UPT PERPUSTAKAAN UMS RAPPANG

THE EFFECT OF INTERACTIVE E-BOOKS ON THE FINE MOTOR DEVELOPMENT OF CHILDREN AGED 5-6 YEARS

ARTIKEL

LP2M

LLDIKTI IX Turnitin Consortium Part III

Document Details

Submission ID
trn:oid:::1:3700493250

Submission Date
Nov 4, 2026, 8:35 AM GMT+7

Download Date
Nov 4, 2026, 8:57 AM GMT+7

File Name
1633_1643_-_ID_1055.docx

File Size
246.4 KB

11 Pages

4,329 Words

26,490 Characters

20% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

Filtered from the Report

- Bibliography
- Small Matches (less than 8 words)

Exclusions

- 3 Excluded Matches

Match Groups

63 Not Cited or Quoted 18%
Matches with neither in-text citation nor quotation marks

8 Missing Quotations 2%
Matches that are still very similar to source material

0 Missing Citation 0%
Matches that have quotation marks, but no in-text citation

0 Cited and Quoted 0%
Matches with in-text citation present, but no quotation marks

Top Sources

17% Internet sources
11% Publications
2% Submitted works (Student Papers)

Integrity Flags

0 Integrity Flags for Review

No suspicious text manipulations found.

Our system's algorithms look deeply at a document for any inconsistencies that would set it apart from a normal submission. If we notice something strange, we flag it for you to review.

A Flag is not necessarily an indicator of a problem. However, we'd recommend you focus your attention there for further review.

Match Groups

- **63** Not Cited or Quoted 18%
  Matches with neither in-text citation nor quotation marks
- **8** Missing Quotations 2%
  Matches that are still very similar to source material
- **0** Missing Citation 0%
  Matches that have quotation marks, but no in-text citation
- **0** Cited and Quoted 0%
  Matches with in-text citation present, but no quotation marks

Top Sources

17% Internet sources
11% Publications
2% Submitted works (Student Papers)

Top Sources

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	Internet	jurnal.umt.ac.id 1%
2	Publication	Yang Jingwen, Yin Zhihua, Jiang Jiajun, Pei Jingjing. "Effects of an 8-week progress... 1%
3	Internet	lp2m.stikesayani.ac.id <1%
4	Internet	pmc.ncbi.nlm.nih.gov <1%
5	Internet	ejournal.uin-suka.ac.id <1%
6	Internet	ijmra.in <1%
7	Publication	Bhukya, Yamini Sumalatha. "The Influence of Motor Skills on Language Skills and ... <1%
8	Internet	www.mdpi.com <1%
9	Internet	ijltr.urmia.ac.ir <1%
10	Internet	journal.umpo.ac.id <1%

11	Internet	
www.erudit.org		<1%
12	Internet	
www.scientiasocialis.lt		<1%
13	Publication	
Dwi Lestari, Junita Dwi Wardani. "An Innovative Strategy for Development Childr...		<1%
14	Internet	
jurnal.poltekkespalembang.ac.id		<1%
15	Internet	
oaklearners.ca		<1%
16	Internet	
ejournal.ipinternasional.com		<1%
17	Internet	
iiesecore.com		<1%
18	Student papers	
Politeknik Kesehatan Kemenkes Yogyakarta		<1%
19	Internet	
aulad.org		<1%
20	Internet	
cloud.unri.ac.id		<1%
21	Internet	
doaj.org		<1%
22	Publication	
Yuliana Yuliana, Firman Ashadi, Hendrik Siswono. "<b>Improving Letter Recogniti...		<1%
23	Internet	
fahruddin.org		<1%
24	Publication	
M. Yusran Rahmat, Tasrif Akib, Kiki Rizki Anggraini. "Enhancing kindergarten chil...		<1%

25 Internet
e-journal.stkipsiliwangi.ac.id <1%

26 Internet
repositorio.ipcb.pt <1%

27 Internet
researchid.co <1%

28 Publication
Markel Rico-González. "Physical Education in Early Childhood - Movement and De... <1%

29 Internet
mdpi-res.com <1%

30 Publication
Sharnay Botha, Eileen K. Africa. "The Effect of Perceptual-Motor Training on Grad... <1%

31 Internet
journal.qqrcenter.com <1%

32 Internet
pscipub.com <1%

33 Publication
Jiawei Shao, Siti Nazleen Abdul Rabu, Chuang Chen. "Gamified interactive e-book... <1%

34 Publication
Jones, Emily L.. "Initial Pilot Test of a Single-Session Social Support Program for In... <1%

35 Publication
Nadia Siddiqui, Yi Feng. " Digital Exposure, Inequalities and Early Learning Outco... <1%

36 Publication
Ongur, Müge. "The Effect of E-Storybooks in Different Group Sizes on the Story Co... <1%

37 Publication
Setiyo Utoyo, Ismaniar, Nur Hazizah, Elsy Assari Putri, Sri Cahaya Sihombing. "... <1%

38 Internet
ejournal.lucp.net <1%

39 Internet
garuda.ristekbrin.go.id <1%

40 Internet
hal.science <1%

41 Internet
istanbulmedicaljournal.org <1%

42 Internet
journal.globalcendekia.or.id <1%

43 Internet
jurnalftk.uinsa.ac.id <1%

44 Internet
obsesi.or.id <1%

45 Internet
repository.uinfasbengkulu.ac.id <1%

46 Internet
s3-eu-west-1.amazonaws.com <1%

47 Internet
www.aulad.org <1%

48 Internet
www.tandfonline.com <1%

49 Internet
www.wosconkongreleri.com <1%

turnitin Page 7 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

JTH: Journal of Technology and Health *ISSN 3025-1168*
Vol. 4, No. 2, 2026, pp. 1633 ~ 1643
Open Acces: *https://doi.org/10.61677/jth.v4i2.1055*

THE EFFECT OF INTERACTIVE E-BOOKS ON THE FINE MOTOR DEVELOPMENT OF CHILDREN AGED 5-6 YEARS

Elpinaria Girsang[1*], Elva Ryandara[2], Dewi Nurhasanah[3], Elisabet Sulastina[4], Tukimin Bin Sanswito[5], Liana Fajar[6]

[1*,2,3]Diploma III Midwifery, Wijaya Husada Midwifery Academy, Indonesia
[4]Diploma III Midwifery, STIKES Advaita Medika Tabanan, Indonesia
[5]Lincoln University College, Malaysia
[6]Cipaku Community Health Center, Indonesia
wijayahusada8@gmail.com[1], elva_ryandara20@gmail.com[2], dewinurhasanahwh@gmail.com[3], elisabet.92.sulastina@gmail.com[4], wijayahusada@gmail.com[5], bidan.liana123@gmail.com[6]*
**Corresponding author*

Received September 6, 2026; Revised November 3, 2026; Accepted November 3, 2026; Published November 4, 2026

ABSTRACT

Digital learning media have the potential to support fine motor development in early childhood. This study aimed to determine the effect of interactive digital e-books on the fine motor development of children aged 5–6 years. This quantitative study employed a quasi-experimental two-group pretest–posttest control-group design. The population comprised 60 children aged 5–6 years in the working area of Cipaku Community Health Center. Participants were selected using non-probability purposive sampling based on predetermined eligibility criteria, with 30 children in the intervention group and 30 in the control group. Data were analyzed using paired-samples t-tests and independent-samples t-tests at α = 0.05. Most participants were 6 years old (63%). Fine motor scores increased significantly in both groups, with a larger mean increase in the intervention group (0.800; 95% CI: 0.469–1.131; p < 0.001) than in the control group (0.576; 95% CI: 0.262–0.872; p = 0.001). Interactive digital e-books may be used as a supplementary stimulation medium to support fine motor development in children aged 5–6 years. Their structured activities can provide repeated opportunities for hand–eye coordination and controlled finger movements under appropriate adult guidance.

Keywords: *Children aged 5–6 years, interactive e-book, digital media, fine motor skills, early childhood.*

INTRODUCTION

Early Childhood Education (PAUD) is a stage of education that plays a crucial role in stimulating various aspects of a child's development. At this stage, children undergo rapid growth and development and require appropriate stimulation based on their individual characteristics and developmental needs. This development encompasses religious and moral values, cognitive, language, social-emotional, physical-motor, and artistic aspects. Therefore, learning for young children should be designed to be engaging and interactive while providing opportunities for children to learn through direct experience (Izzatun et al., 2025).

The development of digital technology has transformed educational practice, including early childhood education. Interactive learning media offer alternatives to exclusively conventional materials and may provide guided opportunities to practice fine

This is an open access article under the CC BY-SA 4.0.
Copyright ©2026 by JTH: Journal of Technology and Health. Published by Fahr Publishing

turnitin Page 7 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

motor movements. However, developmental benefits depend on the nature of the activities and the extent of adult support (Fahimah, 2024).

Fine motor skills involve control of small muscles of the hands and fingers in coordination with visual information. These skills support drawing, coloring, cutting, folding, and other manipulative activities and are relevant to school readiness. Age-appropriate practice is therefore important (Ziaurrahman et al., 2024).

Fine motor development problems among young children have also been reported in previous studies. Research at TKIT Ar-Rahman Bogor City showed that there was an increase after cutting treatment with various media Initially, only 20% of the children demonstrated development as expected; this proportion increased to 50% in Cycle I and 90% in Cycle II.These findings indicate that a variety of media and learning activities can contribute to the stimulation of children's fine motor skills (Ida Farida al., 2022).

Another study at the Ar-Rayyan Early Childhood Education Center (PAUD) in Bogor City also showed that the use of educational play equipment plays a role in the development of fine motor skills in early childhood. Educational play equipment, such as media that allow children to engage in manipulative activities, can provide opportunities for children to practice hand and finger coordination. This study specifically examined fine motor development through educational play equipment in Bogor City. This indicates that efforts to stimulate fine motor skills through learning media have been carried out, but some local research still relies more on games or physical media (Asyipa & Hidayat, 2024).

Meanwhile, technological advances have created opportunities to expand the range of learning media available for fine motor stimulation. Digital media can integrate images, animation, sound, video, and games. Educational and interactive activities in one medium. Research on the use of digital media by children at Trimardisunu Kindergarten, Demak, shows that digital media can be used as an alternative learning activity and play that is in line with technological developments, although its use still requires guidance from teachers and parents. With these characteristics, digital media has the potential to provide more engaging learning experiences while stimulating children's fine motor skills (Sa'adah et al., 2023).

Although previous research has demonstrated the benefits of various learning media for improving fine motor skills, empirical evidence on digital interventions for children aged 5–6 years remains limited, particularly in the context of Early Childhood Education (PAUD) in Bogor City. Local studies have predominantly emphasized hands-on activities, educational play equipment, and other physical media. Interactive e-books may address this gap because they can combine visual prompts with structured, repeated activities that require children to coordinate vision, finger movements, and hand actions. Features such as shape matching, guided coloring, tracing or drawing, and step-by-step visual instructions can provide developmentally appropriate opportunities for repeated hand–eye coordination practice. Therefore, experimental evidence is needed to determine whether an interactive e-book can provide measurable additional benefits for fine motor development in this population (Aini et al., 2024).

turnitin Page 8 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

This testing is important because the use of digital media in early childhood should not be assumed to produce positive developmental outcomes automatically. Its effectiveness depends on the design of the activities, developmental appropriateness, duration of use, and guidance from teachers or parents. In the present intervention, the interactive e-book was designed around six fine-motor activities: matching triangles, coloring an elephant picture, drawing a rectangle, cutting out a square, pasting a star, and drawing a circle. These activities target hand–eye coordination, writing-tool control, hand–finger coordination, precision, and fine motor control. Accordingly, an experimental comparison with a control group was used to examine changes in fine motor performance before and after the intervention (Rusliana et al., 2026).

Children require consistent and developmentally appropriate stimulation at home and in educational settings. Previous research has emphasized that directed parental stimulation can support children's developmental progress and that parents should pay attention to opportunities for stimulation in daily activities (Girsang et al., 2025; Yuniarty et al., 2025). This perspective supports the use of learning media that can be implemented with adult guidance both in educational and home contexts.

Based on the description, there is a research gap in the form of limited empirical evidence regarding the influence of digital learning media on the fine motor skills of children aged 5–6 years in the context of early childhood education in Bogor City. Previous research in Bogor City has shown that cutting activities with various media and educational play tools can be used to stimulate fine motor skills, while research in other areas has demonstrated the potential of digital media in fine motor learning. However, the influence of the experimental use of digital learning media on children aged 5–6 years in Bogor City still needs to be proven.

Therefore, this study aimed to determine the effect of interactive e-books as a digital learning medium on the fine motor development of children aged 5–6 years. This study used a Quasi-experimental design so that changes in children's fine motor skills could be compared before and after the intervention and can provide empirical evidence regarding the effectiveness of using digital learning media as an alternative media for stimulating early childhood development.

Furthermore, Ziaurrahman et al. (2024) reported through meta-analysis that e-books have the potential to support early childhood development, particularly when they are integrated with other learning activities. Their findings also indicate that the effectiveness of e-books depends on how the media are designed and implemented in the learning process.

Research shows that digital games can be used as a medium for fine motor skills training. These digital game-based interventions resulted in improvements in graphomotor skills and several related abilities. However, the study was conducted on elementary school children and used digital games, not interactive e-books

turnitin Page 9 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

RESEARCH METHOD

This study used a quantitative quasi-experimental design with a two-group pretest–posttest control-group approach. The study population consisted of 60 children aged 5–6 years within the working area of Cipaku Community Health Center. Non-probability purposive sampling was used based on predetermined eligibility criteria, and all 60 eligible children were included, with 30 children in the intervention group and 30 in the control group. The intervention group received learning activities using the interactive e-book, whereas the control group participated in the comparison condition. Fine motor development measurements were conducted before the intervention (pretest) and after the intervention (posttest). The research period was 2 months, which included the stages of instrument preparation, e-book development and validation, pretest, intervention administration, posttest, data processing, and preparation of the research report.

The study used a pretest–posttest control-group design. A pretest was administered to the intervention group (O1) and the control group (O3). The intervention group then received the interactive e-book intervention, whereas the control group followed the comparison condition. After the two-month study period, a posttest was administered to the intervention group (O2) and the control group (O4). Changes from pretest to posttest were analyzed within each group, and outcomes were compared between groups to evaluate the intervention effect.

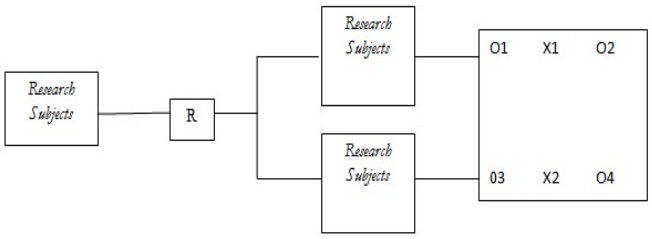


Figure 1. Two-group pretest–posttest study design

Fine motor development was assessed using a fine motor assessment rubric linked to six activities incorporated into the interactive e-book. The activities were: (1) matching triangles to assess hand–eye coordination; (2) coloring an elephant picture to assess control of writing tools; (3) drawing a rectangle to assess hand–eye coordination; (4) cutting out a square to assess hand–finger coordination; (5) pasting a star to assess precision; and (6) drawing a circle to assess fine motor control.

Each activity was assessed using a developmental achievement rubric with four levels: Not Yet Developing (BB), Beginning to Develop (MB), Developing as Expected (BSH), and Developing Very Well (BSB). For quantitative analysis, the categories were coded as BB = 1, MB = 2, BSH = 3, and BSB = 4. The summed rubric score would range from 6 to 24, with higher scores indicating better fine motor performance. However, the reported group means of approximately 3.70–4.65 do not match this total-score scale. The

turnitin Page 10 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

authors must clarify whether analyses used an item mean, a separate developmental index, or another scoring transformation, and reconcile the instrument description with Tables 2 and 3.

Data analysis in this study included univariate analysis to describe respondent characteristics, assessment of data normality distribution, and hypothesis testing using paired-samples t-test and independent-samples t-test. All statistical tests were performed at the 95% confidence level. Normality of data distribution was evaluated using the Shapiro-Wilk test, and homogeneity of variance between groups was assessed using the Levene test. Statistical analyses were performed using IBM SPSS Statistics 26.

RESULTS AND DISCUSSION

Results

Respondent Characteristics

Participant characteristics included age and sex. Respondent characteristic data was used to provide an overview of the research subjects and ensure that the baseline characteristics of the two groups were comparable

Table 1. Respondent Characteristics Based on Age

Age	Intervention (n)	Control (n)	Total (%)
5 years	11	11	37%
6 years	19	19	63%
Total	30	30	100%

As shown in Table 1, participants were aged 5–6 years. In both groups, 11 children were aged 5 years and 19 children were aged 6 years, the intervention group for children aged 5 years consisted of 11 children and for children aged 6 years consisted of 19 children, as well as the control group. These age groups are appropriate for the research targets because at this age, children experience increasingly complex motor skill development and require appropriate stimulation.

Distribution of Mean Scores of Fine Motor Development Before and After Intervention

Table 2. Distribution of Mean Scores for Fine Motor Development Before and After intervention

Group	N	Mean Difference	CI (95%)	p-value
Intervention (Pretest-Posttest)	30	0.800	0.469 – 1.131	< 0.001
Control (Pretest-Posttest)	30	0.576	0.262 – 0.872	0.001

Table 2 shows the mean change in fine motor development from pretest to posttest in both groups. The intervention group increased by 0.800 (95% CI: 0.469–1.131; $p < 0.001$), indicating a statistically significant improvement following the interactive e-book intervention. The control group also improved significantly, with a mean increase of

0.576 (95% CI: 0.262–0.872; p = 0.001). Thus, both groups improved over time, while the intervention group showed the larger numerical mean increase.

Distribution of mean scores of fine motor development before and after intervention

Table 3. Distribution of Mean Scores of Fine Motor Development Before and After Intervention

Group	N	Pretest Mean ± SD	Posttest Mean ± SD	Mean Difference	95% CI	p-value
Intervention	30	3.70 ± 1.055	4.60 ± 1.200	0.800	0.469–1.131	< 0.001
Control	30	4.20 ± 0.847	4.65 ± 1.100	0.576	0.262–0.872	0.001

Table 3 presents the pretest and posttest mean scores for the intervention and control groups. After the two-month study period, the intervention group showed a mean increase of 0.800, while the control group showed a mean increase of 0.576. These within-group changes were statistically significant (intervention: $p < 0.001$; control: $p = 0.001$). The intervention group therefore demonstrated the larger numerical improvement in fine motor scores over the study period.

The intervention group exhibited a numerically larger reported gain than the control group. Nevertheless, within-group significance does not establish a statistically significant treatment effect. A between-group comparison of change scores (or an appropriately adjusted analysis of posttest outcomes) with its effect estimate, 95% confidence interval, and p-value is required before claiming superiority. The interpretation has therefore been limited to the observed mean changes unless the authors confirm the final between-group test statistic, confidence interval, and p-value.

Discussion

Respondent Characteristics

Based on the results of the analysis of the characteristics of research subjects in the Community Health Center work area for children aged 5–6 years who were divided into intervention and control groups, the majority of respondents were in the 6-year-old age range (63%), while children aged 5 years amounted to 37%. The selection of this preschool age group is considered very appropriate developmentally, considering that in this phase children are in a golden period (golden age) where physical growth and motor development occur rapidly and complexly, thus requiring targeted stimulation that is in accordance with the characteristics of their growth and development (Firda Mahanani et al., 2022). From the perspective of Early Childhood Education (PAUD) theory, optimized stimulation in this age range will be very determine the maturity of physiological functions, small muscle strength, and neuromuscular coordination of the child's body before entering further formal education.

The findings of these age characteristics are in line with various previous studies which emphasize the importance of intervention. fine motor skills in children aged 5–6 years. For example, research by Kuswanto et al. (2021) showed that structured activities involving hand-finger coordination had a very significant effect on improving children's fine motor skills ($p < 0.001$). This finding was confirmed by Safitri et al. (2022) and Afifah et al. (2023), who stated that children aged 5–6 years already have sufficient cognitive capacity and motor readiness to receive manipulative exercises, such as holding writing tools and beginning writing, which require good visual-motor coordination. Furthermore, Rahayu Khoerunnisa et al. (2023) and Luvasi et al. (2023) through research on puzzle playing and weaving activities ($p < 0.001$) proved that repetitive hand movements are effective in stimulating finger dexterity in preschool children.

Although environmental factors, parenting styles, and cultural backgrounds (such as local Sundanese culture in the Bogor region) contribute to the development of children's motor skills (Novitasari et al., 2023), the dominant age of 6 years in this study serves primarily as a baseline characteristic for subject homogeneity, ensuring that children have the cognitive maturity to understand digital instructions. The researchers' argument emphasizes that age does not stand alone as a determinant of intervention success, but rather as a window of opportunity where interactive media-based stimulation will be maximally responded to by the child's central nervous system in forming new synaptic pathways that support fine motor skills.

Distribution of Mean Scores of Fine Motor Development Before and After Intervention

Based on the results of data analysis, the group given the interactive e-book intervention experienced a very significant increase in fine motor skills (mean difference = 0.800; 95% CI: 0.469–1.131; $p < 0.001$), while the control group also experienced a significant increase but with a smaller magnitude (mean difference = 0.576; 95% CI: 0.262–0.872; $p = 0.001$). The higher increase in the intervention group occurred because the interactive e-book provided dynamic visual stimulation and manipulative activities that require repeated eye-hand coordination.

These findings are consistent with evidence that structured, active, and visually guided activities can support fine motor practice. Sari et al. (2024) and Luvasi et al. (2023) reported benefits from repeated manipulative and visually guided activities that require coordinated hand and finger movements. Although these studies did not evaluate the same interactive e-book used in the present study, they provide a mechanistic comparison because the activities similarly involve repetition, visual guidance, and hand–eye coordination. Ziaurrahman et al. (2024) further reported that e-book effectiveness depends on how digital content is designed and integrated into learning activities. In the present study, the interactive e-book combined visual instructions with matching, coloring, drawing, cutting, and pasting tasks, thereby linking digital guidance with fine motor practice.

turnitin Page 13 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

Taken together, the findings suggest that the improvement observed in the intervention group may be related to the structured and repeated stimulation provided through the interactive e-book. Improvement in the control group may also reflect normal maturation and routine daily activities. Accordingly, the interactive e-book should be interpreted as a supplementary learning medium rather than as a replacement for conventional physical activities. Its potential value lies in organizing developmentally appropriate tasks and providing repeated visual guidance for hand–eye coordination and controlled finger movements.

Differences in Fine Motor Development (Posttest) Between the Intervention Group and the Control Group.

After two months of treatment, the intervention group showed an increase in the mean change score of 0.80, higher than the control group at 0.58. Fine motor development in children aged 5–6 years involves coordination of small muscles of the hands and fingers as well as mature visual-motor coordination for carrying out directed activities such as drawing, coloring, cutting, and manipulating objects. Firda Mahanani et al. (2022) explained that the age of 5–6 years is a crucial phase that requires appropriate stimulation for optimal achievement of children's fine motor development.

The present findings can be compared with studies of interventions that require repeated visual-motor and manipulative practice. Sari et al. (2024), Purba and Ramadhani (2025), Kuswanto et al. (2021), and Purnomo et al. (2025) reported improvements in fine motor performance following structured activities involving picking up, placing, arranging, stringing, collage, or project-based manipulation. These interventions are not identical to an interactive e-book, but they are methodologically relevant because they employ repeated task-based practice targeting hand–eye coordination and finger control. Evidence specifically evaluating interactive e-books for fine motor outcomes remains limited; this limitation reinforces the contribution of the present study while also indicating the need for further controlled digital-intervention research.

These findings are also consistent with Hakim et al. (2022) and Khairunisa et al. (2026), who reported that structured and repetitive fine motor activities can strengthen coordination and motor control. The present results extend this principle to a digitally guided format. However, because the observed mean gain was larger in the intervention group, rather than relying solely on this numerical difference, the effectiveness of the interactive e-book should be interpreted together with the verified between-group statistical analysis. This cautious interpretation avoids overstating superiority over conventional methods.

CONCLUSION

Most participants were 6 years old (63%). This characteristic describes the sample but does not establish an intervention effect. Fine motor scores improved in both groups, with a larger numerical mean increase in the interactive e-book group (0.800) than in the control group (0.576). These findings indicate that interactive e-books have potential as a supplementary medium for fine motor stimulation in children aged 5–6 years.The

turnitin Page 14 of 17 - Integrity Submission Submission ID trn:oid:::1:3700493250

interactive e-book organized activities requiring hand–eye coordination, writing-tool control, finger coordination, and precision. The larger numerical gain in the intervention group is promising, but superiority over the control condition cannot be established without a verified between-group analysis. Interactive e-books may complement, rather than replace, physical play and supervised fine motor activities.

REFERENCES

Alonso-Martínez, L., Ramírez-Vélez, R., García-Hermoso, A., Izquierdo, M., & Alonso-Martínez, A. M. (2025). Improving preschool fundamental motor skills through interventions targeting 24-hour movement behaviors and socioecological factors: A meta-analysis. *Journal of Physical Activity and Health*, *22*(9), 1076–1085. https://doi.org/10.1123/jpah.2024-0704

Bardid, F., Deconinck, F. J. A., Descamps, S., Verhoeven, L., De Pooter, G., Lenoir, M., & D'Hondt, E. (2013). The effectiveness of a fundamental motor skill intervention in pre-schoolers with motor problems depends on gender but not environmental context. *Research in Developmental Disabilities*, *34*(12), 4571–4581. https://doi.org/10.1016/j.ridd.2013.09.035

Blanco-Martínez, N., González-Devesa, D., Doval-Garabatos, E. M., & Ayán-Pérez, C. (2026). Effect of a psychomotor intervention on motor competence, graphomotor performance and writing proficiency in 5- to 6-year-old preschool children. *Children*, *13*(7), 973. https://doi.org/10.3390/children13070973

Cameron, C. E., Brock, L. L., Hatfield, B. E., Cottone, E. A., Rubinstein, E., LoCasale-Crouch, J., & Grissmer, D. W. (2015). Visuomotor integration and inhibitory control compensate for each other in school readiness. *Developmental Psychology*, *51*(11), 1529–1543. https://doi.org/10.1037/a0039740

Cameron, C. E., Brock, L. L., Murrah, W. M., Bell, L. H., Worzalla, S. L., Grissmer, D., & Morrison, F. J. (2012). Fine motor skills and executive function both contribute to kindergarten achievement. *Child Development*, *83*(4), 1229–1244. https://doi.org/10.1111/j.1467-8624.2012.01768.x

Cameron, C. E., Cottone, E. A., Murrah, W. M., & Grissmer, D. W. (2016). How are motor skills linked to children's school performance and academic achievement? *Child Development Perspectives*, *10*(2), 93–98. https://doi.org/10.1111/cdep.12168

Dinehart, L. H. (2015). Handwriting in early childhood education: Current research and future implications. *Journal of Early Childhood Literacy*, *15*(1). https://doi.org/10.1177/1468798414522825

Dinehart, L., & Manfra, L. (2013). Associations between low-income children's fine motor skills in preschool and academic performance in second grade. *Early Education and Development*, *24*(2), 138–161. https://doi.org/10.1080/10409289.2011.636729

Egert, F., Cordes, A.-K., & Hartig, F. (2022). Can e-books foster child language? Meta-analysis on the effectiveness of e-book interventions in early childhood education and care. *Educational Research Review*, *37*, 100472. https://doi.org/10.1016/j.edurev.2022.100472

Engel, A., Broderick, C., van Doorn, N., Hardy, L., Ward, R., Kwai, N., & Parmenter, B. (2022). Effect of a fundamental motor skills intervention on fundamental motor skill and physical activity in a preschool setting: A cluster randomized controlled trial. *Pediatric Exercise Science*, *34*(2), 57–66. https://doi.org/10.1123/pes.2021-0021

Grissmer, D., Grimm, K. J., Aiyer, S. M., Murrah, W. M., & Steele, J. S. (2010). Fine motor skills and early comprehension of the world: Two new school readiness indicators. *Developmental Psychology*, *46*(5), 1008–1017. https://doi.org/10.1037/a0020104

Hestbaek, L., Vach, W., Andersen, S. T., & Lauridsen, H. H. (2021). The effect of a structured intervention to improve motor skills in preschool children: Results of a randomized controlled trial nested in a cohort study of Danish preschool children, the MiPS study. *International Journal of Environmental Research and Public Health*, *18*(23), 12272. https://doi.org/10.3390/ijerph182312272

Kirkorian, H. L. (2018). When and how do interactive digital media help children connect what they see on and off the screen? *Child Development Perspectives*, *12*(3), 210–214. https://doi.org/10.1111/cdep.12290

Li, H., Zhang, T., Woolley, J. D., An, J., & Wang, F. (2023). Exploring factors influencing young children's learning from storybooks: Interactive and multimedia features. *Journal of Experimental Child Psychology*, *233*, 105680. https://doi.org/10.1016/j.jecp.2023.105680

Li, Y., Wu, X., Ye, D., Zuo, J., & Liu, L. (2025). Research progress on the relationship between fine motor skills and academic ability in children: A systematic review and meta-analysis. *Frontiers in Sports and Active Living*, *6*, 1386967. https://doi.org/10.3389/fspor.2024.1386967

Liang, C., Zhang, L., & Sun, J. (2025). The comparative impact of digital and print storybook reading on preschool children's comprehension and vocabulary learning: A two-decade meta-analysis. *International Journal of Early Childhood*, *57*, 547–573. https://doi.org/10.1007/s13158-024-00410-4

Lin, L.-Y., Cherng, R.-J., & Chen, Y.-J. (2017). Effect of touch screen tablet use on fine motor development of young children. *Physical & Occupational Therapy in Pediatrics*, *37*(5), 457–467. https://doi.org/10.1080/01942638.2016.1255290

Mol, S. E., Bus, A. G., & de Jong, M. T. (2009). Interactive book reading in early education: A tool to stimulate print knowledge as well as oral language. *Review of Educational Research*, *79*(2). https://doi.org/10.3102/0034654309332561

Operto, F. F., Viggiano, A., Perfetto, A., Citro, G., Olivieri, M., de Simone, V., Bonuccelli, A., Orsini, A., Aiello, S., Coppola, G., & Pastorino, G. M. G. (2023). Digital devices use and fine motor skills in children between 3–6 years. *Children*, *10*(6), 960. https://doi.org/10.3390/children10060960

Savva, M., Higgins, S., & Beckmann, N. (2022). Meta-analysis examining the effects of electronic storybooks on language and literacy outcomes for children in grades Pre-K to grade 2. *Journal of Computer Assisted Learning*, *38*(2), 526–564. https://doi.org/10.1111/jcal.12623

Son, S.-H. C., & Butcher, K. R. (2024). Effects of varied multimedia animations in digital storybooks: A randomised controlled trial with preschoolers. *Journal of Research in Reading*, 47(3), 249–268. https://doi.org/10.1111/1467-9817.12452

Takacs, Z. K., Swart, E. K., & Bus, A. G. (2015). Benefits and pitfalls of multimedia and interactive features in technology-enhanced storybooks: A meta-analysis. *Review of Educational Research*, *85*(4), 698–739. https://doi.org/10.3102/0034654314566989

Telford, R. M., Olive, L. S., & Telford, R. D. (2022). The effect of a 6-month physical literacy intervention on preschool children's gross and fine motor skill: The Active Early Learning randomised controlled trial. *Journal of Science and Medicine in Sport*, *25*(8), 655–660. https://doi.org/10.1016/j.jsams.2022.04.009

Van Capelle, A., Broderick, C. R., van Doorn, N., Ward, R. E., & Parmenter, B. J. (2017). Interventions to improve fundamental motor skills in pre-school aged children: A systematic review and meta-analysis. *Journal of Science and Medicine in Sport*, *20*(7), 658–666. https://doi.org/10.1016/j.jsams.2016.11.008

Van der Walt, J., Plastow, N. A., & Unger, M. (2020). Motor skill intervention for pre-school children: A scoping review. *African Journal of Disability*, 9, 747. https://doi.org/10.4102/ajod.v9i0.747