An alternative Strategy for Increasing Indonesian Student Digital Literacy Skills through Interactive Game

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Abstract. Technology development is one of the significant steps fulfill the early childhood needs. The need to get information, remote communication and facilitate interaction in the learning process is an element that could be met by technology. The purpose of this study was to determine the Interactive Game Influence on Digital Literacy Ability in Kindergarten at Padang, Indonesia. This research is quasi-experimental study using interactive games for experimental class, and non-interactive game for control class. The digital literacy rate is measured using Digital Literacy for Early Childhood Inventory. Analysis of experimental data shows the digital literacy ability of children in experimental class by using interactive games show higher results than non-interactive game. Data analyses conclude that interactive games affect the digital literacy ability in kindergarten.

1. Introduction

Early childhood education is one way to develop optimally behavioral and basic abilities in children [1]–[6]. As described in the Law on National Education System No. 20 of 2003 which states that Early Childhood Education (ECD) is a activities to nurture and educate children from birth until reaching the age of six years by providing education stimulation that can occur growth, physical and psychological development of children[7].

Nowadays the use of technology is the one capability that should be owned and developed [8], [9]. The existence of the technology at this time can help the unmet needs of children [10]–[12]. The need is such as to obtain information and knowledge easily [13]–[15], facilitate remote communications and become one of the media that support the learning process [16]–[18]. Technology becomes something important that cannot be avoided, like technology of android, tablets, and computer. All people are entitled to enjoy the facilities available technology, but not all people are able to use technology directly without the proper training and knowledge, especially for young children who have not familiar with the technology [19]–[24].

The introduction of the use of technology can be done through play [25], [26], due the process of learning in early childhood occurs by learning while playing, and playing while learning [27]–[29], because the child's world is a world of play [30]–[33]. The introduction of technology to children from an early age aims to train building capacity and utilize digital technology optimally, known as digital literacy (digital readability) [34]–[36]. Digital literacy relates to the ability to understand [37], [38], build new knowledge and information, then use it from various digital sources so that children are able to survive and adapt in the digital age [38], [39]. Digital literacy for young children is a digital readability and all elements of the development [41]–[43], deployment and use of technology in the context of mental stimuli and physical and spiritual development of the child so that the knowledge and experience of children increases [44], [45].
Build digital literacy in children with supervision will have a positive effect and become an attractive media for children's learning [46]–[49]. One of the effects of digital literacy abilities to stimulate children is will be able to realize the curiosity [50], [51] of children to be supervised by parents and teachers that are directed in accordance with the child's learning objectives. Digital literacy will facilitate the ability of children to acquire knowledge or information and self-development in various aspects such as language, cognitive, social, emotional, physical, motor and moral and religious values [41], [42], [48]. Use of media technology in the learning process will train every digital literacy abilities of children and allows teachers to create learning effective and engaging for children [38], [41], [52]–[54].

Digital literacy can be defined as a survival skill in the digital era [38], [55]. It constitutes a system of skills and strategies used by learners and users in digital environments [56]–[59]. By applying different types of digital literacy, users will increase performance and survive in a variety of difficulties in the face of the digital world. Digital literacy ability at this point is not only limited to the use of computers, but other digital technologies such as android [60]. Digital Literacy is the awareness, attitude and ability of individuals to appropriately use digital tools and facilities to identify, access, manage, integrate, evaluate, analyze and synthesize digital resources [55], [56], [61], [62].

Digital literacy capabilities can be achieved by using integrated methods and approaches through games [63], [64]. This ability can be developed by utilizing interactive games that are easy to run by early childhood. Interactive gaming is a fun play tool that aims to stimulate children's intelligence to take action, active, and have a mutually reciprocal's relationship [65], [66]. Children as social beings need other people or friends in learning so that learning will also develop aspects children's social emotional [67], [68].

2. Methods

This study uses quasi experiment, which aimed to know the effect of treatment to the experimental group [69], [70], but does not fully control the other variables that may affect the subject of research. Sources of data in this study are come from “Fadhilah Amal 3” Kindergarten in Padang, West Sumatra. The sample of this study consists of two classes, which are class B1 as experimental class and B3 as a control class. The digital literacy rate is measured using Digital Literacy for Early Childhood Inventory (DLECI). The experimental class was given treatment by providing an interactive game based [71], while in the control group was given a non-interactive gaming approach.

3. Result

To draw conclusions from the research results, the hypothesis test using t test. Before performing the t test first tested for normality and homogeneity of research findings.

| Conditions | Samples         | Testing Type | n  | Result (L) | X² | Table Value | Conclusions |
|------------|-----------------|--------------|----|------------|----|-------------|-------------|
| Pre-test   | Experiment Class| Normality    | 10 | 0,1643     | 0,1452 | 0,258       | Normal      |
|            | Control Class   |              |    |            |      |             |             |
|            | Experiment Class| Homogeneity  | 10 | 0,223      | 3,841 | Homogeneity |             |
|            | Control Class   |              |    |            |      |             |             |
| Post-test  | Experiment Class| Normality    | 10 | 0,1700     | 0,2090 | 0,258       | Normal      |
|            | Control Class   |              |    |            |      |             |             |
|            | Experiment Class| Homogeneity  | 10 | 0,447      | 3,841 | Homogeneity |             |
|            | Control Class   |              |    |            |      |             |             |
According to the Table 1 shows that in pre-test experimental group has Larithmetic 0.164 and smaller than table value at 0.258. The control group gained Larithmetic 0.145 and smaller than table value. The findings imply that both experimental and control groups have normal data. This also occurs in post-test data. From Table 1 it appears that count of the experimental group and the control group is smaller than the table, both form pre-test and post-test (arithmetic < table), it means that the experimental group and the control group had a homogenous variances. After being tested for normality and homogeneity, it is known that both classes of normally distributed samples and has a homogeneous variance. Then it can be followed by hypothesis testing using t-test techniques.

Further analysis was done to answer the research hypothesis that there is difference of digital literacy level of early child by using interactive game.

Table 2 Different test between the experimental and control groups under pretest and posttest conditions

| Condition | Samples         | n  | Mean | t-test Value | Table Value | Conclusion      |
|-----------|-----------------|----|------|-------------|-------------|----------------|
| Pre-test  | Experiment Class| 10 | 61.5 | 1.417       | 2.100       | Not significantly different |
|           | Control Class   | 10 | 58   |             |             |                |
| Post-test | Experiment Class| 10 | 82   | 3.746       | 2.100       | Significantly different |
|           | Control Class   | 10 | 69   |             |             |                |

Description from the Table 2 can be concluded that there is no significant difference between the pre-test (initial capability) digital literacy abilities both in the experimental group and control group. This condition has not been given any treatment on the sample.

The data show that there is a significant difference in the digital literacy condition of the early child after treatment is given. This shows that the treatment of interactive games given to students has an effect on the level of digital literacy. Based on the findings on the mean indicates that there is a rapid increase in digital literacy of early childhood with interactive gaming treatment, compared to children who were given non-interactive gaming treatment.

Once granted control of visible results of post-treatment test the ability of digital literacy in the classroom experiments using interactive games further increased by an average of 82, while in grade control using application-based game earned an average of 69. It can be concluded that there is a comparison of the pre-test and post-test results of digital literacy ability of the experimental group and the control group. Under these samples conditions, it can be concluded that interactive games significantly influence the digital literacy conditions of early childhood.

4. Discussion

Results showed that children interested in the game because it is done through play while learning, learning while playing [28], [29]. Through this game, children not only gain knowledge through the game but this game is also capable of stimulating the ability of digital literacy of children such as how to run a game, using technology [55], [56], information and construct new knowledge as an end result of the ability of digital literacy, so that interactive games into one game influential in improving the ability of children's digital literacy [48], [72].

The classes that use non-interactive game-based seem monotonous and less provide for the child's interest [73], [74]. In the class of digital literacy activities to develop children only use application-based game just clicks the button and the children will appear in a sequence of letters. In the control class children only pay attention to the button without being able to build new knowledge during game play [74], [75].

The digital literacy ability of children treated with interactive games is better than the result of a control class capability using non-interactive game applications; this can be seen from the mean of the
experiment class higher than the control class. So interactive game for children makes them interested and affects the ability of digital literacy [71], [76]–[79]; children are able to use digital technology, children gain new experience and being able to tell it to the class. While in the control class, game applications are not able to develop digital literacy abilities to the fullest because after playing the game children are not getting knowledge and were not able to tell it in to the class.

References

[1] Sarama J and Clements D H, 2009 Early childhood mathematics education research: Learning trajectories for young children Routledge.
[2] Bruce T, 2012 Early childhood education Hachette UK.
[3] Gordon A M and Browne K W, 2013 Beginnings & beyond: Foundations in early childhood education Cengage learning.
[4] Heckman J J, 2011 The Economics of Inequality: The Value of Early Childhood Education. Am. Educ. 35, 1 p. 31.
[5] Egan K, 2012 Primary understanding: Education in early childhood Routledge.
[6] Roskos K A, 2017 Play and literacy in early childhood: Research from multiple perspectives Routledge.
[7] Wardhani F P, 2018 Student gadget addiction behavior in the perspective of respectful framework Konselor 7, 3 p. 116–123.
[8] Zhang M and Tansuhaj P S, 2007 Organizational culture, information technology capability, and performance: the case of born global firms Multinatl. Bus. Rev. 15, 3 p. 43–78.
[9] Li X, 2011 Sources of external technology, absorptive capacity, and innovation capability in Chinese state-owned high-tech enterprises World Dev. 39, 7 p. 1240–1248.
[10] Lee H and Templeton R, 2008 Ensuring equal access to technology: Providing assistive technology for students with disabilities Theory Pract. 47, 3 p. 212–219.
[11] Guha M L Druin A and Fails J A, 2008 Designing with and for children with special needs: an inclusionary model in Proceedings of the 7th international conference on Interaction design and children p. 61–64.
[12] Kirk S Gallagher J J Coleman M R and Anastasios N J, 2011 Educating exceptional children Cengage Learning.
[13] Hidayat H Herawati S Syahmaid E Hidayati A and Ardi Z, 2018 Designing of technopreneurship scientific learning framework in vocational-based higher education in Indonesia Int. J. Eng. Technol. 7, 4 p. 123–127.
[14] Ardi Z et al., 2019 Exploring the elementary students learning difficulties risks on mathematics based on students mathematical anxiety, mathematics self-efficacy and value beliefs using rasch measurement in Journal of Physics: Conference Series 1157, 3 p. 32095.
[15] Ardi Z Sukmawati I Idfil I Afidal A Rangka I B and Suranata K, 2018 Exploring the acceptability of internet-based mental health mobile app services using network psychometrics analysis in Journal of Physics: Conference Series 1114, 1 p. 12106.
[16] Dabbagh N and Kitsantas A, 2012 Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning Internet High. Educ. 15, 1 p. 3–8.
[17] Popescu E, 2014 Providing collaborative learning support with social media in an integrated environment World Wide Web 17, 2 p. 199–212.
[18] Zheng B Yim S and Warschauer M, 2018 Social Media in the Writing Classroom and Beyond TESOL Encycl. English Lang. Teach.
[19] Archer K Savage R Sanghera-Sidhu S Wood E Gottardo A and Chen V, 2014 Examining the effectiveness of technology use in classrooms: A tertiary meta-analysis Comput. Educ. 78 p. 140–149.
[20] Uddin S M N Muhandiki V S Sakai A Al Mamun A and Hridi S M, 2014 Socio-cultural acceptance of appropriate technology: identifying and prioritizing barriers for widespread use
of the urine diversion toilets in rural Muslim communities of Bangladesh Technol. Soc. 38 p. 32–39.

[21] Hawes Z Moss J Caswell B and Poliszczuk D, 2015 Effects of mental rotation training on children’s spatial and mathematics performance: A randomized controlled study Trends Neurosci. Educ. 4, 3 p. 60–68.

[22] Ardi Z Yendi F M and Ifdil I, 2013 Konseling Online: Sebuah Pendekatan Teknologi Dalam Pelayanan Konseling J. Konseling dan Pendidik. 1, 1 p. 1–5.

[23] Daharnis D and Ardi Z, 2016 THE COMPATIBILITY STUDENT CHOICE OF UNIVERSITY MAJORING: A PRELIMINARY STUDIES Guid. J. Guid. Couns. Psychol. Educ. 6, 1 p. 101–109.

[24] Ardi Z and Yendi F M, 2017 Students Attitude Towards LGBTQ; the Future Counselor Challenges J. Konseling dan Pendidik. 5, 2 p. 74–79.

[25] Naranjo-Bock C and Ito J, 2017 Playing together: The importance of joint engagement in the design of technology for children in Proceedings of the 2017 Conference on Interaction Design and Children p. 749–752.

[26] Andersen R and Mirrlees T, 2014 Introduction: Media, technology, and the culture of militarism: Watching, playing and resisting the war society Democ. Commun. 26, 2 p. 1.

[27] Thompson P, 2013 The digital natives as learners: Technology use patterns and approaches to learning Comput. Educ. 65 p. 12–33.

[28] Genishi C and Dyson A H, 2015 Children, language, and literacy: Diverse learners in diverse times Teachers College Press.

[29] Brooker L, 2017 Learning to play, or playing to learn? Children’s participation in the cultures of homes and settings Young Child. Play Creat. Mult. Voices.

[30] Engelen L et al., 2013 Increasing physical activity in young primary school children—it’s child’s play: A cluster randomised controlled trial Prev. Med. (Baltim). 56, 5 p. 319–325.

[31] Gray P, 2015 Free to learn: Why unleashing the instinct to play will make our children happier, more self-reliant, and better students for life Basic Books.

[32] Burns-Nader S and Hernandez-Reif M, 2016 Facilitating play for hospitalized children through child life services Child. Heal. Care 45, 1 p. 1–21.

[33] Taylor D D and Bratton S C, 2014 Developmentally appropriate practice: Adlerian play therapy with preschool children J. Individ. Psychol. 70, 3 p. 205–219.

[34] Daharnis D Ardi Z Alizamar A Ifdil I Rangka I B and Suranata K, 2018 Adaptation and validation of mathematics anxiety: Rasch and network psychometrics analysis in Journal of Physics: Conference Series 1114, 1 p. 12113.

[35] Alizamar A et al., 2018 Measuring internet addiction: Adaptation and validation of the Chen Internet Addiction Scale (CIAS) on Indonesian version in 2018 Workshop on Multidisciplinary and Its Applications: Applied Mathematics, Computer Science, Information Systems, and Information Technology, WMA-Mathcomtech 2018 1114, 1.

[36] Taufik T et al., 2018 Adaptation and validation of the smartphone addiction: a Rasch perspective in Journal of Physics: Conference Series 1114, 1 p. 12096.

[37] Prior D D Mazanov J Meacheam D Heaslip G and Hanson J, 2016 Attitude, digital literacy and self efficacy: Flow-on effects for online learning behavior Internet High. Educ. 29 p. 91–97.

[38] Momhamdayari S and Singh H, 2015 Understanding the effect of e-learning on individual performance: The role of digital literacy Comput. Educ. 82 p. 11–25.

[39] Lewis B, 2014 Raising Children in a Digital Age: Enjoying the best, avoiding the worst Lion Books.

[40] Sukma D Ananda A Gistituti N and Daharnis D, 2019 Just community approach to character education: school change or student change? COUNS-EDU Int. J. Couns. Educ. 4, 1 p. 15–22.

[41] Çoklar A N Yaman N D and Yurdakul I K, 2017 Information literacy and digital nativity as determinants of online information search strategies Comput. Human Behav. 70 p. 1–9.

[42] Dalton B and Proctor C P, 2007 Reading as thinking: Integrating strategy instruction in a
universally designed digital literacy environment Read. Compr. Strateg. Theor. Interv. Technol. p. 423–442.

[43] Ardi Z, 2014 Cita-cita Perkerjaan dan Pilihan Peminatan Siswa Sekolah Menengah Atas Negeri di Sumatera Barat Cita-cita Perkerjaan dan Pilihan Peminatan Siswa Sekol. Menengah Atas Negeri di Sumatera Barat.

[44] Cordes C and Miller E, 2000 Fool’s Gold: A Critical Look at Computers in Childhood.

[45] Watts G, 2011 Intellectual disability and spiritual development J. Intellect. Dev. Disabil. 36, 4 p. 238–245.

[46] Tyner K, 2014 Literacy in a digital world: Teaching and learning in the age of information Routledge.

[47] Neumann M M and Neumann D L, 2014 Touch screen tablets and emergent literacy Early Child. Educ. J. 42, 4 p. 231–239.

[48] Ronimus M Kujala J Tolvanen A and Lyytinen H, 2014 Children’s engagement during digital game-based learning of reading: The effects of time, rewards, and challenge Comput. Educ. 71 p. 237–246.

[49] Iversen O S Smith R C Blikstein P Katterfeldt E-S and Read J C, 2016 Digital fabrication in education: Expanding the research towards design and reflective practices Int. J. Child-Computer Interact. 5, 1–2 p. 1–2.

[50] Small R V, 2014 The Motivational and Information Needs of Young Innovators: Stimulating Student Creativity and Inventive Thinking. Sch. Libr. Res. 17.

[51] Saliba R, 2017 The Impact of Digital Technologies on Emergent Readers How do Maltese Mothers Child. with Autistic Spectr. Disorder. Perceive Music as an Educ. Interv. Early Childhood? p. 72.

[52] Alizamars A et al., 2019 Are there statistical anxiety differences between male and female students? 1157, 4.

[53] Rangka I B et al., 2019 Exploring of mathematics classroom goal structures in senior high school: An engaging in academic work for student in Journal of Physics: Conference Series 1157, 3 p. 32084.

[54] Suranata K et al., 2019 Exploring of mathematics learning difficulties for students based on heterogeneous group and cognitive style in elementary school in Journal of Physics: Conference Series 1157, 3 p. 32091.

[55] Gallardo-Echenique E E de Oliveira J M Marqui& L and Esteve-Mon F, 2015 Digital competence in the knowledge society J. Online Learn. Teach. 11, 1 p. 1.

[56] Meyers E M Erickson I and Small R V, 2013 Digital literacy and informal learning environments: an introduction Learn. Media Technol. 38, 4 p. 355–367.

[57] Fitria L et al., 2018 Exploring internet addiction on adolescents in 2018 Workshop on Multidisciplinary and Its Applications: Applied Mathematics, Computer Science, Information Systems, and Information Technology, WMA-Mathcomtech 2018 1114, 1.

[58] Daharnis D et al., 2019 Mathematics anxiety among prospective elementary school teachers and their treatment in Journal of Physics: Conference Series 1157, 4 p. 42089.

[59] Afdaa A et al., 2019 Contribution of statistical anxiety to student learning outcomes: Study in Universitas Negeri Padang 1157, 4.

[60] Rambe S A Mudjiran M and Marjohan M, 2017 Pengembangan Modul Layanan Informasi untuk Mengembangkan Kontrol Diri dalam Penggunaan Smartphone Konselor 6, 4 p. 132–137.

[61] Ifdil I et al., 2018 Measuring internet addiction: comparative studies based on gender using Bayesian analysis in Journal of Physics: Conference Series 1114, 1 p. 12073.

[62] Rangka I B et al., 2018 Measuring psychometric properties of the Indonesian version of the NoMoPhobia Questionnaire (NMPQ): insight from Rasch measurement tool in Journal of Physics: Conference Series 1114, 1 p. 12127.

[63] Nellitawati N et al., 2018 Internet addiction among college student of educational administration programs: Network psychometrics analysis in 2018 Workshop on
Multidisciplinary and Its Applications: Applied Mathematics, Computer Science, Information Systems, and Information Technology, WMA-Mathcomtech 2018 1114, 1.

[64] Syahniar S et al., 2018 Social media fear of missing out: psychometrics evaluation based on Indonesian evidence in Journal of Physics: Conference Series 1114, 1 p. 12095.

[65] Beavis C Muspratt S and Thompson R, 2015 “Computer games can get your brain working”: student experience and perceptions of digital games in the classroom Learn. Media Technol. 40, 1 p. 21–42.

[66] Beavis C et al., 2014 Teachers’ beliefs about the possibilities and limitations of digital games in classrooms E-learning Digit. Media 11, 6 p. 569–581.

[67] Craig A B Brown E R Upright J and DeRosier M E, 2016 Enhancing children’s social emotional functioning through virtual game-based delivery of social skills training J. Child Fam. Stud. 25, 3 p. 959–968.

[68] Larassati R, 2018 Effectiveness of Group Counseling with People-Centered Approach to Improve Student’s social skills COUNS-EDU Int. J. Couns. Educ. 3, 4 p. 133–139.

[69] Wildemuth B M, 2016 Applications of social research methods to questions in information and library science ABC-CLIO.

[70] Campbell D T and Stanley J C, 2015 Experimental and quasi-experimental designs for research Ravenio Books.

[71] Hsiao H-S and Chen J-C, 2016 Using a gesture interactive game-based learning approach to improve preschool children’s learning performance and motor skills Comput. Educ. 95 p. 151–162.

[72] Lin Y-H and Hou H-T, 2016 Exploring young children’s performance on and acceptance of an educational scenario-based digital game for teaching route-planning strategies: a case study Interact. Learn. Environ. 24, 8 p. 1967–1980.

[73] Tan J L Goh D H-L Ang R P and Huan V S, 2013 Participatory evaluation of an educational game for social skills acquisition Comput. Educ. 64 p. 70–80.

[74] Hardy S Dutz T Wiemeyer J Göbel S and Steinmetz R, 2015 Framework for personalized and adaptive game-based training programs in health sport Multimed. Tools Appl. 74, 14 p. 5289–5311.

[75] Abdullah M Q, 2017 Psychosocial problems of schoolchildren and the psychological counseling approaches implicated by counselors for treating it COUNS-EDU Int. J. Couns. Educ. 2, 4 p. 150–159.

[76] Martinovic D Burgess G H Pomerleau C M and Marin C, 2016 Computer games that exercise cognitive skills: What makes them engaging for children? Comput. Human Behav. 60 p. 451–462.

[77] Schuller B et al., 2013 ASC-Inclusion: Interactive emotion games for social inclusion of children with Autism Spectrum Conditions in Proceedings 1st International Workshop on Intelligent Digital Games for Empowerment and Inclusion (IDGEI 2013) held in conjunction with the 8th Foundations of Digital Games.

[78] Suranata K et al., 2018 Diagnosis of students zone proximal development on math design instruction: A Rasch analysis in Journal of Physics: Conference Series 1114, 1 p. 12034.

[79] Ilyas A et al., 2018 Validation of AUM software: A counselor tool for analyse human problems on counseling and educational practice J. Phys. Conf. Ser. 1114, 1.