SPECIJALNA EDUKACIJA I REHABILITACIJA
2026, Vol. 25, Br. 3, str. 225–240
CC BY SA
UDK: 37.091.3::51
159.922.72.072-053.5-056.262
Originalan naučni rad
DOI: https://doi.org/10.5937/specedreh25-64427

Mathematics productive disposition of visually impaired students: a student-centered analysis of profile, contributing factors, and strategies in inclusive classes

Sumbaji Putranto*

State Islamic University of Sunan Kalijaga, Faculty of Tarbiyah and Education, Sleman, Indonesia

Introduction. Previous research indicated that visually impaired (VI) students often face significant challenges in understanding and solving mathematical problems within inclusive classes, highlighting the importance of developing a strong mathematical productive disposition (MPD). *Objective*. This study aimed to explore the characteristics of MPD among VI students, the factors influencing it, and strategies to enhance it in inclusive classrooms. *Method*. This study used an explanatory sequential design. The quantitative phase used questionnaires to collect data from 8 VI students and 144 sighted peers, which were analyzed using descriptive statistics followed by a Mann-Whitney test. The qualitative phase involved semi-structured interviews and classroom observations with 8 VI students and was analyzed inductively. *Results*. The findings indicate that the MPD of VI students falls within the moderate category and tends to be lower than that of sighted peers, although both groups remain within the same category. Results of the Mann-Whitney test show no significant overall difference between the two groups; however, VI students scored significantly lower on the indicators of viewing mathematics as useful and valuable, as well as on self-efficacy. A key challenge identified is that VI students rarely participate in classroom discussions and are reluctant to express their ideas. Therefore, teachers need to design contextualized learning experiences, provide adequate scaffolding, and implement peer tutoring. *Conclusion*. These findings underscore the importance of designing mathematics instruction that explicitly supports the development of MPD among VI students, particularly in strengthening their sense of usefulness of mathematics and their self-efficacy.

Keywords: mathematics productive dispositions, visually impaired, profile, contributing factors, strategies

Correspodence: Sumbaji Putranto, sumbaji.putranto@uin-suka.ac.id
* https://orcid.org/0000-0003-3492-4052

Introduction

As one of the central pillars in the transformation of modern education systems, inclusive education has attracted global attention due to its role in ensuring that every individual has equitable access to learning opportunities. Inclusivity is closely associated with diversity (Burner et al., 2018), justice (Shaeffer, 2019), equality (Lundahl, 2016), and the universal right to education (Gran, 2017; McAnelly & Gaffney, 2019). Inclusive education emphasizes the quality of teaching within an integrated framework that is responsive to diversity (Hajisoteriou & Sorkos, 2023; Vislie, 2003), fosters equitable and adaptive school structures that support the development of all students (Felder, 2021; Rapp & Corral-Granados, 2024), and seeks to eliminate exclusion while promoting accountability and social equity (Kairiene & Sprindziunas, 2016; Messiou et al., 2016). Nevertheless, the implementation of inclusive education continues to face substantial challenges in addressing the needs of visually impaired (VI) students (Naude & Meier, 2019; Negash & Gasa, 2022), including within the Indonesian context (Putranto et al., 2024; Putranto & Permatasari, 2023). Therefore, sustained efforts to improve inclusive classroom services that effectively accommodate students with VI remain critically important.

Mathematics education is a field that has long emphasized the importance of inclusive educational practices and equity (Baykaldı et al., 2023; Roos, 2019), including for VI students. A substantial body of research indicates that students with special educational needs tend to develop more optimally—academically, socio-emotionally, and intellectually—when learning in inclusive environments rather than in segregated settings (Hehir et al., 2016; Schnepel et al., 2020; Szumski et al., 2017). However, VI students still face significant challenges in learning mathematics. One of the primary obstacles is the heavy reliance on visual representations, which hinders VI students from accessing and comprehending mathematical content, particularly topics involving graphs, charts, diagrams, figures, and illustrations (Baykaldı et al., 2023; Putranto et al., 2024). These barriers may contribute to lower mathematics learning outcomes and restrict the active participation and meaningful learning experiences of VI students within inclusive classroom settings.

Low mathematics achievement is associated with low mathematical proficiency (Awofala, 2017), which has become a central goal of effective mathematics teaching and learning (Awofala et al., 2022). Kilpatrick et al. (2001) identified four cognitive strands of mathematical proficiency—conceptual understanding, procedural fluency, strategic competence, and adaptive reasoning—which students flexibly employ when approaching or solving mathematical tasks. These four cognitive strands do not operate in isolation; rather, they interact dynamically to support students' mathematical thinking processes. In addition to the cognitive dimensions, mathematical proficiency also encompasses an affective strand, namely productive disposition, which plays a

crucial role in shaping students' attitudes and inclinations toward mathematics. Productive disposition enables the cognitive strands to function and interact effectively in the process of mathematical problem solving (Awofala et al., 2022).

Mathematics Productive Disposition (MPD) refers to students' consistent tendency to perceive mathematics as useful and worthwhile, which in turn fosters perseverance and confidence in its efficacy (Awofala et al., 2022; Awofala, 2017; Chua, 2021; Siegfried, 2012). Students with MPD view mathematics as an evolving conceptual framework that can be developed through persistence and determination, rather than as a set of isolated procedures to be internalized through rote memorization (Awofala, 2017; Siegfried, 2012). Students who exhibit a high level of MPD tend to demonstrate stronger mathematics achievement (Awofala et al., 2022). Collectively, these findings underscore the critical role of MPD in supporting successful mathematics learning. However, empirical investigations of MPD among VI students in inclusive classroom contexts remain limited, thereby highlighting an important gap and the need for further research.

Bibliometric mapping indicates that research on MPD and mathematics learning among VI students has expanded considerably in recent years. However, analyses conducted using VOSviewer reveal that studies on mathematics learning for VI students remain largely dominated by investigations into the use of assistive technologies and instructional media (Putranto, 2025). In contrast, research that explicitly addresses MPD among VI students is still relatively scarce. This finding points to a significant research gap that has become increasingly salient, particularly given prior evidence suggesting that VI students often have more limited opportunities to engage with advanced mathematical concepts than their sighted peers (Bateman et al., 2018; Stylianidou & Nardi, 2019). Consequently, examining MPD is essential for supporting the engagement and success of VI students in mathematics learning.

Research Question

This study addressed three research questions:

1. What is the profile of MPD among VI students in inclusive classrooms?
2. What factors influence the level of MPD from VI students' perspectives in inclusive classrooms?
3. What efforts can be undertaken to enhance MPD from VI students' perspectives in inclusive classrooms?

Method

This study used an exploratory sequential design consisting of quantitative and qualitative phases (Creswell & Clark, 2017) to obtain a more comprehensive understanding of the research focus. In the quantitative phase, the researchers examined

the MPD profiles of VI students in detail and conducted statistical comparisons with their sighted peers in inclusive classrooms. The qualitative phase explored the barriers to MPD development and identified potential efforts to enhance MPD from the perspectives of students with VI in inclusive classroom settings.

Quantitative Phase

The quantitative phase involved 8 VI students and 144 sighted peers from six different inclusive classrooms (Table 1). All participants were enrolled in Grade 10 of senior high schools in Indonesia. Detailed demographic information of the research participants is presented in Table 1.

Table 1

Demographics of the Research Participants

Group	VI Students			Sighted Students
	Code	Gender	Category	
1	S1	Male	Totally Blind	11
	S2	Male	Totally Blind	
2	S3	Female	Low Vision	14
3	S4	Male	Totally Blind	30
4	S5	Male	Totally Blind	30
5	S6	Female	Low Vision	28
	S7	Female	Totally Blind	
6	S8	Male	Totally Blind	28

A questionnaire was employed as the data collection instrument in the quantitative phase. The questionnaire consisted of 28 items with four response options. It was developed based on seven key indicators of MPD, namely: (1) perceiving mathematics as a sensible activity; (2) viewing mathematics as useful and valuable; (3) the ability to learn mathematics through appropriate approaches; (4) habits of mathematical thinking; (5) mathematical integrity; (6) motivation to learn mathematics; and (7) self-efficacy. Prior to its administration, the MPD questionnaire was evaluated by five experts and achieved a very high level of content validity based on Aiken's V index (.95). Furthermore, reliability testing using Cronbach's alpha yielded a coefficient of .900, indicating that the MPD questionnaire demonstrates adequate internal consistency. These results suggest that the instrument is trustworthy and reliable for data collection.

The questionnaire results were analyzed descriptively to categorize the MPD achievement of VI students and sighted peers in inclusive classrooms, based on the criteria presented in Table 2 (Widoyoko, 2009). The analysis was followed by a Mann-Whitney test at a significance level of $\alpha = .05$ to examine the differences in MPD achievement between VI students and their sighted peers in inclusive classrooms.

Table 2

MPD Categorization Criteria

Formula	Average MPD Score	Category
$X > \overline{X}_i + 1.8 \times sb_i$	$X > 3{,}4$	Very High
$\overline{X}_i + 0.6 \times sb_i < X \leq \overline{X}_i + 1.8 \times sb_i$	$2.8 < X \leq 3.4$	High
$\overline{X}_i - 0.6 \times sb_i < X \leq \overline{X}_i + 0.6 \times sb_i$	$2.2 < X \leq 2.8$	Moderate
$\overline{X}_i - 1.8 \times sb_i < X \leq \overline{X}_i - 0.6 \times sb_i$	$1.6 < X \leq 2.2$	Low
$X \leq \overline{X}_i - 1.8 \times sb_i$	$X \leq 1.6$	Very Low

Qualitative Phase

The qualitative phase involved 8 VI students (S1 to S8) and utilized observations and semi-structured interviews for data collection. Semi-structured interviews were employed due to their flexibility, allowing the researcher to add questions during the interview and obtain more in-depth information (Creswell, 2007). This qualitative phase addressed the second research question (RQ 2), concerning the factors influencing MPD among VI students, and the third research question (RQ 3), regarding efforts to enhance MPD in learning from the perspectives of VI students. The interview protocol consisted of five key questions evaluated by two experts (one in mathematics education and one in mathematics learning assessment). Face-to-face interviews were conducted with all research participants, lasting between 45 and 60 minutes per participant. All participants were informed of the purpose of the interviews and provided consent for the entire process to be documented. Meanwhile, observations were conducted across five mathematics lessons in each class group. The observations focused on the participation and engagement of VI students in discussions and group work, obstacles encountered during mathematics learning, and barriers to MPD development.

Qualitative data were analyzed inductively through data management, data presentation, and data interpretation (Cohen et al., 2007). The analysis began with detailed examination of the data, followed by the identification of significant patterns or categories, ultimately allowing for the formulation of general statements about the phenomena under study. The identified patterns or categories were then presented narratively. Research credibility was maintained through prolonged engagement in the field and methodological triangulation (Korstjens & Moser, 2018). Prolonged engagement involved returning to the research context to ensure consistency and accuracy of previously collected data. Methodological triangulation was achieved by integrating questionnaires, observations, and interviews to strengthen the findings. Research dependability was ensured through an internal audit conducted by two independent reviewers who examined the entire research process (Korstjens & Moser, 2018). Confirmability referred to the researcher's transparency regarding the data and the analysis process (Lincoln & Guba, 1985). To achieve confirmability while enhancing transferability, the researcher provided a thick description, enabling readers to assess the extent to which the findings may be applied to similar contexts.

Results

This study revealed the MPD profiles of VI students and statistically compared their achievement with that of sighted peers in inclusive classrooms. It also explored factors influencing MPD achievement and efforts to enhance MPD from the perspectives of VI students in inclusive classrooms.

MPD Profile of Students with VI in Inclusive Classrooms

Overall, the MPD achievement of VI students was categorized as moderate (*mean* = 2.44). Compared to sighted students (*mean* = 2.77), VI students demonstrated slightly lower MPD levels, although both groups remained within the same moderate category. The Mann–Whitney test at a significance level of .05 indicated no statistically significant difference between the MPD of VI students and sighted peers in inclusive classrooms (p = .082). However, when examining individual MPD indicators, VI students achieved significantly lower scores on two dimensions: (1) perceiving mathematics as useful and valuable, and (2) self-confidence, compared to their sighted peers. Detailed results are presented in Table 3.

Table 3

MPD Achievement of VI Students and Sighted Peers in Inclusive Classrooms

Indicator	VI Students		Sighted Students		*p-value*	Conclusion
	Mean	Category	Mean	Category		
1	2.50	Moderate	2.77	High	.472	H_0 accepted
2	2.45	Moderate	2.89	High	.001	H_0 rejected
3	2.25	Moderate	2.55	Moderate	.335	H_0 accepted
4	2.56	Moderate	2.61	Moderate	.240	H_0 accepted
5	2.68	Moderate	2.95	High	.310	H_0 accepted
6	2.47	Moderate	2.83	High	.165	H_0 accepted
7	2.20	Low	2.84	High	.000	H_0 rejected

Note: Student scores range from 1 to 4

The achievement of VI students on indicator 2, viewing mathematics as useful and valuable, was significantly lower compared to sighted peers in inclusive classrooms. Based on interview results, most VI students reported low interest in mathematics because they had not been able to directly perceive its benefits and usefulness in daily life (S2, S3, S5, S7, and S8). This perception was further reinforced by some students who explicitly expressed dislike for mathematics (S1, S2, S4, and S5). These attitudes were often linked to repeated experiences of failure in mathematics, as reported by S1 and S4, which ultimately contributed to negative attitudes toward the subject. Additionally, several students perceived mathematics as difficult, abstract, and lacking clear relevance to their lives (S5, S6, and S8).

VI students also scored significantly lower on Indicator 7, self-confidence, compared to their sighted peers. Interview data revealed that VI students often doubted their mathematical abilities (S1, S3, S4, and S7) and felt incapable of progressing successfully in mathematics (S2, S5, S6, and S8). These findings were corroborated by classroom observations, which showed that VI students tended to be passive and minimally engaged in discussions, both in whole-class and group settings. During lessons, VI students rarely asked questions or volunteered opinions, even when the teacher encouraged discussion. They typically expressed their views only when directly called upon or questioned by the teacher.

Factors Influencing MPD Achievement of VI Students in Inclusive Classrooms

Interview and observation findings revealed three main factors affecting the MPD achievement of students with visual impairment (VI), particularly regarding the indicators of viewing mathematics as useful and valuable and self-confidence. The first factor is that mathematics instruction in inclusive classrooms is not yet contextualized for VI students, making it difficult for them to relate learned mathematical concepts to accessible real-life experiences. This condition leads VI students to perceive limited benefits and functional value of mathematics in daily life. For example, S2 stated: *"Often the teacher presents contextual problems for sighted students but not for me. For instance, the teacher explains linear equations using this story: 'Mother buys 2 batik shirts and 3 striped shirts for 320,000.' I don't know what batik or striped patterns look like."* This statement illustrates that contexts that appear meaningful to sighted students can be abstract and meaningless for VI students due to their different sensory experiences. Consequently, VI students struggle to connect mathematics to real-life situations, resulting in a low perception of mathematics' usefulness and value.

Another factor influencing MPD achievement is that the mathematics learning process is not yet fully accessible to VI students. S8 reported: *"The lessons mostly involve explanations followed by exercises. Sometimes the teacher explains briefly and quickly, making it difficult to follow."* Meanwhile, S3 stated: *"Topics involving images, graphs, tables, and materials that need to be observed are often not explained in detail or specifically."* These statements indicate that instructional delivery relying heavily on visual representations without comprehensive verbal explanations makes it difficult for VI students to fully understand mathematical concepts. Furthermore, the assessment process in inclusive classrooms is not yet fully accessible to VI students, as noted by S2, S3, and S6, limiting their ability to demonstrate their capabilities. This situation negatively affects VI students' self-confidence, as they often feel left behind or incapable of keeping up with the learning process.

Another factor affecting MPD is that social support and the inclusive classroom climate are not yet optimal, which limits the engagement and self-confidence of VI students. S8 reported: *"Sometimes I am not given the opportunity to participate in group tasks."* This statement indicates that classroom social interactions do not fully support VI students' active participation. Limited opportunities to contribute lead VI students to become passive, hesitant to ask questions, or reluctant to express their opinions. As a result, their self-confidence and willingness to engage in mathematics learning do not develop optimally.

Efforts to Develop MPD of VI Students in Inclusive Classrooms

From the perspectives of VI students, fostering MPD can begin by providing mathematics instruction that is contextualized for them. VI students require problem contexts that can be experienced or understood through real-life experiences. S5 stated: *"I prefer it when mathematics is related to everyday activities, such as counting stationery, pocket money, or objects that I can physically touch. This makes it more meaningful and helps me connect mathematical concepts to my experiences."* By providing relevant contexts, VI students' perception regarding the usefulness and value of mathematics can be enhanced.

In addition, VI students emphasized the importance of appropriate teacher scaffolding. They require step-by-step explanations (S2, S3, and S7), the use of clear language (S5), provision of concrete examples (S4, S6, S8), and multisensory experiences (S2 and S7) to help them fully understand mathematical concepts. VI students also need repetition and additional processing time (S2) so that they do not feel left behind and can build self-efficacy.

The third solution identified from VI students' perspectives is optimizing peer-assisted learning. Collaborative interactions and opportunities to actively participate in group discussions can enhance the engagement of VI students. S4 stated: "I enjoy learning and understand better when my friend explains. I also feel comfortable asking questions if I don't understand." When peers provide support, opportunities to speak, and cooperation in completing tasks, VI students feel valued and are more confident in expressing ideas or asking questions. This supportive social environment not only increases engagement but also strengthens self-efficacy and motivation to learn mathematics.

Discussion

The findings of this study indicate that, overall, VI students' MPD achievement in inclusive classrooms falls within the moderate category and does not differ significantly from sighted peers. This suggests that an inclusive learning environment can facilitate the development of MPD for

VI students relatively equally to their sighted peers, despite differences in sensory characteristics and learning needs. Therefore, visual impairment does not inherently constitute a primary barrier to MPD development, provided that the learning process is designed responsively and supported by inclusive pedagogical strategies (Florian & Black-Hawkins, 2011). These results support previous research showing that mathematics learning in inclusive classrooms positively impacts the development of students with special needs (Onyishi & Sefotho, 2021). Furthermore, Holzer and Moser Opitz (2025) demonstrated that inclusive education not only achieves comparable learning outcomes but, in many cases, outperforms separate special education programs.

However, when examined in detail by MPD indicators, two areas require special attention. The low achievement of VI students on the indicator of perceiving mathematics as useful and valuable suggests that they have not yet fully internalized mathematics as knowledge relevant to their lives. This issue arises because mathematics instruction in inclusive classrooms is not fully contextualized for VI students, making the problem contexts meaningful primarily for sighted students. These findings indicate that mathematics teachers may lack the knowledge and skills to identify the learning needs of VI students (Baykaldı et al., 2023) and have limited understanding of their cognitive processes (Dick & Kubiak, 1997). Consequently, instructional strategies may be suboptimal (Bayram et al., 2015), including the use of contexts that are inappropriate for VI students.

Problem contexts relying on visual experience tend to create difficulties for VI students in linking mathematical concepts to real-life experiences accessible to them. This situation affects their perception of mathematics as abstract, difficult to understand, and of limited practical value in daily life. Several studies highlight that providing direct and multisensory learning experiences is crucial for supporting conceptual understanding of mathematics for VI students (Hayes & Proulx, 2023). Moreover, contextualized instruction has been shown to help students build meaning and conceptual understanding in mathematics (Borji et al., 2025; Pratiwi & Widjajanti, 2020). This approach not only facilitates connections between abstract concepts and students' real-life experiences but also enhances attention, motivation, and the ability to recognize and reflect on knowledge being learned.

Negative perceptions of the usefulness of mathematics among VI students are further reinforced by repeated experiences of learning failure, which can lead to dislike of the subject. Fear of failure may be influenced by internal factors, such as learning motivation, as well as external factors related to the learning environment (Giel et al., 2020; Taylor et al., 2023). When VI students frequently encounter difficulties without successful learning experiences, their motivation to actively engage in mathematics learning tends to decrease. This situation is exacerbated by negative emotions, such as anxiety

or embarrassment, which may arise when students are unable to complete tasks correctly in front of teachers and peers (Gómez-López et al., 2020). Conversely, mastery experiences achieved through successful instruction are the most powerful source of positive and stable self-efficacy expectations, which are critical for enhancing engagement and perseverance in mathematics learning (Morris et al., 2017)

VI students indicated that fostering MPD requires mathematics instruction that not only provides contextualized problems but also offers learning experiences that allow them to experience success. They require three types of scaffolding to develop MPD: analytical, social, and affective scaffolding (Bakker et al., 2015). Analytical scaffolding relates to content and enhances understanding of mathematics through step-by-step explanations, clear language, appropriate prompting questions, and concrete examples. Social scaffolding involves developing norms for effective classroom interaction, including discipline and avoidance of mocking mistakes. Affective scaffolding provides emotional support by giving appreciation and recognition for students' successes. Teachers can also offer repetition and additional processing time so that VI students do not feel left behind and can build self-efficacy. Such scaffolding is essential for creating a supportive learning environment that enables students to learn effectively (Li et al., 2024).

In addition to perceptions of mathematics' usefulness, VI students' low achievement on the self-efficacy indicator reflects challenges in their belief in their mathematical abilities. Low self-efficacy manifests in passive behavior during learning, limited participation in discussions, and hesitation to express opinions voluntarily. VI students reported that peer-assisted learning (peer tutoring) can help address these challenges. Peer tutoring can take various forms, such as providing additional explanations when initial information is insufficient, demonstrating expected skills, or encouraging and providing feedback to support active learning (Haegele et al., 2024). Peer tutoring has been shown to improve learning, participation, and a sense of inclusion (Kalef et al., 2013). VI students noted that they felt more comfortable asking peers questions. These findings support previous research by Baiduri (2017), Berso and Lorente (2020), Campbell (2019), and Johnston (2021), which found that students receiving peer tutoring became more comfortable asking questions, developed social skills, participated more in discussions, and increased self-efficacy. Teachers should encourage inclusive collaborative interactions by ensuring that all group members, including VI students, have roles and opportunities to contribute. Peer support, opportunities to ask questions without hesitation, and a supportive learning environment can strengthen engagement, enhance willingness to participate, and ultimately foster self-efficacy in mathematics learning.

Conclusion

This study advances knowledge in inclusive mathematics education by identifying the most vulnerable dimensions of MPD among VI students in inclusive classrooms. Although the overall MPD of VI students does not differ significantly from that of their sighted peers, they exhibit notable weaknesses in perceiving mathematics as useful and valuable and in mathematical self-efficacy, suggesting that their challenges are concentrated in specific affective dimensions rather than in productive disposition as a whole. These findings extend current understanding of MPD in inclusive education by demonstrating that affective vulnerabilities, rather than overall disposition, represent the primary barriers to meaningful mathematical engagement among VI students. Qualitative evidence further explains these vulnerabilities by showing that VI students have not yet fully internalized the relevance of mathematics to their daily lives and often doubt their mathematical abilities, as reflected in their limited participation in classroom discussions and learning activities. Accordingly, this study recommends inclusive instructional practices that promote contextualized mathematics learning, structured scaffolding, and peer-assisted learning to strengthen these vulnerable dimensions of MPD.

A major strength of this study lies in its explanatory mixed-methods design, which enabled the integration of quantitative and qualitative evidence to identify specific affective vulnerabilities in VI students' MPD and explain the factors underlying them. However, the findings should be interpreted with caution due to the relatively small sample of Grade 10 VI students and the use of self-report questionnaires, despite being supported by interviews and classroom observations. In addition, this study did not examine the influence of teachers, instructional practices, and school policies on the development of MPD, leaving important contextual factors unexplored.

Building on these findings, future research should involve larger and more diverse samples across educational levels while examining how teachers' instructional practices, classroom environments, and school policies influence the development of MPD among VI students. Longitudinal and intervention-based studies are also needed to investigate how productive disposition develops over time and responds to targeted instructional interventions. Ultimately, fostering MPD should be recognized as a core objective of inclusive mathematics education, as it supports not only mathematical achievement but also students' confidence, persistence, and meaningful engagement with mathematics.

References

Awofala, A. O. A. (2017). Assessing senior secondary school students' mathematical proficiency as related to gender and performance in mathematics in Nigeria. *International Journal of Research in Education and Science*, *3*(2), 488–502. https://doi.org/10.21890/ijres.327908

Awofala, A. O., Lawal, R. F., Arigbabu, A. A., & Fatade, A. O. (2022). Mathematics productive disposition as a correlate of senior secondary school students' achievement in mathematics in Nigeria. *International Journal of Mathematical Education in Science and Technology*, *53*(6), 1326–1342. https://doi.org/10.1080/0020739X.2020.1815881

Baiduri, B. (2017). Elementary school students' spoken activities and their responses in math learning by peer-tutoring. *International Journal of Instruction*, *10*(2), 145–160. https://doi.org/10.12973/iji.2017.10210a

Bakker, A., Smit, J., & Wegerif, R. (2015). Scaffolding and dialogic teaching in mathematics education: introduction and review. *ZDM - Mathematics Education*, *47*(7), 1047–1065. https://doi.org/10.1007/s11858-015-0738-8

Baykaldı, G., Corlu, M. S., & Yabaş, D. (2023). An investigation into high school mathematics teachers and inclusive education for students with visual impairments. *British Journal of Visual Impairment*, *42*(1). https://doi.org/10.1177/02646196231175327

Bayram, G. İ., Corlu, M. S., Aydın, E., Ortaçtepe, D., & Alapala, B. (2015). An exploratory study of visually impaired students' perceptions of inclusive mathematics education. *British Journal of Visual Impairment*, *33*(3), 212–219. https://doi.org/10.1177/0264619615591865

Berso, L. B., & Lorente, R. M. (2020). Peer Tutoring: Exploring The Effects on Learning Grade 9 Mathematics. *PEOPLE: International Journal of Social Sciences*, *5*(3), 881–894. https://doi.org/10.20319/pijss.2020.53.881894

Borji, V., Surynková, P., Kuper, E., & Robová, J. (2025). Using contextual problems to develop preservice mathematics teachers' understanding of exponential and logarithmic concepts. *International Journal of Mathematical Education in Science and Technology, 56*(6), 1022–1052. https://doi.org/10.1080/0020739X.2024.2309284

Burner, T., Nodeland, T. S., & Aamaas, Å. (2018). Critical Perspectives on Perceptions and Practices of Diversity in Education. *Nordic Journal of Comparative and International Education (NJCIE)*, *2*(1), 3–15. https://doi.org/10.7577/njcie.2188

Campbell, A. (2019). Design-based research principles for successful peer tutoring on social media. *International Journal of Mathematical Education in Science and Technology*, *50*(7), 1024–1036. https://doi.org/10.1080/0020739X.2019.1650306

Chua, V. C. (2021). Improving learners' productive disposition through realistic mathematics education, a teacher's critical reflection of personal pedagogy. *Reflective Practice*, *22*(6), 809–823. https://doi.org/10.1080/14623943.2021.1974373

Cohen, L., Manion, L., & Marrison, K. (2007). *Research Methods in Education* (Sixth). Routledge.

Creswell, J. (2007). *Qualitative Inquary and Research Design* (3rd Edition). SAGE Publications.

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and Conducting Mixed Methods Research*. Sage Publications.

Dick, T., & Kubiak, E. (1997). Issues and aids for teaching mathematics to the blind. *Mathematics Teacher*, *90*, 344–349.

Felder, F. (2021). Celebrating diversity in education and the special case of disability. *Educational Review*, *73*(2), 137–152. https://doi.org/10.1080/00131911.2019.1576590

Florian, L., & Black-Hawkins, K. (2011). Exploring inclusive pedagogy. *British Educational Research Journal*, *37*(5), 813–828. https://doi.org/10.1080/01411926.2010.501096

Giel, L. I. S., Noordzij, G., Noordegraaf-Eelens, L., & Denktaş, S. (2020). Fear of failure: a polynomial regression analysis of the joint impact of the perceived learning environment and personal achievement goal orientation. *Anxiety, Stress and Coping*, *33*(2), 123–139. https://doi.org/10.1080/10615806.2019.1695603

Gómez-López, M., Borrego, C. C., da Silva, C. M., Granero-Gallegos, A., & González-Hernández, J. (2020). Effects of motivational climate on fear of failure and anxiety in teen handball players. *International Journal of Environmental Research and Public Health*, *17*(2). https://doi.org/10.3390/ijerph17020592

Gran, B. K. (2017). An International Framework of Children's Rights. *Annu. Rev. Law Soc. Sci*, *13*, 79–100. https://doi.org/10.1146/annurev-lawsocsci

Haegele, J. A., Ball, L. E., Nowland, L. A., Ally Keene, M., & Zhu, X. (2024). Visually impaired students' views on peer tutoring in integrated physical education. *Sport, Education and Society*, *29*(2), 207–220. https://doi.org/10.1080/13573322.2022.2125949

Hajisoteriou, C., & Sorkos, G. (2023). Towards a new paradigm of "Sustainable Intercultural and inclusive education": A comparative "blended" approach. *Education Inquiry*, *14*(4), 496–512. https://doi.org/10.1080/20004508.2022.2071016

Hayes, C., & Proulx, M. J. (2023). Turning a blind eye? Removing barriers to science and mathematics education for students with visual impairments. *British Journal of Visual Impairment*, *42*(2), 026461962211495. https://doi.org/10.1177/02646196221149561

Hehir, T., Grindal, T., Freeman, B., Lamoreau, R., Borquaye, Y., & Burke, S. (2016). *A Summary of The Evidence on Inclusive Education*. Abt Associates.

Holzer, E. M., & Moser Opitz, E. (2025). The benefits of inclusive education: a systematic review of student achievement in secondary schools. *European Journal of Special Needs Education*. https://doi.org/10.1080/08856257.2025.2587615

Johnston, B. M. (2021). Students as partners: peer-leading in an undergraduate mathematics course. *International Journal of Mathematical Education in Science and Technology*, *52*(5), 795–806. https://doi.org/10.1080/0020739X.2020.1795287

Kairiene, B., & Sprindziunas, A. (2016). Social equality as groundwork for sustainable schooling: The free lunch issue. *Journal of Teacher Education for Sustainability*, *18*(1), 127–139. https://doi.org/10.1515/jtes-2016-0010

Kalef, L., Reid, G., & MacDonald, C. (2013). Evidence-based practice: A quality indicator analysis of peer-tutoring in adapted physical education. *Research in Developmental Disabilities, 34*(9), 2514–2522. https://doi.org/10.1016/j.ridd.2013.05.004

Kilpatrick, Jeremy., Swafford, Jane., Findell, Bradford., & National Research Council (U.S.). Mathematics Learning Study Committee. (2001). *Adding it up : helping children learn mathematics*. National Academy Press.

Korstjens, I., & Moser, A. (2018). Series: Practical guidance to qualitative research. Part 4: Trustworthiness and publishing. *European Journal of General Practice*, *24*(1), 120–124. https://doi.org/10.1080/13814788.2017.1375092

Li, R., Cao, Y., Tang, H., & Kaiser, G. (2024). Teachers' Scaffolding Behavior and Visual Perception During Cooperative Learning. *International Journal of Science and Mathematics Education*, *22*(2), 333–352. https://doi.org/10.1007/s10763-023-10379-6

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Sage Publication.

Lundahl, L. (2016). Equality, inclusion and marketization of Nordic education: Introductory notes. *Research in Comparative and International Education*, *11*(1), 3–12. https://doi.org/10.1177/1745499916631059

McAnelly, K., & Gaffney, M. (2019). Rights, inclusion and citizenship: a good news story about learning in the early years. *International Journal of Inclusive Education*, *23*(10), 1081–1094. https://doi.org/10.1080/13603116.2019.1629123

Messiou, K., Ainscow, M., Echeita, G., Goldrick, S., Hope, M., Paes, I., Sandoval, M., Simon, C., & Vitorino, T. (2016). Learning from differences: a strategy for teacher development in respect to student diversity. *School Effectiveness and School Improvement*, *27*(1), 45–61. https://doi.org/10.1080/09243453.2014.966726

Morris, D. B., Usher, E. L., & Chen, J. A. (2017). Reconceptualizing the Sources of Teaching Self-Efficacy: a Critical Review of Emerging Literature. *Educational Psychology Review, 29*(4), 795–833. https://doi.org/10.1007/s10648-016-9378-y

Naude, M., & Meier, C. (2019). Elements of the physical learning environment that impact on the teaching and learning in South African Grade 1 classrooms. *South African Journal of Education*, *39*(1). https://doi.org/10.15700/saje.v39n1a1342

Negash, K. H., & Gasa, V. (2022). Academic Barriers That Prevent the Inclusion of Learners With Visual Impairment in Ethiopian Mainstream Schools. *SAGE Open*, *12*(2). https://doi.org/10.1177/21582440221089934

Onyishi, C. N., & Sefotho, M. M. (2021). Differentiating instruction for learners' mathematics self-efficacy in inclusive classrooms: Can learners with dyscalculia also benefit? *South African Journal of Education*, *41*(4). https://doi.org/10.15700/SAJE.V41N4A1938

Pratiwi, S. A., & Widjajanti, D. B. (2020). Contextual problem in mathematical problem solving: Core ability in Realistic Mathematics Education. *Journal of Physics: Conference Series*, *1613*(1). https://doi.org/10.1088/1742-6596/1613/1/012018

Putranto, S. (2025). *Konstruksi Kecakapan Matematis Siswa dengan Gangguan Penglihatan di Kelas Inklusi Sekolah Menengah Atas* [Doctoral Dissertation, Universitas Negeri Yogyakarta]. Universitas Negeri Yogyakarta.

Putranto, S., Marsigit, M., & Arliani, E. (2024). Active Learning Barriers in Developing Mathematical Proficiency: Comparing Visual Impairment Students' and Teachers' Perspective. *Journal of Curriculum and Teaching*, *13*(1), 48. https://doi.org/10.5430/jct.v13n1p48

Putranto, S., & Permatasari, D. (2023). *Pendidikan Inklusi: Kesetaraan Pendidikan Untuk Anak Berkebutuhan Khusus*. Pena Persada.

Rapp, A. C., & Corral-Granados, A. (2024). Understanding inclusive education – a theoretical contribution from system theory and the constructionist perspective. *International Journal of Inclusive Education, 28*(4), 423–439. https://doi.org/10.1080/13603116.2021.1946725

Roos, H. (2019). Inclusion in mathematics education: an ideology, a way of teaching, or both? *Educational Studies in Mathematics*, *100*(1), 25–41. https://doi.org/10.1007/s10649-018-9854-z

Schnepel, S., Krähenmann, H., Sermier Dessemontet, R., & Moser Opitz, E. (2020). The mathematical progress of students with an intellectual disability in inclusive classrooms: results of a longitudinal study. *Mathematics Education Research Journal*, *32*(1), 103–119. https://doi.org/10.1007/s13394-019-00295-w

Shaeffer, S. (2019). Inclusive education: a prerequisite for equity and social justice. *Asia Pacific Education Review*, *20*(2), 181–192. https://doi.org/10.1007/s12564-019-09598-w

Siegfried, J. M. (2012). *The hidden strand of mathematical proficiency : defining and assessing for productive disposition in elementary school teachers' mathematical content knowledge* [Doctoral Dissertation, University of San Diego]. eScholaship. https://escholarship.org/uc/item/0p0691z0

Szumski, G., Smogorzewska, J., & Karwowski, M. (2017). Academic achievement of students without special educational needs in inclusive classrooms: A meta-analysis. *Educational Research Review, 21*, 33–54. https://doi.org/10.1016/j.edurev.2017.02.004

Taylor, S., Eklund, R., & Arthur, C. (2023). Fear of failure in sport, exercise, and physical activity: a scoping review. In *International Review of Sport and Exercise Psychology*, *16*(1), 500–528. https://doi.org/10.1080/1750984X.2021.1901299

Vislie, L. (2003). From integration to inclusion: Focusing global trends and changes in the western European societies. *European Journal of Special Needs Education*, *18*(1), 17–35. https://doi.org/10.1080/0885625082000042294

Widoyoko, S. E. P. (2009). *Evaluasi program pembelajaran: panduan praktis bagi pendidik dan calon pendidik*. Pustaka Pelajar.

Matematička produktivna dispozicija učenika s oštećenim vidom: Analiza profila, doprinosećih faktora i strategija u inkluzivnim razredima usmerena na učenika

Sumbaji Putranto

Državni islamski univerzitet Sunana Kaljaga, Fakultet za vaspitanje i obrazovanje, Sleman, Indonezija

Uvod: Prethodna istraživanja pokazala su da učenici s oštećenjem vida često imaju značajne poteškoće u razumevanju i rešavanju matematičkih problema u inkluzivnim učionicama, što ukazuje na značaj razvoja snažne matematičke produktivne dispozicije (MPD). *Cilj*: Cilj ovog istraživanja bio je da ispita karakteristike MPD-a kod učenika s oštećenjem vida, faktore koji utiču na njegov razvoj i strategije za njegovo unapređenje u inkluzivnim učionicama. *Metod*: U istraživanju je primenjen eksplanatorni sekvencijalni dizajn mešovitih metoda. Kvantitativna faza obuhvatila je prikupljanje podataka putem upitnika od osam učenika s oštećenjem vida i 144 učenika bez oštećenja vida, pri čemu su podaci analizirani primenom deskriptivne statistike i Man–Vitnijevog testa. Kvalitativna faza uključivala je polustrukturisane intervjue i posmatranje nastave sa osam učenika s oštećenjem vida, a podaci su analizirani induktivnim pristupom. *Rezultati*: Nalazi pokazuju da MPD učenika s oštećenjem vida pripada umerenoj kategoriji i da je nešto niži u poređenju sa učenicima bez oštećenja vida, iako obe grupe ostaju u istoj kategoriji. Rezultati Man–Vitnijevog testa nisu pokazali statistički značajnu razliku u ukupnom MPD-u između dve grupe; međutim, učenici s oštećenjem vida postigli su značajno niže rezultate u dimenzijama percipiranja matematike kao korisne i vredne, kao i u matematičkoj samoefikasnosti. Kao ključni izazov utvrđeno je da učenici s oštećenjem vida retko učestvuju u diskusijama na času i nerado izražavaju svoje ideje. Stoga je potrebno da nastavnici osmisle kontekstualizovana iskustva učenja, obezbede odgovarajuću podršku i primenjuju vršnjačko učenje. *Zaključak*: Ovi nalazi naglašavaju

značaj osmišljavanja nastave matematike koja eksplicitno podržava razvoj MPD-a kod učenika s oštećenjem vida, posebno kroz jačanje njihove percepcije korisnosti matematike i matematičke samoefikasnosti.

Ključne reči: produktivne dispozicije u matematici, oštećen vid, profil, faktori koji doprinose, strategije

PRIMLJENO: 27.01.2026.
REVIDIRANO: 16.07.2026.
PRIHVAĆENO: 11.08.2026.