Responses of students with special needs to online mathematics leaning during pandemic

P S Balkist, and N Agustiani

Department of Mathematics Education, Universitas Muhammadiyah Sukabumi, Jl. R. Syamsudin, S.H. No.1, Sukabumi 43113, Indonesia

E-Mail: pujiabalkist@ummi.ac.id

Abstract. This study aims to understand the responses of students with special needs to learn mathematics during the pandemic Covid-19 in inclusive schools. The method of research is descriptive qualitative. The subject of this study were three students with special needs in class X in the inclusive school SMA N 1 Sukabumi, those are a student with visual impairment, a student with physical disabilities, and a student with mental retardation. The results showed that students were enthusiastic about learning online, and were good enough in the timeliness of collection the task also the accuracy of the content. However, enthusiasm, timeliness, and accuracy of content decreased over time, because it lacks direct interaction and innovation of media online learning.

1. Introduction
Indonesia was ranked 44 out of 49 participating countries in Trends in International Mathematics and Science Study (TIMSS) in 2015 [1–4]. TIMSS results also show that 54% of Indonesian students' ability in math and science in secondary schools was low. Besides that, the Program for International Student Assessment (PISA) in 2018 mentioned Indonesia was ranked by 72 out of 78 PISA partition countries [5–7]. This shows that the mathematical ability of secondary school students in Indonesia is in an alarming position. Respond to that situation, the new education minister has prepared various breakthroughs in education including the transformation of education and training for teachers to improve the quality of education in Indonesia.

The pandemic raises various obstacles in education in the world. Learning that had gone face-to-face then must be transformed into online learning. Although the internet is the biggest facility and is not new for high school students, the implementation of online education is certainly a new thing and presents many obstacles for teachers and students in learning activities.

Obstacles in implementation online learning are strongly felt by students with special needs, both in SLB or inclusive schools, which at this time are already numerous in Indonesia. Whereas the implementation of inclusive schools for children with special needs should make them enjoy, friendly, and can foster the confidence of students with special needs [8].

Inclusive schools must certainly provide good services for learning, includes facilities, infrastructure, and a supportive environment [9]. The learning environment is the role of the teacher, student friends, and the school community who must understand the treatment given to students with special needs [10]. So that self-acceptance, overprotective adaptation from parents, motivation for achievement, and adaptive guidance from teachers will not be obstacles learning in school [11].

Even during direct learning, various obstacles were encountered which varied with their diverse special needs. Students with visual impairment have obstacle attention if the sounds around them start...
getting noisy, and they difficult to interact with people who are rarely close to them. Besides that, the teacher difficult to give them assignments because of their blindness and previous obstacles [12]. Students with physical disabilities have difficulty in recording and understanding teachers because of their limitations to move. So that the ability of perception to respond stimulus includes visual, auditory, tactile, and kinesthetic hamper the flow of understanding [13]. Students with mental retardation have difficulty with abstract thinking and weak memory [14].

These obstacles will be felt differently during online learning where students with special needs do not interact directly with the teacher. So that researchers intend to see the response of students with special needs including student with visual impairment, student with physical disabilities, and student with mental retardation in online learning mathematics, especially in inclusive schools.

2. 
Method
The case study is focused on looking at the responses of students with special needs in learning mathematics during the pandemic in inclusive schools. The responses by students’ enthusiasm for each learning activity, timeliness of task submission on each task, and content accuracy on each task. This research is descriptive qualitative research to present the results by the crosscheck and triangulation process. The subject of this study were three students with special needs in class X in the inclusive school SMAN 1 Sukabumi, those are a student with visual impairment, a student with physical disabilities, and a student with mental retardation. Data collection is done by observation on each material session and private learning, interviews on private learning, and documentation on observation and task results. Data were analyzed qualitatively by the results of observations of learning activities, private learning, and assignments also interviews for crosschecks, then synthesizing from the analysis of these data and reducing by triangulation.

3. 
Result and Discussion
Research subjects are students with special needs in inclusive schools who have the same level but have different classes. Class A consists of 34 normal students and a student with visual impairment namely FA, where the visual impairment background is blind from birth. FA comes from SLB-A with good computer skills and high curiosity. However, FA has a limited understanding of mathematics because of her blindness. Class B consists of 35 normal students and a student with physical disabilities, namely DR, where the background of disabilities is the obstruction of motor sensation from birth. DR comes from an ordinary junior high school, has never received special treatment for his disabilities, so more observations are needed to examine the obstacles in the process of learning mathematics. Class C consists of 35 normal students and a student with mental retardation, namely BA, where the background of disability is likely from birth but has never been detected because parents consider it to be a mild slow learner. BA comes from an ordinary junior high school. He did not get professional treatment while in school.

The three of them studied mathematics with trigonometric themes on right triangles, special angular trigonometry, and correlated angular trigonometry. The stages of learning for each material are divided into three steps, as follows: (1) All students studied through Zoom teleconference. Class A, B, and C have different times. In this session parents or companions are suggested to accompany students with special needs to help technical implementation of online learning. (2) Private learning via Zoom teleconferences to guide children with special needs to understand learning previously. Parents or companions are suggested to accompany students with special needs to help the technical implementation of online learning. In this session, a structured interview was held to find out further student responses. (3) Assignments for each student, whether they have special needs or not, with the collection deadline. In this session parents or companions aren't suggested to accompany the students during assignments, to train the independence of students when online assignments.

Online learning activities are observed for analysis and then synthesized were followed: (1) Response, obtained from the description of the involvement of students with special needs when learning, private learning, and structured interviews. (2) Enthusiasm, measured using a questionnaire with the main aspects observed were a response, attention, concentration, willingness, awareness, and
self-involvement during learning which then calculated its percentage of the total maximum score of the questionnaire.

\[ \text{enthusiastic} = \frac{\text{enthusiastic questionnaire score}}{\text{total enthusiastic questionnaire score}} \times 100\% \]

(3) Timeliness of task collection, measured by reducing the total time spent working on tasks by late time divided by the total time spent on tasks.

\[ \text{timeliness} = \frac{\text{total time spent on work} - \text{late collection time}}{\text{total time on task}} \times 100\% \]

(4) The accuracy of the content, measured by the correct answer score divided by the maximum total score of the instrument for each assignment.

\[ \text{content accuracy} = \frac{\text{correct answer score}}{\text{maximum total score}} \times 100\% \]

Learning begins with learning together with all students, then students with special needs get private learning, and finally do the assignments. There are the calculation results of student responses, which include enthusiasm, timeliness of task collection, and accuracy of the content. It can be seen changes in the response of students with special needs every day with different materials. Description of comprehensive learning activities, private learning, and online assignments.

3.1 Session: Trigonometry for Angles on the right triangles

a. Online material and learning sessions via Zoom

In this material, all students were asked to understand the parts of a right triangle namely the front side, the side, and the hypotenuse then connect it to the Pythagorean Theorem. After that trigonometric comparison are introduced namely sine, cosine and tangent and their inverse

b. Online personal learning Via Zoom

Each special student was asked to prepare their learning media at home with the help of their parents or supervisor at home

1) Student with visual impairments was asked to prepare several right triangle-shaped papers (assisted by their families at home) because the FA needs media to be touched in knowing the parts of an object. FA is quite interested in this online learning process, seen from its activity in answering questions and feedback from the teacher.

2) DR student was asked to pay attention and record teacher explanations (assisted by parents). So hopefully the teacher's explanation can be repeated and the DR can understand the material well without being hampered by its limitations in note-taking. DR was also asked to prepare some right triangle-shaped paper (assisted by his family at home) to understand the material exposure from the teacher. DR is quite interested in this online learning activity, seen from its activity in answering questions and feedback from the teacher.

3) Student with mental retardation was asked to pay attention and record the teacher's explanation (assisted by parents). So hopefully the teacher's explanation could be repeated and BA could understand the material well without being hampered by its limitations in note-taking. BA was also asked to prepare some right triangle-shaped paper (assisted by his family at home) to understand the material exposure from the teacher. The role of parents as a companion to BA here has a fairly large part. BA is quite interested although many are distracted by several things in his home, parents still try to be patient to accompany BA.

c. Assignments via google classroom

All students were asked to work on trigonometric comparison questions for 10 short answer questions which must be submitted at maximum 15.00

1) Student with visual impairment FA: submitted assignments on time even though previously guided by the teacher in doing their work.
2) Student with physical disabilities DR: submitted assignments a little late and beforehand are still guided by teacher and parents in doing their work.
3) Student with mental retardation BA: submitted assignments lately and previously still guided by teacher and parents in doing their work.

3.2 Session 2: Trigonometry for Special Angles

a. Material sessions and online learning via Zoom

In this material, all students were asked to recall the material on the previous presentation which is the comparison of sine, cosine, and tangent trigonometry and its inverse. Then students were asked to find trigonometric comparisons at special angles of 0°, 30°, 45°, 60° and 90°.

b. Online personal learning Via Zoom

FA, DR, and BA were asked to record material exposure from teachers regarding trigonometric comparisons for special angles so that teacher exposures could be played repeatedly and made it easier for them to understand teacher exposure.
1) Students with visual impairment FA: quite interested in the online learning process, seen from their activity in answering questions and feedback from the teacher.
2) Students with physical disabilities DR: quite interested in these online learning activities, seen from their activity in answering questions and feedback from the teacher. Although his enthusiasm began to decline to understand the material as a whole.
3) Students with mental retardation BA: quite interested even though many are distracted by some things in his home, but parents still try to be patient to accompany BA.

c. Assignments via google classroom

All students were asked to memorize trigonometric comparisons for special angles in quadrant I and record them in video format and must be submitted at maximum 18.00
1) Students with visual impairment FA: submitted assignments on time even though previously guided by the teacher in doing their work.
2) Students with physical disabilities DR: submitted assignments a little late and previously still guided by teachers and parents in doing their work.
3) The student with mental retardation BA: submitted assignments lately and previously still guided by teachers and parents in doing their work.

3.3 Session 3: Trigonometry for Correlated Angles

a. Material sessions and online learning via Zoom

In this material, all students were asked to recall the material on the previous presentation, namely trigonometry for special angles in quadrant I. Then students were asked to find a comparison of trigonometry at special angles in quadrants II, III and IV.

b. Online personal learning Via Zoom

FA, DR, and BA were asked to record material exposure from a teacher on trigonometric comparisons for special angles in quadrants II, III, and IV so that teachers were expected to be able to play repeatedly and make it easier for them to understand teacher exposure.
1) Students with visual impairment FA: quite interested in the online learning process, seen from their activity in answering questions and feedback from the teacher.
2) Students with physical disabilities DR: quite interested in these online learning activities, seen from their activity in answering questions and feedback from the teacher. Although his enthusiasm began to decline to understand the material as a whole.
3) Students with mental retardation BA: quite interested even though many are distracted by some things in his home, but parents still try to be patient to accompany BA.
c. Assignments via google classroom

All students are asked to memorize trigonometric comparisons for special angles in quadrants II, III and IV and record them in video format and must be submitted at maximum 18:00

1) Students with visual impairment FA: submitted assignments on time even though previously guided by the teacher in doing their work.
2) Students with physical disabilities DR: submitted assignments a little late and previously still guided by teachers and parents in doing their work.
3) Students with mental retardation BA: submitted assignments lately and previously still guided by teachers and parents in doing their work.

From these learning activities, there are challenges in learning for students with special needs in inclusive schools, but FA, DR, and BA remained enthusiastic. Their reaction when studying together, private learning, and structured interviews. Besides these, the response, attention, concentration, willingness, awareness, and self-participation during learning also appear at the time of observation[15]. And also, the timeliness of submitting assignments and the accuracy of the content are good enough.

When studying together on a material session, other friends continue to support and help students with special needs to bring learning that is quite conducive, although sometimes they still break the concentration of other students including students with special needs. But this is a challenge for teachers to always be responsive in guiding students when doing online learning so that teachers are expected to always innovate[16].

When personal learning and assignment for students with special needs, it seems that the owner of an important role is the student’s guide (parent/sibling) who helps to prepare learning media, conditions telecommunications media, and helps with time management. This shows that even for inclusive learning at home, teachers still need guidance for children with special needs[17,18].

Many factors influence the sustainability of online learning at home, including constrained interaction with teachers and other friends, support from home mentors, and adaptation from all parties involved in this online learning activity. Facilities at home have become a very influential factor during implementation. Because not all students have an internet connection, adequate telecommunications media, and a home environment that is conducive to learning[19]. All of that is illustrated by the percentage of enthusiasm, Timeliness of Task Collection, and Content Accuracy for each Learning Activity of FA, DR, and BA by the following Table 1.

| Table 1. Percentage of enthusiastic, Timeliness of Task Collection and Content Accuracy for each Learning Activity of FA, DR, and BA |
|-------------------------------------------------|-----------------|-----------------|-----------------|
| Learning Activity 1                             | Learning Activity 2 | Learning Activity 3 |
| FA Enthusiastic                                 | 86%              | 84%              | 80%              |
| Timeliness of task submission                   | 90%              | 87%              | 83%              |
| Content accuracy                                | 95%              | 80%              | 75%              |
| DR Enthusiastic                                 | 77%              | 68%              | 65%              |
| Timeliness of task submission                   | 86%              | 75%              | 75%              |
| Content accuracy                                | 90%              | 90%              | 70%              |
| BA Enthusiastic                                 | 60%              | 60%              | 60%              |
| Timeliness of task submission                   | 70%              | 65%              | 63%              |
| Content accuracy                                | 75%              | 70%              | 62%              |

According to table 1, the enthusiasm of the FA, the DR, and the BA at the beginning of online learning decreased over time. The timeliness of collecting tasks and the accuracy of the content also decreased. Based on the interviews it turns out that FA, DR, and BA are starting to get bored with online learning activities due to the lack of direct interaction with teachers and their friends as before the pandemic. The students with visual impairments will get a good understanding of the teacher if there is
innovation as a supporting medium to replace his limitations [20]. However, if direct interaction is lacking, it will still inhibit learning activities, especially in terms of enthusiasm for learning. The same thing happened to DR, students with physical disabilities are not only just visual auditory in the learning process but also need tactile and kinesthetic even though his obstacle in his motor skills [21]. Although the teacher presents assignments that need tactile and kinesthetic when memorizing, social interaction can increase the spirit of learning. Whereas BA, the students with mentally retarded are quite difficult to think abstractly and their memory is weak, even though parents always try to provide in-depth guidance during learning activities [14].

At the time of observation of student responses in each learning activity, the support from friends made the self-acceptance for students with special needs is quite good. Because in general, they feel insecure when side by side with others [22]. This is usually avoided by parents who overprotectively adapt because this has a negative relationship for students with special needs [20]. But the FA, DR, and BA families have adaptations that are not overprotective, this is clear when they are free to not go with the students during assignments. People around them can foster motivation [23,24].

The adaptation of teachers who present the media as an aid to interesting learning, private guidance for students with special needs, the guidance of parents at home, and support from classmates is very important in learning in inclusive classes [25–27]. It also must be present during online learning, especially for DR and BA. However, for students with special needs not to get bored in carrying out online learning activities, teachers are expected to be always innovative in presenting varied learning [28].

4. Conclusion

Learning obstacles when a pandemic is felt by students with special needs in inclusive schools. So that researchers try to present online learning with interesting aids to help students with special needs to understand the material even within their limitations. Besides these, parental guidance at home plays an important role in online learning, especially for DR and BA.

The media that the teacher presents in the online learning process, makes the FA, DR and BA quite enthusiastic in accepting lessons, the timeliness of collection and the accuracy of the content are also good enough for all three. However, enthusiasm, timeliness, and accuracy of content decreased over time. This is due to the lack of direct interaction and the lack of variety of learning presented so that the three of them have started to feel bored with online learning activities. Especially for FA (student with visual impairments), needed media innovation as a substitute for his obstacles. DR (students with physical disabilities) need tactile and kinesthetic to increase their enthusiasm. BA (student with mental retardations), has a weak memory and difficulty in abstract thinking that needs more guidance.

It is necessary to present innovative learning so that students with special needs are not easily bored in the learning process, so they can understand the material. Collaboration with parents is also needed to guide their children during the learning process.

5. Acknowledgments

This research is the output of lecturers' activities in guiding PLP (Pengenalan Lingkungan Persekolahan) in inclusive schools SMAN 1 Sukabumi.

6. References

[1] Hadi S and Novaliyosi 2019 TIMSS Indonesia (Trends in International Mathematics and Science Study) Pros. Semin. Nas. Call Pap. Progr. Stud. Magister Pendidik. Mat. Univ. Siliwangi
[2] Mullis I V S, Martin M O, Foy P and Hooper M 2016 TIMSS Advanced 2015 International Results in Advanced Mathematics and Physics (Boston College, TIMSS & PIRLS International Study Center)
[3] Mullis I V S, Martin M O, Foy P and Hooper M 2015 TIMSS 2015 International Results in Mathematics (New York: TIMSS & PIRLS)
[4] Mullis I V S, Martin M O and Sainsbury M 2015 PIRLS 2016 Assessment framework
[5] Nugrahanto S and Zuchdi D 2019 Indonesia PISA Result and Impact on The Reading Learning Program in Indonesia
[6] OECD 2019 *PISA 2018 Results: Combined Executive Summaries, Volume I, II & III* (OECD Publishing)

[7] OECD 2019 PISA 2018 insights and interpretations *OECD Publ.*

[8] Darma I P and Rusyidi B 2015 Pelaksanaan Sekolah Inklusi Di Indonesia *Pros. Penelit. dan Pengabdi. Kpd. Masy.*

[9] Herawati N I 2016 Pendidikan Inklusif *EduHumaniora | J. Pendidik. Dasar Kampus Cibiru*

[10] Bateman D and Bateman C F 2001 *A Principal’s Guide to Special Education*

[11] Osborne A and Russo C 2014 *Special Education and the Law: A Guide for Practitioners*

[12] Saksono D Y 2020 Meningkatkan Kemampuan Koneksi Matematis Siswa Tunanetra Dengan Alat Peraga Manipulatif *Delta J. Ilm. Pendidik. Mat.*

[13] Pancawati A H 2016 Self efficiency anak tunanetra di sd negeri margosari *J. Pendidik.*

[14] Chasanah N U and Pradipta R F 2019 Pengaruh Penggunaan Media Sempoa Geometri pada Kelompok Belajar Tunanetra *J. ORTOPEDAGOGIA*

[15] Marteney T and Bernadowski C 2016 Teachers’ perceptions of the benefits of online instruction for students with special educational needs *Br. J. Spec. Educ.*

[16] Lagier J 2003 Distance learning and the minority student: Special needs and opportunities *Internet High. Educ.*

[17] Ikematsu Y, Mizutani M, Tozaka H, Mori S, Egawa K, Endo M and Yokouchi M 2014 Nursing students with special educational needs in Japan *Nurse Educ. Pract.*

[18] Hakim L L, Alghadari F and Widodo S A 2019 Virtual manipulatives media in mathematical abstraction *Journal of Physics: Conference Series*

[19] Buli-Holmberg J and Jayaprathaban S 2016 Effective practice in inclusive and special needs education *Int. J. Spec. Educ.*

[20] Widyastuti R 2016 Pola Interaksi Guru dan Siswa Tunanetra SMPLB A Bina Insani Bandar Lampung *Al-Jabar J. Pendidik. Mat.*

[21] Sakrani, Halidjah S and Margiati K Y 2013 Peningkatan Hasil Belajar Siswa Tunanetra Menggunakan Media Torso *Artik. Penelit. Prodi PGSD Univ. Tanjungpura*

[22] Mir’atunnisa I M 2017 Resiliensi Mahasiswa Tunanetra (Studi Kasus terhadap Mahasiswa Tunanetra tidak dari Lahir di Fakultas Ilmu Pendidikan Universitas Negeri Yogyakarta) *J. Ris. Mhs. Bimbing. Dan Konseling*

[23] Humphrey N, Lendrum A, Barlow A, Wigelsworth M and Squires G 2013 Achievement for All: Improving psychosocial outcomes for students with special educational needs and disabilities *Res. Dev. Disabil.*

[24] Nurnaini K 1975 Motivasi Berpesta Mahasiswa Penyandang Tunadaksa *J. Food Hyg. Soc. Japan*

[25] Stivers J, Cramer S and Riordan K 2012 Involuntary Teacher Transfer in Special Education: Concepts and Strategies for Teachers Facing New Assignments. *J. Am. Acad. Spec. Educ. Prof.*

[26] Widodo S A 2018 Selection of Learning Media Mathematics for Junior School Students *Turkish Online J. Educ. Technol. - TOJET 17* 154–60

[27] Widodo S A, Darhim and Ikhwanudin T 2018 Improving mathematical problem solving skills through visual media Improving mathematical problem solving skills through visual media *J. Phys. Conf. Ser. 948* 1–6

[28] Fernandes R 2018 Adaptasi Sekolah Terhadap Kebijakan Pendidikan Inklusif *SOCIUS*