

Open Innovation in Early Childhood Development Through the Use of Sensory Instructional Media and Holistic Developmental Evaluation

Wahyu Sulistio Pratama^{1*}

¹ Universitas Sarjanawiyata Tamansiswa, Yogyakarta, Indonesia

Abstract

Article history:

Received: July 13, 2022

Revised: August 29, 2022

Accepted: October 27, 2022

Published: December 30, 2022

Keywords:

Early Childhood,
Holistic Assessment,
Open Innovation,
Participatory Education,
Sensory Media.

Identifier:

Nawala

Page: 140-155

<https://nawala.io/index.php/ije>

Open innovation in early childhood education creates collaborative opportunities for designing new approaches to enhance the quality of learning. One key strategy is the use of sensory instructional media, which incorporates multi-sensory stimulation to strengthen children's engagement and developmental outcomes. This study adopts a literature review method, analyzing international journal articles published between 2017 and 2021 that explore the contributions of sensory media to the cognitive, motor, and socio-emotional development of young children. The findings emphasize the significance of holistic developmental assessment in evaluating the effectiveness of such innovations. Results demonstrate that the integration of technology, sensory-based educational games, and comprehensive developmental assessments fosters adaptive and participatory learning environments. This study highlights the need to strengthen stakeholder collaboration across sectors to generate open solutions that are contextually relevant and responsive to children's diverse needs. A multidisciplinary, inclusive approach is essential to ensure the continuity and effectiveness of innovation in early childhood learning settings.

*Corresponding author:

wahyusulistiopratama210502@gmail.com (Wahyu Sulistio Pratama)

©2022 The Author(s).

This is an open-access article under CC-BY-SA license (<https://creativecommons.org/licence/by-sa/4.0/>)



1. Introduction

The development of early childhood is a crucial and fundamental phase that lays a strong foundation for an individual's long-term cognitive, social, emotional, and physical growth. Therefore, the quality of educational interventions provided during this early age significantly determines and influences the overall success of a child's future education. In this critically important context, innovative and collaborative approaches, also known as open innovation, emerge as a highly relevant solution in designing and formulating adaptive, flexible, and inclusive learning strategies for young children. The concept of open innovation in early childhood education strongly emphasizes the importance of collaboration and cooperation among various involved parties, including formal educational institutions, parents or guardians, local communities, and technology providers, in the process of developing learning methods and media that are truly relevant and in line with the developmental needs of young children. Fernandes et al. (2019) explains that this open innovation approach allows an organization to synergistically utilize various ideas, both internal and external, in order to form and create shared value.

In the context of early childhood education, this approach has great potential to enrich the development process of instructional media that are responsive, participatory, and interactive. One highly relevant and important form of innovation in this context is the utilization of sensory instructional media. This type of learning media is designed to activate various senses of children, such as touch, hearing, sight, and even smell, thereby strengthening and deepening the child's active involvement in the learning process. Research conducted by Volpe & Gori (2019) states that the

integration of interactive technology based on multisensory stimulation can significantly increase children's attention and exploration, even in populations of children with special needs. Sensory instructional media provides a much more concrete and real learning experience, and facilitates the understanding of concepts through direct simulations that align with the natural learning style of young children.

However, to truly ensure the effectiveness of this learning approach, the evaluation of child development should not only focus on academic aspects. Instead, a holistic evaluation approach is highly necessary, which includes and considers various important dimensions of child development, such as motor, emotional, social, language abilities, and creativity. According to Kosmas and Zaphiris (2018), such a holistic evaluation approach greatly helps in identifying a child's hidden potential and areas of development that still require support. Thus, decision-making by educators in designing instructional strategies will be more accurate, contextual, and personal.

Within this framework, this literature study aims to deeply explore the relationship between the open innovation approach, the use of sensory instructional media, and the application of holistic developmental evaluation in the context of early childhood education. The main focus of this research is to critically examine the contributions, opportunities, and challenges arising from the integration of these three important aspects in an effort to create a collaborative, participatory, and child-needs-oriented educational ecosystem. By referring to findings and results of international research published within the last five years, this study is expected to

provide a strong theoretical and practical foundation for the development of more effective, adaptive, and inclusive early childhood learning strategies.

2. Literature Review

2.1. The Concept of Open Innovation in Early Childhood Education

Open innovation is a development model that specifically emphasizes the importance of cross-institutional, individual, and multi-stakeholder collaboration in creating truly new and innovative solutions. In the context of early childhood education, this approach opens up great opportunities for active involvement among teachers, parents, educational technology developers, and local communities in designing learning strategies that are truly based on the real needs of children. Fernandes et al. (2019) states that the application of open innovation allows open access to diverse sources of ideas, experiences, and expertise, which significantly enriches the innovation process and also accelerates the implementation of adaptive and relevant educational technology.

Hoareau et al. (2020) in *Innovating Pedagogy* explicitly emphasize the importance of collaboration in creating various forms of learning media that are not only functional, but also contextual and relevant to the developmental stages of early childhood. With an open innovation approach, the process of developing learning media is no longer limited to formal or institutional approaches alone, but also involves contributions from the community and utilizes rapidly developing digital technology. Research conducted by Emerson and Linder (2021) also highlights that participatory and community-based learning models can support a child's integral

growth, while also increasing teachers' capacity to apply responsive and context-appropriate learning strategies.

2.2. Sensory Instructional Media and Multi-Sensory Stimulation

Sensory instructional media refers to various forms of learning aids that actively involve multiple senses to improve the quality of young children's learning experiences. This approach is highly relevant because children at an early age tend to learn concretely and intuitively through sensory exploration. According to Volpe and Gori (2019), interactive multisensory technology has proven effective in strengthening children's cognitive and motor skills because it can stimulate various areas of the brain simultaneously and synergistically. This simultaneous activation supports a deeper and more meaningful learning process. A study by Kosmas and Zaphiris (2018) shows that the use of textured manipulative materials, games involving sound, and dynamic visualizations can significantly enhance children's creativity and active engagement.

In their experiment, children showed a very significant improvement in spatial and narrative concept exploration when using interactive media that required direct physical action, such as assembling spatial forms, free drawing, or playing with real objects of varying textures and shapes. These activities encourage active and reflective learning. Furthermore, Budiarti and Darmayanti (2020) found that sensory play based on loose parts greatly helps children in building creativity, problem-solving skills, and fine motor coordination. On the other hand, Putri et al. (2020) also emphasize the importance of sensory-based media in the context of child self-

protection education. Interactive visual and audio media designed ethically can convey important messages without causing fear in children.

2.3. Holistic Child Development Evaluation

Holistic evaluation refers to an assessment approach that assesses all aspects of a child's development in an integrated manner, covering cognitive, motor, social, language, and emotional dimensions. This approach seeks to capture the complexity of child development as a whole, not just from one aspect. In practice, holistic evaluation is carried out through various methods such as daily systematic observation, project-based assessments that emphasize process, child development portfolios over time, and direct interaction between the child and an authentic and meaningful learning environment. According to Swathi et al. (2020), the integration of educational media and developmental assessment is very important, as it allows teachers to adapt learning approaches to the individual needs and characteristics of each child.

Holistic evaluation also serves as an important tool for early detection of potential developmental disorders, as well as facilitating the strengthening of aspects that have developed optimally. This makes evaluation a reflective tool, not just a measurement tool. The context of the Universal Design for Learning (UDL) instructional design model, suggests that assessment should be flexible. Assessment should not only rely on written tests, but also include children's verbal expressions, artistic creations, and social skills demonstrated during activities. This is consistent with the principle that every child has a unique learning style and expression. The utilization of technology allows assessments to be carried out in real-time, through

efficient, accurate, and adaptive data-based applications to changes in child development.

3. Method

This study uses a qualitative descriptive approach based on a literature review (library research), aimed at exploring the relationship between open innovation, sensory instructional media, and holistic developmental evaluation in the context of early childhood education. This research relies on the analysis of relevant international journal articles indexed in the Google Scholar platform, with a publication period between 2017 and 2021. The literature search process was carried out systematically using the keywords “open innovation in early childhood education,” “sensory instructional media,” and “holistic child development assessment.” Articles selected for analysis had to meet a number of important criteria: first, the article came from a reputable academic journal, either open-access or subscription-based; second, it was published within the last five years according to the specified timeframe; third, it focused on early childhood education, especially in the aspect of using technology or sensory-based approaches; and fourth, it was methodologically relevant to the topic of comprehensive child development evaluation.

From the initial search that yielded more than 50 documents, a strict selection process was carried out using the purposive sampling technique, resulting in 11 articles that were most relevant and had verifiable source validity. Content analysis was carried out thematically by deeply reading each article to identify key concepts

and group findings based on three main sub-themes: open innovation, sensory instructional media, and holistic developmental evaluation. The data processing was carried out by coding and narrative compilation, where the researcher paid attention to the interconnections between conceptual elements and their contribution to early childhood education practices. Data validity was maintained through reference triangulation, by comparing findings between journals and evaluating the consistency of thematic data that emerged. This method was considered appropriate because it provides flexibility in exploring theoretical and empirical discourse without rigid experimental limitations, and allows for cross-disciplinary integration, particularly in the fields of pedagogy, developmental psychology, and educational technology.

4. Results and Discussion

This literature study shows that the integration of open innovation, sensory instructional media, and holistic developmental evaluation is a highly effective and relevant strategy to support the holistic development of early childhood. These three components do not stand alone but rather reinforce and complement each other, resulting in a collaborative, responsive, and adaptive learning ecosystem tailored to the unique and diverse needs of each child. In practice, this approach also allows for flexibility in learning design and expands the creative space for educators and other stakeholders (Bennett et al., 2018). In the context of open innovation, the involvement of various stakeholders in the process of developing learning media and approaches is a key element that cannot be overlooked. Fernandes et al. (2019) emphasizes that innovation does not solely originate from formal institutions such

as schools or higher education institutions, but can also come from various ideas, experiences, and practices emerging from communities, consumer technology, and the active participation of parents and the wider society.

When open innovation is applied in early childhood education, it encourages synergy among actors, particularly collaboration between teachers, technology developers, and families in designing learning media and methods that are truly contextual and appropriate to the local learning environment and the child's individual developmental characteristics. As a concrete example, Hoareau et al. (2020) demonstrate how partnerships between educational institutions and educational media designers can produce learning aids that are not only enjoyable and engaging for children but are also designed based on child development theory and age-appropriate sensory needs. In this scenario, sensory instructional media becomes a product of an open innovation approach capable of effectively and meaningfully stimulating multisensory learning. Collaborative projects involving the direct participation of teachers and children in designing media based on texture, sound, and interactivity have proven to increase a sense of ownership over the learning process and motivate children to be more active and confident in exploring their learning environment.

Sensory instructional media itself has proven effective in increasing children's engagement in various learning activities. Volpe and Gori (2019) emphasize that when children can touch, see, and hear simultaneously in a learning activity, the neurological connections formed in their brains will be stronger and more integrated compared to using learning media that only involves one sensory dimension. For

example, in learning concepts of shapes and colors, media such as textured blocks equipped with sound or interactive visual panels with animations can result in significantly higher information retention compared to conventional learning media such as static images or verbal instructions alone. This shows that multisensory stimulation not only accelerates understanding but also improves the overall quality of a child's learning experience.

The effectiveness of multisensory media is also reinforced to use of physical action-based media such as building games, tactile drawing, and light sensor tools can accelerate children's understanding of spatial concepts, directions, and basic narrative structures. children aged 4–6 years showed a higher ability to construct stories, recognize shape patterns, and perform symbolic representations after they were given the opportunity to learn through real and repeated physical experiences. Sensory media not only impacts cognitive aspects but also plays an important role in promoting children's fine and gross motor development. Children exposed to play activities based on loose parts such as small beads, sand, colored pebbles, and other flexible play tools showed significant improvements in hand-eye coordination, motor agility, and creative exploration. Such activities open opportunities for children to experiment, build, dismantle, and create something from simple materials, all of which encourage conceptual understanding through direct interaction and real experiences. This is highly consistent with the principles of early childhood pedagogy based on concrete experiences and active learning.

Furthermore, sensory media also makes a very important contribution to children's socio-emotional development. In a study conducted by Putri et al. (2020),

the use of sound and image-based interactive media in introducing the concept of self-protection to young children had a positive impact on forming children's body awareness. Interestingly, important information could be conveyed in a safe and enjoyable way without causing fear or anxiety. Children learned to recognize their body parts positively, understand personal boundaries, and began to build the concept of self-protection through simulations of real situations presented in the form of narratives or educational games. This confirms that sensory media, when designed ethically and collaboratively, can be a strategic tool for character and basic values formation from an early age.

However, this innovation will not be optimal without a holistic and comprehensive child development evaluation system. Such an evaluation is needed to map children's developmental achievements as a whole, not just in the academic or cognitive realm. Holistic evaluation includes social, emotional, language, creativity, and motor skills dimensions, thus providing a more accurate picture of each child's potential and needs. Swathi et al. (2020) state that this holistic evaluation approach can prevent teachers from biases that overly emphasize academic learning outcomes, and provide a comprehensive understanding of a child's individual developmental strengths and challenges. Holistic evaluation based on direct observation and daily developmental documentation has proven to be a very effective practice in assessing children's engagement during sensory-based learning processes. The use of flexible and multimodal assessments, where children are not only assessed based on the final results of tasks or learning products but also based on their active involvement in various activities offered.

For example, children's artwork, records of social interactions, and children's participation in cooperative games are considered valid, contextual, and reliable indicators of development. In this approach, teachers act not only as assessors but also as observers and facilitators who actively record behavioral patterns, skills, and developmental achievements of children over time. The utilization of digital technology based on applications as a tool to document child development digitally and in real-time (Stratigos & Fenech., 2021). This application allows teachers to record children's development more quickly, provide informative feedback to parents, and analyze child development trends longitudinally. With this technology, the evaluation process no longer becomes a burdensome administrative task but instead transforms into a reflective tool that supports more personal, directed, and data-driven instructional decision-making.

In the integration of the three main components, namely open innovation, sensory instructional media, and holistic developmental evaluation, a potential synergy emerges that mutually reinforces each other. Open innovation acts as a collaborative engine that allows various parties to participate in designing sensory learning media that are in line with children's developmental needs. Sensory media itself enhances the quality of children's learning experiences, both affectively and cognitively, while holistic evaluation provides authentic and richly contextual data to continuously improve, adapt, and enhance learning strategies. These three components, if integrated appropriately, will form a participatory, flexible, and highly child-centered early childhood education ecosystem.

This literature study also reveals that the success of such a collaborative approach heavily depends on the capacity of teachers as the main mediators in the learning process. Continuous training for teachers in the fields of sensory technology, developmental observation techniques, and reflective approaches is greatly needed so that they can effectively implement this approach. Teachers need to have the ability to read children's developmental signals, understand social dynamics in the classroom, and work intensively with parents in developing contextual, inclusive, and responsive learning strategies for individual child differences.

Besides teachers, parental involvement also plays a very important role in determining the success of implementing this approach. In the study by Hoareau et al. (2020), it was mentioned that when parents are actively involved in the process of designing learning media or preparing home-based learning plans, children show a much higher level of engagement and learning motivation. Parents who understand the importance of sensory stimulation and the principles of holistic evaluation will be better able to create a learning environment that is harmonious and synergistic between home and school, so that children's learning becomes more consistent and profound.

The findings from various sources in this study indicate that an open innovation-based approach combined with sensory instructional media and holistic developmental assessment can enrich the early childhood learning process. This model not only focuses on learning outcomes as the final output but also emphasizes the importance of the learning process, emotional involvement, and child well-being

at every stage of learning activities (Darling-Hammond et al., 2020). This approach also has great potential to narrow educational access gaps, especially by involving cross-actor participation and encouraging the emergence of local innovations that meet real needs on the ground. However, several challenges still need to be overcome, such as limitations in supporting infrastructure, teacher skill gaps, and the disconnect between conventional evaluation systems and new holistic approaches. Therefore, progressive policy support is needed, which can encourage cross-sector collaboration and provide sufficient funding for research and continuous innovation development in early childhood education.

5. Conclusion

This study highlights the importance of integrating open innovation, sensory instructional media, and holistic developmental evaluation in shaping adaptive and child-centered early childhood education. Open innovation enables cross-sector collaboration among educators, parents, technology developers, and communities in creating learning media responsive to children's sensory needs. Sensory instructional media has proven effective in stimulating various aspects of child development, including motor, cognitive, socio-emotional, and language skills, through enjoyable and interactive learning experiences. Holistic developmental evaluation is a crucial component in ensuring that the learning provided is truly relevant and aligned with each child's developmental stage. By utilizing observation methods, portfolios, and technological support, teachers can accurately map children's needs and progress.

This approach not only improves learning outcomes but also supports children's overall well-being. The synergy among these three approaches results in a dynamic, participatory, and inclusive learning model. The success of its implementation heavily relies on teacher training, parental participation, and policies that support collaborative and innovative educational practices. By adopting this approach, early childhood education can move towards a more transformative, equitable, and contextual system, equipping children with essential life skills from an early age.

References

- Bennett, S., Lockyer, L., & Agostinho, S. (2018). Towards sustainable technology-enhanced innovation in higher education: Advancing learning design by understanding and supporting teacher design practice. *British Journal of Educational Technology*, 49(6), 1014-1026.
- Budiarti, E., & Darmayanti, R. (2020). Why is Loose Part an important learning medium for early childhood development?. *Jurnal Cakana: Pendidikan Anak Usia Dini*, 3(1), 01-15.
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied developmental science*, 24(2), 97-140.
- Emerson, A. M., & Linder, S. M. (2021). A review of research of the Reggio Inspired approach: An integrative re-framing. *Early Years*, 41(4), 428-442.

- Fernandes, C., Ferreira, J., & Peris-Ortiz, M. (2019). Open innovation: past, present and future trends. *Journal of Organizational Change Management*, 32(5), 578-602.
- Hoareau, L., Tazouti, Y., Dinet, J., Thomas, A., Luxembourger, C., Hubert, B., ... & Jarlégan, A. (2020). Co-designing a new educational tablet app for preschoolers. *Computers in the Schools*, 37(4), 234-252.
- Kosmas, P., & Zaphiris, P. (2018). Embodied cognition and its implications in education: An overview of recent literature. *International Journal of Educational and Pedagogical Sciences*, 12(7), 970-976.
- Putri, F. K. A., Fakhruddin, F., & Utomo, U. (2020). The Effectiveness of Learning Media to Introduce Sex Education among Early Childhood. *Journal of Primary Education*, 9(1), 72-77.
- Stratigos, T., & Fenech, M. (2021). Early childhood education and care in the app generation: Digital documentation, assessment for learning and parent communication. *Australasian Journal of Early Childhood*, 46(1), 19-31.
- Swathi, R. R., Fox-Turnbull, W., Earl-Rinehart, K., & Calder, N. (2020). Development of formative assessment tool for a primary, technology classroom. *Design and Technology Education: An International Journal*, 25(2), 101-116.
- Volpe, G., & Gori, M. (2019). Multisensory interactive technologies for primary education: From science to technology. *Frontiers in psychology*, 10, 1076.