

*Parents as Learners, Teachers and Facilitators in an Intervention Program for
Enhancing Children's Math Learning in Taiwan*

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Abstract

Parents who are involved in their children's education contribute not only to higher academic achievement, but also to positive behaviors and emotional development (Stevenson & Lee, 1990). In this report, I will share qualitative analyzes on data analyzes from an intervention project (parental involvement in children's math learning) conducted in Taiwan. Data sources are questionnaire, diaries, focus group interviews, worksheets and videos. Results indicated that research-based tasks in math camp engaged parents as learners, teachers, facilitators, leaders (Civil and Bernier, 2006) and observers. Such roles created potentials for parents to take charge of children's math learning in school and at home.

Keywords: Parental involvement, learners, teachers, facilitators, children's math learning

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1. Introduction

This is an intervention project on parental involvement with a goal to enhance children's learning in mathematics in Taiwan. In an elementary school near my university, I offered bi-weekly Friday Math for parents and children year round for each grade over time. Results for grade 1-4 were reported (Leung, 2012; Leung, 2015, Leung 2019, in Chinese). The project was extended to kindergarten (Leung, 2018,) and finally grade 5 and grade 6. The overall goal is for a K-6 model on parental involvement. In this report, the result is on analyzes of data for grade 5 and grade 6.

1.1 Parental Involvement

Educating the next generation is a responsibility for all. The word "education" included 5 vowels that sounds "great" for all nations. In Chinese, education is "教育" which means to cultivate for growth. Research on large scale comparative studies confirmed the importance of parents' involvement (e.g. Chiu & Zeng, 2008). It was found that parents contributed to academic achievement, positive behaviours, and emotional development of children (e.g., Stevenson & Lee, 1990; Weston, 1989). Parental involvement in children's education is gaining increasing attention in many countries.

1.2 Partnership of home, school and community

To date, there are various projects on home school partnerships around the world such as project NNPS in US (Epstein, 1995); for families of socioeconomic status in New Zealand (Maher, 2007); for Latinos families in project CEMELA (Civil & Bernier, 2006) and also in the east like Hong Kong (Ho and Kwong, 2013). These projects are exemplars showing successful outcomes by joining combined efforts from parents, teachers and teacher educators who worked together.

In this study, I attempted to integrate efforts (teachers and parents) in an intervention project. It is on parental involvement with a goal to enhance children's learning in mathematics. In an elementary school near my university, I offered bi-weekly Friday Math Camp for parent-child year round for each grade over time. Preliminary results for grade 1-4 were reported and a book was published (Leung, 2015; Leung, 2019 in Chinese). The project was extended to kindergarten and grade 5/6.

The research questions are: What roles do parents assume as they attend this Math Camp over time? What exemplars can be collected as evidence of roles that carry potentials in enhancing parents and children's math learning?

2 Literature

2.1 Curriculum standards emphasis parental involvement in math learning

In both US and in Taiwan, parental concern for children's learning of mathematics is emphasized in curriculum standards documents. "Families become advocates for education standards when they understand the importance of high-quality mathematics education for their children" (NCTM, 2000 p. 378). In Taiwan math curriculum standards documents, there is a part on reminding parents; "learning math should be a happy experience to students." When parents find children having hard time with learning math or having low scores there is no need to be anxious. In this document, parents are urged to ensure students to complete homework with full

concentration. If not, students make mistakes, get frustrations and finally give up learning math. Research studies on strategies enhancing math learning are useful in intervention program for parents, the activity can be in form of a game (van den Heuvel Panhuizen & Buys, 2008; Leung & Lo, 2010), reading a picture book (van den Heuvel Panhuizen, Boogard, & Doig, 2009), posing problems and diary writing (Leung & Wu, 2000), completing a math trail (English, Humble & Burmes, 2010).

2.2 Combined Efforts: Working together

The framework I used is from co-learners' sharing knowledge by Jaworski (2008). The model by Jaworski (2008) explain the mechanism, when a Venn diagram represents how a mathematics teacher educator (MTE) and teachers share knowledge. One circle carries MTE's knowledge of research and theory while the other circle holds teachers' knowledge of students and schools. The sharing of knowledge, given in the intersection of the two circles, means that passing of knowledge is bi-directional: teachers also pass knowledge to MTE. In this study, a third circle is used to include parents: parents share knowledge of children's behavior at home.

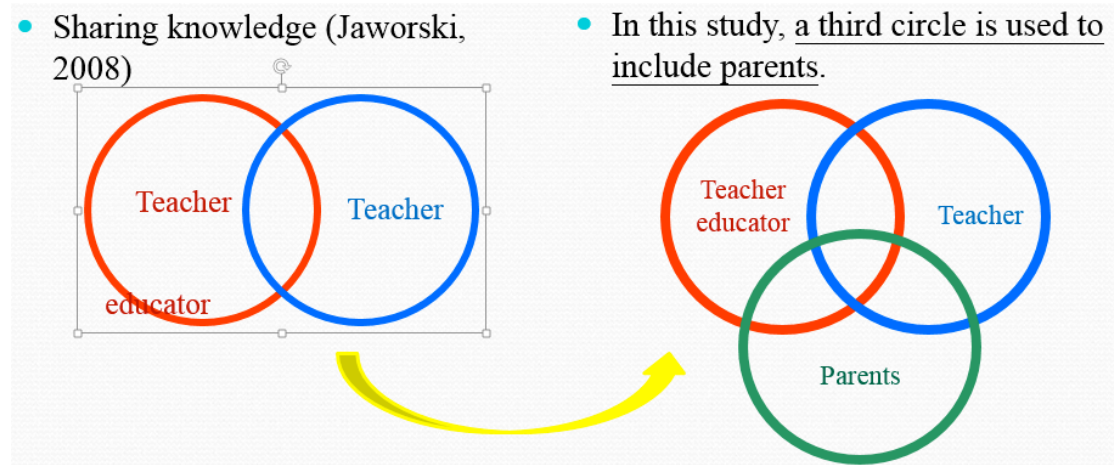


Figure 1: Working together

2.3 Parental Roles

According to Cai (2003) there are 5 roles of parents in assisting children's math learning:

motivator, monitor, resource provider, mathematics content adviser, and, motivator and monitor. The study compared the relationships of children's math performance to parental roles. Among the five roles, motivator and monitor is the best predictor for children's math performance (and not content advisor). However, these five roles from Cai (2003) were "parents as teachers" according to Civil and Bernier (2006). They gave examples of four more parental roles: as learners, as teachers, as facilitators and as leaders. Thus, Cai (2003) addressed to multiple roles of parents that happened to be one role called "parents-as-teachers" according to (Civil & Bernier, 2006). In the east and in countries like Taiwan, parents are anxious about children learning, will they tend to take the role as teachers?

3 Method

3.1 Case study

This is a case study and the method follow that of Yin (1994). The research team consisted of a math teacher educator (myself) and her research team (a research assistant and 2 graduate students). Participants also included an elementary school teacher, parents and children. The teacher educator (myself) had been to elementary schools 4 years teaching her two sons' classes. The elementary school teacher used to be her undergrad student and also her graduate and her master degree thesis is on parents' study group. In this program, the participants came to meet in the elementary school that was only 5 minutes' walk from subway station and from my university. By referring to Civil and Bernier (2006), I started with Parents as learners and have parent-child pairs learn math together. I referred to curriculum standards and textbooks series to develop research-based activities suitable for parent-child Math Camp during Friday afternoons. Two characteristics of each activity are: Learn Math together, Promote Parent-Child interaction. To explain how to motivate parents and child in learning math concepts and as well enhance parent-child interaction, I include one example in Space Strand (S) below. The other activities can be in form of a game, reading a picture book, posing problems, paper folding, writing a diary, or, completing a math trail.

Example Task: Write a story using plane figures from Tangrams (Space Strand). For plane figures, the child and the parent each do paper folding that results into paper Tangrams. Each person in a family used the seven pieces to create an object (e.g. a tree; a kite). When asked how to make shapes, the teacher educator gave examples of "don't"s instead of "do"s. Examples of "don't"s meant the pieces could not overlap nor separate. If she suggested "do"s (e.g.: a cat) the participants might just followed (also make a cat). After each of them finished making a shape (e.g.: a kite and a tree) then parent and child make a story using a tree and a kite and record the story in a diary. Sharing and communication is emphasized and spatial sense is enhanced. Later, they could remove the pieces and made other shapes and wrote different stories. Although the activities were developed by me, I sent to three elementary school teachers to check if they were appropriate. Revisions were made until all agree on the timing, appropriateness of math materials, and potential opportunities for interaction of child with parents.

A typical Friday Math Camp (Time: 13:40 to 15:20)

During the first session parents and children attended class in two separate classrooms. In my classroom (for parents), I talked to parents and explained how children learn math; conducted focus group interviews and asked parents to fill in questionnaire. In the other classroom (for children), the elementary school teacher and the children went to a hands-on activity. For example, asking children to make up teaching aids required for playing math game with parent in the second session; folding paper to form a card for Mothers' Day or, shading colors on fraction cards and cut them into a deck of poker cards. During the second session parents and children attended class together. I introduced math games (so that learning took place in families). The seating arrangement is: one table, one family. I made sure each family could play on their own before all families played together. Finally, there was a whole class discussion and I sent out a follow-up activity and a diary sheet to do at home and share what happened during the next meeting.

3.2 Stages

The stages for this intervention program as above. The order of the grade levels: grade 1 to grade 4; Kindergarten, grade 5 to grade 6 was due to administration decisions on school building and timetabling of this school. As mentioned before, this report only includes results on two research questions for grade 5 and grade 6 (Stage III)

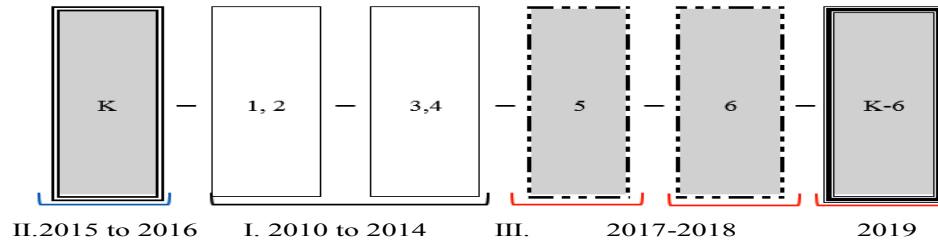


Figure 2: The three stages

3.3 Data Source and Analyses

In each school year, there is total of 16 bi-weekly Friday Math Camps. However, the number of families attended varied according to grade. Data source were: questionnaire, diaries, parents' focus group interviews, worksheets and videos; the data were analyzed qualitatively as in Creswell (2009). Data were coded by two independent raters and reliability was checked. Disagreements were discussed and resolved through e-mails or telephone discussions.

4 Results

Over the two years there are instances of multiple roles of parents over time. They are learners, teachers, facilitators and leaders as given in Civil and Bernier (2006). Also, parents were observers of children learning math in school and were partners or opponents of their children when they played family math games at home. Below are exemplars as evidence of such roles that carry potentials in enhancing parents and children's math learning.

4.1 Parents as learners

First, they learned math themselves. In the activity (Poker Factor-Multiple) the math materials is on Factors and Multiples. Parents learned how to find factor cards of a given number as in a Multiple card and were grade 5 "students". *"I almost forgot what they (Factors and Multiples) are and their relationship until I played this card game"* (2017.11.06). They also learned which 11 configurations of 6 squares that could make a cube by actually making the cube (2018.02.18). Second they learned about children's thinking by reviewing exam papers together. In review of grade 5 first exam, the teacher educator worked out solutions and explained children thinking. Parents talked to each other: guessed how children solved problems and suggested strategies and misconceptions. During "Q and A" session, parents asked about why their children homework was wrong and the teacher educator contrasted the correct methods with common misconceptions. Third, they learn how to respond children: the teacher educator demonstrated how to talk to children, how to use gestures and praise.



Figure 3: Make a Cube, Review Exam paper, and Responding to Children

4.2 Parents as teachers

First, they posed problems for children to solve. In the activity (Guess Me) the math material is on unknown (Algebra Strand) one of them used plastic flower chips as unknown and posed this problem. “the cost of 4 flowers is \$12, when purchase 3 flowers, how many dollars should one pay?” Another evidence is from the Math Fun Fair (Grade 6 end of term), parents created games (Chess, Dragon Boat Festival) and made up teaching aids and during the Fun Fair helped out as teachers (Figure 4). Parents expressed that they learned a lot, as they compared children’s responses.



Figure 4: Fun Fair

Second, our parents monitor, provided resource and then advised on content. How do we play “Make the Most” at home? (A set of cards each with either “0” to “9”, one of the four operations symbols, equal sign, or “.....” meaning remainder. The goal is to use as many cards as possible to form correct expressions. The player who used out the most is the winner.) *When we played “Make the Most” I let my two children flipped the cards out. The older one asked if he could use division so that he could use more cards but his younger brother (who only knew addition/subtraction) did not understand what division was. Until then I just monitored and did not participate. After “division: was mentioned but I helped them to check the expressions.* Diaries (5-1;2017.10.06; Parent: HuaChun Children: Yin, Chian)

Parents as players (partners or opponent of child). When the activity is a Fraction Poker game. *When we played fraction poker cards (parts of circles are shaded as in the fraction indicated on the card with circle) I told her when the shaded parts of two cards added to one circle then the two fractions added to “1” my girl and I found this game fascinating.* Diaries (5-1;2017.10.27; Parent: ChuYuen Child: MinYu)



Figure 5: Resource provider, monitor

4.3 Parents as facilitators

First, they shared thoughts and attempts at home. A parent was asked to present diaries and did story telling about what happened at home. After doing so other parents would join in. *“It was not until I was asked to take a turn to tell during the next meeting then I made an effort to record down what he did at home. He folded a paper and cut out a yellow butterfly which is symmetric. Next he used grid paper and made 2 more figures by line symmetry in red and in blue ...”* (see Figure 6)

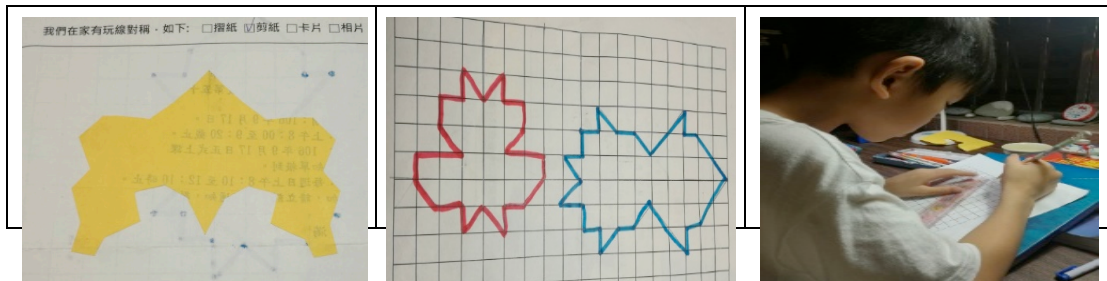


Figure 6: Worksheets (5-2;107.04.27) Parent: Yinwen ; Child: HweiChian

More parents joined in afterwards. One parent told other parents that she used cubes to make a solids then asked her child to find surface area by counting top and bottom (9, 9); left and right (9, 9) and finally front and back (9, 9) then added the total number of faces. (see Figure 7)

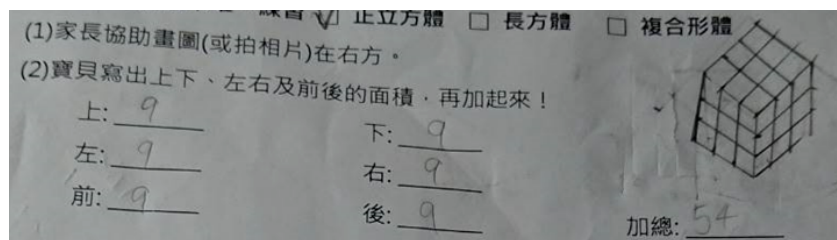


Figure 7: Worksheets (5-2;107.05.04): I know how to find surface area

As they shared results the discussion was facilitated. Parent Tinyi used 10x10 grid (100 squares) paper to play a game on Percents with her girl Pei. The game is “You say I draw”. One say “5%” the other shaded 5 squares. What followed was 20%; 12%, and 35%. When the next ones are 40% and 38% the shading is a Chinese character. Mother and child then changed the game. This time, one player drew and the other told the percentage. The house is 43% while the fish is (26%). Suddenly, the child wrote her Chinese name and occupied three different percentages respectively. To end, she drew “I ♥ U M A” and signed using a face. That was a very sweet ending (see Figure 8 for shadings and percent).

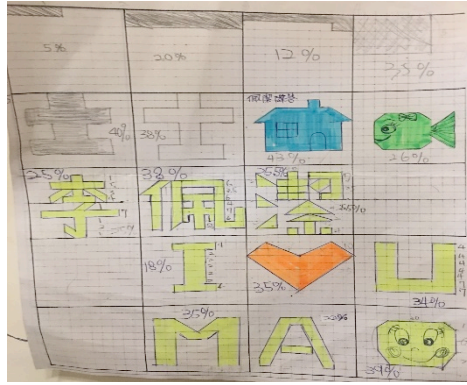


Figure 8: Worksheets (5-2;107.06.08): “You say I draw” (Percent)
Parent: Tinyi ; Child: Peiche

Second, they interacted with other parents in groups and checked each other’s work before reporting findings for the group. In the left photo of Figure 9 parents fold paper into a tangram, cut into seven pieces then used them to make shapes and named them. Finally, they used the named shapes to create a story and came to the stage to tell the story. *“The presentation was most unforgettable. We seldom had a chance to present results.”* (Diaries, 2018.0102). In the right photo of Figure 9, they two parents played “Make the Most” in class settings. To play, display a set of cards each with either “0” to “9”, one of the four operations symbols, equal sign, or “.....” meaning remainder. The goal is to use as many cards as possible to form correct expressions. The player who used out the most is the winner. A daddy and a grandma sat together and did not know how to start. One of them (the grandma) started to remember one day her grandchild told her about the game after school. She started to use cards “ $12 \times 5 = 60$ ” until both of them in the group used out nearly all the cards.



Figure 9: Parents worked in groups

4.4 Parents as leaders

First, they gave a talk. One parent, Kuei, shared what she knew on origami. All of us used 8 sheets of paper and make a kite. Second they came to the front to explain a solution or demonstrate a knowhow. (see Figure 10)

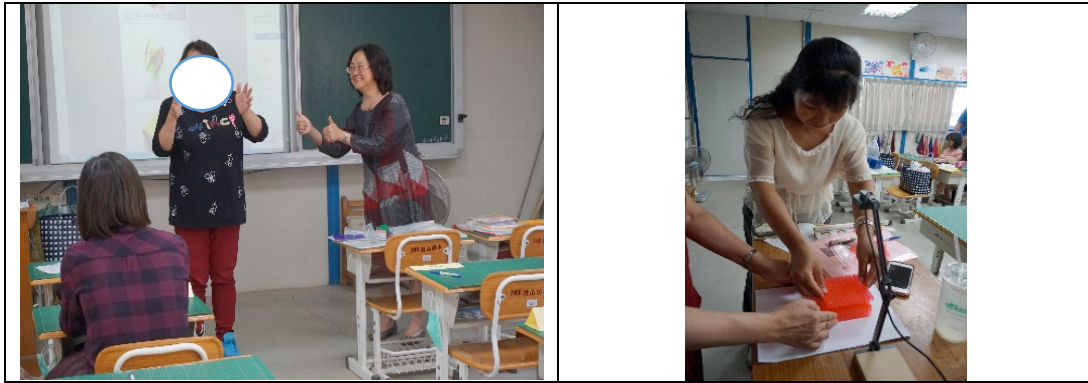


Figure 10: gave a talk, Explain solution

4.5 Parents as observers

I arranged for parents to observe me teaching their children during Wednesday mornings. For example, in teaching factors and multiples I taught them how to play Factor Family: considered the number of factors of a given number and then used number cards to form a “family” of members that are factors of a given number (e.g. 1, 13). Later they used sets of cards to beat each other. The more could beat the less (e.g. a set of “2, 3, 12” will beat the set of “1, 13”). When they went home they played with their family members. Another example is the conversion of units such as “Time”. The game is called “Fair Trade”. A deck of cards with one side writing a unit (day) then the other side another unit (week). I asked them to shuffle the deck of cards and picked one so that one person read only one side. If both players managed to read out the number of units that were equal the 2 players shook hand and recited “THIS IS A FAIR TRADE”. If one said “8 days” and the other said “1 week” then at least one of them will say “I will not trade, this is not a fair trade”. *“I never can imagine how my child (and friends) attend school until I sat at the back of the classroom that Wed morning. Learning math by interaction with friends was meaningful. The games were so interesting that we continues to play at home.”*



Figure 11: Factor family, Fair trade

5 Conclusion

In this study, parental multiple roles and examples at home were analyzed in terms of potentials of learning math and parent-child interactions. In the model I propose, the intersection region of three overlapping circles is the key to success. The findings indicated that working with parents, it is feasible engage parents to take multiple roles by (Cai, 2003) where parents’ roles were teachers. Besides the role as teacher, parent were also as learners of math, facilitate during sessions, and volunteered to be leaders (roles as in Civil and Bernier, 2006). Finally, in order to add the role as observer, I purposely arranged for them to observed me teaching. This arrangement

could assist them to envision how children learn math in class settings. Results indicated that research-based family math tasks engaged parents as learners, teachers, facilitators and leaders (Civil and Bernier, 2006) and observers. Such roles also lead to potentials for enabling parents to take charge of children's math learning in school, at home and in community.

I close with anticipation to my next step: to empower parents, to include them as exemplars; and, to assist them to lead other parents in the community. Parents, as Civil and Bernier (2006) reminded, are resources; the resources are not limited to helping out in cafeteria or doing notice boards; the resources can be an enhancement in children's math learning.

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