



How Do Parents Introduce Basic Mathematics to Down Syndrome Children?

Yubaedi Siron^{1✉}, Aulia Rahmah², Hadiyatun Nadiyah²,
Hani Resti Alawiyah², Nia Alfiyanti², Syifa Fajriah²

¹School of Social Science, Education, and Social Work, Queen's University Belfast, Northern Ireland

²Department Islamic Early Childhood Education, UIN Syarif Hidayatullah, Jakarta, Indonesia

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Abstract

Purpose – This study aims to analyze the involvement of parents in introducing basic mathematics to children with down syndrome.

Design/methods/approach – This study uses a qualitative approach by conducting online interviews with parents of children with down syndrome. Participants were determined using purposive sampling involving five parents. This study reveals that the involvement of parents in introducing basic mathematics to children with down syndrome has different variants. Collecting data was using semi-structured interviews with interview guidelines, recorders, and documentation. Data analysis used the Milles and Huberman model.

Findings – Parents initiate methods and media in introducing basic mathematics to children. Parents can also identify the child's response, identify the advantages and disadvantages of the media, and provide alternative solutions to the obstacles and challenges faced.

Research implications/limitations – This study explains introducing strategic basic mathematical abilities in children with down syndrome and the involvement of parents in educating children with down syndrome in basic mathematics.

Practical implications – Parents of children with down syndrome need to introduce children to math early on. Parents have an essential role in introducing their down syndrome children's basic mathematical abilities by utilizing the media and giving good responses.

Originality/value – This research contributes to educating children with down syndrome in basic mathematics.

Keywords: Down syndrome; Basic mathematics; Parental involvement

Paper type: Case study

Introduction

Down syndrome is a brain function disorder characterized by a decline in social interactions, minimal activities and interests, and weakness in communication and imagination (Fadli, 2010). Down syndrome has a chromosomal abnormality with the addition of chromosome 21 (Papalia et al., 2009). Abnormalities in people with down syndrome can inhibit physical development, learning disabilities, heart disease, and leukemia (Irwanto, 2019).

In Indonesia, there are more than 300 thousand children with the prevalence of down syndrome children, reported by the Indonesian Center for Biodiversity and Biotechnology (ICBB) Bogor (Hasanah et al., 2015). Children with down syndrome need to be appropriately stimulated to reduce the potential for delays in child development through therapeutic programs, exercises, and systematically designed activities (Irwanto, 2019). Early intervention for children with down syndrome has aimed to maximize the competence of children with down syndrome in their development process. So far, from various literature reviews, there is no most effective treatment for children with down syndrome. The effort to stimulate development in children with down syndrome uses a play method that refers to several theoretical bases because playing is the most effective way of learning in children (Fauziddin, 2017). One example of stimulation in children with down syndrome is inviting them to play. This effort to learn while playing can increase children's learning ability to communicate, socialize, and adapt to their environment. In addition, it can train the mental maturity of children with down syndrome, develop socio-emotional children, and train their motor skills to be ready (Prastuti, 2020).

The abilities that need to be possessed by children with down syndrome are the ability to develop themselves, survive, and be independent. The ability to eat, socialize, toilet training, and sleep are included in self-development in children, while this learning takes a long time for children with down syndrome due to physical and cognitive limitations. The ability to self-development is undoubtedly not an easy thing to master for a child with down syndrome. However, this ability is essential to overcome problems in daily life (Radina, 2020). One of the essential skills children with down syndrome should possess cognitive skills related to processing information, such as basic mathematical abilities (Marta, 2017).

The importance of basic mathematics for children with down syndrome is because mathematics dramatically influences human life (Fitria, 2013). Introducing mathematics as early as possible can make it easier for children to do calculations and solve problems (Setyorini et al., 2021). In general, children with down syndrome can not be separated from the relationship with mathematical concepts. Parents can introduce mathematical concepts from an early age through playing experiences or daily activities. Counting, measuring, touching, and feeling are experiences that can be used as the best learning in introducing concepts (Pebrianty et al., 2014). One of the initial introductions on mathematics aims to train children's cognitive skills, give children a sense of pleasure, and help find knowledge from what has been learned (Pebrianty et al., 2014).

The introduction of early mathematics is not enough for teachers only but also parents. Parents are the leading institution closest to the children (Slameto, 2010). Parents play an essential role in the development and education of children (Gonida & Cortina, 2014; Siron, Perdana, et al., 2020; Siron & Mulyono, 2019). The involvement of parents in the child's learning process is one of the factors that can determine the success of children's learning. Parental involvement in learning will control children's enthusiasm for learning (Komsu et al., 2018).

Research related to the involvement of parents with children with down syndrome is quite varied. Rachmawati (2016) said that parents could take care of their children well by themselves. Supported by research by Ghoniyah & Savira (2015), parents can overcome problems in raising children with down syndrome because of the social support from the family. Parents make adjustments by coping with stress. Coping stress is an effort made by regulating emotions so that children can adjust and change emotional experiences in situations that are considered stressful (Lestari, 2012). Likewise, the involvement of parents in treating children with down syndrome (Siron, Firlayani, et al., 2020).

Research related to the involvement of parents who have children with down syndrome still needs to be studied further. Especially in terms of the methods used by parents, learning media as supporting activities for the introduction of mathematics, the response of children when introduced, the advantages and disadvantages of the media used, the obstacles faced by parents when introducing basic mathematics to children with down syndrome, and the solutions used to deal with the problems faced by parents. Problems in introducing early mathematics to children with down syndrome.

Methods

This study uses a qualitative approach to determine the extent of parental involvement in introducing basic mathematics to children with down syndrome. Participants were determined using a purposive sampling technique involving five parents of children with down syndrome aged 4-8 years. The data collection technique in this study used a semi-structured interview technique with the tools used were interview guidelines, recorders, and documentation.

Table 1. Participant Demographics

| Parents' name | Parents Age | Profession | Domicile | Child Name | Child Age |
|---------------|--------------|------------------|---------------|------------|----------------------|
| FT(n1) | 36 years old | Housewife | North Jakarta | V | 5 years 1 month old |
| CEM(n2) | 29 years old | Housewife | Bekasi | K | 4 years 2 months old |
| Y(n3) | 30 years old | Private employee | South Jakarta | E | 4 years old |
| NM (n4) | 35 years old | Housewife | Jakarta | MT | 6 years old |
| EN (n5) | 34 years old | Housewife | East Jakarta | KS | 7 years old |

Table 2. Interview Guidelines

| No. | List of Questions |
|-----|---|
| 1. | The importance of introducing mathematics |
| 2. | The method used to introduce basic mathematics to children |
| 3. | Learning media that used to introduce basic math |
| 4. | The advantages of the media used |
| 5. | The disadvantages of the media used |
| 6. | Children's response |
| 7. | Obstacles or constraints faced when introducing basic mathematics to children |
| 8. | The solution to overcome obstacles when introducing basic mathematics to children |

The data in this study were analyzed using Miles and Huberman methods which consisted of data reduction, data presentation, and data verification or concluding. Data reduction in this study involves collecting the results of interviews, compiling the data by grouping the interviews, and coding the data according to the study results. The presentation of the data uses a table that has been designed and comprehensively makes an overview of the data. Next is data verification or concluding the involvement of parents in introducing basic mathematics to children with down syndrome.

Result and Analysis

The importance of introducing basic mathematics to children with down syndrome

The first question discusses the importance of introducing basic mathematics to children with down syndrome (Table 3). The importance of introducing basic mathematics is included in category one, which consists of 9 codes. Participants stated that basic mathematics in children with down syndrome is essential for daily life, mathematical concepts, mentality, independence, vocabulary, and children's future.

Table 3. The importance of introducing basic mathematics to children with down syndrome

| Category 1 | Code | Quote |
|--|----------------------------------|--|
| The importance of introducing basic mathematics to children with down syndrome | Logical thinking ability (n2) | Introducing basic mathematics to children with down syndrome is very important in various matters such as mathematical concepts, logical thinking, counting, and recognizing number symbols. In addition, it is also significantly affected in the future in daily life such as children's independence, children's mentality, and vocabulary. |
| | Mental (n2) | |
| | Independence (n2), (n5) | |
| | Vocabulary (n2) | |
| | Child's future (n1), (n3) | |
| | Counting (n4) | |
| | Recognize the number symbol (n4) | |
| Mathematical concepts (n5) | | |
| Daily life (n5) | | |

The method used to introduce basic mathematics to children with down syndrome

The second question discusses the methods used to introduce basic mathematics to children with down syndrome (Table 4). The method used in introducing basic mathematics is included in category 2, consisting of 4 codes. Participants stated that the methods used were an assignment, demonstration, Montessori, and singing methods.

Table 4. The method used to introduce basic mathematics to children with down syndrome

| Category 2 | Code | Quote |
|---|---------------------------------|---|
| The method used to introduce basic mathematics to children with down syndrome | Assignment method (n1), (n3) | The method used to introduce basic mathematics to children with down syndrome is the assignment method, singing demonstration, and the Montessori method. |
| | Demonstration method (n2) | |
| | Montessori method (n3) | |
| | Singing method (n3), (n4), (n5) | |

The media used to introduce basic mathematics to children with down syndrome

The third question discusses the media used to introduce basic mathematics to children with down syndrome (Table 5). The media used to introduce basic mathematics is included in category three, consisting of 10 codes. Participants stated that the media used were pom-poms, flashcards, ice cream sticks, number posters, books with pictures counted, and puzzles.

Table 5. The media used to introduce basic mathematics to children with down syndrome

| Category 3 | Code | Quote |
|--|---|---|
| The media used to introduce basic mathematics to children with down syndrome | Books with pictures are then counted (n1), (n4) | The media used to introduce basic mathematics to children with down syndrome are pom-poms, flashcards, counting sets, puzzles, number posters, colorful balls, ice cream sticks. In addition, the media used are bottle caps, number posters, even books with pictures, and then the numbers are counted. |
| | Number poster (n2) | |
| | Pom-poms (n2), (n5) | |
| | Flashcards (n2), (n3) | |
| | Ice Cream Sticks (n2) | |
| | Counting set (n3) | |
| | Puzzles (n4) | |
| | Math concept videos (n4) | |
| | Colorful ball (n5) | |
| | Bottlecap (n5) | |

The advantages of the media used to introduce basic mathematics to children with down syndrome

The fourth question discusses the advantages of the media in introducing basic mathematics to children with down syndrome (Table 6). The advantages of the media used to introduce these basic mathematics are included in category four which consists of 13 codes. Participants stated several advantages of the media, such as being easy to find, attractive, easy to carry, etc.

Table 6. The advantages of the media used

| Category 4 | Code | Quote |
|----------------------------------|---|--|
| The advantages of the media used | Recognize numbers (n1), (n4), (n5) Learn to write (n1) Learn to draw lines (n1) Learn to circle (n1) Easy to find (n2) Cute (n2) Interesting (n2) Clearer (n3) Learn colors (n3) Easy to carry (n3) Recognizing geometric shapes (n4) Thinking actively (n4) Thinking creatively (n4) | The advantages of the media used are that children are familiar with numbers, recognize geometric shapes, learn to write, learn to draw lines, learn to circle, and learn colors. In addition, the pictures are cute, attractive, more straightforward, easy to find, and even easy to carry anywhere. Children are also more active and creative in thinking from the advantages of the media used. |

Disadvantages of the media used to introduce basic mathematics to children with down syndrome

The fifth question discusses the disadvantages of the media used to introduce basic mathematics to children with down syndrome (Table 7). The disadvantages of media used to introduce basic mathematics are included in category 5, consisting of 3 codes. Participants stated that the disadvantages of the media used such as not being easy to carry anywhere, boring, and making children's eyes tired.

Table 7. The disadvantages of the media used

| Category 5 | Code | Quote |
|-------------------------------------|---|--|
| The disadvantages of the media used | Challenging to use outside the home (n1) Bored (n3), (n5) Tired child's eyes (n4) | The disadvantages of the media used are that they cannot or are difficult to use outside the home, are boring, and make children's eyes tired. |

Down syndrome children's response when introduced to basic mathematics

The sixth question discusses the response of children with down syndrome when introduced to fundamental mathematics (Table 8). The response of children with down syndrome is included in category 6, consisting of 8 codes. Participants stated that the responses given by children with down syndrome when introduced to basic mathematics, such as confused, enthusiastic, cooperative, ignorance, etc.

Table 8. Down syndrome children's response when introduced to basic mathematics

| Category 6 | Code | Quote |
|--|--|--|
| Down syndrome children's response when introduced to basic mathematics | Confused (n1), (n5) Remember and understand (n1), (n3) Good (n2) Enthusiastic (n2) Cooperative (n2) Ignorance (n3) Well (n4) Happy (n4) | When introduced to basic mathematics, children's responses are confused at the beginning of giving material, some being easy to remember and easy to understand, giving good, enthusiastic, cooperative, and happy responses. However, some children respond with ignorance. |

Constraints or obstacles faced when introducing basic mathematics to children with down syndrome

The seventh question discusses the obstacles faced when introducing basic mathematics to children with down syndrome (Table 9). The obstacles faced when introducing these basic mathematics are included in category 7, consisting of 7 codes. Participants stated several obstacles in introducing basic mathematics to children with down syndrome: children's lack of mood, children who like to play around, their focus shifts to toys, or lack of focus and crying.

Table 9. Obstacles or obstacles faced when introducing basic mathematics to children down syndrome

| Category 7 | Code | Quote |
|--|--|--|
| Constraints or obstacles faced when introducing basic mathematics to children with down syndrome | Lack of mood (n1), (n3) Bored (n2), (n4) Play around (n2) Switch to toys (n2) Lack of focus (n3), (n4) Cry (n4) Yet to found a suitable concept (n5) | Constraints or obstacles faced when introducing basic mathematics to children include a child's mood lacking, feeling easily bored, children who like to play around, their focus shifts to toys or lack of focus, and cries. In addition, some parents believe that the obstacle they face is that they have not found a suitable concept in introducing basic mathematics. |

Solutions to overcome the obstacles when introducing basic mathematics to children with down syndrome

The eighth question discusses solutions to overcome the obstacles when introducing basic mathematics to children with down syndrome (Table 10). The solution to overcoming the obstacles when introducing basic mathematics is included in category eight, consisting of 5 codes. Participants stated that some of the solutions used to face obstacles when introducing basic mathematics to children with down syndrome were learning while singing, finding the right time to study, creating a comfortable learning atmosphere, and being patient.

Table 10. Solutions to overcome the obstacles when introducing basic mathematics to children with down syndrome

| Category 8 | Code | Quote |
|---|--|---|
| Solutions to overcome the obstacles when introducing basic mathematics to children with down syndrome | Learning while singing (n1), (n3) The right time (n2) Patience (n3), (n4), (n5) Create a comfortable atmosphere (n4) Calm (n5) | Solutions to overcome the obstacles or constraints when introducing basic mathematics to children include learning while singing, finding the right time to study, creating a comfortable learning atmosphere, and always being patient and calm. |

Discussion

The first research question discusses the importance of introducing early mathematics to children with down syndrome. Learning mathematics is one way to train the ability to think logically and systematically (Sujiono, 2011). Beginning mathematics is an introduction to basic and simple mathematical concepts. The introduction of mathematical concepts starts from concrete to abstract things, and children are able to apply them in everyday life (Azhima et al., 2021). Basic mathematics is important for the life of a child with down syndrome in the future because mathematics has a structured, logical, systematic, broad, and interrelated concept. (Suhendra, 2004). Through the introduction of early mathematics, children with down syndrome are equipped to survive in their daily lives.

The second research question discusses the method used by parents in introducing mathematics to children with down syndrome. The method is a way to achieve a goal that has been planned. Participants said that the methods used to introduce mathematics to children with down syndrome were through assignments, demonstrations, singing, and Montessori methods. The Montessori method is a method that provides opportunities for children to develop and explore in every corner of the house because it is a lifestyle that starts from home safely (Kusumo, 2016). The Montessori method effectively stimulates children with down syndrome because it invites children to learn by doing (Kirana & Dewi, 2019). Parents introduce a variety of methods in introducing early mathematics for children. Although mathematics is generally considered difficult to introduce to children with down syndrome (Martinez & Pellegrini, 2010), children can follow the introduction of mathematics well with a good variety of methods.

The third research question discusses the media used by parents in introducing early mathematics to children with down syndrome. Media is a component that can trigger students in the learning process. Learning media is essential in the learning process for children. Besides attracting attention, it can also help children understand learning easily (Jalinus & Ambiyar, 2016). Appropriate and varied media can encourage children's enthusiasm and interest in learning and allow them to learn according to their interests and abilities. Media use is expected to attract children's attention and motivate children to improve their ability to recognize basic mathematics (Patria & Iriyanto, 2014). Participants said that the media used to introduce mathematics to children with down syndrome were: pom-poms, counting sets, number posters, colorful balls, ice cream sticks, flashcards, and puzzles. In addition, the media used can be bottle caps, number posters, even books with pictures, and then count the number of pictures. Flashcard games and puzzles, physical and language-related activities that involve hand-eye coordination, can help children recognize numbers or early math (Decaprio, 2013).

The fourth and fifth research questions discuss the advantages and disadvantages of the media used to introduce early mathematics to children with down syndrome. Learning media has many kinds and forms. In introducing mathematics to children, one of them is using concrete media so that children will know directly, see, and feel the media. The media has advantages and disadvantages to achieving learning objectives (Netriwati, 2017). Participants said that the advantages of the media used by children were familiar with numbers, recognized geometric shapes, learned to write, learned to draw lines, learned to circle, and learned colors. In addition, the pictures are cute, attractive, more precise, easy to find, and even easy to carry anywhere. So that from the advantages of the media used, children can be thinking more actively and creatively. The advantage of the media used by parents is that children with down syndrome can get help from learning media through concrete objects (Amalia, 2020). In addition, participants also said that the disadvantages of the media used are difficult to use outside the home, tedious, and it makes children's eyes tired. Parents using learning media that are less attractive can cause boredom in children, thus affecting children's attention to the material provided (Leonard & Chaidir, 2018).

The sixth research question discusses the response of children with down syndrome when parents introduce basic mathematics. Participants said that some of the responses of children with down syndrome when introduced to basic mathematics were quite diverse. They were confused at the beginning of giving the material. Some were easy to remember and understand, gave good responses, were well, enthusiastic, cooperative, and happy. However, some children are ignorant. When the learning process occurs, children with down syndrome sometimes give responses such as shifts in concentration, memory, and mood swings, whether they are happy, bored, or do not care/ignore (Ismail, 2015). Parental involvement and children's responses are exciting things to discuss. It is not easy for parents to care for a child with down syndrome (Cuskelly et al., 2008; Roach et al., 1999; Van Hooste & Maes, 2003). The high parental stress factor also has an effect Roach et al., (1999) by seeing the varied responses of children. Parents have different perceptions of children's responses after introducing mathematics to their children.

The seventh research question discusses the obstacles or constraints faced by parents when introducing basic mathematics to children with down syndrome. Participants said that the

obstacles or constraints faced when introducing basic mathematics to children where the child's mood was not good, the child likes to play around, gets bored quickly, turns his attention to the toys, and the participants have not found the appropriate concept in introducing the basic mathematics. It happens because children with down syndrome can follow the flow of these activities when carrying out activities. Sometimes they are hampered by a lack of moods (Hazizah, 2020). Providing stimulation and intervention for children with down syndrome needs extra patience if parents want to be successful in optimizing their child's development (Siron, Firliyani, et al., 2020).

The eighth research question discusses solutions in dealing with obstacles when introducing basic mathematics to children with down syndrome. Parents motivate children to learn mathematics by linking context to daily life. When children have problems introducing mathematics, parents should make learning variations interesting for children (Mike, 2010). In order to make children enthusiastic in carrying out activities, parents provide support and motivation to children in terms of morals and material (Putri & Ardisal, 2020). Parents need to make more efforts to keep children focused and make children's moods good (Hazizah, 2020). The participant said that the solutions to overcoming obstacles or constraints when introducing basic mathematics to children were learning while singing, finding appropriate time for learning, creating a comfortable learning atmosphere, and always being patient and calm.

Conclusion

Introducing basic mathematics to children with down syndrome is essential in preparing children's daily lives. Introducing mathematics from an early age makes it easier for children with down syndrome to perform calculations and solve problems related to basic mathematical concepts as a form of self-development and self-help. In mathematical concepts for children with down syndrome help finds knowledge using appropriate and safe methods and media, children with down syndrome are interested in learning mathematics. Although there are still obstacles in introducing basic mathematics, they can be overcome with various solutions such as: finding the right time, having fun learning, and using unique and exciting media for children with down syndrome.

Declarations

Author contribution statement

Yubaedi Siron conceived the presented idea. Aulia Rahmah developed the theory of down syndrome. Hadiyatun Nadiyah developed the theory of basic mathematical. Hani Resti Alawiyah developed the theory of early childhood education. Nia Alfiyanti developed the theory of parent involvement. Syifa Fajriah verified the analytical methods. All authors discussed the result and contributed to the final manuscript.

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Data availability statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Declaration of interests statement

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Additional information

Correspondence and requests for materials should be addressed to ysiron01@qub.ac.uk.

ORCID

Yubaedi Siron  <https://orcid.org/0000-0003-3132-7762>

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