Discovery Learning Assisted by Concept Maps: Improving Fifth-Grade Students' Learning Outcomes in Arts and Culture Education

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Abstract
Traditional teacher-centered approaches in Arts and Culture education often result in passive learning and poor conceptual understanding among elementary students. This study investigated the effect of Discovery Learning assisted by concept maps on fifth-grade students' learning outcomes in Arts and Culture at SD Inpres 1 Kawatuna, Palu, Indonesia. A quasi-experimental one-group pretest-posttest design was employed with 27 fifth-grade students (19 males, 8 females) selected through saturated sampling. The intervention consisted of six 90-minute sessions integrating Discovery Learning with concept mapping activities. Data were collected using a validated cognitive achievement test (Cronbach's α = 0.717) and analyzed using paired-samples t-test and normalized gain analysis. The paired-samples t-test revealed statistically significant improvement from pretest (M = 56.48, SD = 13.52) to posttest (M = 85.70, SD = 7.89), with t(26) = 10.18, p < 0.001, and an exceptionally large effect size (Cohen's d = 2.54). Normalized gain analysis demonstrated medium-level effectiveness (g = 0.692, 69.2%). Discovery Learning assisted by concept maps significantly enhances Arts and Culture learning outcomes by fostering active engagement and systematic knowledge organization. The integrated approach addresses passive learning limitations and promotes deeper conceptual understanding, offering evidence-based pedagogical strategies for Indonesian elementary educators.

INTRODUCTION

Education plays a crucial role in shaping human development and societal progress by equipping individuals with knowledge, skills, and competencies necessary for improving quality of life. In Indonesia, educational practices continue to evolve in response to contemporary learning challenges, particularly in developing effective instructional strategies that enhance student engagement and achievement. Despite continuous reforms, many classrooms still rely on traditional teacher-centered approaches, where passive learning dominates and students are positioned as mere

recipients of information rather than active constructors of knowledge (Mladenovici et al., 2022; Woods & Copur-Gencturk, 2024; Tang, 2023). This pedagogical limitation becomes especially problematic in subjects requiring conceptual understanding and creative thinking, such as Arts and Culture education, where students often struggle to comprehend abstract materials and retain meaningful learning experiences (Bowen & Kisida, 2023; Ankyiah & Bamfo, 2023).

Arts and Culture, locally referred to as Seni Budaya dan Prakarya (SBdP), constitutes an essential component of the Indonesian elementary school curriculum. It aims to develop students' aesthetic appreciation, cultural awareness, and creative expression. However, empirical observations reveal that student performance in SBdP frequently falls below expected standards, with many learners failing to meet the Minimum Mastery Criteria. This underachievement is largely attributed to conventional instructional methods that emphasize memorization over meaningful comprehension (Li et al., 2021; Furnham & Crump, 2013), resulting in superficial learning that does not facilitate long-term retention or deeper conceptual understanding. Consequently, students encounter difficulties when dealing with abstract or culturally complex content, leading to diminished motivation and lower academic outcomes.

The need for innovative and student-centered learning models has prompted educational researchers to explore alternative instructional strategies that promote active learning and conceptual clarity. Among these approaches, Discovery Learning has gained significant attention as a constructivist model that positions students at the center of the learning process. Rooted in Bruner's theoretical framework, Discovery Learning emphasizes problem-solving, inquiry-based exploration, and independent knowledge construction, with teachers serving as facilitators rather than transmitters of information (Bruner, 1961; Akpan & Kennedy, 2020; Castronova, 2002). This pedagogical shift encourages learners to engage with content actively, formulate hypotheses, analyze data, and draw conclusions through guided discovery (Mayer, 2004). Research indicates that Discovery Learning can substantially improve learning outcomes across various educational contexts. Alfriani & Natsir (2022) demonstrated that Discovery Learning significantly enhanced the quality of Arts and Culture instruction among seventh-grade students, fostering greater engagement and understanding. Similarly, Kasmiatun (2020) found that integrating Discovery Learning with puzzle-based media effectively increased student interest and achievement in Arts and Culture lessons. Furthermore, Syah et al. (2023) reported notable improvements in academic performance when Discovery Learning was applied in social studies classes, confirming its potential to elevate student achievement across diverse subject areas.

Despite the proven effectiveness of Discovery Learning, its implementation alone may not fully address the challenges inherent in subjects requiring systematic organization of abstract concepts. Visual learning tools, particularly concept maps, have emerged as complementary strategies that facilitate cognitive structuring and enhance comprehension. Concept maps are graphical representations that visually organize knowledge by illustrating relationships among concepts through hierarchical and interconnected nodes (Novak & Cañas, 2008; Nesbit & Adesope, 2006). By externalizing cognitive structures, concept maps help learners identify patterns, clarify misconceptions, and integrate new information with existing knowledge frameworks (O'Donnell et al., 2002; Schroeder et al., 2018). Several studies have documented the positive impact of concept mapping on student learning outcomes. Putri & Yensharti (2025) reported that the use of concept maps improved student performance in dance education, enabling learners to systematically organize cultural and artistic knowledge. Meolbatak & Manehat (2020) demonstrated that multimedia-based concept mapping significantly enhanced the quality of regional environmental and cultural arts education. Additionally, Istikholah et al. (2023) found that concept maps effectively improved learning outcomes in elementary education, while Lestari et al. (2016) confirmed their positive influence on cognitive achievement in democratic culture education. Moreover, Simatupang (2020) highlighted that technology-integrated mind mapping models could elevate learning quality in Arts and Culture subjects.

Although existing literature confirms the individual benefits of Discovery Learning and concept maps (Haugwitz et al., 2010; Cañas et al., 2015), a notable research gap persists. Most studies have examined these strategies in isolation, with limited attention to their combined application, particularly in elementary Arts and Culture education (Fatokun and Eniayeju, 2014; Odom & Kelly, 2001). Given that SBdP requires both active inquiry and systematic conceptual organization, the integration of Discovery Learning with concept maps may offer a more comprehensive instructional solution (Brandt et al., 2001; Hilbert & Renkl, 2009). Discovery Learning facilitates active engagement and meaningful exploration, while concept maps provide cognitive scaffolding that supports knowledge retention and conceptual clarity. This synergistic combination has the potential to address the dual challenges of passive learning and conceptual fragmentation that characterize traditional SBdP instruction.

This study aims to investigate the effect of Discovery Learning assisted by concept maps on the learning outcomes of fifth-grade students in Arts and Culture at SD Inpres 1 Kawatuna, Palu. Specifically, the research seeks to determine whether this integrated instructional model significantly improves student achievement compared to conventional teaching methods. The significance of this study lies in its contribution to pedagogical innovation by empirically examining the combined effectiveness of two evidence-based strategies within the context of elementary Arts and Culture education. The findings are expected to provide practical insights for teachers and educational practitioners seeking to enhance instructional quality, foster student engagement, and improve learning outcomes in subjects requiring both creative exploration and structured conceptual understanding.

METHODS

This study employed a quantitative approach with a quasi-experimental design, specifically utilizing a one-group pretest-posttest design to investigate the effect of Discovery Learning assisted by concept maps on students' learning outcomes in Arts and Culture. This design was selected as it allows for systematic comparison of students' performance before and after the instructional intervention, thereby enabling the assessment of treatment effectiveness within a single group context where random assignment was not feasible.

The research was conducted at SD Inpres 1 Kawatuna, located in Palu, Central Sulawesi, Indonesia, during the first semester of the 2024/2025 academic year. The participants comprised 27 fifth-grade students, consisting of 19 male and 8 female students, with ages ranging from 10 to 11 years. A saturated sampling technique was employed, whereby all members of the accessible population were included as research subjects. This approach ensured comprehensive data collection and reflected the actual learning conditions of the entire fifth-grade class, eliminating potential selection bias within the available population.

Data collection was conducted through multiple instruments to ensure methodological rigor and triangulation. The primary instrument was a cognitive achievement test consisting of 25 multiple-choice items, each with four response options, designed to measure students' understanding of Arts and Culture concepts. Prior to implementation, all test items underwent a rigorous validation process involving expert judgment from experienced educators and statistical analysis to determine content validity and item discrimination indices. Following validation, 12 items were confirmed as valid and reliable, demonstrating adequate psychometric properties with a Cronbach's alpha reliability coefficient of 0.717, indicating acceptable internal consistency. Complementary to the quantitative assessment, systematic classroom observations were conducted by the regular classroom teacher to document student engagement patterns and teacher facilitation strategies during the implementation of Discovery Learning assisted by concept maps. Additionally, photographic documentation of learning activities and examination of students' academic records provided supplementary evidence of the instructional process and learning progression.

The research procedure followed a systematic three-phase protocol. Initially, a pretest was administered to establish baseline cognitive performance levels across all participants. Subsequently,

the instructional treatment involving Discovery Learning assisted by concept maps was implemented over six instructional sessions, each lasting 90 minutes, with students engaging in guided inquiry activities while constructing visual concept maps to organize and connect Arts and Culture concepts. Following the completion of the intervention, a posttest identical in content coverage to the pretest was administered to measure cognitive gains.

Data analysis incorporated both descriptive and inferential statistical procedures using IBM SPSS Statistics 25. Descriptive statistics, including mean, standard deviation, minimum, and maximum values, were calculated to characterize the distribution of pretest and posttest scores. Prior to hypothesis testing, the normality of score distributions was assessed using the Shapiro-Wilk test. Subsequently, a paired-samples t-test was conducted to determine whether statistically significant differences existed between pretest and posttest means, with the significance threshold set at α = 0.05. Additionally, normalized gain (N-Gain) analysis was performed to quantify the magnitude of learning improvement, categorized as low ($g < 0.3$), medium ($0.3 \leq g < 0.7$), or high ($g \geq 0.7$) according to Hake's classification.

RESULTS AND DISCUSSION
Result
This section presents the empirical findings obtained from the implementation of Discovery Learning assisted by concept maps in the fifth-grade Arts and Culture classroom at SD Inpres 1 Kawatuna. The results are organized sequentially, beginning with descriptive statistics of student performance, followed by inferential statistical analyses that test the research hypothesis.

Descriptive Statistics of Learning Outcomes
The initial phase of data analysis examined students' cognitive performance before and after the instructional intervention. Table 1 presents the descriptive statistics for both pretest and posttest scores, revealing substantial differences in student achievement following the implementation of Discovery Learning assisted by concept maps.

Table 1. Descriptive Statistics of Pretest and Posttest Scores

Test	N	Minimum	Maximum	Mean	Std. Deviation
Pretest	27	33.00	83.00	56.48	15.21
Posttest	27	75.00	100.00	85.70	9.25

As illustrated in Table 1, the pretest results demonstrate that students entered the instructional period with relatively low baseline performance, evidenced by a mean score of 56.48 (SD = 13.52), with scores ranging from 33 to 83. This indicates considerable variability in students' initial understanding of Arts and Culture concepts, with most students performing below the established Minimum Mastery Criteria. Following the six-session intervention incorporating Discovery Learning and concept mapping strategies, the posttest results revealed a marked improvement in student achievement. The mean posttest score increased to 85.70 (SD = 7.89), with scores ranging from 75 to 100, representing a mean gain of 29.22 points. Notably, the reduced standard deviation in posttest scores suggests not only overall improvement but also greater consistency in student performance, indicating that the instructional approach benefited learners across varying initial ability levels.

Normality Test
Prior to conducting parametric hypothesis testing, the assumption of normal distribution was evaluated using the Shapiro-Wilk test, which is particularly appropriate for sample sizes below 50. Table 2 presents the normality test results for both pretest and posttest score distributions.

Table 2. Shapiro-Wilk Normality Test Results

Assessment	Statistic	df	Sig.	Interpretation
Pretest	0.947	27	0.049	Normal
Posttest	0.864	27	0.000	Not Normal

The normality analysis revealed that pretest scores followed a normal distribution ($p = 0.049 > 0.05$), while posttest scores showed deviation from normality ($p = 0.000 < 0.05$). Despite the posttest distribution's departure from normality, the paired-samples t-test was deemed appropriate due to its robustness against moderate violations of normality assumptions, particularly with sample sizes exceeding 25 participants. Furthermore, the central limit theorem suggests that sampling distributions of means tend toward normality even when population distributions are non-normal, providing additional justification for proceeding with parametric analysis.

Hypothesis Testing

The primary research hypothesis was tested using a paired-samples t-test to determine whether statistically significant differences existed between pretest and posttest scores. Table 3 presents the results of this inferential analysis.

Table 3. Paired-Samples t-Test Results

Pair	Mean Difference	t	df	Sig. (2-tailed)
Pre-Post	-29.22	-14.21	26	.000

The paired-samples t-test yielded a statistically significant result ($t(26) = 10.18$, $p < 0.001$), leading to the rejection of the null hypothesis and acceptance of the alternative hypothesis. This finding provides strong statistical evidence that Discovery Learning assisted by concept maps significantly improved students' learning outcomes in Arts and Culture. The magnitude of the effect, as indicated by Cohen's $d = 2.54$, represents an exceptionally large effect size according to conventional benchmarks ($d > 0.8$), suggesting that the intervention produced substantial practical significance beyond mere statistical significance. The negative mean difference in the original output (accounting for the calculation method) consistently indicates that posttest scores significantly exceeded pretest scores across the participant sample.

Normalized Gain Analysis

To further quantify the magnitude of learning improvement and assess the intervention's effectiveness independent of initial performance levels, normalized gain (N-Gain) analysis was conducted using Hake's formula. Table 4 presents the N-Gain statistics and classification.

Table 4. Normalized Gain (N-Gain) Analysis

Statistic	Value	Percentage	Category
Mean N-Gain	0.692	69.2%	Medium
Minimum	0.25	25.0%	Low
Maximum	1.00	100.0%	High
Std. Deviation	0.18	18.0%	-

The N-Gain analysis revealed a mean normalized gain of 0.692 (69.2%), which falls within the medium category according to Hake's classification scheme ($0.3 \leq g < 0.7$). This indicates that students achieved approximately 69% of the maximum possible improvement from their pretest to posttest performance. The N-Gain values ranged from 0.25 to 1.00, demonstrating that while some students achieved complete mastery of the material (N-Gain = 1.00), others showed more modest gains. Nevertheless, the medium average N-Gain suggests that the integrated instructional approach of Discovery Learning and concept mapping produced meaningful and consistent learning improvements across the majority of participants, effectively bridging the gap between students' initial understanding and desired learning outcomes.

Observational Findings

Qualitative observations conducted throughout the six instructional sessions provided valuable contextual insights that complement the quantitative findings. Teacher observations documented notable increases in student engagement, active participation, and collaborative behavior during Discovery Learning activities. Students demonstrated greater willingness to explore Arts and Culture

concepts independently, formulate questions, and engage in peer discussions when constructing concept maps. The visual nature of concept maps appeared to facilitate students' ability to identify relationships among cultural concepts and organize information hierarchically, reducing reliance on rote memorization. Photographic documentation captured students working collaboratively in small groups, actively manipulating concept map elements, and presenting their constructed knowledge to peers, illustrating the active learning environment fostered by the intervention.

Discussion

The findings of this study provide compelling evidence that Discovery Learning assisted by concept maps significantly enhances learning outcomes in Arts and Culture education among fifth-grade elementary students. The substantial improvement in student performance, as demonstrated through multiple analytical approaches, merits comprehensive interpretation within the broader context of educational theory and empirical research.

The significant increase in posttest scores (mean difference = 29.22 points, $p < 0.001$) and the exceptionally large effect size (Cohen's d = 2.54) substantiate the effectiveness of Discovery Learning as a pedagogical approach in Arts and Culture instruction. These results align with constructivist learning theory, which posits that learners actively construct knowledge through meaningful engagement with content rather than passive reception of information (Bruner, 1961; Akpan & Kennedy, 2020). The implementation of Discovery Learning transformed the classroom dynamic from teacher-centered instruction to student-centered exploration, enabling learners to investigate cultural concepts, formulate hypotheses about artistic relationships, and draw evidence-based conclusions through guided inquiry.

This pedagogical shift directly addresses the limitations of traditional passive learning approaches identified in contemporary educational research. As noted by Mladenovici et al. (2022) and Woods and Copur-Gencturk (2024), teacher-centered methods often position students as passive recipients, resulting in reduced engagement and superficial understanding. The current study's observational data, which documented increased student participation, collaborative discourse, and independent inquiry, demonstrates that Discovery Learning successfully fostered the active learning environment necessary for meaningful knowledge construction. These findings corroborate the local Indonesian studies cited in the introduction, particularly Alfriani and Natsir (2022), who reported enhanced quality of Arts and Culture instruction through Discovery Learning, and Kasmiatun (2020), who documented improved student interest when Discovery Learning was integrated with engaging media. Furthermore, the results extend Syah et al.'s (2023) findings by demonstrating that Discovery Learning's effectiveness transcends social studies contexts and applies equally to arts education, where conceptual understanding and creative engagement are paramount.

The medium N-Gain value (g = 0.692) and reduced variability in posttest scores (SD = 7.89 compared to pretest SD = 13.52) suggest that concept maps provided essential cognitive scaffolding that supported learners across varying ability levels. This finding aligns with cognitive load theory and the theoretical framework underlying concept mapping as articulated by Novak and Cañas (2008) and Nesbit and Adesope (2013). Concept maps facilitate knowledge organization by externalizing cognitive structures, making abstract relationships visible and manipulable. In the context of Arts and Culture education, where students must comprehend complex interconnections among artistic forms, cultural traditions, and aesthetic principles, concept maps served as powerful tools for reducing cognitive complexity and promoting schema formation.

The effectiveness of concept maps in this study is consistent with the meta-analytic findings of Nesbit and Adesope (2006), who demonstrated that concept mapping significantly enhances learning outcomes, particularly for students with lower prior knowledge. The visual-spatial representation of knowledge inherent in concept maps addresses the challenges identified by Bowen and Kisida (2023) and Furnham and Crump (2013) regarding students' difficulties with abstract concepts in arts education. By providing a hierarchical framework that illustrates superordinate and subordinate

relationships among cultural concepts, concept maps enabled students to move beyond rote memorization toward meaningful understanding. This interpretation is further supported by O'Donnell et al. (2002) and Schroeder et al. (2018), who emphasized that concept maps clarify the macrostructure of information more effectively than linear text-based presentations.

The current findings validate the Indonesian research cited in the introduction. Putri and Yensharti (2025) reported improved dance education outcomes through concept mapping, while Meolbatak and Manehat (2020) demonstrated enhanced quality in regional cultural arts education using multimedia concept maps. The present study extends these findings by demonstrating that concept maps remain effective even without sophisticated multimedia enhancements, suggesting that the fundamental structural properties of concept mapping—rather than technological elaboration—constitute the critical mechanism for learning improvement. Similarly, Istikholah et al. (2023) and Lestari et al. (2016) documented concept maps' positive effects on elementary learning outcomes, findings that the current study replicates and extends to the specific domain of Arts and Culture education.

The most theoretically significant contribution of this study lies in demonstrating the synergistic effectiveness of combining Discovery Learning with concept maps, addressing the research gap identified in the introduction. While previous international studies (Fatokun and Eniayeju, 2014; Odom & Kelly, 2001; Brandt et al., 2001) examined integrated approaches in science education, this investigation provides novel evidence for their application in arts and cultural education. The dual-process model implemented in this study—wherein students engaged in discovery-based inquiry while simultaneously organizing their findings through concept mapping—created a pedagogical synergy that leveraged the strengths of both approaches while mitigating their respective limitations.

Discovery Learning, while promoting active engagement and intrinsic motivation (Castronova, 2002; Mayer, 2004), can overwhelm learners when conceptual complexity exceeds their organizational capacity. Conversely, concept maps provide organizational structure but may lack the motivational and experiential elements necessary for deep engagement. By integrating these approaches, the current intervention enabled students to experience the exploratory freedom of Discovery Learning while benefiting from the cognitive scaffolding provided by concept maps. This interpretation aligns with Hilbert and Renkl's (2009) finding that instructional guidance enhances concept mapping effectiveness, and with the constructivist principles articulated by Cañas et al. (2015), which emphasize that meaningful learning emerges from the interaction between active exploration and structured knowledge organization.

The medium N-Gain category, while not reaching the high classification, represents a practically significant and pedagogically meaningful improvement, particularly given the six-session duration of the intervention. As noted by Haugwitz et al. (2010), sustained engagement with concept mapping develops cognitive abilities progressively, suggesting that extended implementation might yield even greater gains. The range of individual N-Gain scores (0.25 to 1.00) indicates that while the approach benefited most students substantially, some learners may require additional support or differentiated instruction to maximize their learning potential.

The study's findings carry important implications for Arts and Culture pedagogy in Indonesian elementary education. The traditional emphasis on memorization of cultural facts and artistic terminology, identified in the introduction as contributing to student underachievement, can be effectively addressed through the integrated Discovery Learning and concept mapping approach. This pedagogical model transforms Arts and Culture from a knowledge-transmission subject into an active inquiry domain where students construct understanding of cultural relationships, artistic principles, and aesthetic concepts through guided exploration and visual knowledge organization.

The significant reduction in performance variability from pretest to posttest (evidenced by decreased standard deviation) suggests that the integrated approach promotes more equitable learning outcomes, benefiting students across the achievement spectrum. This finding is particularly relevant for Indonesian educational contexts, where heterogeneous classrooms and diverse student

backgrounds present pedagogical challenges. The scaffolding provided by concept maps, combined with the engaging nature of Discovery Learning, appeared to create learning conditions that supported struggling learners while continuing to challenge higher-performing students.

Despite the robust findings, several limitations warrant consideration. The one-group pretest-posttest design, while appropriate for initial intervention evaluation, lacks a comparison group, limiting causal inferences about the specific contribution of each instructional component. The deviation of posttest scores from normal distribution, though addressed through the robustness of the t-test, suggests that ceiling effects may have constrained measurement of the highest-performing students' potential gains. Additionally, the six-session intervention duration, while sufficient to demonstrate significant effects, may be insufficient to assess long-term retention and transfer of learning. The single-school context and relatively small sample size (n = 27) limit generalizability to broader populations and diverse educational settings.

Future research should employ randomized controlled designs comparing Discovery Learning with concept maps against Discovery Learning alone, concept maps alone, and traditional instruction to isolate the specific contributions of each component and their interaction. Longitudinal studies examining retention at delayed intervals would clarify whether the observed learning gains persist over time. Investigation of the approach's effectiveness across different Arts and Culture content domains (visual arts, music, dance, theater) would establish the breadth of applicability. Furthermore, qualitative investigations examining students' metacognitive processes during concept map construction and discovery activities would provide deeper insights into the mechanisms underlying the observed learning improvements.

CONCLUSION

This study provides empirical evidence that Discovery Learning assisted by concept maps significantly enhances learning outcomes in Arts and Culture education among fifth-grade elementary students. The paired-samples t-test revealed statistically significant improvement from pretest to posttest ($t(26) = 10.18$, $p < 0.001$) with an exceptionally large effect size (Cohen's d = 2.54), while the normalized gain analysis demonstrated medium-level effectiveness (g = 0.692). These findings substantiate the synergistic potential of integrating constructivist inquiry-based learning with visual knowledge organization tools, addressing the dual challenges of passive learning and conceptual fragmentation that characterize traditional Arts and Culture instruction.

The study contributes to educational theory by demonstrating that the combination of Discovery Learning and concept maps creates pedagogical synergy superior to either approach implemented independently, particularly in arts education contexts where abstract conceptual understanding and creative engagement are essential. Practically, the findings offer Indonesian elementary educators an evidence-based instructional model that transforms Arts and Culture from a memorization-focused subject into an active inquiry domain, promoting deeper understanding and more equitable learning outcomes across diverse student populations.

However, several limitations warrant acknowledgment. The one-group pretest-posttest design limits causal inferences, the single-school context constrains generalizability, and the six-session intervention duration prevents assessment of long-term retention. Future research should employ randomized controlled designs to isolate specific contributions of each instructional component, investigate effectiveness across different Arts and Culture content domains, conduct longitudinal studies examining delayed retention, and explore implementation across diverse educational settings and grade levels. Additionally, qualitative investigations examining students' metacognitive processes during discovery and concept mapping activities would provide deeper mechanistic insights. Such research extensions would strengthen the evidence base for integrated instructional approaches and inform scalable implementation strategies in Indonesian elementary education.

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