positive experiences	9	10
Excited about an extracurricular activity in a long time; enjoyed the assignments; excited about science and learning	Enjoyed and excited about learning		34	47
No similar programs for her age group; more in depth about animals than he does in school; focusing on one subject for 3 hours; exposure to higher level math concepts	Providing challenges and widening interests		20	23
New scientific principles she learned; broadening her horizons; learning new things in math	New knowledge	Satisfied children's educational needs	13	16
Creating new things and hands-on activities; touched and enjoyed a new materials	Hands-on activities		20	22

Experiments at home; share with her family after class; talked about it a lot at our house; taught her brother what she learned	Applying the knowledge at home and with family	Long-term benefits beyond the classroom	16	18
Women in science, engineering and astronomy; wants to be an astronaut; college bound opportunities and options	Thinking about the future		4	4

Appendix

Parent Evaluation Form

Class Name: _____Teacher:_____

Please rate how much you agree with each of the following items. Write the appropriate number in the space provided using the following scale:

1= Strongly Disagree **2**= Disagree **3**= Undecided **4**= Agree **5**= Strongly Agree

___ 1. My child's teacher was available to help if he/she had a problem.
___ 2. My child's teacher kept us informed of procedures and activities.
___ 3. My child liked the teacher.
___ 4. Making new friends was one of the best parts of this program for my child.
___ 5. My child enjoyed his/her peers in this program.
___ 6. My child was enthusiastic about his/her class.
___ 7. My child would like to return.
___ 8. My child learned a lot in the class.
____9. The class my child attended was challenging for him/her.
___ 10. My child was motivated to learn in his/her class.
___ 11. I am satisfied with my child's accomplishments in this class.
___ 12. Information in the program brochure was clear.
___ 13. The acceptance packet was informative.
___ 14. Registration procedures were efficient.
___ 15. The online registration process was efficient (if applicable)

For the following two (2) questions, please circle your response.

16. Was your child in a gifted and talented program at his/her home school this past year?

    Yes No My kid's school does not have gifted programs

17. On average, how often does your child access the Internet from home?

    No access Rarely Once a week Multiple Times a Week

    Daily Multiple Times a Day

We appreciate your thoughtful answers to the following questions.

18. What has been the greatest short-term benefit to your child from your child's participation in this program?

19. What has been the greatest short-term drawback to your child from your child's participation in this program?

20. Are there other classes or topics you would like to see offered in future sessions of the program?

21. What was the single most memorable moment your child experienced in his/her class and explain why that experience was important to him/her.

For the following questions please circle or mark the appropriate answer. (This information will be used to evaluate the program only and will not be released to any other individual or organization.)

Student's Gender: ___ Female ___ Male

Student's Ethnicity: ___ Native American / Alaskan ___ Caucasian/Non-Hispanic ___ Hispanic
___African American/Non-Hispanic ___ Asian ___Multi-Racial
___ Pacific Islander ___ Other

Received a Scholarship: ___ No ___ Yes
HOPE Scholar: ___ No ___ Yes

Parent(s) Education: ___ 8th grade ___ Some high school ___ High school graduate
___ Some college ___ Bachelor degree ___ Some post graduate
___ Master degree ___ Ph.D. degree ___ Professional degree

Household Income/yr: ___ $10,000 or less ___ $10,000-15,000 ___ $15,000-25,000
___ $25,000-50,000 ___ $50,000-75,000 ___ $75,000 or more

Housing: ___ Renter ___ Owner

Place of residence: ___ West Lafayette ___ Lafayette ___ Tippecanoe County

___ Other (Please specify) _____

How do you hear about Super Saturday:

From school's Newsletter From Website

From other parents From Brochure

Other (Please specify) _____

Please feel free to make any other comments on the back of this page.After completing this form, please return it to the instructor.