Exploring Science Learning Strategies for Visually Impaired and Blind Students In Higher Education Inclusive Class

Resti Yektyastuti[1,*] La Ode Amril[2] Raden Siti Nurlaela[3] Yogo Dwi Prasetyo[4]
[1]*Universitas Sebelas Maret, Surakarta Central Java 57126, Indonesia*
[2]*Universitas Djuanda, Bogor West Java 16720, Indonesia*
[3,4]*Universitas Lambung Mangkurat, Banjarmasin South Kalimantan 70123, Indonesia*
restiyektyastuti@gmail.com

Abstract. In Indonesia, Visually impaired and blind students take part in learning at higher education in an inclusive class, including in Science Education courses. Considering the characteristics of science learning, which require visual access, various strategies are carried out to involve visually impaired students in science learning. This research uses a qualitative approach with phenomenology methods to explore learning strategies, challenges faced, and assistive technology that can facilitate visually impaired students in learning Science in inclusive class. Participants in this research were four visually impaired students and one lecturer in the Science Learning course in the Special Education study program at Lambung Mangkurat University, South Kalimantan, Indonesia. Data was collected through observation in the first cycle and interviews in the second cycle. The research results show that the strategies implemented include curriculum adjustments, involvement of accompanying students, modification of study rooms, adjustments to learning techniques, and application of education for all. The challenges are related to the characteristics of science learning, learning facilities and infrastructure, institutional readiness, and inclusive education policies in higher education. The things that need to be considered in developing and implementing assistive technology include the characteristics of assistive technology, availability and the use in higher education.

Keywords: Science Education, Blind, Visually Impaired, Assistive Technology, Inclusive.

1. Introduction

The development of an inclusive education system for all students is clearly stated internationally through the Sustainable Development Goals (SDGs) by the United Nations (1) and in Article 24 of the United Nations Convention on the Rights of Persons with Disabilities. -Nation (2). Inclusive education is a pedagogical approach that aims to go beyond the dimensions of disability and support all students to develop their full potential in social interaction and cooperation to overcome disability conditions, including at all

E. Yuliyanto et al. (eds.), *Proceedings of the 2nd Lawang Sewu International Symposium on Humanities and Social Sciences 2023 (LEWIS HUSO 2023)*, Advances in Social Science, Education and Humanities Research 850,
https://doi.org/10.2991/978-2-38476-267-5_18

levels of primary education to higher education (3). An inclusive learning environment a supportive, friendly and accepting atmosphere must be provided to people with all types of disabilities to feel comfortable in the learning process (3–5).

Data on students with special needs in Indonesia shows that there are more than 1,505 students currently taking courses in Diploma, Undergraduate or Postgraduate programs at more than 13 state universities and 152 private universities (6). They are spread across various disciplines and come from various types of obstacles, including visual impairment, hearing impairment, quadriplegic, autism, Attention deficit hyperactivity disorder (ADHD), and others.

Blind students are individuals whose sense of sight (both) does not function as a channel for receiving information in the daily activities of sighted people. Blind students are individuals whose sense of sight (both) is not a channel for receiving information in daily activities like sighted people (4,7). It is said that he is blind if his visual acuity (vision) is less than 6/21 (he can only read letters from a distance of 6 meters, which ordinary people can read from a distance of 21 meters). Blind people are divided into two: (1) blind, if they cannot receive light stimuli from outside their vision and (2) low vision, if their visual acuity is less than 6/21.

The intelligence condition of blind students is no different from that of typical students. Suppose it is found that blind students have low intelligence. In that case, this is generally because blind students experience obstacles in perception, thinking comprehensively and looking for a series of causes and effects. Even blind students, if their development is converted into cognitive development, according to Piaget, are approximately four years late at the sensorimotor level and two years late at the intuitive phase. In order to understand that blind students can compete and balance with sighted students, blind students need special training in both motor and mental aspects, so they need special training. The learning strategy for blind students is the same as for sighted students in general, except in its implementation, which requires modifications so that the message or learning material delivered can be received/captured by those with still functioning senses. It challenges blind students to access learning content (4), including learning Science.

Science learning is characterized by the need for visual learning (8,9). In learning science, students need to be able to observe changes, colours, shapes, and other visual characteristics of various science objects. It is indeed fascinating for those who are sighted. However, it will be a challenge and obstacle for those with visual impairment, whether in the category of visual impairment or total blindness.

This research explores science learning strategies for blind students in inclusive classes at universities in Indonesia. To support a holistic understanding of this phenomenon, this article analyses science learning strategies for blind students in inclusive classes, their challenges, and relevant assistive technology to overcome these challenges. The results of

this discussion will identify implications for policy making and planning, teaching and learning, as well as further research and theory on this important topic in higher education.

This research aims to 1) identify learning strategies that can be applied to involve blind students in Science learning in inclusive classes; 2) identify the challenges faced in Science learning for blind students in inclusive classes; 3) identify assistive technology that can facilitate blind students in learning Science in inclusive classes.

2. Methods

This research uses a qualitative approach with phenomenological methods. Phenomenology does not direct researchers to observe how individuals see things, but phenomenology explores how they see things differently (Wennström, 2012). By definition, phenomenology is an inductive qualitative research method originating in philosophical traditions and principles stated by Husserl and Merleau-Ponty (10,11), who described it as a method which suspended all prior presumptions, was related to interviewees' consciousness, and was based on individualized meanings of certain experiences (12).

Researchers conducting phenomenological studies need to interact with minority groups to investigate variations in their understanding of the same phenomenon or see inherent qualitative differences in the experiences of research subjects (13,14). The starting point of phenomenological research is planning, where the objectives and strategies are explicitly outlined (15). In this regard, Bowden recommends that research objectives be spelt out from the beginning of the research and guide the entire research process.

This research aims to 1) identify learning strategies that can be applied to involve blind students in Science learning in inclusive classes; 2) identify the challenges faced in Science learning for blind students in inclusive classes; 3) identify assistive technology that can facilitate blind students in learning Science in inclusive classes.

2.1 Participants

The participants in this research were four blind students in the Special Education study program at Lambung Mangkurat University, South Kalimantan, namely CAS, MRF, M, and P. The four students comprised three men (CAS, M, MRF) and one female (P). M and P are classified as total blind, while CAS and MRF are classified as low vision students. Moreover, one lecturer, namely DJ, was also involved in this research. Research was conducted on learning in the Science Learning course in the study program. DJ lecturers have long been involved in learning for blind people and have expertise in handling blind people in learning.

2.2 Procedure

Observations were carried out as the first cycle of initial data collection to fulfil these objectives. Observations were carried out on all participants. To explore the results of observations, interviews were conducted as the second cycle of data collection. Observations and interviews were carried out by the researcher and one research assistant, a team trained so that data collection met the standards set by the leading researcher.

Phenomenological interviews reveal the meaning and intentional attitudes of the people who enact the phenomenon being investigated (13). Therefore, in this research, interviews include 'What' questions that ask what the research object does and 'Why' questions to explore participants' awareness or understanding of their experiences regarding the challenges and strategies of science learning for blind students in inclusive classes. Based on this, a semi-structured interview guide was used to collect data for this research. Some of the key questions used to obtain research object responses are as follows:

1. What policies are implemented at your institution regarding the learning of blind students in inclusive classes, especially in science learning?
2. What kind of science learning is carried out in classes attended by blind students inclusively?
3. What strategies are applied in science learning for blind students in inclusive classes?
4. What are the most significant challenges in Science learning for blind students in inclusive classes?
5. How can assistive technology include blind students in Science learning in inclusive classes?
6. Which strategy most successfully involves blind students in science learning in inclusive classes?

A phenomenology analysis strategy was used to help the research team identify themes and subthemes obtained from the transcribed data (15) and compare the views of each research team. The research team needs to agree on emerging themes and subthemes. The data analysis strategy used in this research answers research questions on phenomenology's ontological and epistemological assumptions because it helps represent the character of themes that emerge after data analysis.

3. Results and Discussions

After analyzing the data from observations and interviews, several themes were obtained as follow in Table 1.

Science learning strategies for blind students in inclusive classes

Based on the results of observations in the first cycle and interviews in the second cycle of data collection, it can be analyzed that in involving blind students in inclusive classes, especially in science learning, lecturers apply several learning strategies, including adjusting the curriculum, involving accompanying students, modifying study rooms, adjusting techniques. Learning and application of principles of education for all.

Table 1. Themes and Subthemes of Research Results

Theme	Corresponding Subtheme
Science learning strategies for blind students in inclusive classes	Curriculum adjustments Companion student Study room modifications Adaptation of learning techniques Prinsip education for all
Challenges of science learning for blind students in inclusive classes	Characteristics of science learning Learning facilities and infrastructure Institutional readiness Inclusive education policy in higher education
Assistive technology in Science learning for blind students in inclusive classes	Characteristics of assistive technology Availability of assistive technology Use of assistive technology

Curriculum adjustments

The blind students involved in this research came from Special Schools. The curriculum at special schools has been modified according to the conditions of students' disabilities. The structure of the SLB curriculum is based on the structure of general schools (primary and secondary level) by adapting to the needs of children with special needs, namely functional skills and subjects that support these needs. Special Needs Program subjects aim to help children maximize their senses and overcome their limitations.

At the higher education level, no specific curriculum adjustments are implemented as learning standards for students with disabilities. All students, both disabled and typical students, are given learning using the same curriculum. In the practice observed in this research, curriculum adjustments were made by lecturers in implementing learning. The principle of curriculum adjustments is based on efforts to maximize the senses that are still functioning well. Science content that requires students to observe directly is excluded for blind students. It is an exception if science content that needs to involve the sense of sight can be modified into another form of content presentation, for example, into audio or verbal explanations, without reducing the essence of the material.

Involvement of accompanying students

One excellent strategy implemented in universities where participants study is the existence of a Disability Services Unit that facilitates their interaction with peer mentors. Each blind student is given one accompanying student who works voluntarily. These accompanying students come from their classmates and accompany them permanently from the start of becoming a student until they graduate from college. The companion provided is of the same gender. The companion is always near blind students, either on the side or in front and behind, during class.

In daily activities, accompanying students assist with student mobility from residence to campus, mobility while on campus, and other activities. In learning activities, companions have a significant role. Companions help blind students access learning media, explain learning materials through pictures and videos, and explain activities by lecturers and other friends. Four participants in this study stated that they were very dependent on their companions to participate in campus learning activities.

Classroom modifications

Based on observations made, modifications to learning spaces were also carried out by universities to facilitate inclusive learning for the visually impaired. This modification was made primarily to make it easier for the visually impaired to carry out mobility. The modification provides a path for blind people to walk using a cane. Unique markings on the road and the walls are provided so blind people can feel directly or use a cane.

Lecturers in this study also stated in interviews that blind students have excellent memories and direction orientation. They carry out mobility based on memories of places they have visited or passed and know the direction of movement based on unique signs they encounter on the road. If there are no unique markings on the path they are taking, they will look for nearby objects, such as walls, to find out the orientation of the direction of movement.

Modifications to the study room for blind students are also done by placing them in easily accessible seating positions. In the practice observed in this research, blind students can sit together with other sighted students. This condition is also well supported by accompanying students in class.

Adaptation of learning techniques

The results of observations in inclusive classes in this research show that lecturers adjust the learning techniques used in science learning. Lecturers provide learning media that can be accessed by sighted and blind students, for example, by providing audio media in broadcast materials displayed by lecturers. The lecturer also describes the images in the broadcast material provided by the lecturer.

When using learning media assisted by laptops and cellphones, blind students can operate it using a screen reader. So, if lecturers provide teaching materials in the form of text files, they can access them well via screen readers on laptops or cellphones.

Lecturers also make adjustments to learning techniques in conducting learning evaluations. Under certain conditions, the lecturer states that for developmentally disabled students, learning evaluation

is carried out through direct questions and answers or oral exams. However, in science practicum activities, blind students are not directly involved because there are no practicum learning tools for blind people in science learning at the participating institutions.

Application of education for all

In principle, science learning implemented in inclusive classes where blind students are has implemented education principles for all. Lecturers try to involve all students, typical students and students with disabilities, in learning without making exceptions. Lecturers only make adjustments to necessary things but continue to strive to maintain the essence and learning material provided.

It can also be seen from students' statements during interviews, which stated that they did not feel any difference in the learning process even though they had limitations. Lecturers do not differentiate between the treatment given in learning to them and their non-disabled colleagues. They feel comfortable in the inclusive learning environment provided. They even admitted they were happy because they felt like their fellow students. This kind of climate is perfect for the psychological condition of blind students when taking science lessons.

Challenges of science learning for blind students in inclusive classes

Involving blind students in inclusive science learning classes encounters several challenges. Based on the analysis results, some of these challenges include the characteristics of science learning, learning facilities and infrastructure, institutional readiness, and inclusive education policies in higher education.

Characteristics of science learning

The characteristic of science learning, which requires a dominant sense of sight, is the main challenge in implementing science learning in this research. Science learning becomes interesting because students c, can observe interesting natural symptoms and phenomena such as colour changes, shape changes, reactions, and others. It is inaccessible to blind students. Because of this, all participants in this study stated that they could not understand Science learning well.

Lecturer DJ stated in an interview that to convey science learning; he needed to implement strategies so that students could follow the learning well. DJs experience difficulties when delivering science material, but there is no assistive technology available that can help. If he had to develop assistive technology for the entire material independently, the DJ lecturer admitted it would be difficult. According to DJ, the characteristics of Science learning like this require an adequate role of assistive technology to help deliver material in learning for blind students.

Learning facilities and infrastructure

Another challenge in implementing Science learning in inclusive classes is the availability of learning facilities and infrastructure. Blind students feel comfortable participating in learning when they can move around in familiar spaces, and there is also the availability of teaching materials that they can access using senses that are still functioning well.

DJ also admitted that the availability of learning facilities and infrastructure was essential and made it easier for him to learn. DJ further stated that he needed support in providing facilities and infrastructure to achieve learning objectives for all students in his inclusive class. Providing these facilities and infrastructure needs to be a particular concern for universities in providing inclusive education.

Institutional readiness

Institutional readiness is also challenging in implementing inclusive science learning in higher education. Even though the number of blind students is not the majority, institutional readiness to provide inclusive learning is a priority. Student participants stated that their college choice was based on the readiness of the college's facilitation. CAS stated that he had wanted to continue his education at another university. However, because the university was not ready to accept blind students, he gave up his intention and looked for another university that was ready to accept him.

Inclusive education policy in higher education

The availability of particular policies in higher education is one factor that needs to be considered in implementing inclusive education. DJ states that this policy will become a legal umbrella for facilitating learning for students with disabilities in inclusive university classes. DJ feels significantly helped by a Disability Services Unit at his institution. With this unit, DJ can have a place to consult in organizing learning for blind students in his class.

Based on DJ's experience, not all universities have implemented policies related to inclusive education. Several institutions known to DJ still need to have specific policies regarding the implementation of inclusive education. Others have policies in place but have not implemented them due to the absence of students with disabilities at those institutions.

Assistive technology in Science learning for blind students in inclusive classes

The results of the analysis show that assistive technology is essential in helping blind students participate in science learning at university. Several things that have been analyzed regarding the use of assistive technology include its characteristics, availability, and use in higher education.

Characteristics of assistive technology

In general, blind students can access learning resources in the form of books in braille. They can also access digital materials in the form of text with the help of screen readers, both on laptops and cell phones. All participants in this study stated that it would be constructive if assistive technology were available as an audio-based learning resource.

One example of assistive technology is audiobooks. Learning material is presented in audio form. In science learning, material content in images, charts, plots, and other visuals must be described using audio so students can understand the content.

The audio media provided also requires a particular design. The observations made showed that M and P liked accessing audio media at different sound speeds. M likes the sound of reading content, which tends to be faster than P. Based on this, it can be analyzed that audio media needs to be designed so that the reading speed of the audio can be adjusted.

Apart from that, in cellphone-based media, blind students like it if the buttons on the media are familiar, like the functions of other phone applications they frequently use. The function in question is like how to access the button with a double tap and adjust the reading speed by sliding. In this research, DJ lecturers only used audio-based media as assistive technology in science learning.

Availability of assistive technology

The availability of assistive technology is necessary for implementing science learning. As explained in the previous section, IPA has content characteristics that must be accessed visually. Students M and MRF regret that not all material in science learning can be accessed with assistive technology such as audiobooks. They stated that the availability of assistive technology, such as audiobooks, helped them study Science.

Some material content in science learning courses that requires practice is made an exception for blind students in inclusive classes. It was done because there was no assistive technology available that could facilitate science practice for blind students.

Use of assistive technology

In science learning, it is hoped that students can use the available assistive technology independently. The lecturer gives directions initially, and students can use assistive technology independently. Under certain conditions, accompanying students can help blind students use assistive technology.

Several learning strategies can be applied to involve blind students in Science learning in inclusive classes. The results of observations and interviews in this research show that involving blind students in Science learning in inclusive classes requires specific strategies to carry out effective learning. The strategies that have been carried out include curriculum adjustments, involvement of accompanying students, modification of study rooms, adjustments to learning techniques, and application of education for all principles.

The strategy that has been implemented is considered adequate, as has also been done elsewhere, such as adapting learning techniques (16,17), applying special evaluation tools (18), applying principles education for all (3). Several learning models according to the characteristics of 21st-century learning can also be applied to blind students in Science learning in inclusive classes. One uses a project-based learning model, as has been implemented in several universities (19,20).

Involving blind students in inclusive science learning classes encounters several challenges. Based on the analysis results, some of these challenges include the characteristics of science

learning, learning facilities and infrastructure, institutional readiness, and inclusive education policies in higher education.

Assistive technology can also facilitate blind students' learning science in inclusive classes. In this research, lecturers in science learning in inclusive classes have applied assistive technology in audio media and audiobooks. This media is beneficial for blind students in participating in science learning. When developing audio media such as audiobooks, care must be taken to ensure that science learning content can be delivered according to the learning objectives without reducing the essence of Science (21). Experience in developing assistive technology has been carried out by other researchers, such as audiobooks (22–24), computer-based applications (25), 3D modular (26), and braille books (7).

Further development of assistive technology for blind students can be carried out by developing assistive technology to help students participate in science laboratory experimental activities. This assistive technology can be developed to facilitate students' scientific skills (21). Assistive technology also needs to be developed so that blind students can be actively involved in online learning (19,25,27–29). The use of technology for blind students can now be done quickly with various modifications that are available on technological devices (30).

The results of the analysis of challenges and exploration of strategies and assistive technology that can be used by blind students in Science learning in inclusive classes at tertiary institutions have been presented in this article. Hopefully, this can become a reference for setting learning strategies that can be implemented and continue to be explored for better involvement of blind students in science learning in higher education with an inclusive class format. Further development of various types of assistive technology can also be carried out in future research while still paying attention to the characteristics of science content in its delivery through assistive technology.

4. Conclusions

Implementing learning that involves blind students in Science learning in inclusive university classes requires specific strategies to be implemented effectively. The strategies implemented include curriculum adjustments, involvement of accompanying students, modification of study rooms, adjustments to learning techniques, and application of education for all principles.

Involving blind students in inclusive science learning classes encounters several challenges. Based on the analysis results, some of these challenges include the characteristics of science learning, learning facilities and infrastructure, institutional readiness, and inclusive education policies in higher education.

Assistive technology is essential in helping blind students participate in science learning at university. Several things that need to be considered in its development and implementation include the characteristics of assistive technology, availability and use in higher education.

Authors' Contributions

RY (Data analysis, discussion, and conclution), LOA (Introduction and method), RSN (Research instrument, collecting data), and YDP (collecting data and data analysis).

Acknowledgments

This material is based upon work supported by Directorate General of Higher Education, Research, and Technology - Ministry of Education, Culture, Research, and Technology, Republic of Indonesia 2023.

References

1. Nations U. The Sustainable Development Goals Report 2020. New York, USA. 2020.
2. Nation U. Convention on the Rights of Persons with Disabilities – Articles [Internet]. United Nation. 2022. Available from: https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html
3. Peters SJ. "Education for all?" A historical analysis of international inclusive education policy and individuals with disabilities. J Disabil Policy Stud. 2007;18(2):98–108.
4. Bhardwaj RK. Availability and preferences for information services to visually impaired tertiary students in Delhi. J Enabling Technol. 2022;16(1):1–16.
5. Symeonidou S, Phtiaka H. Using teachers' prior knowledge, attitudes and beliefs to develop in-service teacher education courses for inclusion. Teach Teach Educ [Internet]. 2009;25(4):543–50. Available from: http://dx.doi.org/10.1016/j.tate.2009.02.001
6. Direktorat Pembelajaran dan Kemahasiswaan, Ditjen Dikti K. Panduan Program Bantuan Inovasi Pembelajaran dan Teknologi Bantu untuk Mahasiswa Berkebutuhan Khusus. Jakarta; 2023.
7. Pradhan S, Samanta M. Use of assistive technology in blind schools of West Bengal: A comparative study. Libr Philos Pract. 2018;2018(May).
8. Garraway-Lashley YM. Teaching Science at the Primary school Level: "Problems Teachers' are facing". Asian J Educ e-Learning. 2019;7(3):81–94.

9. Harlen OBE W. The Teaching of Science in Primary Schools. The Teaching of Science in Primary Schools. 2017.
10. 10. Husserl E. Ideas Pertaining to a Pure Phenomenology and to a Phenomenological Philosophy. Fifth. Netherlands: Kluwer Academic Publishers; 2000.
11. Merleau-Ponty M. Phenomenology of Perception. New York: Routledge;
12. Creswell JW, Creswell JD. Mixed Methods Procedures. Research Defign: Qualitative, Quantitative, and Mixed M ethods Approaches. 2018. pg 418.
13. Akerlind G. Learning about phenomenography: Interviewing, data analysis and the qualitative research paradigm. Doing Dev phenomenography [Internet]. 2005;(June):63–73. Available from: http://search.informit.com.au/fullText;dn=036613195735528;res=IELHSS
14. Wennström S. Perspectives on Conceptual Change An Exploration of the Intentional Context and the Phenomenographic Situation. 2012;
15. Bowden JA, Walsh E. Phenomenography. Encycl Eval Encycl Eval. 2012;
16. Amponsah S, Bekele TA. Exploring strategies for including visually impaired students in online learning. Educ Inf Technol. 2023;28(8):9355–77.
17. Borges F, da Silva S de CR, Viginheski LVM, Shimazaki EM. Teaching Geometry Using an Adapted Narrative: A Case Study with a Visually Impaired Student. Acta Sci. 2022;24(6):402–31.
18. Darin T, Andrade R, Sánchez J. Usability evaluation of multimodal interactive virtual environments for learners who are blind: An empirical investigation. Int J Hum Comput Stud. 2022;158(December 2020).
19. Müller FJ. On the Road to Inclusive Education: Supporting Diversity in Education by State-Financed, Large-Scale OER Platforms - The Example of User-Oriented Development of NDLA in Norway. Educ Res Int. 2021;2021.
20. Zhou L, Li J. Developing Core Competence With Project-Based Learning: Voices From Chinese High School Students Serving Visually Impaired Students. ECNU Rev Educ. 2022;5(2):383–9.
21. Ghai G, Raj R, Kaur R. An Inclusive Science Laboratory for Visually Impaired Students. J Eng Educ Transform. 2022;36(2):87–100.
22. Camalia F, Zusanto H, Susilo. Pengembangan Audiobook Dilengkapi Alat Peraga Materi Getaran Dan Gelombang Untuk Tunanetra Kelas. UPEJ Unnes Phys Educ J. 2016;5(2):66–75.
23. Handayani MR. Audiobook Sebagai Alat Bantu Memperlancar Komunikasi Dalam Penyebaran Dakwah Islam Penyandang Tunanetra. Islam Commun J. 2016;1(1):19–29.
24. Purnamayanti A, Putri ATU. Strategi Peningkatan Minat Baca Kelompok Tunanetra melalui Media Audiobook. Anuva [Internet]. 2020;4(1):109–17. Available from: http://ejurnal.undip.ac.id/index.php/anuva
25. Freire AP, Linhalis F, Bianchini SL, Fortes RPM, Pimentel M da GC. Revealing the whiteboard to blind students: An inclusive approach to provide mediation in synchronous e-learning activities. Comput Educ [Internet]. 2010;54(4):866–76.

Available from: http://dx.doi.org/10.1016/j.compedu.2009.09.016
26. Dominguez-Reyes R, Moreno L, Munoz-Sanchez A, Ruiz Mezcua B, Savoini B. Modular 3-D-Printed Education Tool for Blind and Visually Impaired Students Oriented to Net Structures. IEEE Trans Educ. 2023;66(1):55–61.
27. Bhardwaj RK. Information system for visually impaired in Indian universities: a user's perspectives. Inf Discov Deliv. 2022;50(3):312–25.
28. Hermanto H, Supena A. Implementassi Pembelajaran Daring Bagi Siswa Tunanetra di Sekolah Dasar. J Basicedu. 2020;5(1):188–94.
29. Mahfuz S, Sakib MN, Husain MM. A preliminary study on visually impaired students in Bangladesh during the COVID-19 pandemic. Policy Futur Educ. 2022;20(4):402–16.
30. D'Andrea FM, Siu Y-T. Students with Visual Impairments: Considerations and Effective Practices for Technology Use. 2015;1:111–38.