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Colored Notation as a UDL (*Universal Design for Learning*) Strategy in Music Education: A Case Study

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Abstract: This study aims to examine the implementation of colored notation as a Universal Design for Learning (UDL) strategy in angklung music instruction at SLB Yapenas Yogyakarta, a school serving students with hearing impairments, intellectual disabilities, physical disabilities, and cerebral palsy. The research employed a qualitative approach using a case study design. Data were collected through participatory observations of angklung practice sessions, in-depth interviews with the music teacher and five students as key informants, and documentation analysis of instructional materials and recorded learning activities. The data were analyzed thematically to identify patterns aligned with the three core principles of UDL. The results indicate that colored notation effectively supports inclusive learning through: (1) Multiple Means of Representation, in which colors assist students in recognizing pitch, rhythmic patterns, and playing sequences while reducing cognitive load; (2) Multiple Means of Engagement, in which colors enhance students' attention, motivation, and emotional comfort during music lessons; and (3) Multiple Means of Expression, in which students demonstrate increased confidence and accuracy in performing angklung pieces. These findings suggest that colored notation serves as a practical and replicable model for inclusive music education in other special schools.

Keywords: *colored notation, Universal Design for Learning, inclusive, music education, students with special needs*

I. Introduction

Music education in Special Schools (SLB) plays a strategic role in supporting the development of students with special needs, serving not only as a recreational activity but also as a pedagogical instrument that enhances concentration, motor coordination, and emotional expression (Chen & Lee, 2025). Music has long been recognized as both a therapeutic and educational medium that strengthens cognitive, affective, and psychomotor dimensions of learning. Within this context, SLB institutions face the challenge of providing music instruction that is genuinely inclusive and responsive to the diverse ability levels of their students. Ensuring accessibility requires instructional tools and approaches that accommodate varied sensory, cognitive, and motor characteristics.

SLB Yapenas Yogyakarta is one of the institutions that accommodates students with a wide range of special needs, including those with hearing impairments, intellectual disabilities, physical disabilities, and cerebral palsy (Sejati, 2023). Each category exhibits distinct learning characteristics that influence how they respond to music instruction. Students with hearing impairments face difficulties interpreting abstract symbols representing sound; those with intellectual disabilities require concrete and simplified visual supports to understand material effectively; and students with cerebral palsy encounter motor challenges that necessitate modified instruments or learning tools. This diversity underscores the need for adaptive music-learning strategies tailored to individual capabilities.

One of the major challenges in music learning at SLB is the use of conventional musical notation, both numeric and staff notation, which requires symbolic decoding skills, sustained concentration, and strong visual memory. Such notation is abstract and complex, often imposing excessive cognitive load on students with special needs. As a result, music learning activities that ideally provide positive and enjoyable experiences can instead diminish students' motivation when they struggle to access basic information such as pitch names, durations, or musical patterns. Without accessible alternative representations, students may feel excluded from meaningful participation in music learning.

These challenges indicate that conventional notation can become a significant barrier for students in understanding fundamental aspects of music learning. The complexity of its abstract symbols prevents many students, especially those with sensory, cognitive, or motor impairments, from engaging optimally. If these

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barriers are not addressed through pedagogical innovation, music learning risks becoming non-inclusive and fails to provide equitable opportunities for expression and musical experience for all students. Ensuring accessibility is therefore essential to uphold the educational value and emotional benefits that music can offer to learners with special needs.

Within the framework of inclusive education, every student must be given the opportunity to participate actively without being hindered by physical, cognitive, or sensory limitations (Ashokan, 2023). This principle emphasizes that instruction cannot rely on a uniform, one-size-fits-all approach. This is especially critical in music learning, which integrates cognitive, affective, and motor processes simultaneously. A learning environment that is responsive to diversity can help students with special needs feel accepted, motivated, and confident in expressing themselves through enjoyable musical activities (Danek, 2024; Zhan, 2025). Inclusivity in music education therefore requires instructional design that anticipates and reduces learning barriers.

Universal Design for Learning (UDL) offers a robust framework for realizing these inclusive principles. Rooted in neuroeducation, UDL highlights that every learner's brain processes information differently, influencing how they perceive, process, and express understanding (Chávez García et al., 2024). The three core principles of UDL, multiple means of representation, engagement, and expression, encourage teachers to present content in varied forms, design meaningful and engaging activities, and allow students multiple ways to demonstrate learning (Almeqdad et al., 2023). This framework is highly relevant for music instruction in SLB settings, offering structured guidance for designing learning that is accessible by default rather than adjusted retroactively.

Implementing UDL in music learning at SLB enables more flexible and accessible instruction for all students. Teachers may employ visually appealing media, modified instruments, and activities that balance sensory and motor engagement. Previous studies indicate that UDL-based instruction can reduce learning barriers and enhance students' self-confidence, independence, and satisfaction when participating in inclusive music activities (Armes et al., 2022). By providing multiple entry points to understanding musical concepts, UDL helps ensure that all learners can access, process, and express their musical abilities.

One concrete strategy for applying UDL in music learning is the use of colored musical notation. Visual representation through color makes pitch symbols simpler, clearer, and more comprehensible for students with special needs (Trudgen, 2019). Color transforms abstract symbols into concrete and recognizable forms, enabling students to identify pitch patterns, understand pitch sequences, and maintain focus and memory throughout learning activities. This strategy aligns well with multimodal learning, which integrates visual, auditory, and kinesthetic elements to reinforce comprehension.

Colored notation has been shown to offer significant advantages, particularly in capturing attention, improving focus, and supporting memory for students with cognitive impairments (Rogers, 1991). For students with hearing impairments, color serves as a visual substitute for auditory representation; for students with intellectual disabilities, it simplifies the complexity of musical symbols; and for students with cerebral palsy, it provides visual markers that support motor coordination when playing instruments. Consequently, colored notation expands opportunities for all students to participate actively and meaningfully in music activities.

Despite its potential, research on the application of colored notation within the Universal Design for Learning framework in SLB contexts remains limited. Few studies have systematically documented how colored notation is planned, implemented, and evaluated in music-learning settings involving multiple categories of special needs. Moreover, there is a research gap concerning the extent to which colored notation truly aligns with UDL principles and contributes to cognitive, affective, and psychomotor development among SLB students. This lack of systematic inquiry highlights the need for comprehensive analysis.

Given this research gap, the present study aims to provide a comprehensive description of the implementation of colored notation as a Universal Design for Learning strategy in music education at SLB Yapenas Yogyakarta. It examines the planning, instructional processes, and evaluation stages, and analyzes the relationship between the use of colored notation and the UDL principles of multiple means of representation, engagement, and expression. Accordingly, the study is not only descriptive but also analytical, assessing the extent to which this strategy addresses the need for inclusive music instruction for students with diverse special needs.

II. Method

This study employs a qualitative approach with a case study design to obtain an in-depth understanding of the implementation of color notation as a Universal Design for Learning (UDL) strategy in music instruction at SLB Yapenas Condongcatur, Yogyakarta. The case study approach was chosen to enable holistic exploration of the learning context, covering the stages of planning, implementation, and evaluation, while also revealing the experiences of teachers and students in engaging with the learning strategy (Assyakurrohim et al., 2023). The research was conducted over a one-month duration.

Research subjects were selected using purposive sampling based on their active involvement in angklung learning with color notation and the diversity of special needs represented. The subjects included the music teacher as the learning facilitator, students with special needs from various categories such as deafness, physical disabilities, intellectual disabilities, and cerebral palsy, as well as the school principal and parents who served as supporting informants to provide additional perspectives on the effectiveness of the implemented instructional strategy.

Data were collected through participant observation, in-depth interviews, and documentation analysis (Creswell & Poth, 2018). Participant observation was used to record student responses to color notation, the teacher's delivery of the material, and classroom dynamics during instruction. In-depth interviews were conducted with the music teacher, school principal, and students who were able to communicate verbally or through facilitators, with the aim of exploring their perceptions, experiences, and challenges regarding the implementation of UDL strategies. Documentation analysis included the collection of lesson plans, instructional materials, student assessment sheets, photographs, and video recordings of classroom activities as supporting data to reinforce the findings from observations and interviews.

Data analysis was conducted using thematic analysis consisting of data reduction, data presentation, and inductive conclusion drawing (Creswell, 2013). Data obtained from observations, interviews, and documentation were grouped according to the three main UDL principles: multiple means of representation, multiple means of engagement, and multiple means of expression. After the data were presented descriptively, conclusions were drawn by identifying consistent patterns emerging within each category.

To ensure the credibility and validity of the data, source triangulation, methodological triangulation, and member checking were employed. Source triangulation involved comparing information from teachers, students, the principal, and parents, while methodological triangulation involved cross-checking data from observations, interviews, and documentation. Member checking was conducted by confirming preliminary findings with participants to ensure alignment with their actual experiences. Through these systematic procedures, the study aims to provide a comprehensive description of the implementation of color notation as a UDL strategy in music learning and contribute to the development of more adaptive and responsive inclusive music education models for students with special needs.

III. Results and Discussion

A. Visual Representation and Cognitive Accessibility

The implementation of colored notation at SLB Yapenas began with the teacher modifying conventional number notation into a more adaptive visual system by assigning consistent color codes to each pitch (e.g., *do* = red, *re* = green, *mi* = yellow). The teacher also prepared sheet music and colored notation cards adjusted to students' needs, including readability, size, and song complexity. This adaptation was intended not only to create an attractive visual medium but also to transform abstract musical symbols into concrete sensory representations that students could easily understand.

In classroom practice, colored notation was introduced gradually, starting from color and pitch recognition to simple rhythmic exercises using the angklung. During observation, students demonstrated increased focus and motivation, with several showing a faster understanding of color–pitch associations compared to traditional number notation.

These classroom interactions illustrate that colored notation provides a concrete representational scaffold that reduces cognitive load, particularly for students with intellectual disabilities and hearing impairments. Instead of decoding abstract symbols, students rely on visual cues that are familiar, memorable, and easier to differentiate. This finding aligns with the UDL principle of multiple means of representation, which encourages offering varied formats to ensure accessibility. The transformation of

notation into a color-based system supports students who struggle with conventional symbols by providing a more intuitive access point to musical understanding (Demirel, 2022). As strengthened by Effendi et al., (2020), visual reinforcement enhances symbol recognition, while Çenberci & Tufan (2023) emphasize the role of alternative representations in reducing learning barriers. In this context, colored notation serves as a cognitively accessible tool that enables students to process pitch and rhythm through a medium better suited to their sensory and cognitive profiles.

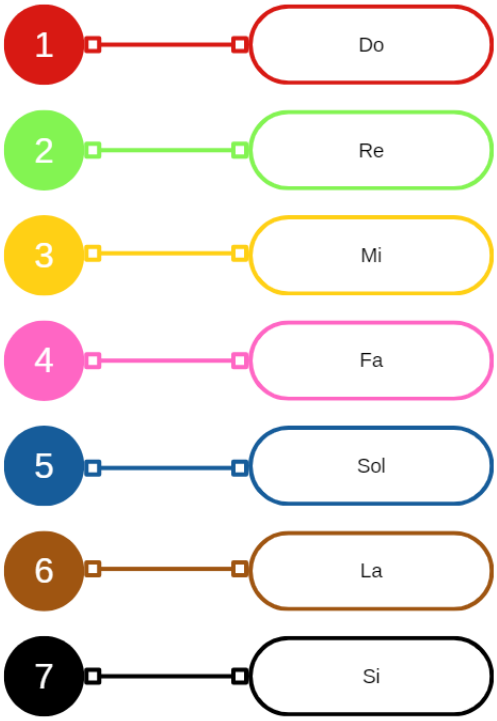

Figure 1. Example of Colored Notation

Figure 1. This image presents a visual design in the form of *colour-coded musical notation*, which connects numbered notation from do to si with solmization names (Do, Re, Mi, Fa, Sol, La, Si) through the use of consistent and easily distinguishable colors. Each number is placed inside a brightly colored circle such as red for Do, green for Re, yellow for Mi, pink for Fa, blue for Sol, brown for La, and black for Si, which is then linked to an oval shape in the same color containing the note name. This design not only provides an appealing visual appearance but also serves as a learning medium that helps students, especially those with special needs, to recognize and remember the relationship between numbers, colors, and note names. With its clear and systematic structure, the image represents a visual-based music learning approach that can enhance cognitive, affective, and motor skills through integrated color and symbol stimuli.

The application of color notation in music learning at SLB Yapenas can be effectively understood through the Universal Design for Learning (UDL) framework, which ensures equal access for all students, including those with special needs. UDL consists of three main principles multiple means of representation, engagement, and expression, each of which helps explain how color-based strategies enhance students' accessibility, motivation, and musical participation.

Under the first principle, multiple means of representation, color notation offers an alternative that is more concrete and visually accessible than conventional numeric or symbolic notation. Consistent color mapping makes it easier for students with cognitive or sensory limitations to recognize pitch patterns, while also serving as visual scaffolding that supports memory and comprehension. Students with intellectual disabilities can associate notes with colors more easily, and deaf students can follow musical sequences through visual cues. This demonstrates that color notation successfully embodies the UDL principle of representation by presenting musical concepts in a form better aligned with students' diverse needs..

B. Emotional Engagement and Learning Motivation

The second principle, multiple means of engagement, emphasizes the importance of motivating students to actively participate in learning. Colored notation has greater visual appeal than black-and-white notation, creating a more enjoyable learning environment (Poast, 2000). Contrasting colors stimulate curiosity, focus

attention, and make students more enthusiastic about following teacher instructions. Classroom observations revealed that previously passive students became more engaged after the introduction of colored notation.

Figure 2. The Atmosphere of Learning to Practice Playing Angklung Music in the School Yard

Figure 2 depicts a music lesson session in the courtyard of the Yapenas Special Needs School, where students are practicing playing the angklung under the guidance of a teacher. The outdoor setting, relaxed atmosphere, and active participation of students including those with physical and cognitive disabilities, reflect a learning environment that fosters emotional engagement and motivation. The students appear attentive and enthusiastic as they follow the teacher's instructions, demonstrating how collaborative music-making can foster a sense of enjoyment, belonging, and self-confidence. The supportive social interactions seen in this scene align with UDL's emphasis on fostering positive emotional connections to learning, demonstrating that accessible and inclusive practices such as color-coded notation and group activities can transform music lessons into meaningful and motivating experiences for all learners.

Students' emotional engagement increases as they begin to view the process of learning music as a fun and accessible activity. Their confidence grows as they learn to play music through the aid of color, which facilitates the understanding of notation. Intrinsic motivation stems from feelings of competence and personal accomplishment, while extrinsic motivation is fostered through support and appreciation from teachers and peers. This strategy reinforces the principle of engagement in UDL by creating an inclusive, engaging, and positively reinforcing learning experience.

C. Expressive Performance and Motor Coordination

The third principle, multiple means of expression, relates to how students demonstrate their understanding and the skills they have learned. Color notation opens up opportunities for students to express their musical abilities without being burdened by the limitations of reading complex notation. For example, a cerebral palsy student who struggles with motor coordination can still express himself by playing the angklung accurately, thanks to clear and easy-to-follow color guidance. This demonstrates that this strategy not only facilitates understanding but also encourages self-expression through performative activities.

Beyond the technical aspects, this principle of expression also relates to students' psychological dimensions. When they successfully play an instrument using color notation, their self-confidence increases and positive experiences with music are formed. This is important because musical expression is not only related to pitch accuracy but also to feelings of accomplishment, togetherness, and self-appreciation. Color notation thus expands access for students to express their musicality, albeit with certain limitations.

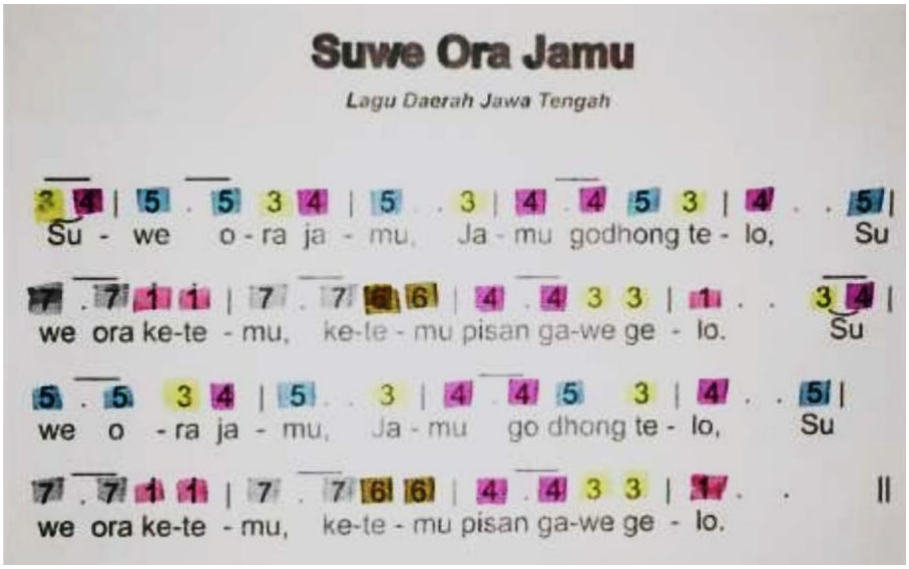

Figure 3. Example of the Score for the Song "Suwe Ora Jamu" in music lessons

Figure 3 shows the color-coded notation of the traditional Javanese song “Suwe Ora Jamu,” demonstrating how visual cues are integrated into music learning at SLB Yapenas to enhance accessibility and motivation. Each numeric pitch is marked with a distinct color, providing an immediate visual representation that reduces the cognitive load typically associated with abstract musical symbols. The

consistent color pitch mapping helps students recognize melodic patterns more easily, maintain focus, and follow the musical structure with greater confidence. As discussed earlier, this approach supports UDL principles by strengthening emotional engagement, students find the colorful notation more inviting and enjoyable while simultaneously improving cognitive processing and performance accuracy. Through this visually adaptive score, learners with diverse cognitive, sensory, and motor needs can participate more meaningfully in music activities, reinforcing both skill development and a positive emotional connection to learning.

The implementation of color notation at SLB Yapenas demonstrates how the UDL framework operates in practice by integrating visual accessibility, emotional engagement, and flexible modes of expression into music learning for students with diverse needs. Rather than merely simplifying the notation system, color coding functions as a cognitive scaffold that restructures how students perceive, process, and perform musical information. This aligns with previous studies indicating that visual supports can reduce abstraction in music learning (Effendi et al., 2020; Uchinokura, 2020), yet SLB Yapenas' approach provides stronger evidence regarding its suitability for students with multiple and overlapping disabilities.

From a cognitive standpoint, color notation enhances symbolic comprehension and pitch recognition, but its effectiveness depends on consistency and structured instructional guidance. Compared to findings by Zsidó (2024), which highlight that color can improve attention but may cause overstimulation when overused, the implementation at SLB Yapenas appears balanced. However, it still presents limitations: the reliance on bright, contrasting colors may not optimally support students with visual sensitivity, and some learners still require tactile or kinesthetic cues, suggesting that color alone cannot fully address all representational barriers. Thus, while the strategy strengthens UDL's principle of representation, its impact is context-dependent and requires multimodal complementarity.

In the affective dimension, student motivation and emotional engagement increased noticeably, consistent with Baker (2015), who argues that accessible multimodal tools enhance self-efficacy in music learning. At SLB Yapenas, color serves not only as an attention cue but as an emotional anchor that transforms music from a difficult task into an enjoyable activity. Nevertheless, reliance on color-driven motivation raises a pedagogical concern: students may become dependent on visual cues and struggle when transitioning to standard notation or environments with fewer visual supports. This indicates the need for a gradual fading strategy so that color enhances learning without becoming a long-term crutch.

Psychomotor improvements, particularly in hand–eye coordination and group synchrony, also align with previous findings on ensemble learning in special education contexts. Color helps stabilize motor planning by reducing cognitive load, but certain students especially those with motor impairments such as cerebral palsy still require additional adaptive tools beyond visual coding. This reflects a broader critique: while color notation increases accessibility, its effectiveness is uneven across disability categories, and its implementation lacks systematic differentiation for varying motor and sensory profiles.

Overall, the experience of SLB Yapenas affirms the pedagogical value of color notation but also highlights key contextual challenges that must be addressed. The strategy aligns with and extends prior research, yet the findings suggest that color should function as one layer in a broader UDL-based system, not as a standalone solution. To enhance sustainability, future implementation should incorporate multimodal supports, progressive transition strategies, and more differentiated adaptations for diverse disability characteristics. Dengan demikian, color notation contributes meaningfully to inclusive music education, but its effectiveness is contingent upon thoughtful integration rather than mere visual modification.

IV. Conclusion and Suggestion

The findings of this study show that the implementation of color notation at SLB Yapenas effectively enhances students' access to musical concepts by supporting the UDL principles of representation, engagement, and expression. Color cues help reduce the abstraction of traditional notation, allowing students with cognitive, sensory, and motor limitations to engage with music more confidently. Nevertheless, the effectiveness of this strategy is shaped by contextual factors such as varying levels of visual sensitivity, motor challenges, and students' prior familiarity with colors which means color coding alone cannot fully meet the needs of all learners. The study is further limited by its short observation period, single-site focus, and the absence of a comparison group that uses conventional notation, making it difficult to generalize the findings broadly.

To strengthen future implementations, teachers are encouraged to combine color notation with complementary supports such as tactile markers, gestures, or simplified rhythmic patterns to ensure

multimodal accessibility. A structured transition plan is also needed for students who may eventually progress toward conventional notation, preventing long-term dependence on colors. Future research should include longitudinal designs to examine learning retention over time, as well as cross-institutional studies to compare the effectiveness of color-based approaches in different SLB contexts. Such efforts will help ensure that color notation remains not only a practical classroom tool but also a sustainable and pedagogically sound strategy in inclusive music education.

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References

Almeqdad, Q. I., Alodat, A. M., Alquraan, M. F., Mohaidat, M. A., & Al-Makhzoomy, A. K. (2023). The effectiveness of universal design for learning: A systematic review of the literature and meta-analysis. *Cogent Education*, *10*(1). https://doi.org/10.1080/2331186X.2023.2218191

Armes, J. W., Harry, A. G., & Grimsby, R. (2022). Implementing Universal Design Principles in Music Teaching. *Music Educators Journal*, *109*(1), 44–51. https://doi.org/10.1177/00274321221114869

Ashokan, V. (2023). Empowering Diversity: Innovative Practices and Strategies in Inclusive Education. *Shanlax International Journal of Arts, Science and Humanities*, *11*(S1i2-Nov), 129–134. https://doi.org/10.34293/sijash.v11iS1i2-Nov.7332

Assyakurrohim, D., Ikhram, D., Sirodj, R. A., & Afgani, M. W. (2023). Metode Studi Kasus dalam Penelitian Kualitatif. *Jurnal Pendidikan Sains Dan Komputer*, *3*(1), 1–9. https://doi.org/10.47709/jpsk.v3i01.1951

Baker, M. J. (2015). Collaboration in collaborative learning. *Interaction Studies. Social Behaviour and Communication in Biological and Artificial Systems*, *16*(3), 451–473. https://doi.org/10.1075/is.16.3.05bak

Çenberci, S., & Tufan, E. (2023). Effect of music education based on Edwin E. Gordon's Theory on children's developmental music aptitude and social emotional learning skills. *International Journal of Music Education*. https://doi.org/10.1177/02557614231196973

Chávez García, E. M., Zula Cujano, J. A., Bósquez Barcenes, V. A., & Pacheco Mendoza, S. R. (2024). Universal design approach to learning: a theoretical-practical model for quality inclusive education, seen from the Postgraduate and Continuing Education Directorate of the State University of Bolívar. *Salud, Ciencia y Tecnología - Serie de Conferencias*, *3*, 723. https://doi.org/10.56294/sctconf2024723

Chen, Q., & Lee, J. (2025). A Qualitative Study on the Professional Adaptation of Novice Music Teachers in Chinese Special Education Schools. *Korean Association For Learner-Centered Curriculum And Instruction*, *25*(6), 615–634. https://doi.org/10.22251/jlcci.2025.25.6.615

Creswell, J. W. (2013). Research Design: Qualitative, Quantitative, and Mixed Methods. In *SAGE Publications, Inc* (Fourth Edi). SAGE Publications, Inc.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative Inquiry and Research Design Choosing among Five Approaches* (4th Editio). SAGE Publications, Inc.

Danek, A. (2024). Inclusive Music Education: Opportunities For Children with Special Educational Needs. *AD ALTA: Journal of Interdisciplinary Research*, *14*(1), 41–45. https://doi.org/10.33543/j.1401.4145

Demirel, S. (2022). A Research on the Design and Use of Colored Notes for Children in Music Education. *Shanlax International Journal of Education*, *10*(1), 11–20. https://doi.org/10.34293/education.v10iS1-Aug.5181

Effendi, D., Lestary, L., Noviansyah, B., & Hardiyana, B. (2020). The Impact of Implementation of Angklung Learning Application for SLB Part B Deaf using Multimedia-Based Coloring Method on User Satisfaction. *IOP Conference Series: Materials Science and Engineering*, *879*(1), 012056. https://doi.org/10.1088/1757-899X/879/1/012056

Poast, M. (2000). Color Music: Visual Color Notation for Musical Expression. *Leonardo*, *33*(3), 215–221. https://doi.org/10.1162/002409400552531

Rogers, G. L. (1991). Effect of Color-Coded Notation on Music Achievement of Elementary Instrumental Students. *Journal of Research in Music Education*, *39*(1), 64–73. https://doi.org/10.2307/3344609

Sejati, I. R. H. (2023). Pengelolaan Pembelajaran Musik di Sekolah Luar Biasa Yapenas Yogyakarta Kajian Kecerdasan Majemuk. *Tonika: Jurnal Penelitian Dan Pengkajian Seni*, *6*(1), 12–27. https://doi.org/10.37368/tonika.v6i1.507

Trudgen, B. (2019). Visuals in the Special Needs Classroom. In *Reflective Practice in Teaching* (pp. 45–50). Springer Singapore. https://doi.org/10.1007/978-981-13-9475-1_7

Uchinokura, S. (2020). Primary and lower secondary students' perceptions of representational practices in science learning: focus on drawing and writing. *International Journal of Science Education*, *42*(18), 3003–3025. https://doi.org/10.1080/09500693.2020.1849854

Zhan, H. (2025). The Influence of Music Education on Students' Social Skills Development. *SHS Web of Conferences*, *213*, 02019. https://doi.org/10.1051/shsconf/202521302019

Zsidó, A. N. (2024). The effect of emotional arousal on visual attentional performance: a systematic review. *Psychological Research*, *88*(1), 1–24. https://doi.org/10.1007/s00426-023-01852-6.