Enhancing Cognitive Development In Kindergarten Children Through A Computer-Based Model With The Reggio Emilia Approach

Parwoto Parwoto[1*], Sitti Nurhidayah Ilyas[2], Dedy Aswan[3]

[1,2,3] Universitas Negeri Makassar, Indonesia
[1*] parwoto@unm.ac.id; [2] nurhidayah.ilyas@unm.ac.id;
[3] dedy_aswan@unm.ac.id

Abstract. The problem of this research is how the cognitive development of computer-based models with the Reggio Emilia approach can enhance children's creative thinking in school. The method used is Mix Method. Methods of data collection used include questionnaires, interviews, observation, and documentation. Descriptive qualitative technique percentages processed data collected to see the level of specific categories and dimensions. The steps performed at the level of the needs assessment, the content validation, and operational or empirical validation of the model. The results of the needs assessment models in general REA PKBK-oriented game experience through the adoption of the program Microsoft Paint, correl draw, and adopt photoshop is needed in schools, particularly for gifted education services. Results of test analysis are limited, and classes showed that there were significant differences between groups of children creativity of children who follow the Reggio Emilia approach and conventional, where creativity plays a computer for children who attend computer-based models of cognitive development at Reggio Emilia system is better than a group of children who follow traditional learning. PKBK-REA models and tools have been developed effectively and efficiently in developing children's creativity in kindergartens.

Keywords: Model, cognitive, computer, Reggio Emilia, children, kindergartens

1 Introduction

Education is an essential aspect of child development, especially in kindergarten. This stage is the initial foundation for the child's learning ability and cognitive development. One skill that must be optimally developed in kindergarten children is the ability to thinking this case, teaching children to think while learning has a crucial role [1], [2]. Developing ways of thinking while learning in kindergartners can help build a strong foundation for understanding concepts[2], [3]. Through thinking while learning, children can think critically and analyze the information provided. For example, when facing simple math problems, children are invited to find solutions through

M. Salimi et al. (eds.), *Proceedings of the 7th International Conference on Learning Innovation and Quality Education (ICLIQE 2023)*, Advances in Social Science, Education and Humanities Research 873,
https://doi.org/10.2991/978-2-38476-301-6_18

logical thinking. In this way, children can develop the ability to understand mathematical concepts more deeply. In addition, thinking while learning also helps kindergarten children to develop problem-solving skills, children often face various challenges that require creative solutions [4], [5]. Through thinking while learning, children invite to find the best alternative solution[6]. For example, children can look for patterns and strategies to complete tasks when playing puzzles effectively. This process trains children to think outside the box and cultivate confidence in facing challenges. Children receive multiple thinking abilities or intelligence that they use for learning. How so can children learn while developing a way of thinking.

A group of people in the industry organizations developed the model by adopting a model created by William JJ Gordon for developing a creativity group[7]. They trained people to work together as problem solvers or product developers. Gordon's synectics adapted for teaching in schools for children, and the material's content received widespread publicity. The process developed from an assumption about the psychology of creativity. First, bringing the process of creativity can enhance the creative abilities of both individuals and groups. The second assumption is that the emotional component is more important than the intellectual and the irrational rational[8]. Creativity is the development of new mental patterns, exploring and expanding the idea, but not a decision-making step[8]. Many rational and intellectual problem solving, but with the addition of irrational, we can expect the possibility of raising fresh ideas. To provide chances of success in problem-solving, the third assumption highlights the importance of highlighting irrational and emotional elements. The design of Reggio Emilia's approach enhances the creativity of individuals and groups. Sharing experiences can build a sense of community among children. Children learn to follow the ideas of class members and then react to ideas and problem-solving in class [9]–[11]. This learning model has the potential to contribute to the process of togetherness[10], [12]. The procedure helps commensurate creations together in a simple way to develop the children's creativity because they can play a full, fast, although the degree supports low participation. The cognitive development model includes elements of (1) general creative capacity, 2) creative capacity in the subject domain, 3) achievement in the subject domain, and 4) group cohesion and productivity Design and technology require intuition, spatial orientation, skills, expertise, emotion, expression (all are operating right hemisphere), also language, sequence, logic, and mathematical operations [13], [14].

Noteworthy, in particular, to give children space to access the functions of the right brain hemisphere by providing an opportunity to bring up and classify ideas through collaboration, discussion, also modeling, sketching, painting, construction of squares, technology, and design of the information describing the package, Relating to the elements that must be developed in creativity playing the computer, Cross revealed that "the element of creativity in playing the computer include: (1) operational capability: thought, action, and constructive action; (2) the reflective capabilities: evaluation, review (the review), and (3) imagination, invention, includes aesthetic and technological creativity "[15]–[17]. Creative play through computer media provides unlimited opportunities for children to imagine for themselves [18]–[20]. Children can develop creativity through painting done through the Microsoft Paint program. Paint-

ing is one way to develop talent, innovation, and creativity, as well as one of the essential fields in realizing the creative self and artistic talent of students in general and artistic talent in kindergarten children in particular[21]–[24]. Microsoft Paint with children can draw anything they want, like pictures of birds that fly in space are realized in the form of an image on the computer screen with a modification direction, large and small, placement, and duplication or deletion. One way is to develop a computer-based learning model applying the Reggio Emilia Approach (REA) to develop children's cognitive[25]. The main problem in this study is "How is the shape of the model-based development of the cognitive abilities of a computer with the Reggio Emilia Approach in children kindergarten effective and efficient for improving children's cognitive abilities?

2 Method

This study aims to produce a computer-based model of cognitive development by approaching The Reggio Emilia on kindergarten children. This research uses mix method in analysis. The shape of the model in question in the form of learning sets, textbooks, teacher guidebooks, learning modules, and assessment systems related to the development of children playing computer creativity [26], [27].Research subjects that teachers and children at kindergarten class B Lotus UNM Makassar and Gowa TK Al Fityan School teacher and child are both kindergarten class B. The number of children involved is a class of 20 children. Then the teachers involved as many as four people. Then, the number of children involved as research subjects in the test phase expanded by 40 children each, 20 children in kindergarten Lotus UNM Makassar and 20 kindergartners in Al Fityan School Gowa. The number of teachers involved is as many as six people. This study used data collection instruments and treatment instruments. Treatment instrument consists of textbooks, handbooks, modules that play and plan learning activities, and assessment systems that play computer creativity. Developing an instrument collecting data on children's creativity in playing computer as a figural test. The Analyses of research data were conducted using a descriptive approach accompanied by a narrative corresponding to the research interests. In addition to knowing the implementation of the Model PKBK-REA, the tendency criteria proposed are used in school. Qualitative analysis was performed to analyze the data results of PKBK-REA Model validation by experts who provide input to repair.

3 Result

3.1 Results Needs Assessment Model

Based on data analysis, findings of the first year of the study, it can be concluded as follows: (1) The results of the needs assessment on the cognitive development of computer-based model of the Reggio Emilia approach to kindergarten children aged 5-6 years, showed that cognitive development Computer-based Reggio Emilia approach is needed and feasible in kindergarten, especially for class B; (2) cognitive

development model based computer with Reggio Emilia approach to kindergarten children aged 5-6 years who developed, consisting of components, rational, objectives, scope, objectives, basic assumptions / principles of work, implementation procedures, teacher guides, working modules children, and the development of assessment instruments worthy of being a reference in the computer-based cognitive development in children kindergarten; (3) Assessment of the needs of the computer-based models of cognitive development at Reggio Emilia approach is showing results: (a) The teacher as the main implementing computer-based learning media aware of the advantages of the computer as a medium of cognitive development that is more comprehensive; (B) Head of the kindergarten as policy makers recognize that the cognitive development of computer-based models with Reggio Emilia approach that focuses on the development of convergent and divergent thinking children should be developed in kindergarten are already ready with the technology and human resources; (4) Assessment of the needs of the computer-based models of cognitive development at Reggio Emilia approach in kindergarten shows the results: (a) At the implementation level, generally the teacher stated excited and will learn more about how media computers can be used as a medium of learning that has to be entered into class; (B) At the level of knowledge, in general, many teachers also do not have knowledge about computers as a learning medium that is able to develop the full potential or intelligence of children; (C) At the level of expectations about the implementation of computer-based cognitive development with Reggio Emilia Approach oriented experience through playing with micro-soft paint program, Corral draw, and adopt pictures are always trained or studied together early childhood educators; (D) At the level of support, teachers and children expressed very supportive if the computer-based learning oriented to the development of creativity are implemented collaboratively or independently in the category support; (5) The results of the assessment needs of the computer-based cognitive development model that aims to develop the ability to think creatively general child-oriented game experience through the adoption of the program micro-soft paint, draw corral, and adopt photo is needed in schools, particularly for gifted education services. Therefore, it is urgent to develop a computer-based cognitive development model oriented towards the development of creative thinking ability of children; (6) a computer-based model of cognitive development at Reggio Emilia oriented approach creativity through the medium of computer experience, consisting of components of the model, namely the rational, objectives, scope, objectives, basic assumptions, and working principles, system support, the role of teachers, procedures implementation, and evaluation, as well as implementation guidelines; has met the eligibility requirements stated contents / conceptual according to the experts: educational technology and feasibility of empirical / operational assessment based school teachers; (7) To date there has been no commencement of the study the cognitive development of computer-based models with Reggio Emilia approach to kindergarten children aged 5-6 years, so the application of the model-REA PKBK be an alternative to the development of children's creativity.

3.2 Limited Test Results

The PKBK-effectiveness assessment model REA was taken only from two sources: a teacher and three (3) people. Five aspects are considered: validity, reliability, objectivity, systematic, and practical. Observations applied model PKBK-REA in a class conducted by two observers and over five meetings. The observation of the two men showed that the model PKBK-REA at the first meeting with attendance was lower than the second, third, fourth, and others. The low yield for the first phase suspected that they are is that the computer-based learning that develops the function of the correct brain thinking, imagination, and creativity that made kindergarten has been less effective, even just more emphasis on edu-game forms loaded on the low motivation of playing children. But after the second exercise, the third, and so on, teacher-savvy can plan their own Daily Activity Plan (RKH) and carry out the PKBK-REA Model with more and better. Overall syntax PKBK-REA Model designed by researchers is already performing very well.The indication shows that the teacher can implement the syntax Model PKBK-REA very well, which has been done. This fact also demonstrates that the model developed by PKBK-REA is practical and easily implemented by teachers. The consistency and stability of the observer in observing adherence to the Model PKBK-REA from meeting to the meeting are known from calculating the percentage of agreement. It can be said that the consistency and stability of Analysts are very high. This is shown by the high percentage of agreement (≥ 94%) for each meeting. Overall, the percentage of observer agreement of 95%. It means that 95% of both observers have the same perception and outlook of the construct observation sheet were observed. Thus, data on the feasibility Model PKBK-REA in the class have a high degree of regularity.

3.3 Expanded Test Results

Five aspects are considered: validity, reliability, objectivity, systematic, and practical. Model effectiveness assessment results signify the PKBK-REA HSIL assessment conducted by teachers, which all signify the PKBK-REA Model is effectively used. It is Effective because the Model PKBK-REA has a valid and reliable instrument is very objective in its assessments, and is systematic and practical in its implementation. Observations implementation Model PKBK-REA in a class conducted by two observers for each class and carried out during the five meetings. There are 15 aspects considered by observers that the implementation of Model PKBK-REA at the first meeting is lower than the other four meetings. Overall, the implementation of Model PKBK-REA in the classroom during the tests is very well. The average adherence of 94.99% shows this. However, any such meeting of kindergarten class B Al Fityan School and preschool “Dharma Wanita” lotus UNM for the first meeting of its appropriateness is only 69.44% specified aspects accomplished. But for the second and subsequent meetings, on its appropriateness in the top 90%. This incident is a natural thing. These two classes of new use PKBK Model-REA for the first time. The mental readiness of teachers and children in applying the model PKBK-REA needs process and time. In contrast to the kindergarten class B Al Fityan School Gowa, teachers

who teach in the classroom is the teacher who often receive training in ICT-based learning in an expanded trial. For these classes, the implementation model PKBK-REA is very good.

Observation of teacher activity in expanded trials conducted in 4 classes. Aspects observed consist of three parts: the initial activity, core activities, and activities end. The beginning of activities includes five aspects, aspects of the eleven core parts, and the end of the two aspects. So there are 18 aspects observed during the learning takes place. Observations made during the five meetings, Measurement consistency and stability of the observer (rater) is done by calculating the coefficient K and coefficient K greater than the criteria used for each meeting. It shows that the observer is providing consistency, stable ratings, and an increasing trend. Overall, the consistency and stability of data observations of teacher activity were calculated by taking the average of the five meetings, namely 0.83. This Result shows that both observers have the same perception and understanding, around 83%, to construct the instruments they use to observe the activities of teachers. This coefficient is greater than the criteria used so that the data obtained from observations of the activities of teachers have high constancy.

3.4 Hypothesis Testing

The results of tests of creativity play computer data showed the creativity of playing computer between children who use collaborative methods (project) and a group of children who use independent methods. Test the hypothesis in this study was conducted with statistical methods that use the formula one track. The result using two lanes analysis of variance result that the value of F count = 5.0864 is greater than the value of Ftable = 4.00 for a significance level of 0.05 (F count = 5.0864> F table (0.05) (1; 63) = 4.00). There is a significant difference in effect between collaborative and independent learning methods on the creativity of children playing computer games. Further, note the average score obtained by the two groups. Groups of children who followed the collaborative learning methods (group A) had an average score of 62.81 for creativity in playing on the computer. In contrast, a group of children who followed their learning methods (group B) had an average score of 59.13 for creativity playing on the computer. So different test shows that the creativity of children playing computer games following the collaborative learning method is higher than that of children playing computer games following the self-learning method.

Table 1. Summary of Difference Test Results

Sumber Varians	**dk**	**JK**	**RJK (JK/dk)**	**F count**	**F table (ά 0,05)**
- Antar A (Learning)	1	217	217	5,0864**	4,00

4 Discussion

This Study found differences in creativity between a group of children playing computer games that use collaborative learning methods and a group of children who use the self-learning method. This Study, evidenced by the analysis of the variance of two lanes 5.0864 F, calculated the price obtained to be significant. In this case, the mean score for the creativity of children playing computer games for children who use the collaborative learning method is higher than the mean score for the creativity of children in groups of children who follow their learning methods in learning computers. More collaborative learning methods allow children to share experiences and play with computer skills in developing their intellectual potential in learning activities developed by computers [28]–[30]. The self-study learning method focuses on individual work for each child so that the skills, experience, and intellectual development are based on their development in computer play [28], [31], [32]. Collaborative learning should only let one group member understand the issues being discussed or done. Learning activities in each meeting centered on cooperation among children. Children who do not understand the material playing on the computer can ask the other children who have understood the material. Likewise, children who already know and understand the material creativity in playing computer must teach a friend who does not understand[33]. Through learning, each encounter is also a practice arena for discussion, mutual respect, acceptance, and giving opinions on others, ultimately raising confidence in each child.

During this time, the computer learning in kindergarten Al Fityan School and kindergarten Lotus learning methods developed more oriented toward individual tutorial methods. Teachers are more dominant in learning the computer, so children tend to be passive. Even if children are actively involved by giving the freedom of children playing on the computer, then some children cannot compete with the other children[34], [35]. Therefore, a suitable learning method to improve children's creativity in playing computer games should be introduced to the teachers. The collaborative learning method allows the formation of cognitive strategies to help the child's ability to think internally and organize in problem-solving, decision-making, critical thinking, and creativity[36]. A learning process like this can cause the acquired knowledge to last long in children's memory. This the collaborative learning method in computer learning is more effective in improving children's creativity in playing with the computer when compared to the creativity of the child playing with a computer to a group of children who use the self-learning method in learning computer.

Although this research is pursued to the fullest, realize that researchers must recognize shortcomings and limitations. However, it cultivated as much as possible to overcome them. Limitations include: (1) The implementation of this study did not separate the child who is the subject of research from children who are the subject of research. This show that the child who is the subject of research joined together and experimented, receiving treatment with children who are not the subject of research. Thus, the effect of interaction between children with various learning processes beyond the research material can't be avoided. It can have good affect the results of children's creativity in playing computer [37]; (2) This study only measured the as-

pects of creative thinking abilities of children, in terms of learning computer affective and social aspects through the implementation of collaborative learning methods are also indispensable achievement, as well as levels of speed (acceleration) of children who have high motivation to play computer, aspects ZDP (proximally development zone) is also indispensable. The accelerated program gives more learning freedom, provides opportunities, and allows children to dig for hidden excellence in personhood[38], [39]. (3) The instrument used in this study is not a standard instrument, although developed with the methodological procedures required, ranging from the study of theory, translation constructs into dimensions and indicators, and develop it in the form of grains of instruments, test, test validation, and calculate the reliability of the instrument. After it was constructed in a data collection tool as an instrument developed by the researchers, it was realized that the measurements have not fully described the actual attributes attached and owned by the subjects of research; (4) Changes in the biological and psychological conditions such as age, fatigue, and saturation that occurs during this study certainly affect the children's creativity in playing computer games[40], [41]. Hence the tendency of the limitations in this study is possible. In connection with these limitations, then the users and decision-makers, including computers for teachers of kindergarten children who will implement and develop the findings of this research[42]. This are expected to pay attention to things that become weaknesses or limitations to this study.

5 Conclusions and Suggestions

Based on the study's findings, it can conclude that implementing a computer-based model using the Reggio Emilia approach for cognitive development in kindergarten children aged 5-6 years is necessary and feasible. The developed model comprises various components: rationale, objectives, scope, working principles, implementation procedures, teacher guides, child activity modules, and assessment instruments. This model can be a valuable reference for computer-based cognitive development in kindergarten settings.The study suggests several recommendations based on the findings: Firstly, teachers should actively enhance their knowledge and skills in effectively utilizing computers as a comprehensive medium for cognitive development. Continuous professional development opportunities can provide to support teachers in this aspect. Secondly, kindergarten administrators are crucial in supporting and promoting the implementation of computer-based cognitive development models. Ensuring the necessary technology and human resources are available to facilitate successful implementation is essential.

Furthermore, efforts should enhance teachers' understanding of using computers to fully develop children's potential and intelligence. Providing training and resources can help teachers effectively utilize computer-based approaches in their teaching practices. Additionally, implementing computer-based cognitive development should incorporate experiential learning approaches, utilizing programs such as Microsoft Paint, Corel Draw, and photo adoption. These programs can provide valuable experiences for children, fostering their creativity and cognitive growth. Overall, there is a

need to develop and implement a computer-based cognitive development model that targets explicitly enhancing children's creative thinking abilities in the context of early childhood education. By following these recommendations, educators can effectively utilize computer-based approaches to support cognitive development in kindergarten children.

References

1. R. J. Duncan, G. J. Duncan, L. Stanley, E. Aguilar, and N. Halfon, 'The kindergarten Early Development Instrument predicts third grade academic proficiency', *Early Child Res Q*, vol. 53, pp. 287–300, 2020, doi: 10.1016/j.ecresq.2020.05.009.
2. J. P. Byrnes, A. Wang, and D. Miller-Cotto, 'Children as mediators of their own cognitive development in kindergarten', *Cogn Dev*, vol. 50, pp. 80–97, Apr. 2019, doi: 10.1016/J.COGDEV.2019.03.003.
3. J. P. Byrnes, D. Miller-Cotto, and A. H. Wang, 'Children as mediators of their own cognitive development: The case of learning science in kindergarten and first grade', *Journal of Cognition and Development*, vol. 19, no. 3, pp. 248–277, May 2018, doi: 10.1080/15248372.2018.1470975.
4. N. Y. Kong, J. J. Carta, and C. R. Greenwood, 'Studies in MTSS Problem Solving: Improving Response to a Pre-Kindergarten Supplemental Vocabulary Intervention', *Topics Early Child Spec Educ*, vol. 41, no. 2, 2021, doi: 10.1177/0271121419843995.
5. L. Hollenstein, S. Thurnheer, and F. Vogt, 'Problem Solving and Digital Transformation: Acquiring Skills through Pretend Play in Kindergarten', *Educ Sci (Basel)*, vol. 12, no. 2, 2022, doi: 10.3390/educsci12020092.
6. R. Srihilmawati, 'PROBLEM SOLVING ABILITY IN EARLY CHILDREN'S MATHEMATICS LEARNING', *International Journal of Emerging Issues in Early Childhood Education*, vol. 4, no. 1, 2022, doi: 10.31098/ijeiece.v4i1.531.
7. WILLIAM J. J. GORDON, *Synectics : the development of creative capacity*. New York: Harper & Row, 1961.
8. B. M. Mitchell, A. F. Stueckle, and R. Wilkens, *Planning for Creative Learning* . Washington: Kendall/Hunt Publishing Company, 1983.
9. T. Strong-Wilson and J. Ellis, 'Children and Place: Reggio Emilia's Environment As Third Teacher', *Theory Pract*, vol. 46, no. 1, 2007, doi: 10.1080/00405840709336547.
10. R. S. New, 'Reggio Emilia as cultural activity theory in practice', *Theory Pract*, vol. 46, no. 1, 2007, doi: 10.1207/s15430421tip4601_2.
11. C. Rinaldi, *IN DIALOGUE WITH REGGIO EMILIA: Listening, Researching and Learning Second edition*. 2021. doi: 10.4324/9780367854539.
12. N. E. Nurjanah and Y. I. Wahyuseptiana, 'THE APLICATION OF PLAYING BASED ON REGGIO EMILIA'S APPROACH TO STIMULATE EARLY CHILDHOOD CREATIVITY', *Social, Humanities, and Educational Studies (SHEs): Conference Series*, vol. 1, no. 1, 2018, doi: 10.20961/shes.v1i1.23600.
13. G. M. Mason, S. Lokhandwala, T. Riggins, and R. M. C. Spencer, 'Sleep and human cognitive development', *Sleep Med Rev*, vol. 57, p. 101472, Jun. 2021, doi: 10.1016/J.SMRV.2021.101472.
14. J. Chaparro, A. Sojourner, and M. J. Wiswall, 'Early Childhood Care and Cognitive Development', *SSRN*, 2020.

15. J. Yeung, A. Bautista, C. T. S. Siu, P. C. Tam, and K. M. Wong, 'Arts and Creativity in Hong Kong Kindergartens: A Document Analysis of Quality Review Reports', *Creativity*, vol. 9, no. 1. 2022. doi: 10.2478/ctra-2022-0005.
16. N. I. Makarau, Hibana, and Susilo Surahman, 'Utilization of Used Materials to Increase Early Childhood Art Creativity in Flamboyan Kindergarten', *JOYCED: Journal of Early Childhood Education*, vol. 2, no. 1, 2022, doi: 10.14421/joyced.2022.21-03.
17. I. A. A. Al-Khaffaf and J. R. A. Abbas, 'Emotional creativity among kindergarten teachers', *Int J Health Sci (Qassim)*, 2022, doi: 10.53730/ijhs.v6ns6.10346.
18. E. Goranova, 'Creation of Electronic Learning Objects for the High Cognitive Levels of Bloom's Digital Taxonomy', *Knowledge International Journal*, vol. 31, no. 2, pp. 585–590, 2019.
19. Y. Sun, 'Coordinated Development of Children's Art Skills and Creativity Based on Human-Computer Interaction Technology', *Lecture Notes on Data Engineering and Communications Technologies*, vol. 129, 2022, doi: 10.1007/978-3-030-99616-1_8.
20. R. Scherer, F. Siddiq, and B. S. Viveros, 'The cognitive benefits of learning computer programming: A meta-analysis of transfer effects', *J Educ Psychol*, vol. 111, no. 5, 2019, doi: 10.1037/edu0000314.
21. O. Firasaty and H. P. Astuti, 'The Creativity of Early Childhood Painting Through Media Waste in Islamic Center Kindergarten Brebes', *Belia*, vol. 6, no. 2, 2017.
22. B. Villarejo, 'Lifelong Kindergarten: Cultivating Creativity through Projects, Passion, Peers, and Play', *Multidiscip J Educ Research*, vol. 9, no. 3, 2019, doi: 10.17583/remie.2019.4713.
23. L. Denissa, R. T. Manurung, O. C. Pattipawaej, I. Z. Effendi, and I. Budiman, 'Visual Impact of Color on Children's Excitement Development, Making Exterior Wall Mural at Taruna Bakti Kindergarten Bandung', *Journal of Innovation and Community Engagement*, vol. 3, no. 2, 2022, doi: 10.28932/ice.v3i2.4238.
24. S. Mahmudah, K. Jannah, and Y. Yunita, 'The Effect of Finger Painting Activities Using Natural Materials on the Creativity of Children Aged 5-6 Years', *TEMATIK: Jurnal Pemikiran dan Penelitian Pendidikan Anak Usia Dini*, vol. 8, no. 1, 2022, doi: 10.26858/tematik.v8i1.27560.
25. T. Strong-Wilson and J. Ellis, 'Children and place: Reggio Emilia's environment as third teacher', *Theory Pract*, vol. 46, no. 1, 2007, doi: 10.1207/s15430421tip4601_6.
26. J. W. Creswell, *Research Design: Qualitative, Quantitative Mixed Methods Approaches*. London: SAGE Publication, 2017.
27. D. Ary, L. C. Jacob, A. Razavieh, and C. K. Sorensen, *Introduction to Research in Education*.
28. N. Dittert, S. Robinson, K. Thestrup, and J. Knudsen, 'Supporting creativity and collaboration: Considerations for the development of a technologically enhanced toolkit for kindergartens', in *ACM International Conference Proceeding Series*, 2019. doi: 10.1145/3335055.3335064.
29. A. N. N. Hui, M. W. J. He, and S. S. Ye, 'Arts education and creativity enhancement in young children in Hong Kong', *Educ Psychol (Lond)*, vol. 35, no. 3, 2015, doi: 10.1080/01443410.2013.875518.
30. M. G. Rohman and P. H. Susilo, 'MEDIA PEMBELAJARAN BERBASIS IT SEBAGAI INOVASI PEMBELAJARAN PADA JENJANG TAMAN KANAK-KANAK (STUDI KASUS GURU TAMAN KANAK-KANAK MUSLIMAT NU MASLAKUL HUDA)', *JURNAL REFORMA*, vol. 7, no. 2, 2019, doi: 10.30736/rfma.v7i2.68.
31. Supplemental Material for The Cognitive Benefits of Learning Computer Programming: A Meta-Analysis of Transfer Effects', *J Educ Psychol*, 2019, doi: 10.1037/edu0000314.supp.

32. M. U. Bers, 'Coding as another language: a pedagogical approach for teaching computer science in early childhood', *Journal of Computers in Education*, vol. 6, no. 4, 2019, doi: 10.1007/s40692-019-00147-3.
33. P. PARWOTO, 'PENGARUH PENERAPAN METODE PEMBELAJARAN COLLABORATIVE PROBLEM BASED LEARNING (CPBL) TERHADAP KREATIVITAS ANAK DALAM BERMAIN KOMPUTER', *JPUD - Jurnal Pendidikan Usia Dini*, vol. 11, no. 1, 2017, doi: 10.21009/jpud.111.07.
34. I. K. Sørenssen and J. M. Bergschöld, 'Domesticated Smartphones in Early Childhood Education and Care settings. Blurring the lines between pedagogical and administrative use', *Int J Early Years Educ*, 2021, doi: 10.1080/09669760.2021.1893157.
35. L. Stošić and I. Stošić, 'Impact of computers on the creativity of children', *International Journal of Cognitive Research in Science, Engineering and Education*, vol. 2, no. 2, 2014.
36. M. Nazhifah Sitorus, A. Yus, and D. Saragih, 'Development of Computer-Based Kindergarten Children's Creativity Portfolio Assessment Instruments', *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, vol. 3, no. 3, 2020, doi: 10.33258/birle.v3i3.1207.
37. A. I. M. Elfeky, S. M. Alharbi, and E. S. A. H. Ahmed, 'The Effect Of Project- Based Learning In Enhancing Creativity And Skills Of Arts Among Kindergarten Student Teachers', *Journal of Positive School Psychology* , vol. 6, no. 8, 2022.
38. R. T. Warne, 'Possible economic benefits of full-grade acceleration', *J Sch Psychol*, vol. 65, 2017, doi: 10.1016/j.jsp.2017.07.001.
39. د. إ. ل. ع. ا. خ. خليفة, 'فاعلية التعلم السريع فى تنمية المفاهيم العلمية والتفكير الناقد لدى أطفال الروضة The Effectiveness of Using Accelerated Learning in Developing Scientific Concepts and Critical Thinking among Kindergarten Children', □□□□□□□□□ □□□□□□□□ □□ □□□□□□, vol. 16, no. 16, 2021, doi: 10.21608/dftt.2021.171022.
40. E. Erlangga, 'THE EFFECT OF TRADITIONAL GAMES ON EARLY CHILDHOOD COGNITIVE DEVELOPMENT', *Journal of Education on Social Issues*, vol. 2, no. 1, pp. 1–18, 2023, Accessed: Jun. 18, 2023. [Online]. Available: http://journal.qpublisher.com/index.php/jesi/article/view/36
41. R. C. Richmond *et al.*, 'The association of early childhood cognitive development and behavioural difficulties with pre-adolescent problematic eating attitudes', *PLoS One*, vol. 9, no. 8, 2014, doi: 10.1371/journal.pone.0104132.
42. N. Rao *et al.*, 'Early childhood development and cognitive development in developing countries', *Education Rigorous Literature Review*, no. September, 2014.