PERINATAL JOURNAL

Original Article

Perinatal Journal 2025; 33(1):936-943

https://doi.org/10.57239/prn.25.033100101

Gamification in teaching social behavior to the hearing impaired through the support of the disability innovation center

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Abstract

Social behavior is important in forming healthy interpersonal relationships and creating a harmonious society. This study aims to examine theories and findings related to the development of social behavior in students with special needs, particularly those with hearing impairments, through a literature review method. The study was conducted by selecting seven articles from various academic sources and using qualitative-descriptive analysis. The results indicate that communication limitations among students with hearing impairments can hinder social interaction, empathy, and cooperation. However, gamification has been proven to enhance learning motivation, strengthen teamwork through elements such as points, badges, leaderboards, and group challenges, and encourage prosocial behavior. Some studies also suggest that cooperatively designed gamification can foster empathy and tolerance. In conclusion, innovative gamification has great potential to improve the social behavior of deaf students.

Keywords: Gamification, Social behavior, Hearing impairment

Introduction

Social interaction is a crucial aspect of an individual's life, especially for children and adolescents who are undergoing intense social-emotional development. Social skills such as cooperation, empathy, and self-control are important foundations for individuals to function adaptively in their social environment and build healthy interpersonal relationships. These abilities also play a role in preventing social isolation and supporting academic success and psychological well-being [1]. The Social Skills Improvement System (SSIS) framework into five key competencies, namely: self-awareness, self-management, social awareness, relational skills, and responsible decision-making. These five domains are in line with the CASEL (Collaborative for Academic, Social, and Emotional Learning) framework, which emphasizes the importance of structured, competency-based social-emotional training. [2], [3].

However, students with hearing impairments face more complex challenges in developing social behavior. The main obstacle lies in limited access to verbal and nonverbal communication, such as facial expressions, voice intonation, and understanding the context of interactions [4], [5]. The students with hearing impairments often experience delays in acquiring sign language and spoken language, which affects their ability to respond appropriately to social cues [6]. This causes them to experience difficulties in forming relationships, resolving conflicts, or actively participating in the school social environment. In the context of inclusive education, this condition requires a learning approach that is not only disability-friendly, but also visually communicative and interactive.

One approach that is beginning to be widely researched and used is gamification, which is the application of game elements such as points, levels, challenges, and rewards in non-game contexts, including education. The gamification can increase student motivation and engagement through a fun and healthy competitive approach [7,43]. For general students, gamification has been proven to encourage engagement and learning achievement. Meanwhile, for students with hearing disabilities, the positive impact of gamification is even more significant because it can function as a visual communication

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medium that bridges social barriers. Gamification provides a concrete and explicit context for social interaction, making it easier for hearing-impaired students to understand social norms and dynamics [8], [9].

Unfortunately, most research related to gamification still focuses on improving academic outcomes or language skills, rather than on developing social behavior. In addition, the available gamification media are often not specifically designed for the needs of students with hearing disabilities, making them less effective in addressing the challenges they face. To address this gap, institutional support is needed to provide inclusion-based technological solutions. In this context, the Disability Innovation Center (DIC) plays a strategic role as an innovative ecosystem that connects educators, researchers, technology developers, and the disability community. The DIC as a collaborative space based on participatory design, where end users (in this case, students with hearing disabilities) are actively involved in the technology product development process [10]. Thus, the resulting learning media are not only technologically innovative but also contextually relevant and tailored to the unique characteristics of the learners. Support from the DIC is a key element in ensuring that gamification-based interventions can effectively bridge social communication barriers and support the development of adaptive social behaviors.

Theoretical Review

1. Gamification in learning

Gamification in learning refers to the application of game elements such as points, levels, badges, leaderboards, challenges, and game narratives into non-game educational environments to increase motivation, engagement, and the effectiveness of the learning process [11], [12], [13]. The primary goal of this approach is to create a learning experience that is enjoyable, interactive, and emotionally engaging for learners, thereby improving focus, sense of ownership, and academic achievement [14]. Based on Self-Determination Theory, gamification supports the fulfillment of three basic psychological needs: autonomy, competence, and relatedness, which form the foundation for deep and sustained learning engagement [15], [16].

In the context of special education, particularly for students with communication barriers such as hearing impairments, gamification has significant benefits in improving information retention, concentration, social interaction, and learning motivation [17], [18]. For example, gamification that integrates sign language and visual elements has been proven to enhance cognitive responses and strengthen the active engagement of deaf students in the learning process. Beyond cognitive aspects, gamification also plays a role in strengthening social behavior through game dynamics such as teamwork, healthy competition, instant feedback, and shared achievements, which foster positive social interactions within the classroom [19].

Gamification strategies based on game dynamics such as narrative, role-playing, and tiered challenges not only activate cognitive aspects but also facilitate the development of social-emotional competencies such as self-confidence, perseverance, and a sense of achievement which are crucial for students with special needs [20]. In the context of digital and hybrid learning, gamification supported by technology such as mobile learning and augmented reality (AR) is increasingly relevant for inclusive implementation, as it can provide visual, flexible, and adaptive learning access tailored to the characteristics of students with hearing disabilities.

Thus, gamification in learning is not only an alternative pedagogical approach but also a transformative strategy for building an inclusive, participatory, and meaningful learning environment that can meet the needs of all learners including those with communication barriers such as children with hearing impairments.

2. Social behavior in students with hearing impairments

Students with hearing impairments often face barriers in developing social skills such as cooperation, nonverbal communication, understanding emotional expressions, and building empathy for others [21]. Limitations in acquiring spoken language and sign language, especially at an early age, can lead to delays in understanding social norms, reduce opportunities for interaction, and increase the risk of social isolation and anxiety in inclusive learning environments [22].

Nonverbal communication such as body language, eye contact, and facial expressions are often not fully understood by deaf students without special training. This can lead to misunderstandings in social interactions that negatively impact their self-confidence and social acceptance in the school environment [23]. Therefore, effective social interventions need to be designed not only to improve linguistic communication but also to strengthen interpersonal skills and social affectivity that support true inclusion.

One approach that is gaining traction is technology-based intervention. Interactive educational technology enables deaf students to explore social scenarios repeatedly, safely, and in a structured manner through digital media. Digital interventions also provide space for personalized learning, where content can be tailored to the social-emotional development level of the students. Some applications even allow for automatic tracking of social skill development, providing immediate feedback that is highly useful in adaptive learning processes [24]. Furthermore, this technology has great potential to encourage active engagement among deaf learners, as it is visual, engaging, and accessible without verbal barriers [25]. Thus, technology-based intervention approaches not only offer pedagogical solutions but also contribute to the holistic improvement of the social quality of life of deaf students within the framework of inclusive education.

3. The role of the Disability Innovation Center (DIC)

The Disability Innovation Center (DIC) is a strategic institution that functions as an incubator for inclusive technology, with a primary focus on the development, validation, and dissemination of digital solutions based on the real needs of people with disabilities. DIC adopts a user-centered design and participatory innovation approach, enabling people with disabilities, educators, technologists, and other stakeholders to actively engage in every stage of innovation from initial research to implementation. Through multidisciplinary collaboration, DIC provides the technical and human resources needed to design, test, and refine gamified learning media, oriented toward the principle of inclusivity by design. Additionally, DIC functions as a training center that educates teachers, facilitators, and content developers on how to use and integrate technology into inclusive educational practices. Thus, DIC not only develops products but also builds the capacity of the educational community to ensure the sustainable use of technology.

One of DIC's main strengths is its ability to validate evidence-based interventions by combining quantitative and qualitative evaluation methods that focus on the effectiveness, accessibility, and social impact of the developed technology [26]. This enables the gamified learning media produced to be tailored to the specific needs of students with hearing impairments, both from a sensory, cognitive, and socio-emotional perspective [27].

Furthermore, DIC plays an important role in connecting research results and technological innovations with inclusive education policies. Through advocacy and partnerships with government institutions, donor agencies, and disability communities, DIC expands the reach of adaptive technology utilization on a systemic scale. This ecosystem-based approach positions DIC as a driver of transformation in delivering equitable, participatory, and sustainable education for all learners, including those with communication barriers such as hearing impairments.

Methodology

This study uses the Literature Review research method, which is a research method conducted by collecting sources or data related to the topic of discussion obtained from various sources such as books, newspapers, journals, magazines, the internet, and other libraries. A literature review is the process of identifying, evaluating, and interpreting summaries derived from research evidence with the aim of answering research questions [28], [29], [30]. This research is generally conducted without having to go directly to the field to find sources related to the topic being discussed. Literature review research is based on several written works, including published and unpublished research results. In conducting a literature review/literature review, there are several basic steps that need to be considered according to Snyder (2019): (1) Designing the review; (2) Conducting the review; (3) Analysis (4) Writing the review.

Next, the analysis procedure is carried out on the selected articles by noting information related to the author, year of publication, and location of the research, object, subject, measurement, intervention design, and findings. Then, descriptive data analysis is performed to draw conclusions about the main ideas of each literature in a structured and factual manner.

Findings and Discussion

1. Integration and implementation of gamification for the hearing impaired

Contemporary research shows that the integration of technology with gamification elements can significantly improve attention span, working memory, and social skills in students with hearing impairments. This combination creates a dynamic and contextual learning experience, where learners not only observe visual information but also actively engage through digital interactions based on challenges, narratives, and reward systems [19]. From a neurological perspective, gamification activates dopaminergic pathways that trigger the brain's reward center, thereby enhancing intrinsic motivation and emotional engagement [8]. For deaf learners who face challenges in language processing and social interaction, this approach provides an alternative learning pathway that is more visual, exploratory, and empathetic [32], [33]. Several applications have been developed to address their needs, such as a 3D-based sign language learning platform using badge systems and missions [34], [35]. A narrative game simulating social situations to train cooperation and symbolic communication [36]. The implementation of gamification design elements such as levels, social missions, collaborative leaderboards, and symbolic rewards has proven effective in building collaboration and conflict resolution skills [20]. Thus, gamification opens up opportunities for cognitive and socially responsive inclusive education transformation for deaf learners.

2. Infrastructure and innovation support from DIC

The involvement of the Disability Innovation Center (DIC) in the development of technology-based curriculum and learning platforms plays a crucial role in driving inclusive education transformation. Not only acting as a technology provider, DIC also builds learning systems that are oriented towards the diverse needs of students with disabilities through an inclusive design thinking approach [26]. This approach positions students with disabilities not merely as passive users but as active co-creators involved in the process of identifying problems, exploring solutions, and evaluating the final design.

By applying the principles of co-design and human-centered innovation, DIC encourages meaningful participation from deaf students in defining the features, structure, and content of gamified learning media. This aligns with the “nothing about us without us” paradigm, which is a cornerstone in the development of adaptive and inclusive technology [37]. In this context, the involvement of end-users in the innovation cycle not only improves the accuracy of needs but also builds a sense of ownership and digital empowerment for students with disabilities.

Furthermore, DIC involvement in the curriculum also includes aligning digital learning content with learning outcomes specific to students with sensory impairments. DIC plays a role in adapting the national competency framework into interactive modules, gamified narratives, and simulations that enable students with hearing impairments to access, understand, and reflect on the material visually and kinesthetically [38]. For example, learning social values such as empathy, collaboration, and communication can be packaged in the form of collaborative challenges, role-playing games, or storylines that facilitate safe and meaningful social learning experiences. DIC also has the capacity to provide training for teachers and technology developers to understand the principles of inclusive curriculum design and build synergy between pedagogy, technology, and specific disability needs. This positions DIC as a bridge institution between the education community, the world of technology, and disability-friendly social policies. Thus, DIC's role is not only as a provider of technology products, but as a key actor in the systemic process of creating inclusive, transformative, and sustainable education.

3. Impact on social behavior

A longitudinal study shows that the implementation of gamification can have a significant positive impact on improving social interaction, teamwork, and

communication initiatives among deaf children [39]. During the intervention period, which lasted more than six months, children who participated in the learning program with game elements showed improvements in the frequency and quality of social interactions, both with peers and teachers. These findings reinforce the hypothesis that the gamification approach not only increases cognitive engagement but also creates a social learning environment that facilitates consistent and measurable prosocial behavior [19,42]

The success of the intervention is reinforced by the behaviorist and constructivist frameworks in its learning design. The behaviorist approach is implemented through a reinforcement loop positive reinforcement in the form of points, badges, or access to the next level for each displayed social behavior. This aligns with Skinner's principle of operant conditioning, where visual stimuli and digital rewards function as reinforcers to repeat the desired behavior [40].

Meanwhile, the constructivist principle is realized through interactive problem-based learning scenarios that allow students to build social understanding through exploration, reflection, and collaboration in socially relevant contexts.

Gamification-based programs also provide space for repeated social simulations, where learners can try out and correct behaviors without the risk of real-world social consequences. This is particularly important for deaf children, who often experience anxiety or confusion in real-world social interactions due to communication barriers [6]. Through game-based repetition and virtual interactions, learners not only learn to recognize social situations but also form new, more adaptive social schemas.

Furthermore, the importance of sustained long-term interventions, as changes in social behavior require a gradual and consistent process. Their study shows that the impact of AR-based gamification tends to increase progressively from week to week, especially when intervention content is individually tailored and accompanied by support from competent teachers or facilitators. This personalization aspect is what makes it highly effective in special education interventions [41].

Conclusion

Gamification offers an innovative, participatory, and transformative learning approach that significantly improves the quality of learning and social engagement of students, especially those with hearing impairments. This technology has a positive impact in creating a more inclusive learning environment through experiential learning that relies on visual interaction, digital narratives, and safe and flexible social simulations. One of the main advantages of gamification is its ability to present material in an engaging and enjoyable way without compromising the depth of content, thereby enhancing motivation, information retention, and emotional engagement among learners.

The benefits of gamification are evident in the application of game elements such as missions, rewards, points, challenges, and digital avatars, which serve as pedagogical tools to encourage collaboration, communication, and the reinforcement of prosocial behavior skills that pose a major challenge for deaf learners in inclusive settings. In addition, gamification also has a strategic function in creating interactive, adaptive, and individual-needs-based learning scenarios, so that students participate more actively and feel they have control over their learning process.

With the support of the Disability Innovation Center (DIC), the development of gamification technology has become more contextual, collaborative, and sustainable. The DIC plays a crucial role as a synergistic bridge between educators, technology developers, researchers, and the disability community. The DIC's function is not only as a technology facilitator but also as a driver of social innovation, ensuring that learning products are rooted in real needs and have a long-term impact on social inclusion. The co-creation and participatory design approaches used by DIC strengthen the value of active involvement of students with disabilities in the educational innovation process, making them independent learners rather than mere objects of assistance.

This study concludes that the integration of gamification and institutional support such as DIC forms an inclusive learning ecosystem that not only addresses the communication and social challenges

of deaf students but also contributes to building character, independence, and adaptive social behavior. To effectively implement this system, cross-sector collaboration is required, involving educational institutions, government, innovation centers, disability communities, and technology developers. This collaborative effort is crucial to ensuring the long-term success of technology-based learning models while guaranteeing equal and dignified access to education for all learners.

With the rapid development of educational technology and increasing awareness of the importance of inclusive education, ethically designed, adaptive, and participatory gamification has great potential to be replicated, modified, and developed in various educational contexts. Therefore, the findings of this study can serve as an important reference for policy-making, curriculum development, and teacher training to achieve fair, innovative, and learner-centered educational transformation. Based on the study results, it is recommended that gamification be systematically integrated into special and inclusive education curricula to enhance the engagement and social development of students with hearing impairments. To support this, teacher capacity should be strengthened through training in the design and implementation of technology-based gamification, and collaboration between educational institutions, technology developers, and disability communities should be encouraged to ensure that the resulting products are more contextual and have a tangible impact. The role of institutions such as the Disability Innovation Center (DIC) also needs to be strengthened as a center for innovation and assistance in the development of inclusive learning technology. In addition, regulatory and financial support from the government is crucial to ensure the sustainability of this program, while upholding the principle of universal design so that gamification can be accessed equally and fairly by all students.

The recommendation from this study is the need for further development of gamification-based learning media specifically tailored to the characteristics and needs of deaf students with disabilities. Gamification design should incorporate sign language, interactive visualization, and easily understandable digital narratives to effectively reach students with communication barriers. Additionally, it is important to directly involve students with disabilities in the testing and evaluation process of the developed learning media, ensuring that the resulting product is truly relevant, effective, and inclusive. Researchers are further advised to empirically test the effectiveness of this gamification model across various educational levels and learning contexts, both online and offline, to obtain more comprehensive and applicable findings.

Acknowledgement

The researcher would like to thank the Institute for Research and Community Service, the Center for Excellence in Science and Technology, and the Disability Services of Surabaya State University, for their support in carrying out this research.

Daftar Pustaka

[1] H.-E. Al Issa and E. M. Jaleel, “Social isolation and psychological wellbeing: lessons from Covid-19,” *Manag. Sci. Lett.*, vol. 11, pp. 609–618, 2021, doi: 10.5267/j.msl.2020.9.006.

[2] S. Sharmila and R. Nandhakumar, “Analysing The Effectiveness Of Sel Competencies On Enhancing,” *J. Nonlinear Anal. Optim.*, vol. 2, no. 2, pp. 98–105, 2024.

[3] V. Cavioni, L. Broli, and I. Grazzani, “Bridging the SEL CASEL Framework with European educational policies and assessment approaches,” *Int. J. Emot. Educ.*, vol. 16, no. 1, pp. 6–25, 2024, doi: 10.56300/ULTX1565.

[4] M. A. Denham and A. J. Onwuegbuzie, “Beyond words: Using nonverbal communication data in research to enhance thick description and interpretation,” *Int. J. Qual. Methods*, vol. 12, no. 1, pp. 670–696, 2013, doi: 10.1177/160940691301200137.

[5] G. S. Derman and O. C. Yılmaz, “Decoding Nonverbal Cues: The Interplay Of Identity And Communication,” *Int. J. Soc. Econ. Sci.*, vol. 14, no. 1, pp. 22–32, 2024.

[6] M. M. S. Marschark, K. M. Nagle, and L. A. Newman, “Predicting the Academic Achievement of Deaf and Hard-of-Hearing Students From Individual, Household, Communication, and Educational Factors,” *Except. Child.*, vol. 81, no. 3, pp. 350–369, 2015.

[7] S. Deterding, D. Dixon, R. Khaled, and L. Nacke, “From game design elements to gamefulness:

Defining 'gamification,'" *Proc. 15th Int. Acad. MindTrek Conf. Envisioning Futur. Media Environ. MindTrek 2011*, no. March 2014, pp. 9–15, 2011, doi: 10.1145/2181037.2181040.

[8] J. Hamari, D. J. Shernoff, E. Rowe, B. Coller, J. Asbell-Clarke, and T. Edwards, "Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning," *Comput. Human Behav.*, vol. 54, pp. 170–179, 2016, doi: 10.1016/j.chb.2015.07.045.

[9] H. Hanifah, I. Nengah Suastika, and D. Bagus Sanjaya, "A Systematic Review of Gamification-Based Learning Resources in Civic Education: Enhancing Student Engagement and Civic Competence," *J. Profesi Pendidik.*, vol. 4, no. 1, pp. 115–131, 2025, doi: 10.22460/jpp.v4i1.27520.

[10] N. A. Alit, M. S. Ellias, and A. D. Ahmad, "Technology Application in Teaching and Learning for Hearing Impaired Students: a Recent Systematic Review," *Int. J. Educ. Psychol. Couns.*, vol. 10, no. 58, pp. 541–561, 2025, doi: 10.35631/ijepc.1058036.

[11] A. Christopoulos and S. Mystakidis, "Gamification in Education," *Encyclopedia*, vol. 48, no. 3–4, pp. 198–204, 2015, doi: 10.3390/encyclopedia3040089.

[12] A. N. Saleem, N. M. Noori, and F. Ozdamli, "Gamification Applications in E-learning: A Literature Review," *Technol. Knowl. Learn.*, vol. 27, no. 1, pp. 139–159, 2022, doi: 10.1007/s10758-020-09487-x.

[13] A. Khaldi, R. Bouzidi, and F. Nader, "Gamification of e-learning in higher education: a systematic literature review," *Smart Learn. Environ.*, vol. 10, no. 1, 2023, doi: 10.1186/s40561-023-00227-z.

[14] Z. A. Green and S. Batool, "Emotionalized learning experiences: Tapping into the affective domain," *Eval. Program Plann.*, vol. 62, pp. 35–48, 2017, doi: 10.1016/j.evalprogplan.2017.02.004.

[15] A. H. T. Kam and I. N. Umar, "Fostering authentic learning motivations through gamification: A self-determination theory (SDT) approach," *J. Eng. Sci. Technol.*, vol. 13, no. Special Issue, pp. 1–9, 2018.

[16] L. Li, K. F. Hew, and J. Du, *Gamification enhances student intrinsic motivation, perceptions of autonomy and relatedness, but minimal impact on competency: a meta-analysis and systematic review*, vol. 72, no. 2. Springer US, 2024. doi: 10.1007/s11423-023-10337-7.

[17] V. Kachur, "Sensory and Play-Based Learning: How Innovative Methods Help Children With Special Needs Learn English," *Pedagog. Educ. Manag. Rev.*, vol. 2, no. 2(20), pp. 75–82, 2025, doi: 10.36690/2733-2039-2025-2-75-82.

[18] Y. A. Mohamed Abouelenein, N. E. M. Ibrahim Salem, E. M. Mohamed Mahdy, and M. H. Ragab Khalaf, "Impact of a serious games-based adaptive learning environment on developing communication skills and motivation among autistic children," *Educ. Inf. Technol.*, 2025, doi: 10.1007/s10639-025-13728-w.

[19] M. B. Ibanez, A. Di-Serio, and C. Delgado-Kloos, "Gamification for engaging computer science students in learning activities: A case study," *IEEE Trans. Learn. Technol.*, vol. 7, no. 3, pp. 291–301, 2014, doi: 10.1109/TLT.2014.2329293.

[20] A. Domínguez, J. Saenz-De-Navarrete, L. De-Marcos, L. Fernández-Sanz, C. Pagés, and J. J. Martínez-Herráiz, "Gamifying learning experiences: Practical implications and outcomes," *Comput. Educ.*, vol. 63, no. November 2019, pp. 380–392, 2013, doi: 10.1016/j.compedu.2012.12.020.

[21] L. G. Harris, "Social-Emotional Development in Children with Hearing Loss," *Commun. Sci. Disord.*, 2014.

[22] M. Marschark, D. M. Shaver, K. M. Nagle, and L. A. Newman, "Predicting the Academic Achievement of Deaf and Hard-of-Hearing Students From Individual, Household, Communication, and Educational Factors," *Except. Child.*, vol. 81, no. 3, pp. 350–369, 2015, doi: 10.1177/0014402914563700.

[23] B. M. S. Da Silva, C. Rieffe, J. H. M. Frijns, H. Sousa, L. Monteiro, and G. Veiga, "Being Deaf in Mainstream Schools: The Effect of a Hearing Loss in Children's Playground Behaviors," *Children*, vol. 9, no. 7, pp. 1–11, 2022, doi: 10.3390/children9071091.

[24] Y. Bouzid, M. A. Khenissi, F. Essalmi, and M. Jemni, "Using educational games for sign language learning - A signwriting learning game: Case study," *Educ. Technol. Soc.*, vol. 19, no. 1, pp. 129–141, 2016.

[25] K. I. K. Gyonyoru, "Adaptive learning systems and artificial intelligence in language learning," *Gradus*, vol. 12, no. 1, 2025, doi: 10.47833/2025.1.art.010.

[26] M. Viner, A. Singh, and M. F. Shaughnessy, "Assistive Technology to Help Students With Disabilities," *IGI Glob.*, no. September, pp. 240–267, 2020, doi: 10.4018/978-1-7998-1431-3.ch012.

[27] N. K. S. Putri, U. L. Yuhana, D. O. Siahaan, W. Rahayu, and E. Pardede, "Assistive Technology Classification for Students with Disabilities in Higher Education: A Systematic Literature Review," *IEEE Access*, vol. 13, no. January, pp. 28135–28149, 2025, doi: 10.1109/ACCESS.2025.3538322.

[28] U. E. Chigbu, S. O. Atiku, and C. C. Du Plessis, "The Science of Literature Reviews: Searching, Identifying, Selecting, and Synthesising," *Publications*, vol. 11, no. 1, 2023, doi: 10.3390/publications11010002.

[29] A. Ramdhani, M. A. Ramdhani, and A. S. Amin, "Writing a Literature Review Research Paper: A step-by-step approach," *Int. J. basic Appl. Sci.*, vol. 3, no. 1, pp. 47–56, 2014, doi: 10.1177/0021886391273004.

[30] G. van der Waldt, "Elucidating the application of literature reviews and literature surveys in social science research," *Adm. Publica*, vol. 1, no. 29, pp. 1–20, 2021.

[31] H. Snyder, "Literature review as a research methodology: An overview and guidelines," *J. Bus. Res.*, vol. 104, no. March, pp. 333–339, 2019, doi: 10.1016/j.jbusres.2019.07.039.

[32] D. Septiani, S. Koebanu, and N. Lustyantie, "Exploring Writing Challenges in Deaf and Hard of Hearing Students With Cochlear Implants: the Role of Dysgraphia," *J. Eduscience*, vol. 12, no. 3, pp. 874–885, 2025, doi: 10.36987/jes.v12i3.7208.

[33] O. A. Desmet, S. Ippolito, J. Herren, and S. Guzman-Roman, "A Phenomenological Exploration of Academically Gifted Individuals Who Are Deaf or Hard of Hearing," *Educ. Sci.*, vol. 15, no. 5, pp. 1–23, 2025, doi: 10.3390/educsci15050530.

[34] M. Cook *et al.*, "Challenges and strategies for educational virtual reality: Results of an expert-led forum on 3D/VR technologies across academic institutions," *Inf. Technol. Libr.*, vol. 38, no. 4, pp. 25–48, 2019, doi: 10.6017/ital.v38i4.11075.

[35] S. Choi *et al.*, "Building Korean DMZ Metaverse Using a Web-Based Metaverse Platform," *Appl. Sci.*, vol. 12, no. 15, 2022, doi: 10.3390/app12157908.

[36] K. Atsalaki and I. Kazanidis, "Combining Virtual Reality Visual Novels and Social Stories to Support Social and Emotional Development in Children with Autism Spectrum Disorder," *Appl. Sci.*, vol. 15, no. 12, pp. 1–21, 2025, doi: 10.3390/app15126584.

[37] K. Jones, G. Crawford, and J. Jancey, "Are We There Yet? Co-Production in Recovery Colleges," *Heal. Promot. J. Aust.*, vol. 36, no. 3, pp. 1–11, 2025, doi: 10.1002/hpja.70047.

[38] T. Hussain, L. Yu, M. Asim, A. Ahmed, and M. A. Wani, "Enhancing E-Learning Adaptability with Automated Learning Style Identification and Sentiment Analysis: A Hybrid Deep Learning Approach for Smart Education," *Inf.*, vol. 15, no. 5, 2024, doi: 10.3390/info15050277.

[39] E. Korosidou, "The Effects of Augmented Reality on Very Young Learners' Motivation and Learning of the Alphabet and Vocabulary," *Digital*, vol. 4, no. 1, pp. 195–214, 2024, doi: 10.3390/digital4010010.

[40] T. Kurnia Sari and P. Hanifah Rahmani, "The Role of Positive Reinforcement on Students in English Language Learning: A Skinnerian behaviorist," *J. English Ibrahimy*, vol. 3, no. 1, pp. 1–5, 2024.

[41] F. S. Fayda-Kinik, "Augmented Reality in Education: An Overview of Research Trends," in *EJERCongress 2023 Conference Proceedings Augmented*, 2023, pp. 273–291.

[42] Abbas, M., Khan, T. I., & Jam, F. A. (2025). Avoid Excessive Usage: Examining the Motivations and Outcomes of Generative Artificial Intelligence Usage among Students. Journal of Academic Ethics, 1-20.

[43] Moghavvemi, S., & Jam, F. A. (2025). Unraveling the influential factors driving persistent adoption of ChatGPT in learning environments. Education and Information Technologies, 1-28.