Digitalization of Play and Games: Artificial Intelligence in Early Childhood Education

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Abstract:
This research study discusses the integration of artificial intelligence (AI) in Early Childhood Education (PAUD) units to improve play and game activities for children as well as innovation in implementing AI-based learning. AI technology has very good prospects and potential in changing teaching and learning activities in educational units with its ability to think and learn like humans, understand human feelings, find solutions in complex decision making, and so on. However, this is sometimes not in line with the application of AI in early childhood education units which are still in their early stages, especially in developing countries like Indonesia. The method used in this research is qualitative research, the data collection technique is from various journal articles about the benefits and impact of AI on early childhood play and play activities. With the support of AI, PAUD units can improve the results of their teaching and learning activities by facilitating more diverse play experiences, increasing operational efficiency, monitoring children’s play and play results in real time. Although progress in the application of AI has been seen, there appear to be challenges and shortcomings, including limited AI research in fields outside of STEAM (Science, Technology, Engineering, Arts, and Mathematics), the lack of AI theories and models in play and gaming activities, and resistance in adopting AI in a child’s play activities. It is important for PAUD units to integrate AI more optimally in the process of playing and playing activities for children, as well as providing training to educators, education staff and PAUD students to optimize the education system in the future.

Keywords: digitalization of play and game activities, PAUD units, Artificial Intelligence.
INTRODUCTION

Educators have a very important role in the process of playing and learning in early childhood in facilitating teaching and learning activities. As an educator, it is important to understand child development, understand how to communicate well with early childhood, and know their needs. In addition, utilizing a variety of appropriate educational play tools is needed to help children grow and develop (Tabi’in, 2020).

Early childhood educators in educational units always make maximum efforts to develop various aspects of child development, such as physical motor, cognitive, language, social-emotional, and artistic aspects (Khaironi, 2018). These efforts are based on a deep understanding of the needs, interests, and abilities of each learner (Ilsa & Nurhafizah, 2020). This requires a variety of creative and innovative learning strategies, as well as providing a safe, comfortable, and conducive learning environment (Rachman, 2020). Educators must be thorough and know what the basic needs of a student are (Zagoto et al., 2019). Educators also need to prepare and utilize a variety of infrastructure facilities used for children's activities in adequate play, these infrastructure facilities can take the form and form of media or any teaching and learning tools that are able to stimulate all aspects of early childhood development (Rohiyatun & Najwa, 2021). If there are students who have not been able to focus their attention, or students have not been able to listen to the direction of the educator properly, in other words, it should be given extra training first by providing stimulation independently until they are accustomed to carrying out play and game activities (Nurwahidah, 2020).

However, in practice in the field, educators tend to use the lecture method in teaching and learning activities for their students, and very limited utilization of educational game tools to help children's play and play activities that are able to develop artificial intelligence in early childhood, even though for early childhood students to make students have good listening skills is a basic ability that requires habituation from an early age in students who become the foundation or basis for learning.

The world today has begun to transition to the era of artificial intelligence (Zahroh et al., 2024). Often abbreviated as AI, artificial intelligence is increasingly important in many aspects of human life. Its prominence and impact on early childhood games and play activities is attracting a lot of attention, influencing people around the world, and continues to disrupt various industries. AI has developed new games as well as innovative solutions for teaching and learning that have been tested in various educational environments. In addition to education, AI has a huge impact on the labor market, industry, agriculture, value chains, and work environments (Kelly, 2021).

The Covid-19 pandemic has brought significant disruption in the world of education, including in the Early Childhood Education (ECE) sector. To overcome various learning challenges during the pandemic, the utilization of AI in education systems around the world is rampant (Nurhaeti et al., 2024). Education units in ECE are one of the most influential service sector industries (Senel & Can, 2021). To get ready for the changes in the market, many educational institutions are starting to use it more quickly in various disciplinary sectors. These technological developments hold great promise for creating and developing individualized play and learning activities for students, improving methods for creating teaching and learning activities, and opening access to a larger spectrum of students.

Artificial intelligence requires an explanatory description of the skills that educators in an educational unit must transmit to students in preparing themselves for a future that involves artificial intelligence (Grace Ufuk, 2020). Here it is increasingly clear that artificial intelligence
affects the world of education which can have an impact on the quality of education, the learning process or games and games, assessment and career paths in the future (Slimi, 2021).

The future utilization of AI will bring significant changes in education, including: 1) engaging and interactive educational activities. Education will be able to take place anytime and anywhere, providing greater flexibility in the teaching and learning process; 2) personalized AI educators, AI will help learners identify and achieve their goals more efficiently through customized guidance; 3) mass personalization, AI will be tailored to each learner's learning style, age level, and their specific needs, enabling a more relevant and effective learning experience. However, despite the many potential benefits of AI and digitization in early childhood play and games, there is still resistance to the adoption of these technologies. This is due to the perception that education units need to adjust, as children's play strategies are unique compared to other education settings (Hutson et al., 2012).

The widespread use of AI does not mean that AI can be adopted quickly in all fields in educational units (Yu, 2020). Citing an activity report, it is estimated that 400 to 800 million jobs will be replaced by 2023 due to AI and automation (Nisa et al., 2024). While this will be followed by the anticipated extinction of permanent activities due to AI by 2030, it can be predicted that 555 - 890 million new activities will emerge because of it. Therefore, early childhood education centers need to prepare their students to carry out a variety of play activities and games that are always up to date which are expected to be able to collaborate and balance them instead of fighting or staying away from artificial intelligence Hurson, et al., (2022).

Appropriate stimulation in this phase can optimize early childhood growth and development, one of which is through play learning activities or digital introduction activities. Novitasari and Fauziddin (2022) state that learning activities have a positive influence in optimizing child development. To create meaningful play activities, educators need digital literacy competencies to provide relevant information to their students. Fitriani explained that the use of digital media can be a new means of sharing and transferring knowledge that can be accessed easily. The ability to access and own digital content that is appropriate to the level of development of children is very important. Educators face challenges in this digital literacy process, especially in the era of digital transformation that is increasingly integrated with AI technology. Digitalization is a social change that utilizes technology, and the use of AI can facilitate access to learning activities (Tulungen, et al., 2022).

METHODS

This research is a type of qualitative research. According to Sugiyono (2020), the qualitative method is one of the inductive and descriptive research methods, meaning that qualitative research describes the results of its research in the form of words. Furthermore, Moha (2019), added that qualitative research is research in the form of words obtained from interview or observation data (oral or written). In this case, researchers use a literature study approach to study habits as a whole, see the attitudes and behavior of subjects directly in real terms and without any connection to certain variables. The literature study approach used in this research aims to explore the integration of AI in Early Childhood Education (ECE) units to improve play and learning activities in children, as well as innovations in the implementation of AI-based learning.

This research is expected to provide a clear, complete, well-organized picture, and achieve the goals that have been set. In the research process, determining the source of data is a very important step. Therefore, the researcher determined the research subjects including educators, education
personnel, and students in ECE units in Gresik as the main source of information relevant to the research topic. The main instrument in this study was the researcher himself, as he was directly involved in the data collection process. The methods used in this research include interviews, observation, and documentation through the utilization of various journal articles on artificial intelligence in education. Data analysis was conducted using the Miles and Huberman analysis method (Miles, 2014) which includes data reduction, data presentation, and conclusion drawing. Quoting Sugiyono's (2019) explanation, data analysis is a data collection process that is systematically organized through the stages of interviews, field notes, and documentation. After the data collection process is complete, the researcher analyzes the data that has been collected. The steps in data analysis include classification of data that has been collected, detailed data description, data organization for easy processing, data synthesis, further data organization, and preparation of simple conclusions. This process helps in presenting the data systematically and provides a clear picture of the research findings.

Thus, this research is expected to make a significant contribution in understanding the role and integration of artificial intelligence in the field of education, especially early childhood education, and is expected to be able to contribute to constructive development in direct application in education.

RESULTS AND DISCUSSION
a. Study on Artificial Intelligence in Early Childhood

Studies on artificial intelligence in early childhood education units have shown considerable improvement. In terms of academics, artificial intelligence has been developed so as to support, facilitate and improve the work process, although it can be fully used by educators, education personnel, or students. Several studies have identified the benefits of artificial intelligence in educational units, the results of play activities and games in early childhood are growing and improving, access to educational activities becomes easier and wider, retention of students is higher, the cost of play or educational activities is cheaper, and the time to complete the final project is shorter with the help of artificial intelligence technology (Klutka, et al, 2018; Hutson, et al, 2022). Quoting Khare & Stewart's (2018) explanation that artificial intelligence can be utilized in various fields of activity, such as chatbots that facilitate and support learning, prepare educational services for students, and can also provide an overview of academic results and take preventive action solutions so that student performance can improve (Alyahyan & Dustegor, 2020).

Other studies focus less attention on the use of artificial intelligence outside of the STEAM (Science, Technology, Engineering, Arts, and Mathematics) field and learner support services. According to Zhang & Aslan (2021), more studies are needed to use artificial intelligence in other fields of science to develop educational models that are compatible with artificial intelligence technology. Ultimately, by providing educators and students with educational gaming tools that enable faster responses to the demands of teaching and learning, artificial intelligence in education has the potential to create more flexible, inclusive, personalized, and engaging play and gaming activities (Schiff, 2021; Taneri, 2020). It is important that the use of artificial intelligence in the classroom is based on moral principles and good governance. Referring to the justification provided by Bozkurt et al. (2021), it can be concluded that to guarantee the ethical, reliable, and fair application of artificial intelligence technologies, governance rules and guidelines are necessary.
b. Artificial Intelligence in ECE School

According to Hutson et al. (2022), the five main topics that often come up when talking about the use of AI in education and learning activities are the main goal of AI in education is to make connections and promote greater feedback and socialization, leading to a more efficient and effective learning environment.

1. Chatbot: A chatbot is a type of artificial intelligence that assists learners in learning activities by providing assistance and answering questions in real time. One of the benefits of chatbots is that they can interact with users in real time, making them less dependent on direct interaction with educators, which allows educators to concentrate more on encouraging early childhood games and play. However, there are some studies that show that using chatbots is not always beneficial in teaching and learning activities.

2. Expert Systems: Using an expert system used in education is expected to facilitate lesson planning in early childhood education units and maximize LMS (learning management system) capabilities. In the expert system, it can be set how to change the way users interact with the LMS system, which will result in better play and game activities for students (Dias et al., 2015).

3. Educator: The educator acts as a guide who provides direction and feedback to learners in a timely manner. Educators can provide/facilitate learning media that is suitable for students so that it helps students in playing activities.

4. Machine Learning (ML): Machine Learning has been widely used in education but not much research has specifically addressed the use of AI in education and learning. ML can only predict learners' feelings towards cloud-based teacher applications (Arpaci, 2019).

5. Augmented Reality (AR) and Mobile Learning Apps: Kose (2018) found that AR and AI make personalized mobile learning apps accessible, improving learning outcomes and experiences. It is possible to improve learners' learning experiences and outcomes by incorporating them into customized play and game activities (Kose & Arslan, 2016).

Research has investigated the possible advantages of virtual learning environments (VLEs), which combine virtual reality (VR) technology, and visualization in an educational context. In contrast to traditional techniques, Griel, Molina, and Callejas (2014) showed that visualization and comprehensive virtual learning environments enable better learning collaboration and higher participation in the learning process. Ijaz, Bogdanovych, and Trescak (2017) provide evidence to support this, stating that combining AI with VR has been shown to increase learner engagement and learning. Due to children's different play styles and games, there is opposition to the adoption of AI in early childhood education settings, even though this technology has enormous potential to change the way we approach education.

c. Artificial Intelligence Issues in Early Childhood Education Units

The results of research by Muhie (2020), artificial intelligence is known as a solution that is able to develop teaching and learning activities as well as play and game activities in educational units. Related problems that arise in education units today include global competition, lack of student skills, high cost of education and facilities, lack of technology experts, lack of engagement with students, and readiness to face change (Kerr, 2017). However, artificial intelligence is able to provide solutions to these issues, the following are some of the opportunities offered by artificial intelligence in education units quoting from Muhie's (2020) presentation:

1. Simulation of play environments and educators, AI can create virtual play environments where learners can experiment and practice in various themes. In addition, artificial
intelligence educators can also provide solutions and guidance independently.

2. Smart content collection, artificial intelligence can be used to create smart learning content that can be used according to the needs and desires of learners.

3. Artificial intelligence can be utilized in intelligent tutoring systems to provide tutorials tailored to the progress and difficulties experienced by each learner.

4. Artificial intelligence can help with administrative tasks instantly, making work time efficient and increasing focus on learner activities.

By adopting AI technology in education units, the problems encountered in the learning and playing process of learners can be more easily overcome and provide effective and efficient solutions.

d. The Benefits of Artificial Intelligence

Artificial intelligence (AI) is the utilization of technology in creating devices that can behave like humans, allowing computer devices to complete certain tasks in a way that mimics human understanding and judgment (Murphy, 2019). In the context of AI, computers and other machines use algorithms and methods to carry out various activities related to teaching and learning as well as play and games. Referring to the explanation of John Paul Muller (2018), there are four basic concepts in the definition of artificial intelligence:


2. Think Like Humans: Computers perform tasks that are like the way the human brain works such as, psychological testing, requiring intelligence by means of observation/review, psychological testing, and brain imaging.


4. Act Rationally: Computers work in certain situations where there are limitations in a rational way, just like humans.

In the world of education in particular, the benefits of artificial intelligence (AI) are also very pronounced. In the world of education, all aspects can utilize the development of this technology. Both in terms of administration and in terms of the direct learning process in the classroom carried out by teachers or educators. The following is an explanation of some of the benefits of AI obtained in the field of education:

1. From the learner's side, AI can analyze learning tailored to the needs of each learner. The results of the analysis conducted on AI students can explain the level of understanding/ability of each student and provide learning materials in accordance with the results of their analysis based on the needs of students. With the analysis conducted on students, this can create an optimal learning environment in the learning process.

2. AI for learners with special needs. The benefits of AI are not only for learners in general, but also for learners with special needs. One example of AI can be developing systems/applications in the form of text-based learning materials accompanied by sound and developing hearing aids that can be specially designed for learners with dyslexia, hearing impairment, and visual impairment diagnoses.

3. Artificial intelligence (AI) can also increase learners’ activeness and engagement in the learning process. One of the AI technologies that can be used is virtual reality (VR) and Augmented reality (AR) where both technologies can make users able to feel direct experience, see and hear certain events or events that have already occurred or even
something that might exist in the future. This can make students become more motivated in the learning process so that the learning process can be more interactive and interesting.

4. In terms of administration, the use of AI can also be used even greater. Administrative tasks that are usually carried out manually by an administrator in schools or other educational fields can be easily and quickly if using artificial intelligence-based applications. Starting from the assessment in the learning process both directly and the assessment at the end of the learning semester. Automatic creation of teaching schedules, data recording to the preparation of final reports for students in full and in detail.

5. Artificial intelligence-based learning media. Learning that uses AI by educators in the field of education is inseparable from the role of learning media which is very helpful in the process of transferring knowledge or material to be conveyed by teachers or educators. Artificial intelligence-based learning media can facilitate in many ways. For example, the Powtoon application where this application can create animation-based learning media that can be adapted to learning materials. Another example of an application, Quizizz, is a platform that can create quizzes automatically that can be adapted to learning content. Artificial intelligence-based learning media used can make it easier for teachers or educators to compile/design learning media from various sources, to expand the latest information about learning media needed by students in the classroom so that in the learning process students can be varied and make learning more effective and efficient.

Artificial Intelligence is needed and can be crucial to the future of early childhood education. This can happen because AI can provide personalized learning or teaching and learning activities, AI can also increase the level of efficiency in teaching and management in the classroom, and provide intelligent solutions to real-world problems. It is important that learners are equipped with AI skills so that they can adapt and have a greater impact in various disciplinary fields. Aoun (2017) explains that the utilization of artificial intelligence in educational units can provide significant changes and provide opportunities for users to develop long-lasting skills that can be applied in various fields of activity. However, achieving these benefits requires support and collaborative efforts from all parties involved in the education unit. This support includes curriculum adjustments, educator training, as well as adequate technology infrastructure to ensure that the implementation of AI can run effectively and provide maximum benefits for learners.

e. Impact of Artificial Intelligence in Early Childhood Education Units

For educational units, there are pending things to understand and respond to changes in a world that is increasingly developing and influenced by artificial intelligence or artificial intelligence in order to create relevant learning experiences for students, a number of research findings regarding the positive impact of artificial intelligence in various aspects of educational units according to Slimi (2021) are as follows:

1. Impact on the quality of education, artificial intelligence is changing the quality of education in a positive way. The utilization of artificial intelligence can help teaching and learning activities become more efficient and make it easier for educators to connect with information resources from around the world. Not only that, the use of artificial intelligence such as the internet of things and the cloud plays a role in the development and innovation of the early childhood education curriculum.

2. Impact on the process of play and game activities, artificial intelligence has an important role in the learning and teaching process, utilizing the use of neutral algorithms and works to help create better and more efficient recognition and teaching mechanisms.
3. The impact of artificial intelligence on assessment is also very influential, the utilization of artificial intelligence in assessment validates the results of the assessment to the level of evaluation. In addition, artificial intelligence also helps analyze assessments and strengthen interventions for the development or graduation level of learners.

4. Impact on education units, i.e. the existence of new influences, the application of artificial intelligence in education units must be based on the principle of rules and be responsible for ensuring benefits for society and humans as a whole.

In the face of rapid changes in the development of artificial intelligence technology, educational units must adapt well and integrate the technology wisely to create a better learning experience for students in the future.

Educators in the scope of ECE especially teachers, have a very close role from this artificial intelligence. ECE educators can utilize artificial intelligence especially in teaching and learning activities in the classroom to increase their competence using artificial intelligence. Here are some applications that can be used by educators. Educators can develop learning materials that are used in the classroom well. AI material development carried out by educators can create material/content that makes the class interactive, can make learning more interesting, and material can be tailored to the needs of educators both individually and in general. Pre-school teachers can improve digital competencies from the application of AI. Starting from understanding learning materials, processing learning materials, creating new ideas, developing learning media to be used later in the learning process so that the teaching process runs effectively.

In the application of AI in ECE. Teachers must be ready for the changes that occur and take a positive attitude towards the use of AI technology. Teachers are expected to quickly adapt to the development of AI technology. Furthermore, EC teachers/educators are expected to collaborate and cooperate with experts in the field of technology. This will have an impact on the development of individual competencies by the teacher and can also help provide insight, understanding in overcoming problems or obstacles faced technically in the use of AI in the development of the learning process. The assessment stage in the learning process can also be carried out using AI so that a thorough assessment of children can be carried out properly. Assessment can be done by focusing on the needs of learners. This assessment can not only measure and understand the ability of learners in terms of cognitive, but also includes the care, health and nutrition needed by learners. In other words, assessment based on learner development.

CONCLUSION

Artificial intelligence is a computer system that is capable of performing tasks that normally require human intelligence. This digital technology can also help make decisions by analyzing and using data available in the system. The implementation of artificial intelligence in human work is to obtain optimal performance results with a fast time process and maximum results.

Artificial intelligence in the process of learning activities or play and games in early childhood education units has potential in various fields. The utilization of artificial intelligence in education units can improve the quality of education, assist learning and teaching, facilitate better learner support services, and prepare learners with skills relevant to future developments. Other studies highlight the lack of attention to the application of artificial intelligence outside of STEAM (Science, Technology, Engineering, Arts, and Mathematics) fields and learner support services. In
the face of technological change, educators and education personnel must be ready to adapt and engage in the application of artificial intelligence in education. Regarding the positive impact of artificial intelligence in various aspects of education units, there is a change in the quality of education in a positive way. The use of artificial intelligence helps teaching and learning activities become more efficient and connected to the outside world; artificial intelligence has an important role in the learning and teaching process; artificial intelligence in assessment is also very influential and changes in education units.

REFERENCES


