International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 14, Issue 3, 2020

Mathematic Communication Skills for 1st Graders with Down Syndrome in Primary School

Dyah Worowirastri Ekowati[a], H. Husamah[b*], Erlyna Abidasari[c], [a]Department of Elementary School Teacher Education, FTTE-Universitas Muhammadiyah Malang, East Java, Indonesia, [b]Department of Biology Education, FTTE-Universitas Muhammadiyah Malang, East Java, Indonesia, [c]Department of English Education, FTTE-Universitas Muhammadiyah Malang, East Java, Indonesia, Email: [b*]worowirastri@umm.ac.id

Down syndrome (DS) is characterised by weak motor control, lack of ability to coordinate, but on the other hand, the person can still be trained to reach the ability to the point of the normal condition in terms of mathematic communication skills in learning mathematics. In order to analyse the mathematic communication skills of a student with DS, descriptive qualitative research was carried out, while the data collection was done by observation, interview, and documentation techniques. The research subject was one DS student in the 1st grade of elementary school. This study was conducted at SD Muhammadiyah 9 Malang, East Java, Indonesia. The results of the analysis stated that of the three indicators of the mathematic ability in the verbal production aspect, the DS student was able to master the indicators of asking and answering questions. Whereas in the mathematic communication skills of the written aspect, of the three indicators shown, only one indicator had been mastered by the student, namely declaring a situation into the form of a mathematical model, although that ability has to be improved.

Keywords: *Down syndrome, Mathematical communication skills, Mathematics learning.*

Introduction

Down syndrome (DS) is a condition of physical and mental developmental retardation in children (Bruckner, Singh, Lelong, & Khoshnood, 2019; Clarós et al., 2019; Dandashi et al., 2015; Halliday & Mallucci, 2019), due to abnormalities in chromosome development (Ahlfors et al., 2019; Zampini & Zanchi, 2020). As one part of the group of Children with Special Needs, DS children generally have more abnormalities than other disabilities, especially in terms of their intelligence (Enea-Drapeau, Carlier, & Huguet, 2017; Godfrey & Lee, 2018; McKenzie, Milton, Smith, & Ouellette-Kuntz, 2016). Physically, children with DS show abnormalities that give rise to the typical facial appearance associated with this condition, including increased palpebral clefts with inner epicanthic folds, the flatness of nasal bridges, mid-facial hypoplasia, and tendency to stick out the tongue, especially when they are very young. Many other minor functional abnormalities that are not too significant in the ears, hands, and feet and stature are usually less perfect (Bull et al., 2011; Patil, Rao, & Majumdar, 2014).

DS children are also characterised by weak motor control and a lack of ability to coordinate. On the other hand, they can still be trained to reach their ability to the normal point (Alesi & Battaglia, 2019; Ferreira-Vasques & Lamônica, 2015; Pise, Pradhan, & Gharote, 2018; Zeng et al., 2017). In terms of cognitive abilities, DS children experience a slowdown in learning and retardation in their ability to overcome problems so they cannot solve a causal relationship problem (Marchetti, 2018; Miendlarzewska & Trost, 2014; Pauli, 2019). Slow learning in children with DS cannot be cured, but with maximum support and attention, DS children can grow happily and maximise their potential. One of the supports that can be done is in learning done in schools (DSAWM, 2010; Ferguson, 2014; Mcfadden, 2014).

At the primary school level, there are several subjects that all students need to master, including DS students. One of these subjects is mathematics (Engevik, Næss, & Berntsen, 2018; Faragher & Clarke, 2016; Gil Clemente & Cogolludo-Agustín, 2019; Leonard & Chaidir, 2018; Opoku, Tawiah, Agyei-Okyere, Osman, & Afriyie, 2019). In learning mathematics, when students think about mathematics and communicate thought results verbally or in writing, it means students are learning to explain and convince what is in their minds. This condition also applies to DS students (Hill et al., 2008; Sedova et al., 2019; Zaslavsky & Shir, 2005).

The activity of thinking about mathematics and communicating the results of thoughts verbally or in writing in mathematics learning becomes the most fundamental point for measuring learning success (Bambaeeroo & Shokrpour, 2017; Freeman, Higgins, & Horney, 2016; Yayuk & Husamah, 2020). Mathematical communication is not just exposing ideas but also involving activities to talk, explain, describe, listen, ask, clarify, and share opinions

(Bambaeeroo & Shokrpour, 2017; Scusa, 2008; Wichelt, 2009; Wood, 2012; Zwiers et al., 2017). With all its limitations, DS students also do the same thing in learning mathematics.
As the results of the initial interview with Teachers for Children with Special Needs grade 1 at SD Muhammadiyah 9 Malang of East Java Province, it was known that DS students did mathematics learning activities following the material that has been determined. When learning mathematics, for example, the theme of number recognition, students had difficulties in recognising, differentiating, and writing numerical symbols. The implication was that DS students had more challenges in communicating numerical symbols in spoken language. The results of observation in January-February 2020 indicated that the teachers had been drilling introduction to numbers material, pronunciation, and writing practice that were conducted continuously in class. However, DS students had not been able to meet the learning objectives.

On the other hand, it should be understood that when students get information in the form of mathematical concepts given by the teacher or obtained from various sources (reading material/media/learning methods), there will be a transformation of mathematical information from the source to the students. Students will respond based on their interpretation and understanding of the information. The problem that often arises is the response given by students to the information received is not following what is expected. This might happen because of the mathematical characteristics that are full of terms, symbols, and formula, so it is not uncommon for students to be able to solve mathematical problems well, but do not understand what they are doing (no concept understanding). Therefore, skills in expressing and communicating mathematical ideas become important both verbally and in writing. According to Astuti and Leonard (2015) and Nuraini and Surya (2017), by communicating mathematically, students can improve vocabulary, develop speaking skills, write ideas systematically, and have better learning abilities. Accordingly, Freeman et al. (2016) mention, mathematical communication skills are one of the determinants of whether students have understood mathematical concepts that have been learned during the learning process, including for DS students.

Research Problems

Mathematical communication needs to be the focus of attention in mathematics learning, and it should be the main aspect of education and learning researchers, including in this case children with special needs, especially children with DS. In the Indonesian context based on searches through Google Scholar, there are several studies related to mathematical communication in slow learners (Supriadi & Damayanti, 2016), autistic children (Damiyanti & Hidayat, 2019; Irawan & Febriyanti, 2018), and children with mental retardation (Sholikhah, 2018), and hearing impairment. On the other hand, there is only one research on communication aspects of DS children, and that only addresses general communication skills

(Mujib, 2016), not mathematical communication skills. Search results using the Scopus database found that there are only 12 journal articles related to mathematics for DS. The emerging themes, for example, are related to teaching mathematics in general (Faragher, 2019; Lemons, Powell, King, & Davidson, 2015; Onnivello, Lanfranchi, & Zorzi, 2019; Opoku et al., 2019; Tangarife Chalarca, 2018), numerical (Abreu-Mendoza & Arias-Trejo, 2015; Lanfranchi, Aventaggiato, Jerman, & Vianello, 2015; Novalia et al., 2020), number (Porter, 2019; Simms, Karmiloff-Smith, Ranzato, & Van Herwegen, 2020), geometry (Gil Clemente & Cogolludo-Agustín, 2019), and Cartesian plane and Algebraic formulas (Monari Martinez & Neodo, 2020). Various research themes on the implementation of mathematics are focused on gifted students (Dada & Akpan, 2019; David, 2019; Hartinah et al., 2019; Huda et al., 2019; Jarrah & Almarashdi, 2019; Novalia et al., 2020; Pardimin, Arcana, & Supriadi, 2019; Sumaji, Sa'dijah, Susiswo, & Sisworo, 2020). There is no research at all related to mathematical communication in DS children. Therefore, research with the theme of mathematical communication in children with DS is critical to be conducted.

This article aimed to explain the results of the analysis of the mathematical communication skills of students with Down syndrome in grade 1 Elementary School. The results of this analysis contribute to providing alternative approaches that can be done by class teachers, teachers of children with special needs and "shadow" teachers in assisting DS students to learn mathematics in elementary schools. This study will be a reference for relevant researchers, especially in Indonesia, amidst the scarcity of references relating to mathematical communication skills of DS children. This research will also be the basis for the development of DS children's creativity in mathematics because as according to Cevher, Ertekin, and Koksal (2014) this it is also very important to do.

Method

Research Design

This research implemented a qualitative approach, and the type of research was descriptive. A qualitative approach was intended to understand the phenomena about what was experienced by research subjects such as their behaviour, perception, motivation, action, and so on holistically, and utilising descriptions in the form of words and language, in a special natural context and by utilising various scientific methods. This research described the mathematical communication skills of elementary school students with DS. The indicators of mathematical communication skills refer to the product by Juhrani, Suyitno, and Khumaedi (2017), as presented in Table 1.

Table 1: Indicators of mathematical communication skills

No.	Mathematical skills	Indicators
1.	Verbal communication	The ability to ask of students with DS The ability to answer students with DS The ability to summarise of students with DS
2.	Written communication	Explaining ideas or situations from a picture or graphic with his/her own words in written formats (writing); Describing a situation from a picture or graphic (drawing);
		Stating a situation into a mathematical model.

Participants

This study was conducted in grade 1 SD Muhammadiyah 9 Malang, East Java Province, Indonesia. The implementation of this research was done in the even semester of Academic Year 2019/2020 and was carried out in January-March 2020.
Research subjects can be interpreted as people or anything that is the subject of research. The subjects of this study were 1 DS student grade 1 elementary school with the initials EM and one teacher for Children with Special Needs grade 1 who has more than 15 years of teaching experience at SD Muhammadiyah 9 Malang.

Data Collection

The data in this study were compiled through several techniques, namely observation, interviews, and documentation. The researchers observed the activities of students and teachers and environmental conditions (class). Researchers also conducted interviews with a teacher for children with special needs. Various learning materials and products used by the teacher and the products produced by students were documented to enrich research data.

Data Analysis

Data analysis in this qualitative research was started when the data collection took place, and after the data collection was completed within a certain period. The data analysis implemented content analysis techniques. Activities in data analysis included data reduction which summarised, chose the main points, focused on the important things, as well as looking for themes and patterns. Moreover, data display organised the data, arranged in a relationship pattern, so that it would be more easily understood. Finally, the conclusion drawing/verification was to conclude the data originally compiled as temporary and would change if no substantial evidence was found that supports the next stage of data collection. If the conclusions expressed at an early stage were supported by valid and consistent evidence

by the time the researchers returned to the field to collect data, then the conclusions put forward were assumed as credible conclusions.

Results

SD Muhammadiyah 9 Malang, East Java is one of the inclusive schools under the coordination of Muhammadiyah, the largest modern Islamic organisation in Indonesia. Inclusion schools place special needs children in regular classes, along with other general students. However, in the implementation of DS student learning, the school uses an Individual Learning Program. The Individual Learning Program is significantly needed by every child with special needs. This is because every child with special needs has their limitations, hence requires different treatment.

In regular classroom learning, thematic learning was carried out with the themes: "Myself", with "Me and Myself" sub-theme, which consists of several subjects, namely mathematics, cultural arts and crafts, and civic education. Mathematics learning to be specific taught (1) Basic Competence 3.2, which explains numbers up to two-digit numbers and the value of the place compiler of the number symbol using a collection of concrete objects and how to read them. The next competencies taught were (2) Basic Competence 4.2, which is writing symbols of numbers up to two-digit numbers that state many members of a collection of objects with the idea of place values. For children with special needs in class 1, especially for DS specifications, the teacher set the Individual Learning Program that contains the achievements or targets that had to be met in one semester. The target was to understand the symbol number from 11-20, and the students were required to be able to write the number symbols.

Based on the learning done by the teacher for the student with special needs, data were obtained on the mathematical communication skills of DS students. The mathematical communication skills of DS student with the initials EM can be explained in-depth on the oral and written aspects. The verbal aspect included the ability to ask, answer, and infer. Also, written communication can be grouped into three, namely (1) explaining the idea or situation of a picture or graph in his/her own words in written form (writing), (2) expressing a situation with pictures or graphics (drawing), and (3) stating a situation in the form of a mathematical model.

Observation results showed the mathematical communication skills in the oral aspect with indicators of the ability to ask from EM student. The participant gave more questions to the teacher. The results of observations when students were thickening the number symbols indicated that each teacher had conveyed both new and repeated information. EM always asked questions and asked again to be repeated. The teacher responded to EM student's

questions by giving answers, but often the teacher also asked back some questions to EM. However, the answers given by EM were sometimes not right. This was because the student tended to be constrained by limited vocabulary mastery. To overcome the low ability to answer, the teacher asked EM to repeat answers. Although the student could not convey the answers properly through verbal vocabulary production, EM tried to support the answers through body movement. At this stage, it can be seen that questions have encouraged two-way communication between teachers and students, even though the grammar used when asking is not very clear and tends to only use body language to indicate the desire to ask. The answers given by EM were not right because the vocabulary mastery was still low.

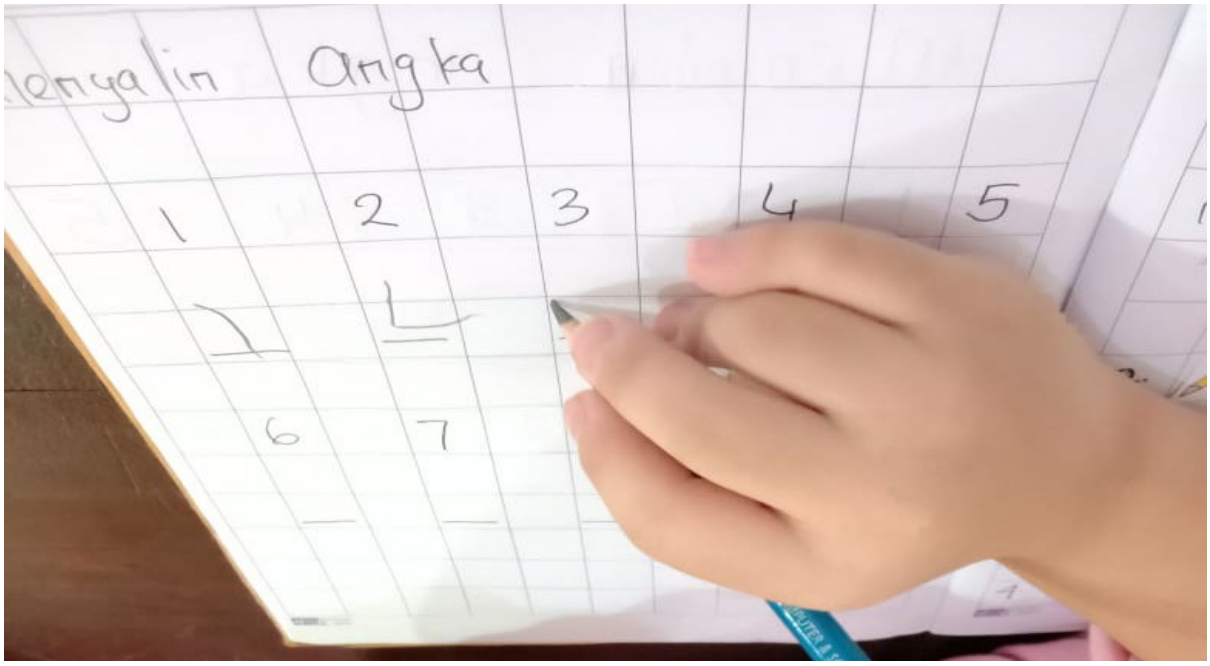
The results of the interview with the teacher showed that EM had difficulty thinking abstractly. Therefore, EM had to be given concrete media to practice the ability to speak, remember, understand, arouse, and distinguish numbers. Concrete media can bridge the cognitive abilities of DS students. The concrete media used in the interaction is shown in Figure 1.

Figure 1. Mathematics learning media for DS students

The media has proven able to stimulate DS students to be more active in bridging what is being learned. However, mathematical communication on the verbal aspect of 'concluding/inferring' could not be done perfectly by EM. EM had not been able to generate a conclusion or infer information well on the material being studied and was still limited to the ability to answer teacher's questions. The results of interviews with the teacher suggested that he was optimistic that learning media play a major role in assisting EM in stimulating this ability to conclude information, although the learning process might take longer than other regular students.

Based on the described results previously, it can be concluded that the ability to communicate mathematically in verbal aspects such as the ability to ask and answer questions were well mastered, but the ability to deduce information was still not mastered perfectly. Furthermore, mathematical communication skills in the written aspect were known from the results of fine motor drilling of EM student. During the lesson, EM was given the assignment sheet to bold the number symbols. Observation results projected that the muscles of EM's hands were very weak. When writing activities on symbols that only required a single writing step, EM student was able to do it well. For example, number symbols 1, 6, 7. However, when having to write the symbols that needed more than one stroke, EM experienced difficulty, for example, on numbers 2, 3, 4, 5, 8, and 9. This condition is illustrated in Figure 2.

Figure 2. The results of writing number symbols by the DS student



Responding to the results of the student's writing as presented in Figure 2, when drilling was considered as an activity to write numerical symbols to strengthen student mastery, the teacher provided the media repeatedly in the learning process for 4-5 times face to face. In one day, face to face drillings was conducted for 2x35 minutes. From this process, it seemed that EM had not been able to explain ideas or situations from a picture or graph in his/her own words in written form (writing), but with the help of the teacher and learning media, EM could fulfil the task. In another aspect, namely describing the situation with pictures or graphics (drawing), EM also had not mastered the skill. This was due to the very weak hand muscles. Based on the results of interviews with the teacher, the best strategy was to play and provide assistance in the form of drilling.

The ability of mathematical communication in the aspect of writing the form of a mathematical model was seen when EM student answered the teacher's question about the numerical symbol. EM wrote the numbers to answer the instruction from the teacher. This situational activity is presented in Figure 3.

Figure 3. Process of the DS student writing down symbols according to the teacher's instructions

Discussion

Many children with DS have difficulty forming questions. Often, they use a one-word construction to make a statement that the listener interprets as a question or request (Bekins, 2011; Kent & Vorperian, 2013). The repeated and intense "asking and answering" activity is very important for the teacher to do for DS children. Questions and answers will encourage children to enrich vocabulary in an atmosphere of two-way communication between teacher and students (Frizelle, Thompson, Duta, & Bishop, 2018; Kabashi & Kaczmarek, 2019). Answering questions encourages children to hear questions, think about meaning, understand the meaning, form answers, and say the answers they make (Chin & Osborne, 2008; DSAWM, 2010; Griffin & Hart, 2018; Scharfenaker & Stackhouse, 2013). Asking questions involves thinking about what you want to ask, forming questions in your mind, and then generating questions that you want to ask (DAAS, 2020; Fortnum et al., 2014; Iannone & Meredith, 2015). According to Mara and Mara (2011), through an intense communication process, DS children will be able to answer correctly for verbal instructions, save visual contact, and work closely with the teacher. Eventually, almost all actions will repeat when asked. However, Watson (2019) gave signs that "the teacher should use appropriate language for student understanding, speak slowly when necessary, and always break tasks into smaller

steps and provide instructions for each step. Students with DS usually have good short-term memory".

A child with DS, like any other child, may benefit from interacting with memory stimuli, but needs additional support and help (da Cruz Netto et al., 2020). Until now, there have not been advanced teaching tools that are suitable for DS children to use in their learning process. DS children used simple words and images during the learning session (Yussof, Anuuar, Rias, Abas, & Ariffin, 2016). According to Watson (2019), through a multimodal approach, a teacher may use as many concrete materials and authentic real-world situations as possible to help the DS children comprehend better.

The drilling method is an exercise that is done repeatedly on certain parts of the material that are considered not yet under the existing learning guidance (Maryamatussalamah, Milyartini, & Nusantara, 2013). The main teaching strategy in DS is repetition and drilling so that a habit is created by the repetitive production of the language (Polo, 2017). The research results of Adnyani, Suarni, and Jampel (2015) show that the drill method has an effect on learning motivation and towards the abilities of students with special needs. Meanwhile, Halaliah (2019) claims that the implementation of the drill method encourages students with special needs to memorise.

In general, mathematical communication skills in the aspect of writing consist of the ability: (a) explaining an idea or situation from a picture or graphic in his/her own words in written form (writing), (b) describing a situation with pictures or graphics (drawing), and (c) displaying a situation in the form of a mathematical model. The results of observations and interviews indicated that EM had not been able to explain ideas or situations from a picture or graphic in his/her own words in written form (writing), but EM needed the help of the teacher and the learning media. This finding is in line with da Cruz Netto et al. (2020), confirming that "A child with DS may benefit from interacting with memory stimuli, but needs additional support and help. The use of special teaching methods can enhance the memory processes of these children". Teacher's motivation and stimulus become very important, as it is supported with the opinion of Baksi (2005), "many people who have DS are strongly motivated to interact with others, and become skilled and successful communicators using whatever means is effective: actions, facials expressions, gestures and sign languages, or words, phrases, and sentences".

In other indicators, namely stating the situation with pictures or graphics (drawing) EM student had not mastered the skill. This is in line with Clements and Barrett's (1994) assertion, "it was found that all participants performed better on the picture-selection tasks than on the drawing tasks and that the individuals with Down's syndrome performed significantly worse than the children without learning difficulties". While in the indicator of

displaying a situation in the form of a mathematical model, the student had demonstrated this ability even though it still needed to be improved. Referring to Leonard and Chaidir (2018), there is hope for DS students to be able to learn and improve their abilities. Therefore, in the future, teachers need to make effective learning designs. The learning designs can be used to improve the quality of education in meeting the learning needs of DS children according to the principle of active and fun cognitive development for elementary school children.

Conclusion

The mathematical communication skills of the verbal aspects of DS students in the aspects of the ability to ask and answer questions are well mastered, but the ability to infer is still not developed perfectly. The ability to communicate mathematical aspects of writing is still weak. EM had not been able to explain ideas or situations from a picture or graphic with his/her own words in written form (writing), but it was achieved with the help of the teacher and learning media. In another indicator namely stating the situation with pictures or graphs (drawing), EM had not mastered the skill, while in the indicator of displaying a situation in the form of mathematical models, EM had shown an improvement although a particular help was still necessary. The indicators that were still weak require further efforts; therefore, it is not only a challenge for teachers but researchers who are concerned about DS children learning success. In-depth and comprehensive research with more subjects, classes, and education levels also needs to be done so that various efforts to help children with DS can be maximised.

Acknowledgements

Our gratitude goes to the Rector, the Dean of Faculty of Teacher Training and Education, and the Director of the Directorate of Research and Community Service the Universitas Muhammadiyah Malang-Indonesia, who have supported this research. All authors of this article declare they have no conflicts of interest.

REFERENCES

Abreu-Mendoza, R. A., & Arias-Trejo, N. (2015). Numerical and area comparison abilities in Down syndrome. *Research in Developmental Disabilities*, *41–42*, 58–65. https://doi.org/10.1016/j.ridd.2015.05.008

Adnyani, D. N. N., Suarni, N. K., & Jampel, I. N. (2015). Pengaruh metode drill terhadap motivasi belajar dan kemampuan merawat diri sendiri bagi anak tunagrahita pada pelajaran bina diri siswa kelas I SLB.C1 Negeri Denpasar tahun pelajaran 2014/2015. *E-Journal Program Pascasarjana Universitas Pendidikan Ganesha Program Studi Penelitian Dan Evaluasi Pendidikan*, *5*(1), 601–610. https://doi.org/10.23887/jpepi.v5i1.1586

Ahlfors, H., Anyanwu, N., Pakanavicius, E., Dinischiotu, N., Lana-Elola, E., Watson-Scales, S., … Tybulewicz, V. L. J. (2019). Gene expression dysregulation domains are not a specific feature of Down syndrome. *Nature Communications*, *10*(1). 148-156. https://doi.org/10.1038/s41467-019-10129-9

Alesi, M., & Battaglia, G. (2019). Motor development and Down syndrome. In R. C. Urbano (Ed.), *International Review of Research in Developmental Disabilities* Vol. 56, pp. 169–211. https://doi.org/10.1016/bs.irrdd.2019.06.007

Astuti, A., & Leonard, L. (2015). Peran kemampuan komunikasi matematika terhadap prestasi belajar matematika siswa. *Jurnal Formatif*, *2*(2), 102–110. Retrieved from https://journal.lppmunindra.ac.id/index.php/Formatif/article/viewFile/91/88

Baksi, L. (2005). *Supporting people who have Down's syndrome to overcome communication difficulties*.16, 1–15. Retrieved from http://downsyndromedevelopment.org.uk/wp-content/uploads/2013/03/Overcoming_communication_difficulties.pdf

Bambaeeroo, F., & Shokrpour, N. (2017). The impact of the teachers' non-verbal communication on success in teaching. *Journal of Advances in Medical Education & Professionalism*, *5*(2), 51–59. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/28367460%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC5346168

Bekins, J. (2011). Getting children with Down syndrome to answer questions: Part I asking the right questions. Retrieved April 1, 2020, from Talk – Down Syndrome website: https://talk-ds.org/2011/02/10/getting-children-with-down-syndrome-to-answer-questions-part-i-asking-the-right-questions/

Bruckner, T. A., Singh, P., Lelong, N., & Khoshnood, B. (2019). Down syndrome among

primiparae at older maternal age: A test of the relaxed filter hypothesis. *Birth Defects Research*, *111*(20), 1611–1617. https://doi.org/10.1002/bdr2.1553

Bull, M. J., Saal, H. M., Braddock, S. R., Enns, G. M., Gruen, J. R., Perrin, J. M., … Spire, P. (2011). Clinical report - Health supervision for children with Down syndrome. *Pediatrics*, *128*(2), 393–406. https://doi.org/10.1542/peds.2011-1605

Cevher, A. H., Ertekin, P., & Koksal, M. S. (2014). Investigation of scientific creativity of eighth grade gifted students. *International Journal of Innovation, Creativity and Change*, *1*(4), 19–26.

Chin, C., & Osborne, J. (2008). Students' questions: A potential resource for teaching and learning science. *Studies in Science Education*, *44*(1), 1–39. https://doi.org/10.1080/03057260701828101

Clarós, P., Remjasz, A., Clarós-Pujol, A., Pujol, C., Clarós, A., & Wiatrow, A. (2019). Long-term outcomes in Down Syndrome children after cochlear implantation: Particular issues and considerations. *Otology and Neurotology*, *40*(10), 1278–1286. https://doi.org/10.1097/MAO.0000000000002410

Clements, W., & Barrett, M. (1994). The drawings of children and young people with Down's Syndrome: a case of delay or difference? *British Journal of Educational Psychology*, *64*(3), 441–452. https://doi.org/10.1111/j.2044-8279.1994.tb01115.x

da Cruz Netto, O. L., Rodrigues, S. C. M., de Castro, M. V., da Silva, D. P., da Silva, R. R., de Souza, R. R. B., … Bissaco, M. A. S. (2020). Memorisation of daily routines by children with Down syndrome assisted by a playful virtual environment. *Scientific Reports*, *10*(1), 3144. https://doi.org/10.1038/s41598-020-60014-5

DAAS. (2020). Frequently asked questions. Retrieved April 1, 2020, from Down Syndrome Association of Atlanta website: https://www.dsaatl.org/frequently_asked_questions

Dada, O. A., & Akpan, S. M. (2019). Discriminant analysis of psycho-social predictors of mathematics achievement of gifted students in Nigeria. *Journal for the Education of Gifted Young Scientists*, *7*(3), 581–594. https://doi.org/10.17478/jegys.605981

Damiyanti, Y., & Hidayat, W. (2019). Analisis kemampuan komunikasi matematik serta konsep diri siswa di SMA inklusi. *Journal On Education*, *01*(03), 75–80.

Dandashi, A., Karkar, A. G., Saad, S., Barhoumi, Z., Al-Jaam, J., & El Saddik, A. (2015). Enhancing the cognitive and learning skills of children with intellectual disability through physical activity and edutainment games. *International Journal of Distributed Sensor Networks*,25, 26, 187-196. *2015*. https://doi.org/10.1155/2015/165165

David, H. (2019). Teaching mathematically gifted students in Israel: The state of the art. *Journal for the Education of Gifted Young Scientists*, *7*(1), 57–69. https://doi.org/10.17478/JEGYS.466451

DSAWM. (2010). Supporting the student with Down syndrome in your classroom-Educator manual. In L. T. Barta & Y. Salinas (Eds.), *Down Syndrome Association of West Michigan*. Retrieved from https://www.kcdsg.org/files/content/Supporting the Student with Down Syndrome in Your Classroom-Teacher Manual.pdf

Enea-Drapeau, C., Carlier, M., & Huguet, P. (2017). Implicit theories concerning the intelligence of individuals with Down syndrome. *PLoS ONE*, *12*(11), 1–12. https://doi.org/10.1371/journal.pone.0188513

Engevik, L. I., Næss, K. A. B., & Berntsen, L. (2018). Quality of inclusion and related predictors: Teachers' reports of educational provisions offered to students with Down syndrome. *Scandinavian Journal of Educational Research*, *62*(1), 34–51. https://doi.org/10.1080/00313831.2016.1212252

Faragher, R. (2019). The New 'Functional Mathematics' for Learners with Down Syndrome: Numeracy for a Digital World. *International Journal of Disability, Development and Education*, *66*(2), 206–217. https://doi.org/10.1080/1034912X.2019.1571172

Faragher, R., & Clarke, B. (2016). Teacher identified professional learning needs to effectively include a child with Down syndrome in primary mathematics. *Journal of Policy and Practice in Intellectual Disabilities*, *13*(2), 132–141. https://doi.org/10.1111/jppi.12159

Ferguson, G. (2014). *Including children with disabilities in mainstream education: An exploration of the challenges and considerations for parents and primary school teachers* (Technological University Dublin). Retrieved from https://arrow.dit.ie/aaschssldis%0Ahttp://arrow.dit.ie/aaschssldis

Ferreira-Vasques, A. T., & Lamônica, D. A. C. (2015). Motor, linguistic, personal and social aspects of children with down syndrome. *Journal of Applied Oral Science*, *23*(4), 424–430. https://doi.org/10.1590/1678-775720150102

Fortnum, H., Leighton, P., Smith, M. D., Brown, L., Jones, M., Benton, C., … Sutton, K. (2014). Assessment of the feasibility and clinical value of further research to evaluate the management options for children with Down syndrome and otitis media with effusion: A feasibility study. *Health Technology Assessment*, *18*(60). https://doi.org/10.3310/hta18600

Freeman, B., Higgins, K. N., & Horney, M. (2016). How students communicate mathematical ideas: An examination of multimodal writing using digital technologies. *Contemporary Educational Technology*, *7*(4), 281–313. https://doi.org/10.30935/cedtech/6178

Frizelle, P., Thompson, P. A., Duta, M., & Bishop, D. V. M. (2018). The understanding of complex syntax in children with Down syndrome. *Wellcome Open Research*, *3*(140), 1–34. https://doi.org/10.12688/wellcomeopenres.14861.1

Gil Clemente, M. E., & Cogolludo-Agustín, J. I. (2019). The effectiveness of teaching geometry to enhance mathematical understanding in children with Down syndrome. *International Journal of Disability, Development and Education*, *66*(2), 186–205. https://doi.org/10.1080/1034912X.2019.1571171

Godfrey, M., & Lee, N. R. (2018). Memory profiles in Down syndrome across development: A review of memory abilities through the lifespan. *Journal of Neurodevelopmental Disorders*, *10*(1).155-165. https://doi.org/10.1186/s11689-017-9220-y

Griffin, P., & Hart, N. (2018). *Supporting children with Down Syndrome in primary school*. Retrieved from https://downsyndrome.ie/wp-content/uploads/2018/03/Supporting-Children-with-Down-syndrome-in-Primary-School.pdf

Halaliah, R. (2019). *Implementasi metode drill dalam pembelajaran al-Qur'an pada anak tunagrahita jenjang SMA di SLB Paedagogia Surabaya* (UIN Sunan Ampel Surabaya). Retrieved from http://digilib.uinsby.ac.id/31323/4/Rizky Halaliyah_D91215108.pdf

Halliday, M., & Mallucci, G. R. (2019). Translating translation in down syndrome. *Science*, *366*(6467), 797–798. https://doi.org/10.1126/science.aaz7128

Hartinah, S., Suherman, S., Syazali, M., Efendi, H., Junaidi, R., Jermsittiparsert, K., & Umam, R. (2019). Probing-prompting based on ethnomathematics learning model: The effect on mathematical communication skills. *Journal for the Education of Gifted Young Scientists*, *7*(4), 1–16. https://doi.org/10.17478/jegys.574275

Hill, H. C., Blunk, M. L., Charalambous, C. Y., Lewis, J. M., Phelps, G. C., Sleep, L., & Ball, D. L. (2008). Mathematical knowledge for teaching and the mathematical quality of instruction: An exploratory study. *Cognition and Instruction*, *26*(4), 430–511. https://doi.org/10.1080/07370000802177235

Huda, S., Sholikhakh, R. A., Bina, N. S., Lestari, F., Habibi, B., & Suharso, P. (2019). Effect of application smart circuit learning media to mathematics learning outcomes: A case study of Islamic School Students. *Journal for the Education of Gifted Young Scientists*, *7*(3), 699–715. https://doi.org/10.17478/jegys.597053

Iannone, N. M., & Meredith, S. H. (2015). *Welcoming a newborn with Down Syndrome: A new parent's guide to the first month*. Retrieved from https://dsagreatercharlotte.org/wp-content/uploads/2018/12/Welcoming-a-Newborn-wDS-EN.pdf

Irawan, A., & Febriyanti, C. (2018). Pembelajaran matematika pada siswa berkebutuhan khusus di sekolah inklusi. *Journal of Medives: Journal of Mathematics Education IKIP Veteran Semarang*, *2*(1), 99–106. https://doi.org/10.31331/medives.v2i1.509

Jarrah, A. M., & Almarashdi, H. S. (2019). Mathematics teachers' perceptions of teaching gifted and talented learners in general education classrooms in the UAE. *Journal for the Education of Gifted Young Scientists*, *7*(4), 835–847. https://doi.org/10.17478/jegys.628395

Juhrani, J., Suyitno, H., & Khumaedi, K. (2017). Analisis kemampuan komunikasi matematis berdasarkan self-efficacy siswa pada model pembelajaran Mea. *Unnes Journal of Mathematics Education Research*, *6*(2), 251–258. Retrieved from http://journal.unnes.ac.id/sju/index.php/ujmer

Kabashi, L., & Kaczmarek, L. (2019). Educating a child with Down syndrome in an inclusive kindergarten classroom. *Journal of Childhood & Developmental Disorders*, *5*(2), 1–9. https://doi.org/10.36648/2472-1786.5.2.81

Kent, R. D., & Vorperian, H. K. (2013). Speech impairment in Down Syndrome: A review. *Journal of Speech Language and Hearing Research*, *56*(1), 178–210. https://doi.org/10.1044/1092-4388(2012/12-0148)

Lanfranchi, S., Aventaggiato, F., Jerman, O., & Vianello, R. (2015). Numerical skills in children with Down syndrome. Can they be improved? *Research in Developmental Disabilities*, *45–46*, 129–135. https://doi.org/10.1016/j.ridd.2015.07.006

Lemons, C. J., Powell, S. R., King, S. A., & Davidson, K. A. (2015). Mathematics interventions for children and adolescents with Down syndrome: A research synthesis. *Journal of Intellectual Disability Research*, *59*(8), 767–783. https://doi.org/10.1111/jir.12188

Leonard, L., & Chaidir, M. (2018). The development of learning design on Down syndrome children's numbers recognition. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, *8*(1), 17–30. https://doi.org/10.30998/formatif.v8i1.2285

Mara, D., & Mara, E. L. (2011). Characteristics of learning process at children with Down syndrome. *Procedia - Social and Behavioral Sciences*, *30*, 73–78.

https://doi.org/10.1016/j.sbspro.2011.10.015

Marchetti, G. (2018). Consciousness: a unique way of processing information. *Cognitive Processing*, *19*(3), 435–464. https://doi.org/10.1007/s10339-018-0855-8

Maryamatussalamah, H., Milyartini, R., & Nusantara, H. (2013). Singing activity of Down syndrome student in SLB-C Yayasan Karya Bakti Garut. *Swara: Jurnal Antologi Departemen Pendidikan Seni Musik FPSD UPI*, *1*(3), 1–7. Retrieved from https://ejournal.upi.edu/index.php/antomusik/article/view/241

Mcfadden, A. (2014). *The experiences of teachers teaching children with Down syndrome in the early years of schooling* (Queensland University of Technology). https://doi.org/10.1080/10428190802035966

McKenzie, K., Milton, M., Smith, G., & Ouellette-Kuntz, H. (2016). Systematic review of the prevalence and incidence of intellectual disabilities: Current trends and issues. *Current Developmental Disorders Reports*, *3*(2), 104–115. https://doi.org/10.1007/s40474-016-0085-7

Miendlarzewska, E. A., & Trost, W. J. (2014). How musical training affects cognitive development: Rhythm, reward and other modulating variables. *Frontiers in Neuroscience*, *7*(8 JAN), 1–18. https://doi.org/10.3389/fnins.2013.00279

Monari Martinez, E., & Neodo, K. (2020). Working with the Cartesian plane and Algebraic formulas by students with Down syndrome: Findings of a small-scale study. *International Journal of Disability, Development and Education*, *00*(00), 1–14. https://doi.org/10.1080/1034912X.2020.1722072

Mujib, M. (2016). Komunikasi matematis siswa tunarungu dalam pembelajaran matematika didasarkan pada Teori Schoenfeld. *Journal Al Jabar: Jurnal Pendidikan Matematika*, *7*(1), 85–90. https://doi.org/10.24042/ajpm.v7i1.136

Novalia, Ahid, N., Cahyadi, R., Faelasofi, R., Pertiwi, S. D., Putra, F. G., & Jermsittiparsert, K. (2020). Numerical skills analysis gifted young scientists: The impact of the team assisted individualisation (TAI) learning model. *Journal for the Education of Gifted Young Scientists*, *8*(1), 47–59. https://doi.org/10.17478/jegys.665117

Nuraini, N., & Surya, E. (2017). Perbandingan kemampuan komunikasi matematis siswa yang belajar dengan model pembelajaran kooperatif tipe think talk write dan tipe think pair share di SMP Negeri 3 Percut Sei Tuan. *Jurnal Inspiratif*, *3*(3), 15–25. Retrieved from https://jurnal.unimed.ac.id/2012/index.php/jpmi/article/viewFile/8956/7809

Onnivello, S., Lanfranchi, S., & Zorzi, M. (2019). Mathematical abilities in Down syndrome.

In *International Review of Research in Developmental Disabilities* Vol. 56. 58, 158-169.. https://doi.org/10.1016/bs.irrdd.2019.06.005

Opoku, M. P., Tawiah, R., Agyei-Okyere, E., Osman, S., & Afriyie, S. A. (2019). Teaching students with Down syndrome in regular classrooms in Ghana: views of secondary school mathematics teachers. *International Journal of Disability, Development and Education*, *66*(2), 218–232. https://doi.org/10.1080/1034912X.2018.1527297

Pardimin, P., Arcana, N., & Supriadi, D. (2019). Developing media based on the information and communications technology to improve the effectiveness of the direct instruction method in mathematics learning. *Journal for the Education of Gifted Young Scientists*, *7*(4), 1311–1323. https://doi.org/10.17478/jegys.562636

Patil, S., Rao, R. S., & Majumdar, B. (2014). Chromosomal and multifactorial genetic disorders with oral manifestations. *Journal of International Oral Health : JIOH*, *6*(5), 118–11825.

Pauli, R. M. (2019). Achondroplasia: A comprehensive clinical review. In *Orphanet Journal of Rare Diseases* (Vol. 14). https://doi.org/10.1186/s13023-018-0972-6

Pise, V., Pradhan, B., & Gharote, M. (2018). Effect of yoga practices on psycho-motor abilities among intellectually disabled children. *Journal of Exercise Rehabilitation*, *14*(4), 581–585. https://doi.org/10.12965/jer.1836290.145

Polo, L. S. (2017). *Teaching English as a foreign language to students with learning difficulties*. Universidad Complutense De Madrid Master's.

Porter, J. (2019). Discriminating quantity: New points for teaching children with Down syndrome about number? *International Journal of Disability, Development and Education*, *66*(2), 133–150. https://doi.org/10.1080/1034912X.2019.1569208

Scharfenaker, S., & Stackhouse, T. (2013). My child won't answer questions! Behavioral challenges. Retrieved April 1, 2020, from The National Fragile X Foundation website: https://fragilex.org/treatment-and-intervention/my-child-wont-answer-questions/

Scusa, T. (2008). *Five processes of mathematical thinking* (Vol. 38). Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1030&context=mathmidsummative

Sedova, K., Sedlacek, M., Svaricek, R., Majcik, M., Navratilova, J., Drexlerova, A., … Salamounova, Z. (2019). Do those who talk more learn more? The relationship between student classroom talk and student achievement. *Learning and Instruction*, *63*(June), 101217. https://doi.org/10.1016/j.learninstruc.2019.101217

Sholikhah, M. T. S. S. E. Y. (2018). Kemampuan komunikasi matematis siswa tunagrahita ringan SMALB-C Negeri Jember dalam menyelesaikan soal penjumlahan dan pengurangan aljabar menggunakan alat peraga kertas aljabar. *KadikmA*, *9*(2), 98–107. Retrieved from https://jurnal.unej.ac.id/index.php/kadikma/article/view/9781

Simms, V., Karmiloff-Smith, A., Ranzato, E., & Van Herwegen, J. (2020). Understanding number line estimation in Williams syndrome and Down syndrome. *Journal of Autism and Developmental Disorders*, *50*(2), 583–591. https://doi.org/10.1007/s10803-019-04268-7

Sumaji, S., Sa'dijah, C., Susiswo, S., & Sisworo, S. (2020). Mathematical communication process of junior high school students in solving problems based on APOS theory. *Journal for the Education of Gifted Young Scientists*, *8*(1), 197–221. https://doi.org/10.17478/jegys.652055

Supriadi, N., & Damayanti, R. (2016). Analisis kemampuan komunikasi matematis siswa lamban belajar dalam menyelesaikan soal bangun datar. *Al-Jabar: Jurnal Pendidikan Matematika*, *7*(1), 1–9. https://doi.org/https://doi.org/10.24042/ajpm.v7i1.21

Tangarife Chalarca, D. (2018). La enseñanza de las Matemáticas a personas con síndrome de Down utilizando dispositivos móviles. *Revista Electrónica de Investigación Educativa*, *20*(4), 144. https://doi.org/10.24320/redie.2018.20.4.1751

Watson, S. (2019). Teaching students with Down syndrome. Retrieved April 1, 2020, from ThoughtCo website: https://www.thoughtco.com/teaching-students-with-down-syndrome-3110772

Wichelt, L. (2009). *Communication: A vital skill of mathematics*. Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1075&context=mathmidactionresearch

Wood, L. N. (2012). Practice and conceptions: Communicating mathematics in the workplace. *Educational Studies in Mathematics*, *79*(1), 109–125. https://doi.org/10.1007/s10649-011-9340-3

Yayuk, E., & Husamah, H. (2020). The difficulties of prospective elementary school teachers in item problem solving for mathematics: Polya's steps. *Journal for the Education of Gifted Young Scientists*, Vol. 8, pp. 361–368. https://doi.org/10.17478/jegys.665833

Yussof, R. L., Anuuar, W. S. W. M., Rias, R. M., Abas, H., & Ariffin, A. (2016). An approach in teaching reading for Down Syndrome children. *International Journal of Information and Education Technology*, *6*(11), 909–912.

https://doi.org/10.7763/ijiet.2016.v6.815

Zampini, L., & Zanchi, P. (2020). Mother–child dyadic co-regulation in children with intellectual disability: A comparison among dyads with children with chromosome 14 aberrations, Down syndrome and typical development. *Journal of Intellectual and Developmental Disability*, *45*(1), 23–29. https://doi.org/10.3109/13668250.2019.1577641

Zaslavsky, O., & Shir, K. (2005). Students' conceptions of a mathematical definition. *Journal for Research in Mathematics Education*, *36*(4), 317–346. https://doi.org/10.2307/27646367

Zeng, N., Ayyub, M., Sun, H., Wen, X., Xiang, P., & Gao, Z. (2017). Effects of physical activity on motor skills and cognitive development in early childhood: A systematic review. *BioMed Research International*, *2017*, 1–13. https://doi.org/10.1155/2017/2760716

Zwiers, J., Dieckmann, J., Rutherford-Quach, S., Daro, V., Skarin, R., Weiss, S., & Malamut, J. (2017). *Principles for the design of mathematics curricula: Promoting language and content development*. Retrieved from http://ell.stanford.edu/content/mathematics-resources-additional-resources