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Development of a Practical Urban Parenting Module Using Deep Learning Approach

[1]Gustri Wahyuni*, [2]Herlina, [3]Rusmayadi, [4]Syamsuardi, [5]Salma Samputri
[1]*Universitas Negeri Makassar, Indonesia*
[2]*Universitas Negeri Makassar, Indonesia*
[3]*Universitas Negeri Makassar, Indonesia*
[4]*Universitas Negeri Makassar, Indonesia*
[5]*Universitas Negeri Makassar, Indonesia*

*Corresponding Author,Email: gustriwahyuni545@gmail.com

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ABSTRACT

This study aims to develop a Deep Learning-based collaborative parenting module to support the socio-emotional development of children aged 4–7 years in urban early childhood education. The research employed a Research and Development design using the 4-D model, consisting of Define, Design, Develop, and Disseminate stages. The study involved 20 parents, 4 teachers, and 20 children in an urban kindergarten setting. Data were collected through questionnaires, interviews, observations, expert validation sheets, and pretest–posttest assessments. The results show that the developed module is highly valid with a Total Average Validation Score of 3.59. The practicality test indicated very high acceptance from parents with a mean score of 4.91 and positive responses from teachers regarding usability and collaboration support. The effectiveness analysis using the Wilcoxon Signed Ranks Test revealed a statistically significant improvement in children's socio-emotional development ($Z = -4.002$, $p < 0.001$), with all participants showing positive improvement from pretest to posttest.

In conclusion, the Deep Learning-based collaborative parenting module is feasible, practical, and shows promising potential effectiveness in enhancing parent–teacher collaboration and supporting children's socio-emotional development in urban early childhood education contexts.

Introduction

Early childhood education represents a crucial stage in establishing the foundation of children's development, particularly in cognitive, language, socio-emotional, moral, and learning habit domains. Children require consistent stimulation not only from educational institutions but also from the family environment, where parents serve as primary educators and teachers act as supportive partners. The quality of collaboration between parents and teachers is therefore essential in supporting children's social, emotional, and academic development (Zulauf-McCurdy et al., 2024).

In urban early childhood education settings, parents face increasingly complex challenges. Work demands, limited time, pressures of urban life, high mobility, and extensive exposure to digital devices may reduce the quality of parent-child interaction. Liu et al. (2024) found that teacher-parent relationships, work-family conflict, and parenting efficacy are associated with social behavioral problems among preschool children. Furthermore, screen use in early childhood should be considered contextually, including the type of content, co-use with adults, and caregivers' device use within children's daily routines, as these factors are related to children's cognitive and psychosocial outcomes.

Herlina (2025) emphasizes that the integration of technology in early childhood learning requires an adaptive curriculum and professional training for educators to ensure that its implementation remains developmentally appropriate and promotes children's engagement. This highlights the importance of practical parenting guidance that assists parents in providing consistent, meaningful, and reflective caregiving experiences for children. In line with this perspective, the parenting module developed in this study integrates the principles of Deep Learning, namely mindful, meaningful, and joyful learning, to guide parents in supporting children's socio-emotional development while collaborating effectively with teachers.

Communication between schools and families often remains administrative in nature and has not fully supported reflective collaboration. High-quality parent-teacher relationships contribute to the continuity of children's experiences at home and at school. Zulauf-McCurdy et al. (2024) emphasize that interventions aimed at strengthening parent-teacher relationships are important for supporting child development; however, practical strategies that are easy to implement and adaptable to family needs are still required.

Parenting programs implemented in early childhood education institutions are generally delivered through seminars, workshops, or periodic meetings. Although these programs can enhance parents' knowledge, they have not fully provided practical guidance that is systematic, flexible, and applicable to daily life. Parents in urban contexts require parenting modules that include caregiving activities, reflection sheets, connection journals, and guidelines for collaboration with teachers. The parenting module developed may incorporate the principles of observation, imitation, and direct experience, as demonstrated in the AR study at TK Telkom Makassar, which improved children's teamwork, self-control, and empathy (Herman et al., 2025). An effective module should strengthen parents' skills, facilitate structured parent-child interactions, connect home and school contexts, and be presented in a flexible format that suits family needs (Vatou et al., 2026).

Previous studies have shown that parental involvement and parent-teacher relationships support children's socio-emotional development. Liu et al. (2024) found that positive relationships between teachers and parents are associated with lower levels of social behavioral problems among preschool children. In addition, parents' emotion regulation is related to positive parenting behaviors and children's emotion regulation abilities (Zimmer-Gembeck et al., 2022). These findings emphasize that socio-emotional support for children should not only be provided at school but also strengthened through parental involvement at home.

Conceptually, this study adopts a developmental ecological approach, viewing children as individuals who develop through interactions with their immediate environments, particularly the family and school. In early childhood education, the home-school relationship should be built collaboratively so that children receive consistent support. Recent research indicates that parent-teacher relationships are closely related to children's social-emotional competence. The study found that perceptions of the relationship between parents and teachers were positively correlated with the social-emotional competence of young children (Jeon et al., 2026).

The deep learning approach is used as the foundation for module development. In this study, deep learning is understood as a pedagogical approach that emphasizes profound, reflective, contextual, and real-life-related learning experiences, rather than as artificial intelligence technology. Andayanie et al. (2025) explain that deep learning in education can integrate the principles of mindful learning, meaningful learning, and joyful learning to create holistic, reflective, and relevant learning experiences for learners.

The principle of meaningful learning in the parenting module helps parents connect parenting practices with children's real-life experiences, such as playing, storytelling, assisting with simple tasks, observing the urban environment, and discussing emotions. Mindful learning encourages parents' awareness of their emotional states, communication patterns, and responses to children. Joyful learning creates enjoyable caregiving interactions, allowing children to feel safe, valued, and motivated to participate. These principles are essential because the socio-emotional development of young children is highly dependent on the quality of their daily interactions with caregivers.

Based on these considerations, this study focuses on the development of a parenting module entitled *Parenting in the City: Building the Socio-Emotional Intelligence of Children Aged 4–7 Years through Parent-Teacher Collaboration*. This module serves as a practical guide based on deep learning principles that can be used by parents and teachers to support children's socio-emotional development. The study discusses parents' needs for a collaborative module, the module development process, and the feasibility and acceptability of the module based on expert and user evaluations.

The novelty of this study lies in the integration of the urban family context, parent-teacher collaboration, and the deep learning approach into a single practical module. Unlike conventional parenting programs, this module provides applicable guidance, caregiving activities, reflection sheets, connection journals, home-school collaboration strategies, and a digital version. The module is specifically designed to assist parents of children aged 4–7 years in developing children's socio-emotional intelligence through meaningful, mindful, and joyful parenting experiences. Thus, this study produces both a learning product and a collaborative parenting model that is contextualized to the challenges faced by urban families.

Method

This study adopted a Research and Development (R&D) approach to develop a collaborative parenting module based on the Deep Learning framework for parents of children aged 4–7 years in urban early childhood education settings. The study was conducted at TK Nurul Qur'an As Shafa Makassar, involving 20 parents and 4 teachers selected through purposive sampling based on their direct involvement in early childhood caregiving and education. The development process followed Thiagarajan's 4-D model, consisting of Define, Design, Develop, and Disseminate stages.

The Define stage involved a comprehensive needs analysis to identify challenges, expectations, and requirements of parents and teachers in supporting

children's socio-emotional development in an urban context through questionnaires, interviews, and classroom-based observations.

In the Design stage, the initial prototype of the module was developed by determining its structure, learning objectives, Deep Learning-based parenting materials, reflective parent–child activities, reflection sheets, and parent–teacher collaboration guidelines. The module was designed in both printed and digital (flipbook) formats to ensure flexibility and accessibility for urban families with varying levels of digital literacy.

The Develop stage included expert validation and a limited field trial. Expert validation was conducted by three experts, consisting of a material expert in early childhood education, a media design expert in educational technology, and an evaluation expert responsible for instrument validation. The validation focused on content feasibility, instructional design, media presentation, and alignment with Deep Learning principles. The validation results were analyzed using the Total Average Validation Score (RTV) based on a 4-point Likert scale, and revisions were made according to expert feedback, including simplification of language, improvement of visual design, and strengthening of reflective instructions and activity guidance. Following validation, a limited trial was conducted over four weeks, during which the module was implemented by 20 parents at home while 4 teachers monitored children's socio-emotional development in school settings. The module was used continuously as part of daily parenting activities, and observations focused on interaction quality and the implementation of Deep Learning principles. Inter-rater reliability procedures were applied to ensure consistency in observations, and all observation instruments had been previously validated.

The Disseminate stage was carried out through socialization sessions with parents and teachers, including training on module usage, explanation of each unit, and guidance on implementing parent–teacher collaboration strategies. The module was distributed in both printed and digital formats to maximize accessibility and usability in urban contexts. Feedback from users was collected to evaluate practicality and acceptance of the module. Ethical considerations were strictly applied in this study by obtaining informed consent from parents and school authorities, ensuring confidentiality of participant data, and emphasizing voluntary participation. Data were collected using validation sheets, questionnaires, interviews, observations, and documentation. Qualitative data were analyzed thematically to identify patterns of needs and user experiences, while quantitative data were analyzed descriptively to assess validity, practicality, and effectiveness. Due to non-normal data distribution, inferential analysis was conducted using the Wilcoxon Signed Ranks Test with a significance level of 0.05 using SPSS software. The results of the analysis were used to

determine the feasibility, practicality, and potential effectiveness of the Deep Learning-based collaborative parenting module in supporting children's socio-emotional development in urban early childhood education settings.

Discussion

Results and Discussion

This section presents the research findings and discussion on the development of a Deep Learning-based Collaborative Parenting Module for parents of young children in urban kindergarten settings. The product developed in this study is entitled *A Practical Guide to Deep Learning-Based Parenting: Parent Module: Parenting in the City, Building the Socio-Emotional Intelligence of Children Aged 4–7 Years through Parent-School Collaboration*.

The presentation of the findings is organized based on the stages of the 4-D model, namely Define, Design, Develop, and Disseminate. The 4-D model was selected because it provides a systematic framework for developing educational products, beginning with needs analysis, followed by design, development, and product dissemination. Each of these stages is relevant to educational innovation development, particularly in designing a parenting module intended to strengthen home-school collaboration in supporting the socio-emotional development of young children (Waruwu, 2024).

Define Stage

The Define stage was conducted to identify the needs of parents and teachers regarding the development of a Deep Learning-based collaborative parenting module in an urban early childhood education context. Data were collected from 20 parents and 4 teachers at TK Nurul Qur'an As Shafa Makassar through questionnaires, interviews, and classroom observations.

The results of the needs analysis indicated that parents face several challenges in supporting children's socio-emotional development. These include limited time due to work demands, difficulties in managing children's emotional behavior, and limited knowledge of effective parenting strategies. In addition, the increasing exposure of children to digital devices in urban environments further complicates parental involvement in consistent emotional guidance at home.

Teachers also reported that collaboration with parents has not been optimally implemented. Although communication between teachers and parents exists, it is generally limited to administrative matters such as school announcements and daily activities, rather than reflective discussions related to children's socio-emotional development. This indicates that home–school collaboration remains unstructured and lacks continuity in parenting strategies.

Furthermore, both parents and teachers emphasized the need for a structured and practical parenting guide that can bridge the gap between home and school environments. They expressed the need for a module that is easy to understand, applicable in daily life, and capable of facilitating consistent communication between parents and teachers in supporting children's socio-emotional development.

These findings confirm that there is a strong need for a collaborative parenting module based on the Deep Learning approach. Such a module is expected to support reflective parenting practices, strengthen emotional engagement between parents and children, and improve alignment between home and school in fostering socio-emotional development in early childhood.

Design Stage

The Design stage involved the systematic development of the initial prototype of the Deep Learning-based collaborative parenting module based on the findings obtained from the Define stage. The module was designed to address the identified needs of parents and teachers in urban early childhood education settings, particularly in supporting children's socio-emotional development through structured home–school collaboration.

The module structure was developed into four main units, namely Deep Awareness, Deep Connection, Deep Collaboration, and Deep Stimulation. Each unit was designed to reflect the principles of Deep Learning, including mindful learning, meaningful learning, and joyful learning. These principles were integrated to support reflective parenting practices, strengthen emotional bonding between parents and children, and promote enjoyable learning experiences in daily parenting activities.

The content of the module included learning objectives, parenting guidance materials, reflective questions, parent–child interaction activities, reflection sheets, and structured collaboration guidelines between parents and teachers. These components were designed to facilitate both cognitive understanding and practical application of parenting strategies in daily life.

In addition, the module incorporated reflection journals and connection sheets to encourage continuous communication between home and school. These tools were intended to support consistent monitoring of children's socio-emotional development and to strengthen parent–teacher collaboration in a structured and reflective manner.

To ensure accessibility and flexibility for urban families, the module was developed in two formats: printed and digital (flipbook). The printed version was designed for direct use in home settings, while the digital version allowed

easier access through mobile devices, considering the high level of digital engagement among urban parents.

Overall, the Design stage produced a structured prototype that is practical, contextually relevant, and aligned with Deep Learning principles, serving as the foundation for further validation and implementation in the Develop stage.

Develop Stage

The Develop stage involved expert validation, product revision, and a limited field trial to evaluate the feasibility, practicality, and preliminary effectiveness of the Deep Learning-based collaborative parenting module. The Develop stage was carried out through expert validation and a limited trial. Expert validation aimed to assess the feasibility of the module in terms of media, content, and research instruments. The validation results were used as the basis for product revision before the module was tested with users. Validation was conducted by calculating the Total Average Validation Score (RTV) based on the scores provided by the validators. The formula for calculating the Total Average Validation Score (RTV) is as follows:

1. The average score for each indicator from each validator was obtained by dividing the total indicator score by the number of assessment items.
2. The average score for each aspect (Ai) was obtained from the average validator scores for each aspect.
3. The Total Average Validation Score (RTV) was obtained by dividing the sum of the average scores of all aspects by the total number of aspects.

The validation score categories were determined as follows:

$4 > RTV \geq 3.5$: Very Valid (SV)
$3.5 > RTV \geq 2.5$: Valid (V)
$2.5 > RTV \geq 1.5$: Fairly Valid (CV)
$1.5 > RTV \geq 1$: Invalid (TV)

Thus, the RTV score of 3.59 indicates that the module falls into the *Very Valid* category. The results of expert validation in this study are presented in Table 1.

Table 1. Expert Validation Results of the Parenting Module

No.	Validation Component	Average Score	Category
1	Media Validation	3.75	Very Valid

2	Material Validation	3.33	Valid
3	Instrument Validation	3.70	Very Valid
	Total Average Validation Score	**3.59**	**Very Valid**

Based on Table 1, media validation obtained an average score of 3.75, which falls into the *Very Valid* category. This result indicates that the module's visual appearance, layout, illustrations, color composition, navigation, and ease of use have met the criteria as a supporting parenting medium. Content validation obtained an average score of 3.33, which is categorized as *Valid*. This means that the materials in the module are aligned with the development objectives, relevant to parents' needs, and incorporate the deep learning approach, although some refinements are still needed to make the content more communicative and practical for users. Instrument validation obtained an average score of 3.70, which is categorized as *Very Valid*, indicating that the questionnaires and observation sheets used in this study were appropriate for the research objectives and the characteristics of the respondents.

The total average validation score was 3.59, placing the module in the *Very Valid* category. Therefore, the module was considered feasible for limited trial implementation, with revisions based on the validators' suggestions. The validators' feedback focused on reducing text density, simplifying academic terminology, improving the color scheme and visual appearance, and strengthening the instructions on the reflection sheets to make them easier for parents to complete independently. Revisions were carried out by improving the language, adding examples of activities closely related to urban family life, and clarifying the module usage instructions.

Following the validation stage, a limited field trial was conducted over a period of four weeks in TK Nurul Qur'an As Shafa Makassar. The trial involved 20 parents and 4 teachers, while 20 children aged 4–7 years participated indirectly through home-based and school-based implementation. During this period, parents used the module as part of daily parenting activities, while teachers observed children's socio-emotional development in classroom settings. The implementation focused on consistent use of reflective activities, parent–child interaction tasks, and structured communication between parents and teachers. The limited trial was conducted to examine

users' acceptance and the practicality of the module. Parents' responses to the module are presented in Table 2.

Table 2. Parents' Responses to the Parenting Module

NO.	ASSESSED ASPECT	AVERAGE SCORE	CATEGORY
1	Content Feasibility	4.94	Very Good
2	Language and Readability	4.87	Very Good
3	Appearance and Design	4.91	Very Good
4	Ease of Use	4.95	Very Good
5	Deep Learning Approach	4.88	Very Good
6	Impact on Children	4.94	Very Good
7	Teacher Collaboration	4.88	Very Good
	Overall Average	4.91	Very Good

Based on Table 2, parents' responses to the module were categorized as very good in all aspects. The ease-of-use aspect obtained the highest score, namely 4.95. This finding indicates that the module is easy to use independently at home, that the activities provided are realistic to practice with children, and that the activity steps can be followed by parents. The aspects of content feasibility and impact on children each obtained a score of 4.94, indicating that parents considered the module content appropriate to the needs of early childhood parenting and helpful in enabling them to observe changes in children's social-emotional behavior.

The appearance and design aspect obtained an average score of 4.91, while the deep learning approach and teacher collaboration aspects each obtained a score of 4.88. This indicates that parents not only found the module visually attractive but also experienced the benefits of reflective activities, meaningful activities, and collaboration guidelines with teachers. The language and readability aspect obtained a score of 4.87 and remained in the very good category. Although this score was still very high, it may serve as a note that the use of terms in the module should continue to be simplified so that it can be understood by parents from various backgrounds.

The overall average parent response score of 4.91 indicates that the module was very well accepted and had a high level of practicality. This

positive acceptance strengthens the finding that the module is not only feasible according to validators but can also be used by the intended users. Parents felt assisted because the module provided clear guidance, examples of activities that were easy to implement, and reflection sheets that helped them evaluate how they communicated and responded to children's emotions. Teachers were also assisted because the module provided common language and strategies that could be aligned between home and school.

In addition, the effectiveness of the Deep Learning-based collaborative parenting module was analyzed using the Wilcoxon Signed Rank Test to examine differences between pretest and posttest scores of children's socio-emotional development. This non-parametric test was applied due to the non-normal distribution of the data. The results of the Wilcoxon test are presented in Table 3.

Table 3. Wilcoxon Signed Rank Test Results of Pretest and Posttest Scores

Category	**N**	**Mean Rank**	**Sum Of Ranks**
Negative Ranks (Posttest < Pretest)	0	0.00	0.00
Positive Ranks (Posttest > Pretest)	20	10.50	210.00
Ties (Posttest = Pretest)	0	-	-
Total	**20**		

Statistic Test

Statistic	**Value**
Z	-4.002
Asymp. Sig. (2-tailed)	0.000
lpha	0.05

The results show that all participants (N = 20) experienced an increase in posttest scores compared to pretest scores, as indicated by 20 positive ranks and no negative ranks or ties. This demonstrates a consistent improvement in children's socio-emotional development after the implementation of the parenting module.

Furthermore, the Wilcoxon Signed Rank Test revealed a statistically significant difference between pretest and posttest scores ($Z = -4.002$, $p < 0.001$). Since the significance value is lower than 0.05, it indicates that the difference is statistically significant.

These findings suggest that the Deep Learning-based collaborative parenting module has a positive impact on improving children's socio-emotional development. However, the results should be interpreted as preliminary evidence of effectiveness due to the limited sample size and absence of a control group.

Disseminate Stage

The Dissemination stage was conducted to introduce, distribute, and evaluate the acceptance of the Deep Learning-based collaborative parenting module in real educational settings. This stage aimed to ensure that the developed product could be implemented effectively by parents and teachers in supporting children's socio-emotional development.

The dissemination process was carried out through structured socialization sessions involving parents and teachers at TK Nurul Qur'an As Shafa Makassar. During these sessions, the researcher provided guidance on the use of the module, explained each unit of the module, and demonstrated how reflective parenting activities and parent–child interaction tasks should be implemented in daily practice. In addition, strategies for strengthening parent–teacher collaboration through structured communication were also introduced.

The module was distributed in both printed and digital (flipbook) formats to accommodate the varying accessibility needs of urban families. The digital version was designed to increase flexibility and usability, particularly for parents with high mobility and limited time for direct learning sessions.

Feedback from participants was collected during and after implementation to evaluate usability, clarity, and acceptance of the module. The responses indicated that both parents and teachers perceived the module as easy to use, relevant to daily parenting needs, and helpful in strengthening communication between home and school. This feedback also served as a basis for minor refinements to improve clarity and user experience.

Ethical considerations were strictly applied throughout the dissemination process. Informed consent was obtained from all parents and school authorities prior to implementation. Participants were informed about the purpose of the study, voluntary participation, and confidentiality of data usage.

Overall, the Dissemination stage confirmed that the module is acceptable and feasible for broader implementation in early childhood education settings, particularly in urban contexts where structured parenting support and home–school collaboration are highly needed.

Discussion

The findings of this study indicate that the development of a collaborative parenting module based on the deep learning approach is relevant to the needs of parents and teachers in urban settings. Urban family challenges, such as limited time, work pressure, high mobility, and the increasing use of digital devices among children, require practical and flexible parenting guidance. This condition is in line with Liu et al. (2024), who found that teacher-parent relationships, work-family conflict, and parenting efficacy are associated with social behavioral problems among preschool children. In addition, the context of screen use in early childhood, including caregivers' use of digital devices within children's daily routines, is related to children's cognitive and psychosocial outcomes. Therefore, families need parenting strategies that can guide children toward more meaningful real-life activities (Latifa, 2024). Furthermore, the development of this parenting module aims to enhance children's independence through the stimulation of interpersonal intelligence and social skills integrated into play activities and collaboration with teachers (Rusmayadi, 2019). Thus, the module developed in this study addresses these needs by providing concise materials, simple activities, reflection journals, and collaborative strategies that can be applied in daily life.

The findings from the Define stage show that collaboration between parents and teachers still needs to be strengthened, particularly in supporting children's socio-emotional development. This is consistent with Habibullah et al. (2024), who emphasized that positive parent-teacher relationships are associated with lower levels of social behavioral problems among preschool children. This collaboration is also supported by the review conducted by Parera & Supriadi (2025), which highlights the important role of parent-teacher collaboration in children's socio-emotional development, while also exploring practical strategies such as regular communication, parental involvement development, and strong partnerships that can be replicated in early childhood learning contexts. When parent-teacher communication is

active and reflective, children receive more consistent support between home and school. Such consistency is important because young children need repeated experiences, aligned disciplinary language, and stable emotional responses from the adults around them.

The findings of this study also support the findings of Li and Lagos (2026), who stated that parent-teacher collaboration can enhance children's social-emotional learning in kindergarten through two-way feedback, contextual collaborative guidance, and structured communication. The module developed in this study facilitates such forms of involvement through parenting activities, reflection sheets, connection journals, and dialogue guidelines with teachers. Therefore, this module does not merely function as reading material, but also serves as a bridging medium between parents and teachers in supporting children's socio-emotional development.

The use of the deep learning approach is one of the main strengths of this module. Masayu Andayanie et al., (2025) explain that the deep learning approach in education can integrate the principles of mindful learning, meaningful learning, and joyful learning to create learning experiences that are more holistic, reflective, and relevant to twenty-first-century needs. The principle of meaningful learning helps parents connect parenting practices with children's real-life experiences, such as playing, storytelling, helping with simple tasks, discussing feelings, and observing the urban environment. The principle of mindful learning encourages parents to become more aware of their emotional states, communication patterns, and responses to children. Meanwhile, the principle of joyful learning helps create enjoyable parenting experiences, allowing children to feel safe, valued, and motivated to interact.

The integration of deep learning principles is reflected in the four units of the module. *Deep Awareness* encourages parents to avoid reactive responses and begin developing self-regulation before guiding their children. This is supported by Zimmer-Gembeck et al. (2022), who found that parents' emotion regulation is associated with positive parenting behaviors and children's emotion regulation abilities. *Deep Connection* helps parents develop children's emotional literacy through emotion naming, emotional validation, and co-regulation. A review by Al Adawiyah et al. (2026) shows that mindful parenting, caregivers' emotion regulation, and children's emotion regulation are interconnected within daily parenting interactions.

Deep Collaboration strengthens the alignment between home and school through agreements, connection journals, and parent-teacher dialogue. *Deep Stimulation* guides parents to utilize the urban environment as a space for

socio-emotional learning while reducing children's dependence on digital devices through meaningful real-life activities. The integration of play experiences and interactive learning in this parenting module is similar to the implementation of Creative Apron Media, which has been shown to improve children's numerical skills and participation (Herlina et al., 2025).

The expert validation results indicate that the module has strong feasibility, particularly in terms of media and instruments. Content validation was categorized as valid, indicating that the module content is appropriate to the needs of early childhood parenting, although it still requires refinement to make it simpler, more communicative, and closer to parents' lived experiences. This finding suggests that parenting modules for urban families should be developed using easy-to-understand language, attractive visual design, and realistic activities. A module that is overly theoretical may be difficult to implement; therefore, a practical and reflective approach is more appropriate. This finding is consistent with Vatou et al. (2026), who stated that effective parenting programs should strengthen parents' skills, facilitate structured parent-child interactions, integrate home and school contexts, and provide flexible formats suited to family needs.

The high practicality scores from parents and teachers indicate strong acceptance of the module. Parents particularly highlighted ease of use and relevance to daily parenting challenges, suggesting that the module is suitable for integration into busy urban family routines. This finding reinforces Amallya et al. (2025), who argue that parenting interventions are more effective when they are feasible, flexible, and directly applicable in everyday contexts.

The improvement in children's pretest and posttest results indicates positive changes in socio-emotional development after the use of the module. Children progressed from the category of beginning to develop to developing very well. This change is related to the activities in the module that encourage parents to help children recognize emotions, name feelings, use calming strategies, develop empathy, follow rules, and shift from digital device use to meaningful real-life activities. With teacher support, children's experiences at home and at school became more aligned, thereby strengthening socio-emotional development consistently. This finding is consistent with Daulay et al. (2023), who showed that parenting programs can improve emotion recognition, emotion regulation, empathy, prosocial behavior, and positive discipline among preschool children.

The novelty of this study lies in the integration of the urban family context, parent-teacher collaboration, and the deep learning approach into a single module. Unlike conventional parenting programs, this module provides guidance that can be used independently and continuously by parents. The module is available in both printed and digital formats, offering flexibility for parents to access the material according to their needs and circumstances. This finding is consistent with Magister & Herlambang (2025), who affirm that deep learning pedagogy involves reflective awareness and active engagement in meaningful education.

Although the findings indicate the feasibility, acceptance, and improvement of children's socio-emotional development, this study has several limitations. The trial was conducted in only one kindergarten, so the findings cannot yet be widely generalized. The measurement of effectiveness was still descriptive, based on pretest and posttest scores. Further research is recommended to involve a larger number of participants, a longer implementation period, and more in-depth statistical analysis. This is in line with Parveen and Singh (2023), who noted that interventions aimed at strengthening parent-teacher relationships in early childhood education require stronger designs, strategies, and impact measurements.

Conclusion

This study developed a Deep Learning-based collaborative parenting module to support children's socio-emotional development in urban early childhood education settings. Based on the findings, it can be concluded that the developed module demonstrates good feasibility, high practicality, and promising potential effectiveness in supporting collaborative parenting practices between parents and teachers.

First, the needs analysis indicated that parents and teachers in urban contexts require structured and practical parenting guidance due to limited time, parenting challenges, and weak home–school collaboration. These conditions highlight the importance of developing a collaborative parenting intervention that is easy to apply and contextually relevant.

Second, the module was successfully developed using the 4-D model and organized into four structured units, namely Deep Awareness, Deep Connection, Deep Collaboration, and Deep Stimulation. These units integrate the principles of mindful, meaningful, and joyful learning to support reflective parenting practices.

Third, expert validation results confirmed that the module is highly valid with minor revisions, while the practicality evaluation showed very high

acceptance from both parents and teachers. This indicates that the module is easy to use and suitable for implementation in daily parenting practices.

Finally, the effectiveness analysis using the Wilcoxon Signed Ranks Test revealed a statistically significant improvement in children's socio-emotional development after the implementation of the module ($Z = -4.002$, $p < 0.001$). All participants showed improvement, indicating consistent positive change across the sample.

However, these findings should be interpreted as preliminary evidence of effectiveness due to the limited sample size and the absence of a control group. Future research is recommended to involve larger samples and more rigorous experimental designs to strengthen the generalizability and causal inference of the findings.

Overall, the Deep Learning-based collaborative parenting module can be considered a feasible, practical, and promising intervention to enhance parent–teacher collaboration and support children's socio-emotional development in urban early childhood education contexts.

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