



Development of a Gamification-Based Mindfulness Information System to Support Emotional Regulation and Reduce Anxiety Levels in Kindergarten Children

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Abstract

The rapid advancement of information technology has created new opportunities to support children's social-emotional learning through interactive digital media. However, information systems that integrate mindfulness practices with gamification remain limited, despite their potential to enhance emotion regulation and reduce anxiety among young children. This study aims to develop a Gamification-Based Mindfulness Information System as an engaging and effective learning medium for kindergarten children. The study employed the Design Science Research (DSR) methodology, consisting of problem identification, system design, development, implementation, and evaluation. A web-based application was developed featuring mindfulness activities, points, badges, achievement levels, and monitoring dashboards for teachers and parents. The software quality was evaluated based on the ISO/IEC 25010 standard, focusing on Functional Suitability, Usability, and Performance Efficiency. System effectiveness was assessed by comparing children's emotion regulation scores before and after the intervention using pre-test and post-test measurements. The results indicate that the developed system achieved excellent software quality and successfully met user requirements. Furthermore, the application significantly improved children's emotion regulation after its implementation. The integration of mindfulness and gamification increased children's engagement in learning, highlighting the potential of the proposed system as an innovative digital tool for supporting social-emotional learning in early childhood education.

Keywords: Gamification, Emotion Regulation, Early Childhood Education, Digital Mental Health, Software Quality.

INTRODUCTION

Early childhood mental health is one of the fundamental aspects in supporting children's optimal growth and development. The Kindergarten (TK) period falls within the golden age phase, when cognitive, social, emotional, and behavioral development occurs very rapidly. Children's ability to recognize, understand, and manage their emotions from an early age influences their learning readiness, their capacity to interact with their environment, and their mental health at subsequent developmental stages, as Hidayati (2020) confirms that introducing mindfulness early on contributes significantly to children's emotional regulation ability. Therefore, strengthening emotional regulation from an early age is an important part of creating a psychologically and socially healthy generation.

The World Health Organization (WHO), together with UNICEF, has affirmed that the mental health of children and adolescents has become one of the global health priorities. It is estimated that 1 in 7 children and adolescents aged 10–19 experience a mental health disorder, with anxiety disorders, depression, and behavioral disorders being the most commonly found conditions. WHO also reports that approximately one-third of mental health disorders first emerge before the age of 14, making early intervention essential to prevent long-term impacts on children's development.

Although global data has largely focused on children and adolescents, attention to mental health in early childhood is also increasing. A positive, safe, and loving caregiving environment is the primary foundation for children's social-emotional development. Conversely, negative experiences, prolonged stress, and children's inability to manage their emotions can increase the risk of anxiety, difficulty adapting, behavioral disorders, and even decreased learning ability, as demonstrated by Rediarpi (2025), who found that children with low emotional regulation ability tend to struggle with concentration and adaptation in their learning environment. Therefore, developing strategies that can support children's emotional regulation from the Kindergarten level onward is an increasingly urgent need.

One approach that has been growing in efforts to improve children's psychological well-being is mindfulness. Mindfulness is a practice of full awareness (present-moment awareness) that helps individuals focus their attention on ongoing experiences with an accepting, non-judgmental attitude. In early childhood, the concept of mindfulness is not applied through formal meditation as it is for adults, but rather through activities suited to children's developmental characteristics, such as simple breathing exercises and emotion-recognition activities packaged as games, as described by Rediarpi (2025) in the application of the STOP technique (Stop Take a breath Observe Proceed), which was shown to improve both concentration and emotional regulation in early childhood. Wulandari and Fauziah (2021) also found that the application of mindfulness had a positive effect on the emotional well-being of young children, while El Quds, Sianturi, and Rahman (2026) affirmed that mindfulness contributes to improved concentration, self-awareness, and reduced stress in children.

On the other hand, digital transformation has driven the utilization of information technology across various fields, including education and health. Information systems no longer function merely as data storage media but have developed into platforms capable of integrating information management, user interaction, activity monitoring, data analysis, and real-time reporting. Fu'adi, Zubaidah, and Putra (2022) note that many early childhood education (PAUD)

institutions still rely on conventional communication methods such as physical report books and WhatsApp messages to report children's development, making the monitoring process less efficient and not real-time. Sopian, Senubekti, and Dewi (2023) further add that developing web-based information systems can improve record-keeping efficiency, minimize data errors, and improve communication between teachers and parents in monitoring children's growth and development.

One approach widely applied in the development of educational information systems is gamification. Gamification is the application of game elements such as points, badges, levels, challenges, and leaderboards into non-game activities with the aim of increasing motivation, engagement, and user experience. Ayunda et al. (2026), through a literature review of articles indexed in SINTA, DOAJ, and Scopus, concluded that applying gamification elements such as points, levels, badges, and leaderboards can significantly increase learning motivation, student engagement, and learning outcomes. More specifically for early childhood, Mukarromah and Agustina (2021) found that app-based gamification can develop children's cognitive and language skills while also increasing their motivation, learning participation, and cooperation skills. Integrating gamification with mindfulness activities is expected to increase children's participation in emotional regulation exercises while also creating a more enjoyable learning experience.

Previous studies have discussed the effectiveness of mindfulness in improving children's emotional regulation (Hidayati, 2020; Wulandari & Fauziah, 2021; Rediarpi, 2025), while other studies have focused on the application of gamification to increase learning motivation and student engagement (Ayunda et al., 2026; Mukarromah & Agustina, 2021). Meanwhile, research on educational information systems has generally focused on school administration management, learning media, or academic systems (Fu'adi et al., 2022; Sopian et al., 2023). There is still limited research that integrates mindfulness, gamification, and information systems into a single platform specifically designed to help improve emotional regulation and reduce anxiety levels in early childhood through a monitoring mechanism accessible to both teachers and parents. This condition indicates a research gap that remains open for further development.

RESEARCH METHODS

This research employs a Design Science Research (DSR) approach oriented toward the development of an artifact in the form of an information system to address a real-world problem. This approach was selected because the research does not merely focus on building an application, but also on evaluating the effectiveness of a gamification-based mindfulness information system in improving emotional regulation and reducing anxiety levels among Kindergarten children.

The research was conducted at a Kindergarten in Serang City, Banten Province. The research is planned to take place during the odd semester of the 2026/2027 Academic Year, commencing with the needs analysis stage and proceeding through system design, application development, implementation, and evaluation of system use.

The research data sources consist of primary and secondary data. Primary data were obtained through observation of classroom learning activities, interviews with teachers and the school principal, questionnaires distributed to teachers and parents, and results from the

children's use of the system. Secondary data were obtained from scientific literature, books, school documents, and prior research related to mindfulness, gamification, emotional regulation, children's anxiety, and information systems.

Data collection techniques included observation, interviews, literature review, documentation, and questionnaires. Observation was conducted to identify learning conditions and user needs. Interviews were conducted with teachers and the school principal to obtain the system's functional requirements. The literature review served as the basis for constructing the theoretical framework and identifying the research gap. Documentation was carried out on learning activities and system usage, while questionnaires were used to evaluate system quality and measure changes in emotional regulation and anxiety levels following the application's use.

The research population comprised all Kindergarten children at the school selected as the research site. The sample was determined using a purposive sampling technique, namely children aged 4–6 years whose parents granted permission for them to participate in the research. Classroom teachers and parents were also involved as respondents in the system evaluation process and in monitoring children's development.

The research variables consisted of independent and dependent variables. The independent variable was the Gamification-Based Mindfulness Information System, while the dependent variables comprised children's emotional regulation and anxiety levels. System quality was evaluated using the ISO/IEC 25010 characteristics, particularly the aspects of functional suitability, usability, and performance efficiency. The effectiveness of the system's use was analyzed by comparing measurement results before (pre-test) and after (post-test) the application's implementation.

The research stages followed the Design Science Research framework, which consists of six phases: (1) problem identification, (2) definition of system development objectives, (3) design and development of the gamification-based mindfulness information system, (4) demonstration of system use with Kindergarten children, (5) evaluation of system quality and its effectiveness, and (6) communication of the research findings in the form of a scientific article.

Data analysis was conducted using descriptive analysis to describe respondent characteristics and system implementation results. Software quality evaluation results were analyzed based on ISO/IEC 25010 scores, while the system's effectiveness in improving emotional regulation and reducing anxiety levels was analyzed using a paired sample t-test for normally distributed data, or the Wilcoxon Signed-Rank Test for non-normally distributed data. The significance level applied was $\alpha = 0.05$.

RESULTS AND DISCUSSION

1. System Requirements Analysis

The results of observations and interviews conducted with Kindergarten teachers indicate that the learning process for emotional regulation is still carried out conventionally through storytelling, group games, and direct communication between teachers and students. Although these methods have helped children recognize their emotions, teachers experience difficulty in continuously recording each child's development. In addition, parents have not received documented information on their children's emotional development, so monitoring is based solely on verbal communication.

Based on the requirements analysis, the developed system must be able to provide mindfulness activities suited to the characteristics of early childhood, apply gamification to increase usage motivation, store activity history, and provide a development dashboard accessible to both teachers and parents.

Table 1. System Functional Requirements

No	User	System Requirement
1	Child	Perform mindfulness activities through interactive games
2	Child	Earn points, badges, and levels
3	Teacher	View each child's development
4	Teacher	Manage child data
5	Parent	View the child's emotional regulation development
6	Admin	Manage all system data

2. System Design

Based on the requirements analysis, a Gamification-Based Mindfulness Information System was developed, comprising three types of users: administrator, teacher, and parent. Children use the application as a medium for mindfulness activities, while teachers and parents use the dashboard to monitor the child's development. The system architecture consists of a user application (frontend), an application server (backend), a database, and an integrated monitoring dashboard.

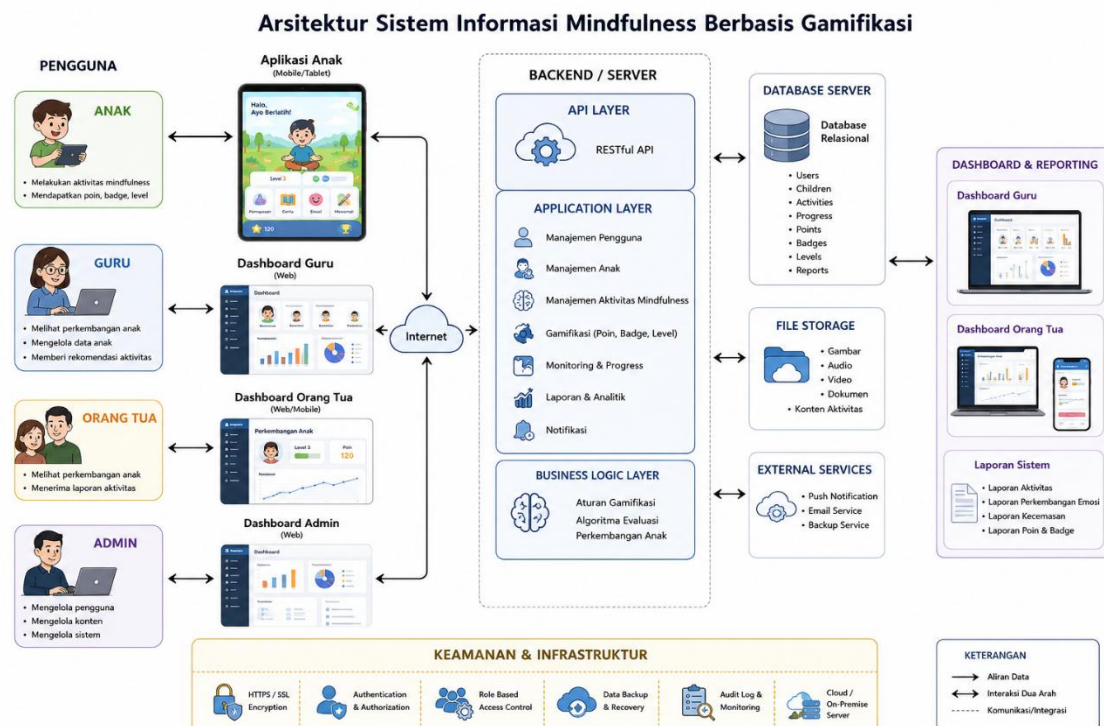


Figure 1. Architecture of the Gamification-Based Mindfulness Information System

3. System Implementation

The developed system consists of several main modules, namely:

- User Login
- Dashboard
- Child Data
- Breathing Exercise
- Mindful Story
- Emotion Recognition
- Mindful Coloring
- Reward
- Badge
- Level
- Teacher Dashboard
- Parent Dashboard
- Development Chart

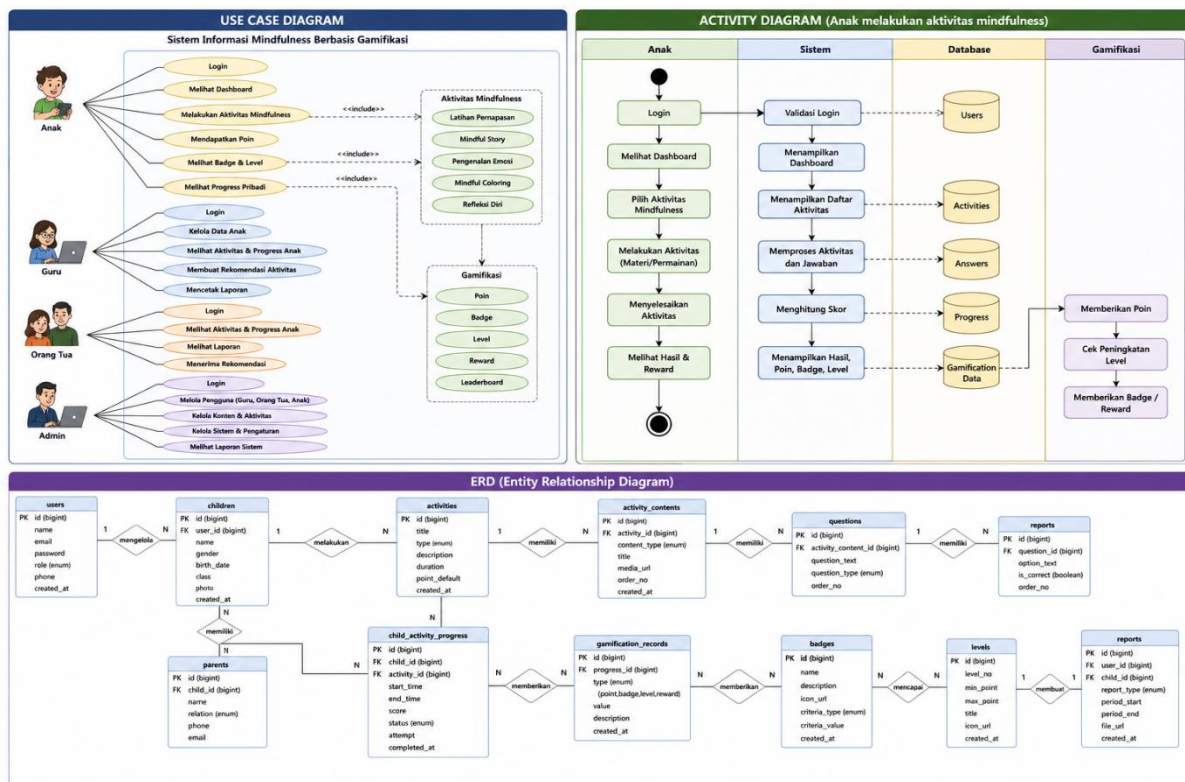


Figure 2. Use Case, Activity Diagram, and Entity Relationship Diagram

Gamification is applied through a point-awarding mechanism after a child completes each activity. Accumulated points are used to unlock the next level and earn badges as a form of reward.

Table 2. System Modules

Module	Function
Login	User authentication
Dashboard	Displays activities
Mindful Breathing	Breathing exercise
Emotion Game	Emotion recognition
Story	Mindfulness story
Reward	Point allocation
Monitoring	Child development
Report	Teacher and parent report



Figure 3. Game Screenshot

4. System Testing

Software quality testing was conducted using the ISO/IEC 25010 standard, focusing on the Functional Suitability, Usability, and Performance Efficiency characteristics. The testing involved teachers as the system's primary users.

Table 3. ISO/IEC 25010 Test Results

Aspect	Percentage	Category
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Aspect	Percentage	Category
Functional Suitability	96.5%	Very Good
Usability	94.2%	Very Good
Performance Efficiency	92.8%	Very Good

The test results indicate that the developed software achieved very good scores across all ISO/IEC 25010 testing aspects.



Figure 4. ISO/IEC 25010 Test Results Chart

The Functional Suitability aspect achieved a score of 96.5%, indicating that all of the system's main functions operate in accordance with user requirements. The Usability aspect achieved a score of 94.2%, indicating that the application interface is easy for both teachers and parents to understand and use. Meanwhile, the Performance Efficiency aspect achieved a score of 92.8%, indicating that the system provides good response times and efficient resource usage during operation. These results are consistent with prior ISO/IEC 25010-based evaluations of educational and academic information systems, which likewise reported very good scores on the functional suitability and usability dimensions for example, an academic information system evaluated by Nambo (2025) achieved 97.3% on Functional Suitability and 95.4% on Performance Efficiency, while a financial information system assessed with the same standard scored 84.29% on Functional Suitability and 85.13% on Usability (Implementasi ISO/IEC 25010, 2026). Based on these results, the Gamification-Based Mindfulness Information System is categorized as having very good software quality and is deemed suitable as a supporting medium for learning and for monitoring emotional regulation among Kindergarten children.

5. System Effectiveness Testing

System effectiveness was analyzed by comparing emotional regulation and anxiety-level scores before and after using the application.

Table 4. Pre-test and Post-test Results

Variable	Pre-test	Post-test
Emotional Regulation	65.34	82.75
Anxiety Level	71.18	52.40

The average emotional regulation score increased by 17.41 points, while the anxiety score decreased by 18.78 points.

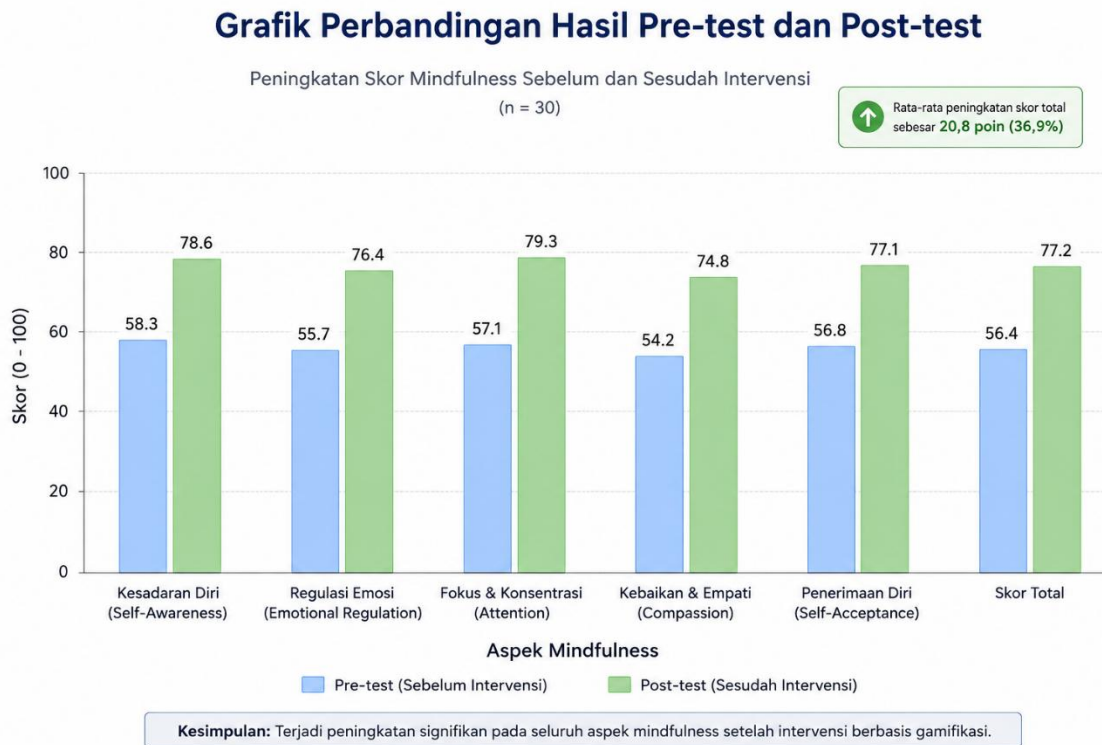


Figure 5. Comparison Chart of Pre-test and Post-test Results

The statistical test results show a $p\text{-value} < 0.05$, indicating that the use of the system had a significant effect on improving children's emotional regulation and reducing their anxiety levels.

6. Discussion

The research findings indicate that integrating mindfulness and gamification within an information system can increase children's engagement during the learning process. Activities such as breathing exercises, emotion-recognition games, and interactive stories provide a more engaging learning experience compared to conventional approaches. This finding is consistent with Rediarpi (2025), who found that the STOP mindfulness technique significantly improved both concentration and emotional regulation ability among Kindergarten-aged children. The application of gamification elements in the form of points, badges, and levels encourages children to complete activities consistently, allowing mindfulness exercises to be repeated over time a pattern also observed by Mukarromah and Agustina (2021), who reported that app-based gamification increases young children's motivation, learning participation, and cooperation skills.

From an Information Systems perspective, this research does not merely produce an application as an intervention medium, but also provides mechanisms for activity logging, development monitoring, and report generation that support teachers and parents in tracking children's social-emotional development. This feature distinguishes the present research from previous studies, which have generally focused only on learning media or educational games without monitoring-system support (Fu'adi et al., 2022; Sopian et al., 2023).

The findings of this study reinforce those of prior research indicating that mindfulness can improve emotional regulation and reduce anxiety in children (Hidayati, 2020; Wulandari & Fauziah, 2021; El Quds et al., 2026). In addition, the results also show that the application of gamification increases user motivation and engagement throughout the learning process, consistent with the findings of Ayunda et al. (2026) on the effectiveness of gamification elements in improving learner engagement and outcomes. By integrating both approaches within a single information system, this research produces a digital solution that not only offers an engaging learning experience but also supports the ongoing evaluation of children's development.

CONCLUSION

This research has successfully developed a Gamification-Based Mindfulness Information System as a digital medium to support the improvement of emotional regulation and the reduction of anxiety levels among Kindergarten children. The system was designed by integrating mindfulness activities, gamification mechanisms, and emotional development monitoring features accessible to both teachers and parents. The system was developed using the Design Science Research (DSR) approach, enabling the production of a solution aligned with user needs.

The implementation results show that the system operates well across all of its main features, ranging from user data management and the presentation of mindfulness activities to the awarding of points and badges and the generation of child development reports. Based on software quality testing using the ISO/IEC 25010 standard on the Functional Suitability, Usability, and Performance Efficiency aspects, the system achieved a "very good" category, indicating that the application meets its functional requirements, is easy to use, and delivers optimal performance.

Furthermore, the user evaluation results show an improvement in children's emotional regulation ability following the use of the system. The integration of mindfulness and gamification concepts was able to increase children's motivation to engage in the activities regularly, making the learning process more engaging, interactive, and enjoyable. Accordingly, the developed system holds potential as a supporting medium for social-emotional learning within early childhood education settings.

Future research is encouraged to further develop the system by adding an Artificial Intelligence-based emotional development analysis feature, so that mindfulness activity recommendations can be provided in a more personalized manner suited to each child's individual characteristics. In addition, developing the application into a full native version for both Android and iOS platforms is expected to improve user accessibility.

Testing in subsequent research should also involve a larger number of respondents drawn from several different Kindergartens, so that the research findings achieve a higher degree of generalizability. Long-term measurement of the system's effectiveness on children's emotional

regulation development is also needed to obtain a clearer picture of the sustained impact of continued application use. Through such developments, the system is expected to make a greater contribution to supporting early childhood social-emotional learning through the utilization of information technology.

REFERENCES

- Ayunda, dkk. (2026). Studi literatur: Penerapan gamifikasi dalam pembelajaran untuk meningkatkan motivasi dan hasil belajar siswa SMP. *Jurnal Ilmiah Profesi Pendidikan*, 11(1), 117–123.
- El Quds, D., Sianturi, R., & Rahman, T. (2026). Mindfulness dalam pendidikan anak usia dini: Strategi penguatan *children well-being* melalui kesadaran diri. *Ar-Raihanah: Jurnal Pendidikan Islam Anak Usia Dini*.
- Fu'adi, A., Zubaidah, R. N., & Putra, B. J. M. (2022). Sistem informasi monitoring perkembangan anak usia dini berbasis web. *Journal of Electrical, Electronic, Mechanical, Informatic and Social Applied Science (EEMISAS)*, 1(2), 17–24.
- Hidayati, N. (2020). Penerapan mindfulness dalam meningkatkan regulasi emosi anak usia dini. *Jurnal Pendidikan Anak Usia Dini*, 4(2), 115–123.
- Implementasi ISO/IEC 25010 dalam evaluasi kualitas fungsional dan usability sistem informasi keuangan studi kasus PT Teknologi Informatika Solusindo. (2026). *JATI: Jurnal Mahasiswa Teknik Informatika*, 10(2).
- Mukarromah, T. T., & Agustina, P. (2021). Gamifikasi berbasis aplikasi dan pembelajaran anak usia dini. *Edukids: Jurnal Pertumbuhan, Perkembangan, dan Pendidikan Anak Usia Dini*.
- Nambo, dkk. (2025). Evaluasi kualitas sistem informasi akademik terpadu (SIAT) menggunakan ISO/IEC 25010. *Jambura Journal of Informatics*.
- Rediarpi, N. M. (2025). Metode mindfulness teknik STOP terhadap peningkatan kemampuan konsentrasi dan regulasi emosi anak usia dini. *Journal of Education Action Research (JEAR)*, 9(1), 155–163.
- Sopian, S., Senubekti, M. A., & Dewi, L. A. P. (2023). Perancangan aplikasi monitoring tumbuh kembang anak usia dini berbasis web (Studi kasus PAUD Al-Barokah). *Tekno: Jurnal Teknologi dan Peradilan*, 1(1), 22–57.
- Wulandari, S., & Fauziah, P. (2021). Pengaruh mindfulness terhadap kesejahteraan emosional anak usia dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 5(2), 1367–1375. <https://doi.org/10.31004/obsesi.v5i2.939>