

**IDENTIFIKASI SPATIAL AWARENESS ANAK USIA DINI
DALAM KEGIATAN PEMBELAJARAN
DENGAN MENGGUNAKAN MEDIA LOOSE PARTS**

TESIS

Diajukan untuk memenuhi sebagian dari Syarat Memperoleh Gelar Magister
Pendidikan pada Program Studi Pendidikan Anak Usia Dini



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Sebuah Tesis yang diajukan untuk memenuhi salah satu syarat memperoleh gelar
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ABSTRAK

Penelitian ini dilatarbelakangi oleh masih minimnya penelitian terdahulu terkait dengan *spatial awareness* anak, karena pembelajaran matematika lebih banyak ditekankan pada pengenalan konsep bilangan. TK X di Kabupaten Bandung menggunakan media *loose parts* untuk menstimulasi kemampuan anak, termasuk pada pengenalan konsep matematika. Perlu kajian lebih lanjut mengenai identifikasi *spatial awareness* anak dalam pembelajaran dengan menggunakan media *loose parts*. Tujuan penelitian ini adalah untuk mengetahui upaya yang dilakukan, kendala yang dihadapi dan solusi yang dilakukan oleh guru dalam menstimulasi *spatial awareness* anak, serta mengetahui profil *spatial awareness* anak dalam pembelajaran dengan media *loose parts*. Metode yang digunakan yaitu studi kasus dengan teknik pengumpulan data berupa wawancara, observasi dan studi dokumentasi yang melibatkan guru dan anak di TK X Kabupaten Bandung. Hasil penelitian menunjukkan bahwa para guru telah memahami *spatial awareness* dan media *loose parts*, sehingga mereka telah berupaya untuk menstimulasi *spatial awareness* anak menggunakan media *loose parts* melalui beberapa tahapan, diantaranya yaitu persiapan, penginformasian area bermain, pelibatan anak untuk bermain, pendampingan dan pengawasan, serta merapikan media *loose parts*. Beberapa profil *spatial awareness* dalam domain *intrinsic* dan *extrinsic* teridentifikasi dapat distimulasi melalui penggunaan media *loose parts*, diantaranya yaitu pemahaman anak terhadap konsep bentuk dan ukuran, posisi relasi, arah, jarak, dan lokasi dari suatu objek. Namun tak jarang para guru menghadapi kendala berupa kurangnya persiapan dan media, pemahaman awal anak, serta strategi yang digunakan. Rekomendasi bagi pendidik, orang tua, sekolah dan peneliti selanjutnya harus lebih meningkatkan pemahamannya dan mengidentifikasi lebih lanjut terkait dengan *spatial awareness* anak dan upaya-upaya yang dapat dilakukan untuk menstimulasinya.

Kata Kunci: Anak usia dini, spatial awareness, media loose parts

ABSTRACT

This research is motivated by the lack of previous research related to children's spatial awareness, because learning mathematics is more emphasized on concept of numbers. Kindergarten X uses loose parts media to stimulate children's, including to introduce mathematical concepts. The purpose of this study was to find out the efforts, the obstacles faced and the solutions made by the teacher in stimulating children's spatial awareness, as well as knowing the profile of children's spatial awareness in learning with loose parts media. This study uses case study method with data collection techniques such as interviews, observation and documentation studies involving teachers and children in Kindergarten X. The results of the study show that the teacher already understands spatial awareness and freelance media, so he has tried to stimulate children's spatial awareness using freelance media through several stages, including preparation, informing where to play, involving children in playing, mentoring and supervision, and tidy up any loose parts media. Several profiles of spatial awareness in the identified intrinsic and extrinsic domains can be stimulated through loose parts media, such as children's understanding of the concepts of shape and size, relational position, direction, distance, and location of an object. However, it is not uncommon for teachers to face obstacles in the form of lack of preparation and media, children's initial understanding, and the strategies used. Recommendations for educators, parents, schools and future researchers to further increase understanding and further identify children's spatial awareness and efforts that can be made to stimulate it.

Keywords: Early childhood, spatial awareness, loose parts media

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DAFTAR PUSTAKA

- AERA. (2011). AERA Code of Ethics: American Educational Research Association Approved by the AERA Council February 2011. *Educational Researcher*, 40(3), 145–156. <https://doi.org/10.3102/0013189X11410403>
- Alhojailan, M. I., & Ibrahim, M. (2012). Thematic Analysis : A Critical Review of Its Process and Evaluation. *WEI International European Academic Conference Proceedings*, 1(2011).
- Anita, A., Risyak, B., & Surahman, M. (2015). Implementasi Bermain Balok Unit dalam Meningkatkan Kecerdasan Visual Spasial Anak Usia Dini. *Jurnal Pendidikan Anak*, 1(6), 1–7. <http://jurnal.fkip.unila.ac.id/index.php/PAUD/article/view/11377>
- Anita Damayanti, Sriyanti Rahmatunnisa, & Lia Rahmawati. (2020). Peningkatan Kreativitas Berkarya Anak Usia 5-6 Tahun melalui Pembelajaran Jarak Jauh Berbasis Steam Dengan Media Loose Parts. *Jurnal Buah Hati*, 7(2), 74–90. <https://doi.org/10.46244/buahhati.v7i2.1124>
- Aspers, P., & Corte, U. (2019). What is Qualitative in Qualitative Research. *Qualitative Sociology*, 42(2), 139–160. <https://doi.org/10.1007/s11133-019-9413-7>
- Astuti, R. F., & Istiarini, R. (2020). Upaya Meningkatkan Kemampuan Membaca Permulaan AnakUsia 5-6 Tahun Melalui Media Puzzle di PAUD Flamboyan Sukasari Kota Tangerang. *Ceria: Jurnal Program Studi Pendidikan Anak Usia Dini*, 8(2), 31–43. <https://doi.org/http://dx.doi.org/10.31000/ceria.v11i2.2338>
- Aulyalloh, A. Q., & Rakhman, A. (2020). Media Pembelajaran Steam Untuk Meningkatkan Kreativitas Berbahan Loose Parts Di Kelompok B Tk Kasih Ibu. *Ceria (Cerdas Energik Responsif Inovatif Adaptif)*, 3(6), 553–558. <https://doi.org/http://dx.doi.org/10.22460/ceria.v3i6.p%25p>
- BabySparks. (2019). *What is Spatial Awareness & How Does it Develop?* <https://babysparks.com/2019/02/20/what-is-spatial-awareness-how-does-it-develop/>
- Bakken, L., Brown, N., & Downing, B. (2017). Early Childhood Education: The Long-Term Benefits. *Journal of Research in Childhood Education*, 31(2), 255–269. <https://doi.org/10.1080/02568543.2016.1273285>
- Baldy, R., Devichi, C., & Chatillon, J.-F. (2004). Developmental Effects in 2D Versus 3D Versions in Verticality and Horizontality Tasks. *Swiss Journal of Psychology/Schweizerische Zeitschrift Für Psychologie/Revue Suisse de Psychologie*, 63(2), 75. <https://doi.org/https://psycnet.apa.org/doi/10.1024/1421-0185.63.2.75>

- Bartholomew, J. B., & Jowers, E. M. (2011). Physically active academic lessons in elementary children. *Preventive Medicine*, 52, S51–S54. <https://doi.org/https://doi.org/10.1016/j.ypmed.2011.01.017>
- Benz, C., Steinweg, A. S., Gasteiger, H., Schöner, P., Vollmuth, H., & Zöllner, J. (2018). *Mathematics education in the early years: Results from the POEM3 conference, 2016*. Springer.
- BERA. (2018). *Ethical Guidelines for Educational Research*. www.bera.ac.uk
- Black, L., Choudry, S., Pickard-Smith, K., & Williams, J. (2019). Theorising the place of emotion–cognition in research on mathematical identities: the case of early years mathematics. *ZDM*, 51(3), 379–389. <https://doi.org/10.1007/s11858-018-01021-9>
- Bodrova, E., & Leong, D. J. (2005). The importance of play: Why children need to play. *Early Childhood Today*, 20(1), 6–7.
- Bracken, B. A., & Crawford, E. (2010a). Basic Concepts in Early Childhood Educational Standards: A 50-State Review. *Early Childhood Education Journal*, 37(5), 421–430. <https://doi.org/10.1007/s10643-009-0363-7>
- Bracken, B. A., & Crawford, E. (2010b). Basic Concepts in Early Childhood Educational Standards: A 50-State Review. *Early Childhood Education Journal*, 37(5), 421–430. <https://doi.org/10.1007/s10643-009-0363-7>
- Braun, V. and Clarke, V. (2006). (2006). Using thematic analysis in psychology. Qualitative. *Global Shadows: Africa in the Neoliberal World Order*, 3(2).
- Brooks, R., te Riele, K., & Maguire, M. (2014). *Ethics and education research*. Sage.
- Cakmak, S., Isiksal, M., & Koc, Y. (2014). Investigating Effect of Origami-Based Instruction on Elementary Students' Spatial Skills and Perceptions. *The Journal of Educational Research*, 107(1), 59–68. <https://doi.org/10.1080/00220671.2012.753861>
- Caldwell, J. (2016). *Loose Parts*. <https://fairydustteaching.com/author/jenni-caldwell/page/4/>
- Casey, T., & Robertson, J. (2016). Loose parts play. *Inspiring Scotland*.
- Chandler, P., & Tricot, A. (2015). Mind Your Body: the Essential Role of Body Movements in Children's Learning. *Educational Psychology Review*, 27(3), 365–370. <https://doi.org/10.1007/s10648-015-9333-3>
- Cheng, K., Huttenlocher, J., & Newcombe, N. S. (2013). 25 years of research on the use of geometry in spatial reorientation: a current theoretical perspective. *Psychonomic Bulletin & Review*, 20(6), 1033–1054. <https://doi.org/10.3758/s13423-013-0416-1>

- Choo, K. (2018, June 11). *Developing Spatial Awareness and its Impact on Children's Development*. <https://www.neuro.com/blog/spatial-awareness>
- Clements, D. H. (2004). Major themes and recommendations. *Engaging Young Children in Mathematics: Standards for Early Childhood Mathematics Education*, 7–72.
- Clements, D. H., Swaminathan, S., Hannibal, M. A. Z., & Sarama, J. (1999). Young Children's Concepts of Shape. *Journal for Research in Mathematics Education*, 30(2), 192–212. <https://doi.org/10.2307/749610>
- Copple, C., & Bredekamp, S. (2009). *Developmentally appropriate practice in early childhood programs serving children from birth through age 8*. ERIC.
- Creswell, J. W. (2014). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research* (4th ed.). Pearson Education Limited.
- Creswell, J. W. (2015). *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research* (5th ed.). Pearson.
- Creswell, J. W., & Poth, C. N. (2016). *Qualitative inquiry and research design: Choosing among five approaches*. Sage publications.
- Cuffaro, H. K. (1995). *Experimenting with the world: John Dewey and the early childhood classroom*. Teachers College Press.
- Daly, L., & Beloglovsky, M. (2015). Introducing loose parts to preschoolers. *Teaching Young Children*, 9(1), 18–20.
- Daly, L., & Beloglovsky, M. (2016). *Loose parts 2: Inspiring play with infants and toddlers*. Redleaf Press.
- Daly, L., & Beloglovsky, M. (2020). *Loose Parts 4: Inspiring 21st-century Learning*. Redleaf Press.
- Davis, B. (2015). *Spatial reasoning in the early years*. Taylor & Francis.
- Davis-Kean, P. E., Domina, T., Kuhfeld, M., Ellis, A., & Gershoff, E. T. (2022). It matters how you start: Early numeracy mastery predicts high school math course-taking and college attendance. *Infant and Child Development*, 31(2), e2281. <https://doi.org/10.1002/icd.2281>
- Dennis, I., & Tapsfield, P. (2013). *Human abilities: Their nature and measurement*. Psychology Press.
- Devlin, K. (1995). Mathematics: the science of patterns. *Nature*, 373(6511), 206.
- Dillon, A. (2018). Finding Innovation and Imagination in a Bag of Loose Parts. *Childhood Education*, 94(1), 62–65. <https://doi.org/10.1080/00094056.2018.1420369>

- Dornheim, D. (2008). *Prädiktion von Rechenleistung und Rechenschwäche: der Beitrag von Zahlen-Vorwissen und allgemein-kognitiven Fähigkeiten*. Logos Verlag Berlin GmbH.
- Duncan, G. J., Dowsett, C. J., Claessens, A., Magnuson, K., Huston, A. C., Klebanov, P., Pagani, L. S., Feinstein, L., Engel, M., & Brooks-Gunn, J. (2007). School readiness and later achievement. *Developmental Psychology*, 43(6), 1428. <https://doi.org/https://psycnet.apa.org/doi/10.1037/0012-1649.43.6.1428>
- Empson, S. B., & Turner, E. (2006). The emergence of multiplicative thinking in children's solutions to paper folding tasks. *The Journal of Mathematical Behavior*, 25(1), 46–56. <https://doi.org/https://doi.org/10.1016/j.jmathb.2005.11.001>
- England, L. (2019). *Looking for Learning: Loose Parts*. Bloomsbury Publishing.
- Erickson, K. I., Hillman, C. H., & Kramer, A. F. (2015). Physical activity, brain, and cognition. *Current Opinion in Behavioral Sciences*, 4, 27–32. <https://doi.org/https://doi.org/10.1016/j.cobeha.2015.01.005>
- Farikhah, A., Mar'atin, A., Afifah, L. N., & Safitri, R. A. (2022). Meningkatkan Kreativitas Anak Usia Dini Melalui Metode Pembelajaran Loose Part. *WISDOM: Jurnal Pendidikan Anak Usia Dini*, 3(1), 61–73. <https://doi.org/https://jurnal.iainponorogo.ac.id/index.php/wisdom/article/view/3493>
- Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, 5(1). <https://doi.org/10.1177/160940690600500107>
- Fitrah, M. (2018). *Metodologi penelitian: penelitian kualitatif, tindakan kelas & studi kasus*. CV Jejak (Jejak Publisher).
- Forehand, M. (2005). Bloom's taxonomy: Original and revised. *Emerging Perspectives on Learning, Teaching, and Technology*, 8, 41–44.
- Franceschini, S., Gori, S., Ruffino, M., Pedrolli, K., & Facoetti, A. (2012). A Causal Link between Visual Spatial Attention and Reading Acquisition. *Current Biology*, 22(9), 814–819. <https://doi.org/https://doi.org/10.1016/j.cub.2012.03.013>
- Frick, A., & Wang, S. (2014). Mental Spatial Transformations in 14- and 16-Month-Old Infants: Effects of Action and Observational Experience. *Child Development*, 85(1), 278–293. <https://doi.org/https://doi.org/10.1111/cdev.12116>
- Furi, A. Z. (2021). Meningkatkan Kemampuan Kognitif melalui Penerapan Metode Eksperimen Menggunakan Media Loose Parts pada Anak Kelompok B. *Emphaty Cons-Journal of Guidance and Counseling*, 1(2), 7–19.

- Gelman, R., & Brenneman, K. (2004). Science learning pathways for young children. *Early Childhood Research Quarterly*, 19(1), 150–158. <https://doi.org/https://doi.org/10.1016/j.ecresq.2004.01.009>
- Gilmore, J. H., Knickmeyer, R. C., & Gao, W. (2018). Imaging structural and functional brain development in early childhood. *Nature Reviews Neuroscience*, 19(3), 123–137. <https://doi.org/10.1038/nrn.2018.1>
- Gleave, J. (2009). *Children's time to play: A literature review*. National Children's Bureau for Play England.
- Glenn, N. M., Knight, C. J., Holt, N. L., & Spence, J. C. (2012). Meanings of play among children. *Childhood*, 20(2), 185–199. <https://doi.org/10.1177/0907568212454751>
- Goodyear-Brown, P. (2009). *Play therapy with traumatized children*. John Wiley & Sons.
- Gopnik, A., Meltzoff, A. N., & Kuhl, P. K. (1999). *The scientist in the crib: Minds, brains, and how children learn*. William Morrow & Co.
- Greenes, C., Ginsburg, H. P., & Balfanz, R. (2004). Big Math for Little Kids. *Early Childhood Research Quarterly*, 19(1), 159–166. <https://doi.org/https://doi.org/10.1016/j.ecresq.2004.01.010>
- Guest, G., MacQueen, K., & Namey, E. (2014). Applied Thematic Analysis. In *Applied Thematic Analysis*. <https://doi.org/10.4135/9781483384436>
- Gull, C., Bogunovich, J., Goldstein, S. L., & Rosengarten, T. (2019). Definitions of Loose Parts in Early Childhood Outdoor Classrooms: A Scoping Review. *International Journal of Early Childhood Environmental Education*, 6(3), 37–52.
- Gunderson, E. A., Ramirez, G., Beilock, S. L., & Levine, S. C. (2012). The relation between spatial skill and early number knowledge: the role of the linear number line. *Developmental Psychology*, 48(5), 1229. <https://doi.org/10.1037/a0027433>
- Gutierrez, A. M. J., Goonetilleke, R. S., & Robielos, R. A. C. (2021). *Convergence of Ergonomics and Design: Proceedings of ACED SEANES 2020* (Vol. 1298). Springer Nature.
- Hammarberg, K., Kirkman, M., & de Lacey, S. (2016). Qualitative research methods: when to use them and how to judge them. *Human Reproduction*, 31(3), 498–501. <https://doi.org/10.1093/humrep/dev334>
- Hammersley, M., & Traianou, A. (2012). *Ethics in qualitative research: Controversies and contexts*. Sage.

- Harahap, F. (2019). Kemampuan Motorik Halus Anak melalui Kegiatan Melipat Kertas Origami. *Atfaluna: Journal of Islamic Early Childhood Education*, 2(2), 57–62. <https://doi.org/10.32505/atfaluna.v2i2.1284>
- Haring, P., Warmelink, H., Valente, M., & Roth, C. (2018). *Using the revised Bloom Taxonomy to analyze psychotherapeutic games*.
- Hawes, Z., Moss, J., Caswell, B., Seo, J., & Ansari, D. (2019). Relations between numerical, spatial, and executive function skills and mathematics achievement: A latent-variable approach. *Cognitive Psychology*, 109, 68–90. <https://doi.org/https://doi.org/10.1016/j.cogpsych.2018.12.002>
- Heksa, A. (2020). *Pembelajaran inkuiri di masa pandemi*. Deepublish.
- Hewes, J. (2006). *Let the children play: Nature's answer to early learning*.
- Hiatt, L. M., Harrison, A. M., & Trafton, J. G. (2011). Accommodating human variability in human-robot teams through theory of mind. *Twenty-Second International Joint Conference on Artificial Intelligence*.
- Hodgkiss, A., Gilligan, K. A., Tolmie, A. K., Thomas, M. S. C., & Farran, E. K. (2018). Spatial cognition and science achievement: The contribution of intrinsic and extrinsic spatial skills from 7 to 11 years. *British Journal of Educational Psychology*, 88(4), 675–697. <https://doi.org/10.1111/bjep.12211>
- Hodgkiss, A., Gilligan-Lee, K. A., Thomas, M. S. C., Tolmie, A. K., & Farran, E. K. (2021). The developmental trajectories of spatial skills in middle childhood. *British Journal of Developmental Psychology*, 39(4), 566–583. <https://doi.org/10.1111/bjdp.12380>
- Hohmann, M., Weikart, D. P., & Epstein, A. S. (1995). *Educating young children: Active learning practices for preschool and child care programs*. High/Scope Press Ypsilanti, MI.
- Houser, N. E., Cawley, J., Kolen, A. M., Rainham, D., Rehman, L., Turner, J., Kirk, S. F. L., & Stone, M. R. (2019). A loose parts randomized controlled trial to promote active outdoor play in preschool-aged children: Physical Literacy in the Early Years (PLEY) project. *Methods and Protocols*, 2(2), 27. <https://doi.org/https://doi.org/10.3390/mps2020027>
- Houser, N. E., Roach, L., Stone, M. R., Turner, J., & Kirk, S. F. L. (2016). Let the children play: Scoping review on the implementation and use of loose parts for promoting physical activity participation. *AIMS Public Health*, 3(4), 781. <https://doi.org/https://doi.org/10.3934%2Fpublichealth.2016.4.781>
- Hyndman, B. P., Benson, A. C., Ullah, S., & Telford, A. (2014). Evaluating the effects of the Lunchtime Enjoyment Activity and Play (LEAP) school playground intervention on children's quality of life, enjoyment and participation in physical activity. *BMC Public Health*, 14(1), 164. <https://doi.org/10.1186/1471-2458-14-164>

- Imamah, Z., & Muqowim, M. (2020). Pengembangan kreativitas dan berpikir kritis pada anak usia dini melalui metode pembelajaran berbasis STEAM and loose part. *Yinyang: Jurnal Studi Islam Gender Dan Anak*, 15(2), 263–278. <https://doi.org/10.24090/yinyang.v15i2.3917>
- Istim, N., Hendratno, H., & Setyowati, S. (2022). Pengaruh Penggunaan Media Pembelajaran Loose Part Bahan Plastik terhadap Perkembangan Bahasa dan Fisik Motorik pada Anak Usia 5-6 Tahun. *Jurnal Basicedu*, 6(5), 8572–8584. <https://doi.org/https://doi.org/10.31004/basicedu.v6i5.3793>
- Javadi, M., & Zarea, K. (2016). Understanding Thematic Analysis and its Pitfall. *Journal of Client Care*, 1(1). <https://doi.org/10.15412/j.ccc.02010107>
- Johnson, J. E., Christie, J. F., & Wardle, F. (2005). *Play, development, and early education*. Pearson/Allyn and Bacon.
- Jones, E., & Cooper, R. M. (2006). *Playing to get smart*. Teachers College Press.
- Kartal, H., Balantekin, Y., & Bilgin, A. (2016). The importance of early childhood education and school starting age in the reading-writing learning process. *Participatory Educational Research*, 3(1), 79–101. <https://doi.org/10.17275/per.16.05.3.1>
- Katz, L. G. (2015). Lively Minds: Distinctions between Academic versus Intellectual Goals for Young Children. *Defending the Early Years*.
- KBBI. (2016). *Spasial*. <https://kbbi.kemdikbud.go.id/entri/spasial>
- Kell, H. J., Lubinski, D., Benbow, C. P., & Steiger, J. H. (2013). Creativity and Technical Innovation: Spatial Ability's Unique Role. *Psychological Science*, 24(9), 1831–1836. <https://doi.org/10.1177/0956797613478615>
- Kelley, T. R., & Knowles, J. G. (2016). A conceptual framework for integrated STEM education. *International Journal of STEM Education*, 3(1), 11. <https://doi.org/10.1186/s40594-016-0046-z>
- Kennedy, T. J., & Tunnicliffe, S. D. (2022). Introduction: The role of Play and STEM in the Early Years. In *Play and STEM Education in the Early Years* (pp. 3–37). Springer.
- Kuhn, L. J., Willoughby, M. T., Wilbourn, M. P., Vernon-Feagans, L., Blair, C. B., & Investigators, F. L. P. K. (2014). Early communicative gestures prospectively predict language development and executive function in early childhood. *Child Development*, 85(5), 1898–1914. <https://doi.org/https://doi.org/10.1111/cdev.12249>
- Kumastuti, K., Supartono, S., & Dwijanto, D. (2013). Pembelajaran Bercirikan Pemberdayaan Kegiatan Belajar Kelompok untuk Meningkatkan Kemampuan Keruanga. *Unnes Journal of Mathematics Education Research*, 2(1).

- Lauer, J. E., & Lourenco, S. F. (2016). Spatial Processing in Infancy Predicts Both Spatial and Mathematical Aptitude in Childhood. *Psychological Science*, 27(10), 1291–1298. <https://doi.org/10.1177/0956797616655977>
- Learning Potential. (2020). *Early maths skills 2: spatial sense*. <https://www.learningpotential.gov.au/articles/early-maths-skills-2-spatial-sense>
- Lee, S. A., Sovrano, V. A., & Spelke, E. S. (2012). Navigation as a source of geometric knowledge: Young children's use of length, angle, distance, and direction in a reorientation task. *Cognition*, 123(1), 144–161. <https://doi.org/https://doi.org/10.1016/j.cognition.2011.12.015>
- Lowrie, T., Logan, T., & Hegarty, M. (2019). The influence of spatial visualization training on students' spatial reasoning and mathematics performance. *Journal of Cognition and Development*, 20(5), 729–751. <https://doi.org/https://doi.org/10.1080/15248372.2019.1653298>
- Maghfiroh, S., & Suryana, D. (2021). Media Pembelajaran Untuk Anak Usia Dini di Pendidikan Anak Usia Dini. *Jurnal Pendidikan Tambusai*, 5(1), 1560–1566.
- Mardiyah, L., & Hambali, H. (2022). Penggunaan Media Loose Parts untuk Mengembangkan Kreativitas Anak Usia Dini. *Journal on Teacher Education*, 4(1), 334–347. <https://doi.org/https://doi.org/10.31004/jote.v4i1.5970>
- Masnipal. (2013). *Siap Menjadi Guru dan Pengelola PAUD Profesional*. PT Gramedia.
- Maxwell, L. E., Mitchell, M. R., & Evans, G. W. (2008). Effects of Play Equipment and Loose Parts on Preschool Children's Outdoor Play Behavior: An Observational Study and Design Intervention. *Children, Youth and Environments*, 18(2), 36–63. <http://www.jstor.org/stable/10.7721/chlyoutenvi.18.2.0036>
- Mcilroy, T. (2022). *9 Ideas for Developing Position In Space*. <https://empoweredparents.co/position-in-space/>
- Meaney, T., Helenius, O., Johansson, M., Lange, T., & Werberg, A. (2016). *Mathematics education in the early years*. Springer.
- Mirawati, & Silawati, E. (2021). Interactive Flip Book: Media Pembelajaran Digital untuk Menstimulasi *Spatial Sense* Anak Usia Dini. *Prosiding Seminar Nasional Unimus*, 4.
- Misrawati, M., & Suryana, D. (2022). Bahan Ajar Matematika Berbasis Model Pembelajaran Tematik terhadap Kemampuan Berhitung Anak Usia Dini. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(1), 298–306. <https://doi.org/10.31004/obsesi.v6i1.1249>
- Möhring, W., Ribner, A. D., Segerer, R., Libertus, M. E., Kahl, T., Troesch, L. M., & Grob, A. (2021). Developmental trajectories of children's spatial skills:

- Influencing variables and associations with later mathematical thinking. *Learning and Instruction*, 75. <https://doi.org/10.1016/j.learninstruc.2021.101515>
- Montague-Smith, A., Cotton, T., Hansen, A., & Price, A. J. (2017). *Mathematics in early years education*. Routledge.
- Moss, J., Bruce, C. D., & Bobis, J. (2015). Young children's access to powerful mathematics ideas: A review of current challenges and new developments in the early years. *Handbook of International Research in Mathematics Education*, 165–202.
- Moyles, J. (2014). *E-Book: The Excellence of Play*. McGraw-Hill Education (UK).
- Nath, S., & Szűcs, D. (2014). Construction play and cognitive skills associated with the development of mathematical abilities in 7-year-old children. *Learning and Instruction*, 32, 73–80. <https://doi.org/https://doi.org/10.1016/j.learninstruc.2014.01.006>
- National Council of Teachers of Mathematics. (2000). *Principles Standards and for School Mathematics*.
- National Research Council. (2000). *From neurons to neighborhoods: The science of early childhood development*.
- National Research Council. (2015). *Transforming the workforce for children birth through age 8: A unifying foundation*.
- Neill, J. (2018). Loose parts play creating opportunities for outdoor education and sustainability in early childhood. In *The Palgrave International Handbook of Women and Outdoor Learning* (pp. 623–635). Springer. https://doi.org/10.1007/978-3-319-53550-0_42.
- Newcombe, N. S. (2002). The Nativist-Empiricist Controversy in the Context of Recent Research on Spatial and Quantitative Development. *Psychological Science*, 13(5), 395–401. <https://doi.org/10.1111/1467-9280.00471>
- Newcombe, N. S., & Shipley, T. F. (2015). Thinking about spatial thinking: New typology, new assessments. In *Studying visual and spatial reasoning for design creativity* (pp. 179–192). Springer.
- Newcombe, N. S., & Stieff, M. (2012). Six Myths About Spatial Thinking. *International Journal of Science Education*, 34(6), 955–971. <https://doi.org/10.1080/09500693.2011.588728>
- Nicholson, S. (1971). How not to cheat children, the theory of loose parts. *Landscape Architecture*, 62(1), 30–34.
- Nipriansyah, N., Sasongko, R. N., Kristiawan, M., Susanto, E., & Hasanah, P. F. A. (2021). Increase Creativity And Imagination Children Through Learning Science, Technologic, Engineering, Art And Mathematic With Loose Parts

- Media. *Al-Athfaal: Jurnal Ilmiah Pendidikan Anak Usia Dini*, 4(1), 77–89.
<https://doi.org/10.24042/ajipaud.v4i1.8598>
- Novikasari, I. (2016). Matematika dalam program pendidikan anak usia dini (PAUD). *Bunayya: Jurnal Pendidikan Anak*, 2(1), 1–16.
- Nurjanah, N. E. (2020). Pembelajaran STEM berbasis Loose Parts untuk Meningkatkan Kreativitas Anak Usia Dini. *JURNAL AUDI: Jurnal Ilmiah Kajian Ilmu Anak Dan Media Informasi PAUD*, 5(1), 19–31.
<https://doi.org/https://doi.org/10.33061/jai.v5i1.3672>
- Nurkamilah, M., Mirawati, M., & Arumsari, C. (2018). Disposisi matematis anak usia dini (studi kasus di kelompok a paud permata hati aisyiyah tasikmalaya). *Early Childhood: Jurnal Pendidikan*, 2(2b), 19–29.
<https://doi.org/https://doi.org/10.35568/earlychildhood.v2i2b.282>
- Okamoto, Y., Kotsopoulos, D., McGarvey, L., & Hallowell, D. (2015). The development of spatial reasoning in young children. In *Spatial reasoning in the early years* (pp. 25–38). Routledge.
- Pagnan, S., Marcialis, R., Tacconi, G., Minna, L., & Ottonello, C. (2001). Geophysical prospecting of Mars subsoil by TDEM system. *2001 IEEE Aerospace Conference Proceedings (Cat. No.01TH8542)*, 1, 1/339-1/345 vol.1. <https://doi.org/10.1109/AERO.2001.931725>
- Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice*. Sage publications.
- Peterson, E. G., Weinberger, A. B., Uttal, D. H., Kolvoord, B., & Green, A. E. (2020). Spatial activity participation in childhood and adolescence: consistency and relations to spatial thinking in adolescence. *Cognitive Research: Principles and Implications*, 5(1), 43.
<https://doi.org/10.1186/s41235-020-00239-0>
- Piaget, J. (1979). The Child's Conception of the World, trans Tomlinson J. Tomlinson A (Little, Adams, Totowa, NJ).
- Piaget, J., & Cook, M. T. (1952). *The origins of intelligence in children*.
- Platas, L. M. (2017). *The Why and What of Spatial Relations*.
<https://dreme.stanford.edu/news/why-and-what-spatial-relations>
- Platinum, M. (2021). *Catat! Tips Pentingnya Mengenal Warna Pada Anak Usia Dini*. <https://morinagaplatinum.com/id/milestone/catat-tips-pentingnya-mengenal-warna-pada-anak-usia-dini>
- Poole, C., Miller, S. A., & Church, E. B. (2006). Development: Ages & Stages-- Spatial Awareness. *Early Childhood Today*, 20(6), 25–30.
- Pound, L. (2006). *Supporting mathematical development in the early years*. McGraw-Hill Education (UK).

- Pound, L. (2018). Pitch in! *Nursery World*, 2018(4), 16–18.
- Pruden, S. M., Levine, S. C., & Huttenlocher, J. (2011). Children's spatial thinking: does talk about the spatial world matter? *Developmental Science*, 14(6), 1417–1430. [https://doi.org/https://doi.org/10.1111/j.1467-7687.2011.01088.x](https://doi.org/10.1111/j.1467-7687.2011.01088.x)
- Purnamasari, N. K. N., Negara, I. G. A. O., Ke, S. P. M., & Suara, I. M. (2014). Penerapan Metode Demonstrasi Melalui Kegiatan Melipat Kertas (Origami) Untuk Meningkatkan Perkembangan Motorik Halus Anak Tk Kemala Bhayangkari 1 Denpasar. *Jurnal Pendidikan Anak Usia Dini Undiksha*, 2(1). <https://doi.org/10.23887/paud.v2i1.3165>
- Qomariyah, N., & Qalbi, Z. (2021). Pemahaman Guru PAUD Tentang Pembelajaran Berbasis STEAM dengan Penggunaan Media Loose Parts di Desa Bukit Harapan. *JECED : Journal of Early Childhood Education and Development*, 3(1), 47–52. <https://doi.org/10.15642/jeced.v3i1.995>
- Quinsey, A. (2017). *What is Spatial Awareness and why is it important to children?* <https://www.moduplay.com.au/spatial-awareness-important-children/>
- Rahardjo, M. M. (2019). How to use Loose-Parts in STEAM? Early Childhood Educators Focus Group discussion in Indonesia. *Jurnal Pendidikan Usia Dini*, 13(2), 310–326. <https://doi.org/10.21009/JPUD.132.08>
- Rahayu, C., Warlizasusi, J., & Fakhruddin, F. (2022). Management Of Early Children's Learning With Steam Loading With Loose Parts at RA Ummatan Wahidah Curup. *International Journal of Educational Review*, 4(1), 111–139. <https://doi.org/10.33369/ijer.v4i1.22117>
- Reuhkala, M. (2001). Mathematical Skills in Ninth-graders: Relationship with visuo-spatial abilities and working memory. *Educational Psychology*, 21(4), 387–399. <https://doi.org/10.1080/01443410120090786>
- Rich, K., & Brendefur, J. L. (2018). The importance of spatial reasoning in early childhood mathematics. *Early Childhood Education*.
- Ridder, H.-G. (2014). *Book Review: Qualitative data analysis. A methods sourcebook* (Vol. 28, Issue 4). Sage publications Sage UK: London, England.
- Ridwan, A., Nurul, N. A., & Faniati, F. (2022). Analisis Penggunaan Media Loose Part untuk Meningkatkan Kemampuan Motorik Halus Anak Usia 5-6 Tahun. *Mitra Ash-Shibyan: Jurnal Pendidikan Dan Konseling*, 5(02), 105–118. <https://doi.org/https://doi.org/10.46963/mash.v5i02.562>
- Roberts, L. D. (2015). Ethical Issues in Conducting Qualitative Research in Online Communities. *Qualitative Research in Psychology*, 12(3), 314–325. <https://doi.org/10.1080/14780887.2015.1008909>
- Rotas, N. (2019). Outdoor Play and Learning (OPAL): Activating" Loose Parts" in Undisciplined Childhood Environments. *International Journal of Early Childhood Environmental Education*, 7(1), 73–85.

- Roth, W.-M., & von Unger, H. (2018). Current perspectives on research ethics in qualitative research. *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research*, 19(3), 1–12. <https://doi.org/10.17169/fqs-19.3.3155>
- Rüsseler, J., Scholz, J., Jordan, K., & Quaiser-Pohl, C. (2005). Mental rotation of letters, pictures, and three-dimensional objects in German dyslexic children. *Child Neuropsychology*, 11(6), 497–512. <https://doi.org/10.1080/09297040490920168>
- Ryan, K., Woytovech, C. J., Bruya, L., Woytovech, A., Shumate, B., Malkusak, A., & Sievers, J. A. (2012). Loose parts: The collaboration process for a school playground. *Journal of Kinesiology & Wellness*, 1(1), 4–13. <https://doi.org/10.56980/jkw.v1i1.36>
- Sadler, P. M., & Tai, R. H. (2007). The Two High-School Pillars Supporting College Science. *Science*, 317(5837), 457–458. <https://doi.org/10.1126/science.1144214>
- Safira, A. R., & Ifadah, A. S. (2020). *Pembelajaran Sains dan Matematika Anak Usia Dini*. Caremedia Communication.
- Safitri, D., & Lestarineringrum, A. (2021). Penerapan Media Loose Part untuk Kreativitas Anak Usia 5-6 Tahun. *Kiddo: Jurnal Pendidikan Islam Anak Usia Dini*, 2(1), 40–52. <https://doi.org/10.19105/kiddo.v2i1.3645>
- Sanjari, M., Bahramnezhad, F., Fomani, F. K., Shoghi, M., & Cheraghi, M. A. (2014). Ethical challenges of researchers in qualitative studies: The necessity to develop a specific guideline. *Journal of Medical Ethics and History of Medicine*, 7.
- Sarama, J., & Clements, D. H. (2009). *Early childhood mathematics education research: Learning trajectories for young children*. Routledge.
- Sasanguie, D., Göbel, S. M., Moll, K., Smets, K., & Reynvoet, B. (2013). Approximate number sense, symbolic number processing, or number–space mappings: What underlies mathematics achievement? *Journal of Experimental Child Psychology*, 114(3), 418–431. <https://doi.org/https://doi.org/10.1016/j.jecp.2012.10.012>
- Shen, Y., Qiu, Y., Li, K., & Liu, Y. (2013). Beelight: Helping Children Discover Colors. *Proceedings of the 12th International Conference on Interaction Design and Children*, 301–304. <https://doi.org/10.1145/2485760.2485813>
- Sheridan, M., Howard, J., & Alderson, D. (2010). *Play in early childhood: From birth to six years*. Routledge.
- Siantajani, Y. (2020). Loose Parts Material Lepasan Otentik Stimulasi PAUD. *PT Sarang Seratus Aksara*.
- Slot, P. (2018). *Structural characteristics and process quality in early childhood education and care: A literature review*.

- Sluss, D. J. (2005). *Supporting play: Birth through age eight*. Wadsworth Publishing Company.
- Spencer, R. A., Joshi, N., Branje, K., Murray, N., Kirk, S. F., & Stone, M. R. (2021). Early childhood educator perceptions of risky play in an outdoor loose parts intervention. *AIMS Public Health*, 8(2), 213–228. <https://doi.org/https://doi.org/10.3934%2Fpublichealth.2021017>
- Steinweg, A. S., & Weth, T. (2014). *Auch das noch? Tablets im Kindergarten*. WTM.
- Stevens-Smith, D. (2004). Teaching Spatial Awareness to Children. *Journal of Physical Education, Recreation & Dance*, 75(6), 52–56. <https://doi.org/10.1080/07303084.2004.10607258>
- Sutton, M. J. (2011). In the hand and mind: The intersection of loose parts and imagination in evocative settings for young children. *Children Youth and Environments*, 21(2), 408–424.
- Swanborn, P. (2010). *Case study research: what, why and how?* Sage.
- Taljaard, J. (2016). A review of multi-sensory technologies in a science, technology, engineering, arts and mathematics (STEAM) classroom. *Journal of Learning Design*, 9(2), 46–55.
- Temple, B. A., Bentley, K., Pugalee, D. K., Blundell, N., & Pereyra, C. M. (2020). Using Dance & Movement to Enhance Spatial Awareness Learning. *Athens Journal of Education*, 7(2), 153–167.
- Thomas, J., & Harden, A. (2008). Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Medical Research Methodology*, 8. <https://doi.org/10.1186/1471-2288-8-45>
- Tomporowski, P. D., Davis, C. L., Miller, P. H., & Naglieri, J. A. (2008). Exercise and Children's Intelligence, Cognition, and Academic Achievement. *Educational Psychology Review*, 20(2), 111–131. <https://doi.org/10.1007/s10648-007-9057-0>
- Tremblay, M. S., Gray, C., Babcock, S., Barnes, J., Costas Bradstreet, C., Carr, D., Chabot, G., Choquette, L., Chorney, D., & Collyer, C. (2015). Position statement on active outdoor play. *International Journal of Environmental Research and Public Health*, 12(6), 6475–6505.
- Turan, E., Kobaş, M., & Göksun, T. (2021). Spatial language and mental transformation in preschoolers: Does relational reasoning matter? *Cognitive Development*, 57, 100980. <https://doi.org/https://doi.org/10.1016/j.cogdev.2020.100980>
- Uhlenberg, J. M., & Geiken, R. (2021). Supporting Young Children's Spatial Understanding: Examining Toddlers' Experiences with Contents and

- Containers. *Early Childhood Education Journal*, 49(1), 49–60. <https://doi.org/10.1007/s10643-020-01050-8>
- Uttal, D. H., Meadow, N. G., Tipton, E., Hand, L. L., Alden, A. R., Warren, C., & Newcombe, N. S. (2013). The malleability of spatial skills: a meta-analysis of training studies. *Psychological Bulletin*, 139(2), 352. <https://doi.org/10.1037/a0028446>
- van Hoorn, J. L., Monighan-Nourot, P., Scales, B., & Alward, K. R. (2014). *Play at the center of the curriculum*. Pearson Boston.
- van Nes, F., & van Eerde, D. (2010). Spatial structuring and the development of number sense: A case study of young children working with blocks. *The Journal of Mathematical Behavior*, 29(3), 145–159. <https://doi.org/https://doi.org/10.1016/j.jmathb.2010.08.001>
- Vygotsky, L. S. (1967). Play and its role in the mental development of the child. *Soviet Psychology*, 5(3), 6–18. <https://doi.org/10.2753/RPO1061-040505036>
- Wai, J., Lubinski, D., & Benbow, C. P. (2009). Spatial ability for STEM domains: Aligning over 50 years of cumulative psychological knowledge solidifies its importance. *Journal of Educational Psychology*, 101(4), 817. <https://doi.org/https://psycnet.apa.org/doi/10.1037/a0016127>
- Wardhani, W. D. L., Misyana, M., Atniati, I., & Septiani, N. (2021). Stimulasi Perilaku Sosial Anak Usia Dini melalui Media Loose Parts (Bahan Lepasan). *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 5(2), 1894–1904. <https://doi.org/https://doi.org/10.31004/obsesi.v5i2.694>
- Warmansyah, J., & Amalina, A. (2019). Pengaruh Permainan Konstruktif dan Kecerdasan Visual-Spasial Terhadap Kemampuan Matematika Awal Anak Usia Dini. *Math Educa Journal*, 3(1), 71–82. <https://doi.org/10.15548/mej.v3i1.270>
- Waters, J., & Maynard, T. (2010). What's so interesting outside? A study of child-initiated interaction with teachers in the natural outdoor environment. *European Early Childhood Education Research Journal*, 18(4), 473–483. <https://doi.org/10.1080/1350293X.2010.525939>
- Watts, T. W., Duncan, G. J., Clements, D. H., & Sarama, J. (2018). What is the long-run impact of learning mathematics during preschool? *Child Development*, 89(2), 539–555. <https://doi.org/https://doi.org/10.1111/cdev.12713>
- Whiteley, W., Sinclair, N., Davis, B., & Davis, B. (2015). *Spatial reasoning in the early years: Principles, assertions, and speculations*.
- Wiles, R. (2012). *What are qualitative research ethics?* A&C Black.

- Xie, F., Zhang, L., Chen, X., & Xin, Z. (2020). Is Spatial Ability Related to Mathematical Ability: a Meta-analysis. *Educational Psychology Review*, 32(1), 113–155. <https://doi.org/10.1007/s10648-019-09496-y>
- Yang, W., Liu, H., Chen, N., Xu, P., & Lin, X. (2020). Is early spatial skills training effective? A meta-analysis. *Frontiers in Psychology*, 11, 1938.
- Zhang, X., Koponen, T., Räsänen, P., Aunola, K., Lerkkanen, M.-K., & Nurmi, J.-E. (2014). Linguistic and Spatial Skills Predict Early Arithmetic Development via Counting Sequence Knowledge. *Child Development*, 85(3), 1091–1107. <https://doi.org/https://doi.org/10.1111/cdev.12173>