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Development of Batik Art Learning Media to Enhance Concentration in Deaf Children

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Abstract. Concentration serves as a fundamental cognitive component for deaf children, who often face challenges due to high cognitive load and mental fatigue. This study aimed to develop and test the feasibility of a Batik Art Learning Media book to enhance the concentration of deaf children in early childhood. Guided by the Design-Based Research (DBR) method, this study's development process was structured around an iterative validation cycle with 14 experts (media experts, batik experts, deaf education experts, psychologists, and practitioners) and deaf students in early childhood at SLB-B YRTRW Surakarta as trial subjects. The media prototype, a graded activity book consisting of tracing, completing, and coloring tasks, was developed as a structured concentration intervention and has undergone expert validation and field testing. Expert validation results using Aiken's V indicated that all aspects of the media (16 items) were valid ($V > 0.72$) and that the concentration instrument (9 items) was valid ($V > 0.80$). The inter-rater reliability of the concentration instrument was considered satisfactory (ICC=0.850; p=0.001). Field trials employing a one-group pretest-posttest design revealed a statistically significant increase in concentration scores (p=0.000), with an average improvement of 59 points, meaning that children demonstrated noticeably better concentration. This study concludes that the developed batik art media book is feasible, practical, and potentially effective in enhancing the concentration of deaf children in early years setting. This medium effectively merges evidence-based cognitive training with structured local cultural wisdom that aligns with the visual learning characteristics of deaf children.

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1. Introduction

Concentration ability, encompassing sustained and selective attention, is a fundamental cognitive component that determines a child's academic success and social adaptation (Fisher, 2019). For deaf children, achieving this ability presents complex challenges. Deaf children often experience high cognitive load because they must rely heavily on visual modalities to process information, such as lip-reading or interpreting sign language, while simultaneously attempting to filter out environmental distractions (Dye & Terhunw-Cotter, 2021).

This process, which continuously demands extra effort, causes significant mental fatigue (often referred to as listening or visual fatigue). This fatigue subsequently manifests as reduced attention and frustration, and in the long term, may contribute to an increased risk of anxiety symptoms as well as decreased learning motivation (Kushalnagar et al., 2020). This situation creates a vicious circle wherein concentration deficits hinder the learning process, making academic goals difficult to attain and potentially impacting the child's psychological well-being (Hall et al., 2017).

Recent neuroscience research has confirmed that children with hearing loss exhibit developmental patterns of executive functions, including attention components, that may differ from those of hearing children. Several studies have identified deficits in tasks measuring selective and sustained attention control, which cannot be fully compensated by the use of hearing aids or cochlear implants (Nicastri et al., 2021). These deficits are hypothesized to be linked to a suboptimal cognitive workload in the sustained processing of visuospatial information, which affects working memory capacity and focus (Kushalnagar et al., 2020). Therefore, interventions specifically designed to train and strengthen sustained attention through structured visual modalities are a critical necessity. Such interventions are most effective when implemented during early childhood or the "Golden Age," a period characterized by high neuroplasticity and the intensive construction of foundational cognitive skills (Putri et al., 2025).

Pedagogically, deaf children require multisensory learning media, particularly those that optimize visual and tactile channels, designed to minimize distractions and enhance active engagement (Rahman & Jinu, 2023). Various media have been developed, ranging from augmented reality applications for sign language recognition (Aditama et al., 2021) and videos with clear visual representations (Zakia & Yamtinah, 2017), to interactive online learning tools utilizing ICT to improve the online learning and communication skills of deaf children (Alshammari et al., 2018).

However, a literature review indicates that the majority of these media focus on teaching specific a subject content (e.g., mathematics, science, vocabulary) or on communication aspects. A significant research gap lies in the scarcity of media specifically designed with the primary objective of serving as an attention training

tool to train and enhance concentration capacity. Ideally, such tools should employ a structured and tiered approach that can be integrated with occupational therapy or cognitive activities in special education schools (SLB).

On the other hand, Indonesia's cultural richness, specifically traditional geometric batik art, offers an unexplored source of inspiration for this purpose. Geometric motifs such as *Kawung, Parang*, or *Ceplok* are composed of repetitive patterns of fundamental shapes (circles, lines, squares) that are symmetrical, regular, and visually complex. These characteristics align with principles in occupational and art therapy, wherein activities involving regular patterns can be utilized to train visual focus, an eye for detail, and persistence in task completion (Boop et al., 2020).

Studies in the psychology of perception and art therapy indicate that activities such as coloring mandala patterns (which are comparable in complexity to geometric batik motifs) can reduce anxiety and enhance focus and selective attention in children (Campenni & Hartman, 2020). The utilization of batik also offers a contextual advantage: the reinforcement of cultural identity through culture-based education. Culture-based learning approaches have been demonstrated to increase relevance, engagement, and a sense of pride among students, which in turn can enhance intrinsic motivation in learning (Rogoff et al., 2017).

Based on this gap analysis, the present study aimed to bridge two critical areas: the need for batik art learning media that serve as evidence-based cognitive interventions to enhance concentration among deaf children in early years, and the untapped potential of local visual cultural heritage as both a learning medium and a therapeutic tool. Therefore, this study aimed to develop and test the feasibility of a structured learning medium based on Batik Art to improve the concentration of deaf children at an early year setting.

2. Literature Review

This literature review explains: 1) deaf children in early years: characteristics and learning needs, 2) the concept of concentration in learning readiness, and 3) batik as an adaptive art learning medium. These aspects provide a theoretical foundation for understanding the design of batik art learning media to improve the concentration of deaf children in early years.

2.1 Deaf Children in Early Childhood: Characteristics and Learning Needs

Deaf children in their early years' experience limitations in receiving auditory information, necessitating a reliance on visual and tactile modalities as their primary learning channels (Gale & Martin, 2024). These characteristics make visual learning media and hands-on activities a highly effective pedagogical approach. However, deaf children often encounter challenges in maintaining concentration, frequently exhibiting symptoms such as distractibility,

impulsivity, and difficulty focusing, all of which can hinder the acquisition of instructional material.

Consequently, the educational process in these children requires specialized learning media designed with careful consideration of their sensory, cognitive, and motor needs. Recent research emphasizes the importance of inclusive instructional design that accommodates the unique characteristics of deaf children to effectively fulfill their learning requirements (Latino et al., 2025). A previous study has also shown that action video game experience significantly improved visual selective attention accuracy in deaf students in middle school, achieving performance comparable to hearing peers (Cui et al., 2025).

2.2 The Concept of Concentration in Learning Readiness

Concentration, or attention, is a fundamental aspect of a child's learning readiness (Nasution, 2017) Key indicators of learning concentration include: focus during material delivery, responsiveness to lessons, attention directed toward the teacher, accuracy in answering and completing tasks, active questioning, and improvement in learning outcomes (Cecep et al., 2022). Interventions through art-based learning media, particularly those featuring structured and repetitive patterns, are considered to have significant potential for training attentional endurance. Activities involving hand-eye coordination and requiring precision have been proven to enhance focus (Dye & Terhunw, 2021).

2.3 Batik Adaptive Art Learning Media

Batik, as an Indonesian cultural heritage, possesses not only aesthetic value but also significant pedagogical potential. The creation process, which involves fine motor skills such as *canting* (wax-patterning), stamping, and coloring, aligns with the fine motor development activities required for preschool-aged children (Fifiafianti & Gunadi, 2025)

2.3.1 *Philosophy and Geometric Motifs.*

Geometric batik motifs, such as *Kawung* and *Parang*, consist of fundamental elements including dots, straight lines, curved lines, and circles arranged in a recurring manner. These repetitive and predictive patterns are compatible with instructional materials designed to train skills such as connecting dots, tracing lines, and affixing shapes. Therefore, these motifs are ideal for cultivating concentration and precision in children (Saefudin et al., 2025).

2.3.2 *Principles for Developing Batik Learning Media for Deaf Children*

The development of batik-based learning media for preschool deaf children must adhere to specific instructional principles: 1) strong Visualization and High Contrast: Motifs must be distinct, utilizing high color contrast to facilitate visual perception (Saddhono et al., 2019), 2) structured Fine Motor Stimulation: Activities such as holding a *canting* (wax pen) or brush, controlling strokes, and coloring within designated areas stimulate hand-eye coordination. Research by (Ingkir et al., 2020) demonstrates a significant improvement in fine motor skills through batik-making activities, 3) predictive Repetitive Patterns: Repetitive patterns help children anticipate subsequent steps, thereby making it easier to maintain focus and reducing anxiety (Dye & Terhunw, 2021), and 4) multimodal

Integration: The media must integrate visual cues (images, symbols), tactile elements (material textures), and sign language to ensure comprehensive understanding (Haris et al., 2023; Rosdiana & Pratiwi, 2023; Yasin & Mohamad, 2024).

2.3.3 *Modification for Safe and Accessible Batik Learning Media*

To ensure effectiveness and safety, batik learning media must be modified through the following measures: 1) simplification of Motifs; Complex motifs are simplified into basic geometric shapes (circles, squares, lines) that are easily recognized and imitated by children (Saefudin et al., 2025), 2) Use of Safe Materials; The process utilizes non-toxic pigments (such as food coloring or child-safe water colors), blunt tools, and alternative media like wax or playdough to ensure a hazard-free environment (Roostin, 2020), 3) Visual and Sign Language Support; Each instructional step is accompanied by clear visual diagrams and explanations provided in sign language to support deaf learners (Haris et al., 2023).

2.4 Conceptual Framework: From Problem to Solution]

The conceptual framework can be formulated as follows: Preschool-aged deaf children require visual-tactile learning media to overcome concentration challenges and support their fine motor development. Batik, particularly geometric motifs such as *Kawung* and *Parang*, offers a series of structured, repetitive, and predictable activities that theoretically train attention endurance. By modifying this medium based on the principles of safety, visual simplification, and multimodal integration (visual-sign language), it is hypothesized that batik art learning media can function as an effective tool for improving the concentration of preschool-aged deaf children. The expected final product is a complete set of batik art learning media, which include implementation guides and Daily Lesson Plans (RPPH) aligned with the Early Childhood Education (PAUD) curriculum.

3. Methodology

This section presents the research methodology, encompassing the research design and procedures, research location and participants, as well as data collection and analysis techniques.

3.1 Research Type and Design

This study was a Research and Development project utilizing a Design-Based Research (DBR) approach. The DBR approach was selected because it aims to generate a product (a learning media prototype) that is practically effective for resolving real-world classroom issues, while simultaneously developing transferable design principles through an iterative process of design, implementation, and evaluation within an authentic context (McKenney & Reeves, 2018).

3.2 Setting and Research Subjects

This study was conducted at SLB-B YRTRW in Surakarta, Central Java, Indonesia. The selection of SLB-B YRTRW was based on the suitability of the research context

and strategic partnerships. The research subjects comprised of two groups: 1) The Expert Group acting as product validators, which included learning media experts, batik experts, deaf education experts, and practitioners (special education teachers); and 2) The Trial Group, representing the end-users of the product, consisting of 7 (seven) deaf students in early childhood or early grade level at the school. The trial subjects were selected using purposive sampling, with inclusion criteria: students diagnosed as deaf and students exhibiting difficulty in maintaining concentration as determined by teacher assessments (Campbell et al., 2020).

3.3 DBR (Design-Based Research) Development Procedure

The development procedure followed the three-stage iterative cycle model by McKenney & Reeves (McKenney & Reeves, 2018). Figure 1

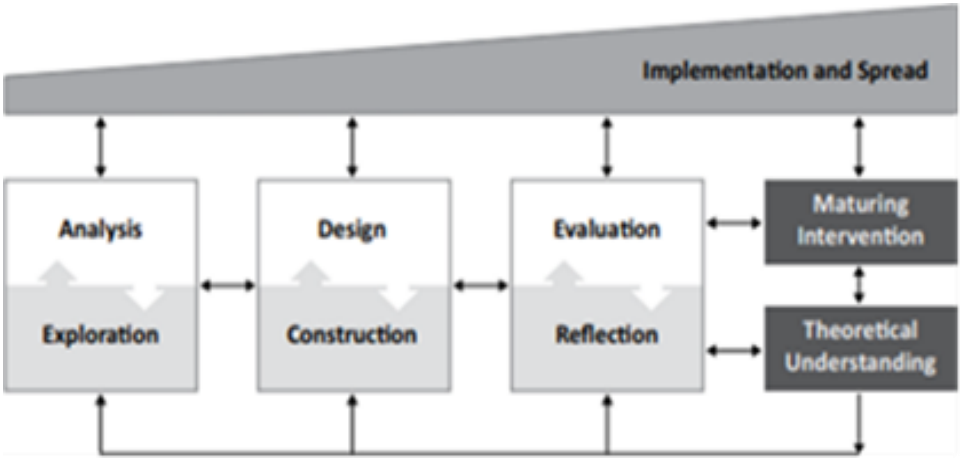

Figure 1: Design-based research approach (McKenney & Reeves, 2018)

3.3.1 *Analysis & Exploration Phase*

This phase served as the foundation of the research to deeply understand the problem context. The activities included: a) a literature study regarding the concentration of deaf children and culture-based learning media; b) preliminary classroom observations to identify student behaviors and concentration constraints; c) in-depth interviews with some teachers and parents at SLB-B YRTRW to uncover practical needs and challenges; and d) analysis of the curriculum and learning environment.

The outcome of this phase was a comprehensive problem map, a needs assessment, and initial specifications for a media design that aligns with the characteristics and needs of the deaf students at the school.

3.3.2 *Design & Construction Phase*

This phase aimed to design and develop the learning media prototype and its user guide. Based on the needs assessment, Prototype 1 of the batik art learning media was designed and developed. The design took the form of an activity book featuring geometric batik patterns (primarily the *Kawung* motif) with tiered difficulty levels, accompanied by a user guide for teachers.

Prototype 1 was evaluated by expert validators to assess content, construct, and media feasibility. The validators consisted of: (1) Learning Media Experts (assessing pedagogical aspects and instructional design); (2) Culture/Batik Experts (assessing accuracy and motif representation); (3) psychologist and Special Education/Deaf Education Experts (assessing suitability with the characteristics and needs of deaf children); and (4) Practitioners (Special Education Teachers) (assessing field practicality). Feedback and suggestions from the experts were considered to revise the product into Prototype 2.

3.3.3 *Evaluation & Reflection Phase*

This phase aimed to test and refine Prototype 2 through field trials. Prototype 2 was trialled with 7 (seven) deaf students. Data were collected to assess preliminary potential effectiveness. Observations and test results were analyzed to facilitate reflection and final revisions, yielding the Final Product: the batik art learning media book.

3.4 Data Collection Techniques

Data were collected using the following instruments: a) expert Validation Sheets: A 5-point Likert scale questionnaire utilized to assess aspects of media feasibility. b) observation Sheets: Employed during trials to record practicality, implementation feasibility, and indicators of student concentration behavior. c) Performance Tests (Pre-test & Post-test): Simple test instruments designed to measure the level of accuracy and completion in batik pattern activities, administered before and after the intervention utilizing the media.

3.5 Data Collection and Analysis

Data analysis was conducted both quantitatively and qualitatively to address the research objectives.

a. Expert Validity: Content Validity; Analyzed using Aiken's V formula to quantify the level of agreement among validators regarding the relevance of each instrument item to the construct being measured (Nurjanah et al., 2023). A value of $V > 0.80$ is considered indicative of good content validity.

b. Reliability Analysis: Inter-Rater Reliability; Analyzed using the Intraclass Correlation Coefficient (ICC) with a two-way random effects model to measure the consistency of ratings among experts (Koo & Li, 2016). An ICC value > 0.75 indicates good reliability.

c. Trial Analysis and Potential Effectiveness: The trial analysis employed a one-group pretest-posttest design to determine the difference resulting from a specific treatment on the subjects (Siedlecki, 2020); 1) practicality: Described qualitatively based on observation results and field notes taken during the trials, 2) potential Effectiveness: Analyzed using the Paired Samples T-Test to compare the mean scores of the students' pre-test and post-test (Ross & Willson, 2018). This test determines whether there is a statistically significant improvement in performance following the use of the media. Supporting analysis was conducted qualitatively regarding observation data on concentration behaviors.

Through this methodological framework, the research expectedly yields medias that is not only theoretically feasible (valid) but also proven practical and

possesses potential effectiveness in assisting to enhance the concentration of deaf children

4. Results and Findings

This section answers the research objectives: 1) explaining the developed instructional design, and 2) evaluating the feasibility of the media book to improve the concentration of deaf students in early childhood.

4.1 Analysis and Exploration Phase

Based on the interviews and observations at SLB-B YRTRW Surakarta, the following contextual overview was obtained:

a. Within a single classroom, there was a variation in abilities and concentration levels. Some students were capable of maintaining focus and completing tasks, while others remained highly susceptible to distraction.

b. The deaf children required personalized guidance and strong visual learning media due to their reliance on visual modalities for learning. A lack of direct teacher attention often resulted in students losing focus and engaging in unrelated activities.

c. A child's readiness for grade progression relied heavily on the maturity of their abilities, with concentration serving as a critical component.

d. There was a lack of art learning media, particularly for batik art, that is specifically designed for the learning characteristics of deaf children, especially regarding the training of concentration.

e. The teachers required a batik art learning medium that is: (a) structured with clear guidelines; (b) relevant to the curriculum and local cultural context; (c) practical and easy to implement in the classroom; and (d) intentionally designed to train the focus and visual attention to detail of deaf students.

These findings highlight an urgent need for visual, structured, and adaptable learning media to train concentration in preschool-aged deaf children, making this analysis phase the foundation for the media design.

4.2 Design and Construction Phase

Based on the needs analysis, this phase produced the Batik Art Learning Media and its user guide. The product was designed on the principle of gradual complexity, using the Kawung pattern from simple dots and circles to more intricate forms to ensure children experience manageable, increasing challenges suited to their capabilities.

4.2.1 *Expert Validation Results and Instrument Testing*

a. Feasibility Validation of Instructional Media Product

The feasibility of the batik art learning media product designed to enhance the concentration of deaf children was assessed through expert judgment involving 14 expert validators. The assessment utilized 16 statement items covering physical aspects (text, images, color) and media benefits. Content The content validity analysis was conducted using Aiken's V, with a minimum index of 0.72.

Table 1: Expert Validation Results

Statement Item	Validity	Interpretation
Item_1	0,80	Valid
Item_2	0,73	Valid
Item_3	0,73	Valid
Item_4	0,77	Valid
Item_5	0,73	Valid
Item_6	0,8	Valid
Item_7	0,75	Valid
Item_8	0,73	Valid
Item_9	0,73	Valid
Item_10	0,73	Valid
Item_11	0,73	Valid
Item_12	0,75	Valid
Item_13	0,73	Valid
Item_14	0,73	Valid
Item_15	0,73	Valid
Item_16	0,73	Valid

The analysis results (Table 1) indicate that all the 16 items were declared valid, with V values ranging from 0.73 to 0.80. No item fell below the criterion threshold of 0.72. The highest V value (0.80) was achieved by Item_1 and Item_6, indicating very strong expert agreement regarding the aspects measured by these items. The average validity across all items was 0.75.

Based on Aiken's V criteria, this batik art learning media product was declared feasible in terms of content and construct from the perspectives of media experts, psychologists, subject matter experts (batik and deaf children), as well as practicality according to the practitioners' assessments. These findings provide empirical justification that the developed medium has met the content validity requirements to proceed to further trials.

b. Validation of Concentration Measurement Instruments

The instrument employed to measure children's concentration (such as observation sheets or performance tests) was also validated by 5 instrument experts. The aspects of concentration included attention, selective focus, sustaining focus, psychomotor response, situational awareness, and shifting attentional focus as needed. Based on these concentration aspects, concentration indicators consisting of 9 items were subsequently formulated. The analysis of these 9 statement items employed Aiken's V with a higher minimum validity threshold of 0.80.

The analysis results indicated that all the 9 items of the concentration instrument obtained validity values exceeding 0.80, with a range between 0.80 and 0.90. The highest V value (0.90) was achieved by Item 4 and Item 5, demonstrating a very high level of expert agreement regarding the aspects being measured. The overall average validity of the instrument was 0.84. This means that the developed

concentration measurement instrument possesses good content validity and is deemed feasible for use. With all items meeting the stringent criteria (V > 0.80), this instrument is considered capable of accurately measuring the concentration construct and is reliable for data collection during the media trials.

c. Reliability Analysis Results

The reliability analysis of the concentration instrument in this study utilized the Intraclass Correlation Coefficient (ICC) to estimate inter-rater reliability. This analysis was conducted to assess the consistency of ratings among the raters (Teachers, Observers, and Researchers) regarding the concentration instrument. The reliability results are presented in Table 2.

Table 2*:* Results of the Intraclass Correlation Coefficient (ICC)

Intraclass Correlation Coefficient

	Intraclass Correlation[b]	95% Confidence Interval		F Test with True Value 0			
		Lower Bound	Upper Bound	Value	df1	df2	Sig
Single Measures	,850[a]	,561	,970	18,000	6	12	<,001
Average Measures	,944[c]	,793	,990	18,000	6	12	<,001

Two-way mixed effects model where people effects are random and measures effects are fixed.

a. The estimator is the same, whether the interaction effect is present or not.

b. Type C intraclass correlation coefficients using a consistency definition. The between-measure variance is excluded from the denominator variance.

c. This estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

Based on Table 2, the ICC value of 0.850 with a significance level of 0.001 indicates that the inter-rater reliability is satisfactory. The significance value ($p < 0.05$) signifies that the correlation between assessments in the initial and subsequent tests was significant; thus, it can be concluded that high consistency existed among the raters.

Figure 2: Learning media products

Thus, this batik art learning media book product (Figure 2.) is declared valid (based on the previous Aiken's V analysis). Meanwhile, the concentration instrument is also reliable based on inter-rater assessments. These results provide a strong basis for conducting field trials.

4.3 Evaluation and Reflection Phase

The Evaluation and Reflection Phase involved conducting the intervention trial of the batik art learning media.

4.3.1 Field Trial Results

Upon being declared valid and reliable through the expert assessment, the product in the form of a batik art learning media book was field-tested on deaf children at SLB-B YRTRW Surakarta, involving 7 (seven) deaf students in early childhood. This study employed a quantitative approach utilizing a one-group pretest-posttest design to determine the difference resulting from a specific treatment on the subjects.

Learning utilizing the batik art media was conducted over 4 (four) meetings; each of which consisted of 3 (three) treatment activities: tracing, completing, and coloring batik patterns. Prior to implementing the treatment, the researcher administered a pretest to these deaf children to measure their concentration behavior. Following the pretest, the deaf children received the treatment. During this process, the children's behavior was observed and assessed by three observers to identify concentration behaviors, referring to the specific concentration behavior indicators for deaf children. Following the treatment, the children's

concentration behavior was measured again through a posttest. The results can be seen in Figure 3.

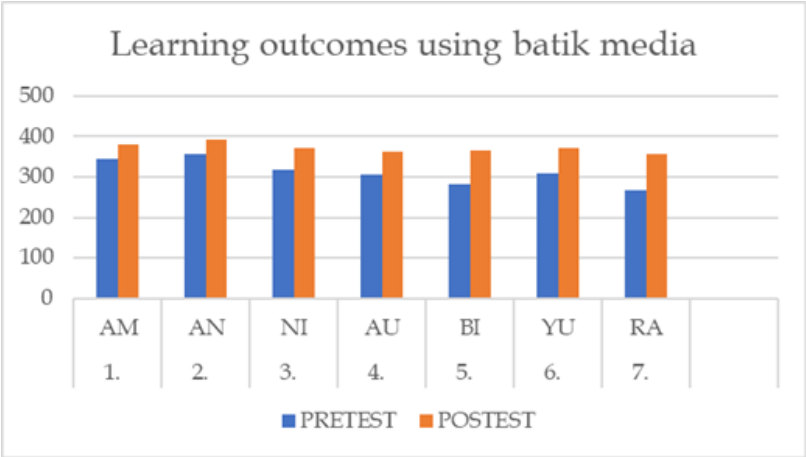

Figure 3: Learning outcomes using media

Figure 3 shows that the average scores of nearly all the children improved, confirming that each child experienced increased concentration.

To test the hypothesis, a statistical analysis was conducted using the Paired Samples T-Test with SPSS-27 software. The data compared were the students' concentration scores during the pre-test (prior to intervention) and the post-test (following the intervention utilizing the batik media). Prior to conducting the t-test, a normality test was performed. The results of the normality test are presented in Table 3.

Table 3: Results of the Normality Test Analysis

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRETES	,138	7	,200*	,970	7	,901
POSTES	,185	7	,200*	,961	7	,827

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

The normality test results for the pre-test and post-test data using the Shapiro-Wilk test are presented in Table 3. Thet normality test for the pre-test data yielded a significance level of 0.901. Since the pre-test significance level (0.901 (> 0.05), so H0 = was accepted, meaning that the pre-test data were normally distributed. The normality test of the post-test yielded a significance level of 0.827 > 0.05, so H0 accepted, meaning that the post-test data were also normally distributed. Therefore, both the pre-test and post-test concentration data had a normal distribution.

As the pre-test and post-test data were normally distributed and homogeneous, the hypothesis testing proceeded using a parametric paired samples t-test. The results of the t-test analysis conducted via SPSS-27 are presented in Table 4.

Table 4: Results of the Paired Samples T-Test on Concentration Scores

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Pretest - Posttest	-59,000	20,817	7,868	-78,252	-39,748	-7,499	6	,000

Hypothesis Testing: Table 4. The paired t-test results yielded a p-value of 0.000, well below the significance limit alpha = 0.05, so the Null Hypothesis (H_0) was rejected. This means that there was a statistically significant difference between concentration scores before and after using the Batik art media. Improvement: There was an average score increase of 59 points, meaning that these children demonstrated noticeably better concentration, including sustained attention to detail and reduced interruption rates during tasks. These findings support the research hypothesis that structured geometric batik motifs (*Kawung*) in learning media possess potential effectiveness as an intervention tool to improve concentration abilities within the target population.

5. Discussion

The results of this study confirm that the developed batik art learning media, based on the geometric Kawung motif, is significantly effective in enhancing the learning concentration of deaf children in early childhood. The statistical analysis revealed a significant difference between the pre-test and post-test scores (p = 0.000), with an average increase of 59 points. This finding aligns with the principle that deaf children require learning media specifically designed to accommodate their visual learning modalities and serve as effective instructional tools (Anggraeni et al., 2023).

The use of appropriate media not only makes learning materials more engaging and enjoyable (Smaldino et al., 2019) but also has the potential to enhance subject matter mastery, facilitate students in managing their learning process, and ultimately increase their intrinsic learning motivation (Mayer, 2024). Pedagogically, learning becomes more optimal when integrated with media that functions as a mediator to deliver information in a way that is more accessible and easily understood (Anggraeni et al., 2023).

This batik art medium specifically leverages the strength of visual modality, which serves as the primary channel for information processing in deaf children. The presentation of materials through these structured visual patterns aligns with research findings indicating that the use of visual media is highly instrumental in achieving learning objectives for deaf students (Zakia & Yamtinah, 2017). The effectiveness of a visual approach is further supported by studies in the context of science education (Alshammari et al., 2018), and for enhancing concentration in students in their early childhood in general (Enns et al., 2021).

The uniqueness and success of this medium also lie in its design principles, which are based on Developmentally Appropriate Practice (DAP). The activities involving the *Kawung* pattern are structured through a scaffolded approach, progressing from simple to complex patterns. This allows children to experience early success while gradually building their concentration endurance. The structured intervention, consists of three stages. First, tracing, aimed at enabling children to imitate the drawing of the *Kawung* batik pattern. Second, completing, intended to reinforce memory of the initially drawn *Kawung* batik pattern, so children can fill in the incomplete parts. Third, coloring, designed to train children to be careful and avoid mistakes while drawing the Kawung batik pattern, with colors matching the provided example.

Each stage is designed to train distinct aspects of attention: visual precision, working memory, and inhibitory control (required when adhering to color templates). The integration of coloring elements also aligns with the natural interests of students in early childhood, thereby enhancing appeal and engagement. Research in the field of art therapy indicates that structured art activities involving repetitive and geometric patterns, such as those found in Kawung batik, are particularly effective in improving selective attention and reducing anxiety in children with special needs. This is consistent with research findings that art therapy significantly improves anxiety symptoms in children (Zhang et al., 2024).

The process of creating the *Kawung* batik motif, with its repetitive pattern, functions as a structured exercise that trains sustained focus and visual precision. This activity trains individuals to improve concentration. A structured intervention consisting of three sequential stages is designed to optimize these cognitive benefits, especially for deaf children: 1) tracing, which trains visual precision and visuomotor coordination through accurate observation and copying of pattern details, 2) completing, which aims to strengthen memory of the pattern by training working memory in reconstructing the mental representation of the pattern, 3) coloring, which is designed to train carefulness and inhibitory control by requiring the child to stay within the lines and follow a color template, thereby suppressing impulsive responses.

The integration of coloring also enhances the appeal and engagement of children. Overall, this series of activities forms a comprehensive cognitive training that builds focus capacity. Repetitive patterns in art facilitate a state of flow, where attention is fully devoted to the present task (Zhang et al., 2023). Consistent repetition across these three stages creates optimal conditions for the development of concentration behavior through the principle of the Law of Exercise, in which consistently applied structured stimuli produce behavioral changes, such as improved concentration (Gershman, 2020; Kurtz et al., 2020; Legler et al., 2025). These findings reinforce evidence that arts-based interventions can enhance cognitive function in the domains of memory, attention, and regulation (Kuang, 2024; Lee et al., 2019).

Beyond serving as a cognitive tool, this medium integrates a cultural dimension through the use of local batik motifs. The importance of a culturally responsive pedagogical approach in special education is increasingly recognized. Studies have indicated that integrating elements of local culture into learning materials not only enhances the relevance and engagement of students from minority backgrounds including those with disabilities but also strengthens their self-identity and cultural pride (Salamanca, 2025).

The success of the intervention can be traced to several unique characteristics of the designed activities:
a. Clear Structure and Sequence: Each stage (tracing, completing, and coloring) possesses specific and achievable operational goals, thereby eliminating ambiguity and guiding the child's attention effectively (Arana-Llanes et al., 2018).
b. Immediate Visual Feedback: Children can directly observe the results of their efforts, which provides immediate satisfaction and reinforces concentration behavior (Gershman, 2020). This aligns perfectly with the visual characteristics of students with hearing impairments (Zakia & Yamtinah, 2017).
c. An Enjoyable and Low-Threat Environment: The art activities foster a low-stress learning atmosphere. Such a comfortable psychological state is vital, as poor mental health can impair concentration and cognitive function (Ebrahem et al., 2024). The presence of responsive therapists also plays a crucial role in establishing this comfort (Bosgraaf et al., 2020).

Furthermore, these activities sharpen visual-spatial skills—an area that is often a significant strength for deaf children (Zakia & Yamtinah, 2017). Overall, this batik art-based learning media book has been proven to be an effective and comprehensive intervention tool. This medium significantly enhances the concentration of early-age deaf children in learning by utilizing the strength of their visual modality, applying the principle of gradual developmental design (scaffolding), and integrating local cultural values.

6. Conclusion

Based on this research, the developed batik art learning media book featuring structured, visual, and individualized geometric motifs is a feasible and potentially effective tool for enhancing concentration in preschool-aged deaf children. By integrating local cultural values with pedagogical and neuroscientific principles, this medium not only supports cognitive training but also fosters cultural engagement and motivation. It offers an innovative, culturally rooted model suitable for both educational and therapeutic contexts.

While promising, this study has limitations. The small sample size (N=7) and single-site setting limit generalizability, and the one-group pretest-posttest design is vulnerable to internal validity threats. To address these, future research should replicate the intervention with a larger, more diverse sample to strengthen findings and allow subgroup analysis. Furthermore, the learning media should be enhanced by integrating digital technology such as interactive tablet applications for zooming, rotating, and coloring batik patterns. This would extend the visual

and scaffolding principles that has been proven effective, while enabling more dynamic engagement and remote learning opportunities.

Conflict of Interest

The authors declare no potential conflicts of interest regarding the research, authorship, and/or publication of this article.

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