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Integrating Meaningful, Mindful, and Joyful Learning to Enhance Academic Achievement and Cognitive Flexibility Among Indonesian Elementary Students Through a Mixed-Methods Design

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ABSTRACT

With deep learning now a focus across the globe, students are no longer required only to perform well academically; they are also expected to 'demonstrate higher-order thinking skills', such as those described by the concept of cognitive flexibility. However, teaching in Indonesian elementary schools remains centered on rote memorisation, which offers students few opportunities for flexible and adaptive thinking. Although the meaningful, mindful, and joyful aspects of learning have to some extent been studied independently in the literature, few studies have integrated them. Aims and objectives: This study evaluated the impact of Meaningful, Mindful, and Joyful (MMJ) Learning on elementary students' academic achievement and cognitive flexibility using an explanatory sequential mixed-methods design. One hundred fifth-grade students participated in the study. Quantitative data were collected through a pretest, two formative assessments, and a posttest in five subjects, and qualitative data through interviews and classroom observations. The results showed that the experimental group achieved significantly higher posttest scores than the control group (mean difference = 12.28 points), with a large effect size (Cohen's d = 0.87). Analysis of achievement indicated that 84% of the students in the experimental group earned high-level grades. Findings: Participants proceeded through five stages of the MMJ learning cycle: meaningful experience, joyful engagement, mindful reflection, strategic exploration, and collaborative consolidation.

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The MMJ model improved academic performance and cognitive flexibility, providing a teachable structure for developing deep learning in primary education.

Keywords: Cognitive flexibility, joyful learning, meaningful, mindful

INTRODUCTION

Cognitive flexibility is a key 21st-century skill that equips students to respond to difficult and uncertain situations. It is defined as the capacity to adapt strategies to changing demands; to pay attention to one's own thinking process, and to evaluate and control cognitive processes. This is a key skill in problem-solving, as it enables students to change tack, consider multiple perspectives, and take context into account (Bougherra et al., 2023; Lai et al., 2023; Wang et al., 2024). Cognitive flexibility is also a core component of executive functions, which develop rapidly during childhood (Legare et al., 2018) and are closely linked to children's success in school (Diamond, 2013). In elementary school, where students build foundational knowledge and thinking habits on which later learning depends, the ability to shift between strategies and approach a problem from multiple angles is particularly important. It has been associated, for example, with Indonesian elementary students' understanding and application of mathematical concepts (Rahayuningsih et al., 2025). Academic achievement, in turn, reflects how well students master core curricular content and provides the foundation for their later schooling. Because learning is meant to go beyond mere procedural recall, cognitive flexibility and academic achievement are best developed together rather than treated as separate goals.

Various studies have reported that elementary school students show limited cognitive flexibility. Many factors contribute to this, one of them being the continued use of traditional teaching methods (procedural memorisation and linear problem solving). Such procedures restrict students' exploration and hinder the generation of more diverse and creative thinking strategies (Agbele et al., 2020; Kuluşaklı, 2025; Liu, 2023). Consequently, students tend to rely on conventional methods and show reluctance to experiment with more efficient or innovative alternatives (Campanati et al., 2022; Rivkin & Gim, 2013). Cognitive flexibility plays a vital role in learning elementary mathematics, including solving open-ended questions and contextual problems (e.g., word problems, comparing fractions, estimating sizes, and interpreting data). It is also relevant to other subjects, such as Science, Indonesian Language, Civic Education, and Arts & Culture, which often require cross-disciplinary application of knowledge. For example, problem solving in Science may involve measurement skills, and story-based questions in Indonesian Language may carry mathematical ideas.

Open and Reflective Learning Environment. To promote cognitive flexibility, students must learn in active, reflective environments that encourage collaboration, inquiry, and evaluation of strategies. Previous studies have found that problem-based learning, inquiry learning, technology-integrated instruction, and project-based education can promote adaptive thinking skills (Maharani et al., 2023; Oishi et al., 2018; Sandika & Fitrihidajati, 2018). Building on this groundwork, Meaningful, Mindful, and Joyful (MMJ) learning has emerged as a promising approach. MMJ combines meaningful learning (relating content to prior experience), mindful learning (raising reflective awareness), and joyful learning (engaging students emotionally through play). It facilitates cognitive and emotional engagement and builds strategic awareness, contributing to a psychologically safe classroom that encourages experimentation (Atrup et al., 2023; Kaur & Rosli, 2021; Lin et al., 2020).

However, despite these theoretical benefits, limited empirical evidence is available on the simultaneous effects of MMJ on academic achievement and cognitive flexibility. It is unclear whether students taught through MMJ differ substantially from those taught through traditional lecture-based instruction, how large the effect of MMJ is across elementary school subjects and across High, Middle, and Low Range Marks (i.e., the distribution of student achievement), and whether grouping strategies or collaboration preferences affect its effectiveness. Additionally, we know very little about how MMJ influences cognitive flexibility by combining cognitive, affective, and social factors.

Hence, the present study attempts to fill these gaps by exploring the impact of MMJ-based teaching in elementary education. Its goals are to investigate achievement differences between MMJ and lecture-based instruction at posttest, to measure the effect size of MMJ on student outcomes, to analyse the distribution of achievement and the role of group dynamics, and to explore how the process-oriented nature of MMJ learning fosters cognitive flexibility through the interplay of cognitive, affective, and social dimensions.

LITERATURE REVIEW

Cognitive Flexibility in the Context of Elementary Education

Cognitive flexibility represents an individual's tendency to shift frames of reference or adopt new rules to solve problems, understand novel information, and reorient oneself to environmental changes. In primary education, it is one of the most essential components in training higher-order cognitive skills such as creativity, problem solving, and decision making.

This study uses three indicators of cognitive flexibility at the primary level, developed by Rahayuningsih et al. (2025): (1) cognitive novelty, the ability to generate new strategies when facing a problem; (2) cognitive variety, the ability to use various approaches to solve a problem; and (3) cognitive framing, the ability to reflect

upon a problem and reframe it in a deeper, more contextual way.

Previous research indicates that cognitive flexibility does not emerge naturally. It needs to be developed through cognitive experiences that are situated, interactive, and stimulating. Learning contexts in which students can consider ideas, reflect on their own thinking, and be emotionally engaged are more likely to support the development of deep and sustained cognitive flexibility.

Purposefully designed learning experiences are important for developing cognitive flexibility. Pedagogical approaches featuring games, simulations, or project-based learning have been shown to have a strong influence on the early development of executive functions and critical thinking (Garzón et al., 2020). These interactive, challenging, personally relevant activities establish a context for learning that prompts students to think flexibly (Legare et al., 2018). Interventions that aim to promote cognitive flexibility should therefore encourage exploration, support emotional engagement, and link learning content to students' life experiences. When students engage in multiple ways of thinking, when the learning connects to their own world, and when they can make meaning for themselves from that process, they will be better equipped to approach later challenges flexibly.

Research also emphasises the need for flexible, responsive learning settings that accommodate students' needs. Instructional techniques that create opportunities for reflection, personal relevance, and active engagement are more likely to support the development of enduring cognitive flexibility (Legare et al., 2018). Additionally, adaptive learning technologies have been found to improve cognitive flexibility among students with special needs (Alqudah & Khasawneh, 2024).

Hence, promoting cognitive flexibility in elementary students requires specific types of instruction and experience that encourage cognitive novelty, variety, and framing. These can be achieved through engaging, reflective, contextually based learning and activities connected to students' life experiences, enabling them to think critically, adaptively, and creatively when they encounter complex and uncertain learning conditions.

The MMJ (Meaningful, Mindful, Joyful) Learning Approach

Meaningful, mindful, and joyful learning together form a well-rounded pedagogy in which students experience learning with full involvement, both cognitively and affectively. This view encourages understanding, reflection, and emotion in the classroom, so that learning is not only cognitive but also meaningful and emotionally fulfilling.

Meaningful Learning

Meaningful learning happens when students can relate new information to what they already know, which enables the formation of deep conceptual understanding and personal meaning in relation to the subject matter.

When knowledge is connected to previous experiences or schema, learners move beyond rote learning and begin to construct meaning, which makes the knowledge applicable and meaningful (Farida & Rasyid, 2019; Genc, 2015). This is consistent with Ausubel (1963), who argued that learning can be meaningful only to the extent that it relates in an organised and systematic way to what the student already knows.

In classroom practice, as articulated in the MMJ (Meaningful, Mindful, Joyful) model, meaningful learning principles are implemented by connecting academic concepts directly to students' real-world experiences. For instance, when teaching food webs and economic activity, students might be asked to take an inventory of their local environment, study living populations or crops, and present the results in tables or graphs. These activities not only strengthen interdisciplinary understanding (Science and Mathematics) but also build intellectual bridges between school-based content and students' real-life interests.

Project-based learning is a tangible example of a meaningful learning experience that allows students to engage deeply with concepts in social, emotional, and personal contexts. Environmental conservation projects or local economic management projects, for example, involve problem solving and collaboration and thereby create opportunities to construct meaning through active involvement (Nawawi et al., 2021; Nuha et al., 2020). These assignments promote creative and critical thinking, encourage personal expression, enhance motivation for student work, and foster student reflection on the learning process.

Such learning is more than cognitive, involving affective and metacognitive dimensions. Activities such as reporting on their work, talking about their thinking, and presenting their outputs introduce students to why and how they learn, a key element of strategic awareness. When learners are able to explain their reasoning and defend their chosen methods, the learning becomes deeply internalised and situated (Mărcuș et al., 2022; Piscayanti, 2021).

Therefore, project-based activities and real-world connections that give learning meaning can contribute to the development of students' cognitive flexibility, helping them apply these 21st-century skills after first understanding, reflecting on, and personally relating to what they are taught.

Mindful Learning

Mindful learning focuses on increasing students' awareness of the learning process itself, and of how they think, feel, and respond to demands. This metacognitive involvement helps learners think consciously about their thinking processes and decisions. Such activities foster intentionality in learning and flexibility in problem solving (Barhoumi & Rossi, 2020; Gabrys et al., 2018).

In the present study, mindful learning was mediated by activities that involved active self-monitoring of students' thinking. This could involve students writing daily reflective diaries, talking about the strategies they were using, and commenting on

changes in their understanding as they engaged in the learning challenge. Students were also prompted to compare different solution strategies, identify mistakes, and critically evaluate the effectiveness of their choices in solving problems (Bakosh et al., 2016). Such activities help students understand not only what they are doing but also how and why they understand it as they do.

This reflective process is consistent with the notion of present awareness and mindful attention in learning. Students explicitly attend their own cognitive activity, feelings, difficulties, and strategies while they learn. Such metacognitive awareness provides an important basis for acquiring cognitive flexibility, that is, knowing when to shift strategies and how best to do so.

Mindful learning is known to contribute to cognitive flexibility by cultivating reflective behaviour, resilient problem solving, and open-mindedness toward uncertainty in the learning experience (Diamond, 2013; Gabrys et al., 2018). For this reason, mindful learning in the present study is a pedagogical practice for developing strategic awareness and adaptive thinking among elementary school children, rather than simply a method of assessing understanding.

Joyful Learning

Joyful learning is not only the creation of an emotionally positive learning environment but also the nurturing of deep affective engagement, on which intrinsic motivation and students' self-confidence are based. Learners who feel safe and valued as individuals in the classroom, and whose teachers use actively engaging activities, are likely to be enthusiastic, curious, and open to new ideas (Rhodes & Rozell, 2017; Salmawati, 2023). An encouraging learning atmosphere also strengthens relationships among students and teachers, which builds a supportive and cooperative learning community.

In this research, principles of joyful learning were incorporated into the design through techniques that focused on creative methods, teamwork, and applied learning. The students worked on projects such as environmental campaigns, processing real-world observation data, and creative media using posters, infographics, and visuals. These projects enabled students to have a voice and to work with others, as they felt their contributions mattered. By building such active learning activities around students' interests and enjoyment, learning was no longer experienced as something formal that students approached with apprehension.

Theoretically, joyful learning contributes to cognitive flexibility by enabling learners to experiment with various methods of problem solving without fear of failure. In a non-threatening and friendly learning environment, students are more likely to feel free to try new ideas, ask questions, and change their thinking (Aska et al., 2022; Nawawi et al., 2021). This bolsters their flexibility in the face of complex, unstructured learning tasks.

The "fun of learning" also strengthens emotional attachment to content, which supports lasting concept comprehension and knowledge retention. Positive learning experiences become part of a way of thinking that supports meaning making and reflection and is directly related to the construction of cognitive flexibility.

Relationship Between MMJ Learning and Cognitive Flexibility

The MMJ (meaningful, mindful, and joyful) approach has shown promise for promoting not only academic achievement but also cognitive flexibility in elementary students. In this investigation, meaningful learning supported the building of deep cognitive pathways when academic content was linked to students' personal contexts, allowing them to solve problems within an authentic frame with the relevant prior knowledge in place. Training in mindful awareness for self-regulation was designed to foster continuous reflection, monitoring, and control of cognition, and this training facilitates deliberate strategic action for adaptive problem solving. Joyful learning created a psychologically safe and affectively engaging classroom context, where students were encouraged to 'try out' different strategies and explore alternative viewpoints without fear of failure.

When combined, these dimensions form an interconnected learning environment that actively encourages students to (1) generate fresh strategies (cognitive novelty), (2) employ multiple methods for solving a single problem (cognitive variety), and (3) reframe problems in more profound, contextually authentic ways (cognitive framing). The quantitative results of the present study demonstrated that MMJ learning led to a statistically and practically significant improvement in students' learning achievement across different subjects, as many students moved to a higher category in their final assessments. The qualitative analysis also revealed an emergent process of cognitive flexibility formation occurring through five interconnected phases: meaningful experience, joyful engagement, mindful reflection, strategic exploration, and collaborative consolidation. These phases show how cognitive, affective, and social aspects interact in practice to foster flexible, creative, and adaptive thinking.

Although research on flexible thinking is expanding rapidly, few studies have charted this developmental process within an integrated MMJ approach, especially in elementary schools. This study addresses that gap by combining quantitative outcome measures with qualitative grounded theory analysis, providing empirical evidence of effectiveness and a conceptual model of how MMJ learning promotes sustained cognitive flexibility in young learners.

Taken together, the literature reviewed above indicates that meaningful, mindful, and joyful learning are consistently associated with gains in cognitive flexibility, yet their combined and simultaneous contribution to academic achievement has rarely been examined within a single framework. Unlike prior project-based or inquiry-based interventions that have

primarily targeted either cognitive flexibility or content mastery in isolation (Maharani et al., 2023; Oishi et al., 2018; Sandika & Fitrihidajati, 2018), the MMJ approach in this study was deliberately designed to integrate the three dimensions into one recursive instructional cycle in which meaning-making, metacognitive reflection, and positive affect operate together to drive both cognitive flexibility and measurable academic achievement across five subject areas. This integrated positioning constitutes the novelty of the present study: rather than treating meaningful, mindful, and joyful learning as separate pedagogical add-ons, MMJ is conceptualised and empirically tested as a single, mutually reinforcing framework that explains how process-level cognitive change (cognitive flexibility) translates into outcome-level academic achievement, a link that has not been previously established in elementary education research.

METHODOLOGY

Research Design

In this research, a sequential explanatory mixed-methods design was used, in which the quantitative study preceded the qualitative study. The purpose was to reveal not only the measurable outcomes of MMJ learning but also the process through which those outcomes were achieved. The quantitative strand was employed to determine the statistical influence of MMJ on students' academic performance, and the qualitative strand was intentionally incorporated to explain, elaborate, and situate the quantitative results. Both strands contributed to the overall study; however, more analytical emphasis was placed on the quantitative results, to build explanatory depth and detailed insight into how the MMJ approach led to cognitive flexibility in natural classroom environments. This methodological orientation is consistent with the explanatory role of mixed-methods research, in which qualitative inquiry acts as an interpretive lens that illuminates and extends quantitative findings (Creswell & Plano Clark, 2018; Tashakkori et al., 2012). It should be clarified that, although the overarching orientation of the study was explanatory, the quantitative strand itself employed a quasi-experimental structure comparing a treatment and a control group. Following Creswell and Plano Clark's (2018) typology of mixed-methods designs, this configuration is more precisely classified as an Experimental Embedded Mixed Methods design, in which qualitative data are embedded within a quasi-experimental framework to explain and enrich the interpretation of the intervention's effects, rather than a purely sequential explanatory design without an experimental component. The term "explanatory" used throughout this paper therefore refers to the interpretive function of the qualitative strand, while the underlying quantitative structure remains quasi-experimental in nature.

To address the outcome- and process-related research questions, a quasi-experimental design was combined with Constructivist Grounded Theory. The quasi-experimental design allowed for comparison

between a treatment group taught using MMJ and a control group taught conventionally through lectures, thus providing data-based evidence of learning gains. Nevertheless, acknowledging that cognitive flexibility is a multidimensional construct that goes beyond the sum of test scores, the qualitative phase focused on students' reasoning processes, their reflective consciousness, strategic adjustments and emotional involvement in learning. This approach treated the qualitative results as essential, rather than supplementary, for explaining how MMJ instruction influenced students' flexibility of thought.

The quantitative strand used a nonequivalent control group design with two intact fifth-grade classrooms because site constraints made random assignment impractical (a common feature of field-based educational research; Campbell & Boruch, 1975). After the intervention and statistical analysis, a qualitative phase was implemented to explain why the experimental group outperformed the control group and to build a process model describing the development of cognitive flexibility during MMJ-based learning. Both strands were then integrated at the interpretation level through meta-inferences that systematically related quantitative patterns to qualitative explanations, producing a coherent and theoretically grounded picture of MMJ as a pedagogical approach.

Participants. The experiment involved 100 fifth-grade students of the primary level (10-12 years) from two elementary school classes. Five subject teachers and one principal served as qualitative informants. Purposive sampling was used to ensure that the educational setting was relevant to the research purpose. The selected school had instructional features consistent with the needs of the study, including periodic thematic-integrative learning and institutional support for pedagogical innovation. The use of intact classrooms reflected the naturalistic classroom environment, maintained ecological validity (Tanaka et al., 1996), and was appropriate for a school-based intervention study, where random reassignment is frequently not feasible (Teddlie & Yu, 2007).

The two groups were designated as the experimental group (n = 50), which was learned through MMJ, and the control group (n = 50), which was taught using the traditional lecture method. The non-random selection enabled comparability between groups in terms of class level, teacher competence, and instructional materials, with minimal contamination across groups. The involvement of teachers and the principal as qualitative informants enhanced situated knowledge by generating multiple perspectives on the school learning culture, instructional operations, and the feasibility of MMJ in real classroom contexts.

This sampling approach fit the sequential explanatory mixed-methods design because it provided both sufficient numbers for statistical analysis in the quantitative phase and information-rich cases for examining the development of cognitive flexibility in depth in the qualitative phase. This kind of sampling is common in mixed-methods

research, in which representativeness in the quantitative strand is balanced by depth and relevance in the qualitative strand (Creswell & Plano Clark, 2018).

Research Instruments

To fulfill the research design and maintain methodological complementarity between measurement and explanation, this study employed several instruments that provided both quantitative and qualitative data in accordance with the mixed-methods design. The instruments were constructed and validated to fit the research purposes of testing academic outcomes and exploring students' flexible thinking processes.

The quantitative data were obtained using an Integrated Learning Achievement Test covering five subjects: Science, Mathematics, Indonesian Language, Civic Education, and Arts and Culture. The test comprised both closed-ended questions to assess procedural accuracy and open-ended questions to examine students' reasoning and application of knowledge. The test items were developed with reference to the competency standards and curricular content specified in the Indonesian 2013 Curriculum for primary education (Ministry of Education and Culture of the Republic of Indonesia, 2013), ensuring alignment with the national curriculum. The instrument underwent content validation by a panel of educational assessment experts and was pilot-tested with students who had characteristics comparable to those of the study participants. The expert panel indicated satisfactory content validity (content validity index [CVI] = .88), and the instrument demonstrated good internal consistency (Cronbach's α = .88), supporting its use in the quasi-experimental comparison.

The qualitative tools were designed to investigate how cognitive flexibility is developed during MMJ instruction. In the first stage, teachers and students took part in semi-structured interviews that examined instructional responsiveness, strategy adaptation, emotional engagement, and learner autonomy in MMJ-based learning. These instruments were reviewed by qualitative methodologists for construct alignment and clarity and were revised after pilot interviews. Member checks were employed to enhance credibility, with participants verifying the accuracy of the interpretations of their responses.

Second, classroom observations using a checklist were conducted to record behavioural indicators of cognitive flexibility along three dimensions: cognitive novelty (creating new strategies), cognitive variety (using multiple representations), and cognitive framing (the ability to reframe tasks or shift strategies). Content validity of the checklist was confirmed by expert pedagogical review, and inter-rater reliability showed high agreement (IRR = 0.88), indicating consistent scoring between raters. These real-time process data complemented the retrospective accounts elicited in the interviews.

Supplementary tools were student reflective journals and learning artifacts (such as worksheets and project outcomes), which served as documentary evidence of

change in thinking and adaptive reasoning over time. By incorporating these measures, the study was able to capture both outcome-level and process-level evidence, which strengthened the explanatory nature of the mixed-methods design.

Data Collection Procedures

Data collection took place over six weeks following a sequential explanatory mixed-methods approach, with quantitative data collected before and after the qualitative phase to support methodological development and interpretive explanation. The procedures were designed to protect internal validity in the quantitative stage and credibility and confirmability in the qualitative stage. Institutional consent and informed consent were obtained from all participants (principals, teachers, students, and parents) before data collection, in line with ethical standards in educational research.

Quantitative data were collected in the first and sixth weeks and consisted of a pre-diagnostic test, two formative assessments administered during the intervention period, and a posttest. Both the experimental and control groups were tested with these measures under similar testing conditions to avoid testing bias. The quantitative strand of the study aimed to determine the extent of academic progress following implementation of the instructional intervention. The experimental group was taught using the Meaningful, Mindful, and Joyful (MMJ) learning model, whereas the control group was instructed traditionally. Standardised procedures and an implementation schedule were used to reduce procedural variability and increase design fidelity across the quasi-experimental phase.

After the quantitative stage, qualitative data were collected to provide insight into how MMJ-based learning leads to cognitive flexibility. Qualitative methods consisted of systematic classroom observation with a structured rubric, semi-structured interviews with students and teachers, study of student reflective journals, and collection of learning artifacts (such as worksheets or project work). Data collection took place over a series of active teaching sessions and was structured to capture real-time behavioural and cognitive traces of how students approached strategy shifts, turned to reflection, or negotiated ideas while collaborating. This approach corresponds to Creswell and Plano Clark's (2018) explanatory design, in which the qualitative stage is used to analyse and expand upon the preceding quantitative findings.

Several measures were used to maintain rigor throughout data collection. Instrument fidelity and consistency of intervention implementation were assessed using protocol adherence checks. In the qualitative component, triangulation across data sources (interviews, observations, and learning artifacts), collection procedures, and the perspectives of diverse participants was employed to enhance trustworthiness. Selected participants took part in member-checking sessions to ensure interpretive credibility, and peer debriefing was adopted

to minimise researcher bias in the qualitative analysis. Field notes and audit trails were kept enhancing transparency and procedural replicability.

This multi-method data collection design allowed the study not only to assess how MMJ learning affected student learning outcomes but also to collect the dynamic learning traces that informed the construction of cognitive flexibility. Incorporating both data sources provided a sound foundation for explanatory interpretation, with the qualitative data giving context to, and extending, the descriptive statistical patterns that emerged from the quantitative phase.

Data Analysis Procedures

Data analysis followed the explanatory logic of the design: the quantitative results were analysed first to establish statistical patterns, and the qualitative analysis was then used to provide interpretive detail and a theoretical explanation of the findings. Critical scrutiny of the methods ensured methodological consistency across the two strands and supported the integration of inferences during interpretation.

During the quantitative phase, descriptive and inferential statistics were used to explore academic achievement differences between the experimental and control groups. Descriptive statistics summarised the central tendency and distribution of scores using means, standard deviations, and gain scores at each assessment stage. The differences between groups at the pre- and posttest were tested with an independent samples t-test. Cohen's d effect sizes were also computed to assess the practical significance of the MMJ intervention, because statistical significance alone does not indicate the practical importance of an outcome in an educational setting. SPSS was used for all statistical analyses. The assumptions of normality, homogeneity of variances, and independence of observations were checked before hypothesis testing to ensure the validity of the tests.

For the qualitative analysis, we adopted the Constructivist Grounded Theory analysis (Charmaz, 2014) to clarify how cognitive flexibility was developed during MMJ-based instruction. The qualitative analysis involved three coding processes: initial coding, focused coding, and theoretical coding. The first-cycle coding involved line-by-line coding of the interview transcripts, observation notes, and student reflective journals to identify significant behaviours and thoughts related to learning. Focused coding condensed recurring ideas into analytically meaningful categories, which represented students' strategic deviation, reflective readjustment, and collaborative reasoning. Theoretical coding was then conducted to organise these categories into an explanatory model that shows the dynamic nature of how meaning-making, mindfulness, and joyful learning promoted cognitive flexibility.

To increase analytic rigor, constant comparison was used throughout the coding process to compare data sources. Triangulation of classroom observations, interviews, and learning artefacts was

employed to minimise researcher bias and strengthen category validation. Memoing supported coding by tracking analytic insights and the evolving theory. Member checking was carried out with some informants to verify the credibility of the category interpretations, and peer review among the researchers supported analytic consistency and theoretical soundness.

Quantitative and qualitative results were integrated in the interpretation phase, using the qualitative findings to explain further the mechanisms through which the MMJ intervention produced its effects. Composite displays were constructed to compare quantitative trends and qualitative themes, facilitating meta-inferences that connected achievement gains with behavioural evidence supporting cognitive flexibility. This integrative process strengthened the explanatory power of the mixed-methods design by linking outcome evidence to process-based evidence.

Trustworthiness and Validity Procedures

Several procedures were used to confirm the methodological soundness of the study and enhance the credibility and validity of both qualitative and quantitative data. In the quantitative strand, internal validity was preserved by treating the experimental and control groups equivalently, using standardised testing procedures, and controlling for selection bias by comparing baseline skills at pretest (Judd & Kenny, 1981). For instrument validity and reliability, expert judgment was used to determine the face validity of the instrument, and Cronbach's alpha ($\alpha = 0.88$), which is above the accepted cutoff point for educational measurement, was used to assess reliability. Procedural validity was enhanced by monitoring treatment fidelity to maintain adherence to the MMJ teaching model.

In the qualitative strand, the four criteria of trustworthiness outlined by Lincoln and Guba (1985) (credibility, transferability, dependability, and confirmability) shaped the analytic procedure. Credibility was established through six weeks of prolonged fieldwork, sustained focus on learning interactions, and triangulation of data sources (interviews, observations, document analysis). Member checking was carried out by sharing the draft findings with a sample of participants to ensure the accuracy of interpretations and to reduce distortion or misrepresentation of their perspectives.

Dependability was addressed through an extensive audit trail that recorded methodological choices, coding decisions, and protocol changes at each stage of the analysis. Two independent qualitative researchers participated in peer debriefing to enhance analytic transparency and minimise researcher bias. Confirmability was supported by reflexive memoing and bracketing, which reduced subjective influence on data analysis. Verbatim student quotes in the reporting conveyed participants' voices authentically.

Transferability was supported by a thick description of the teaching setting, participants, and learning interactions, which allowed readers to judge the applicability of the findings to other educational contexts. Integration validity in the mixed-methods

approach was reinforced by following meta-inference rules and interpretation procedures that ensured the data strands were aligned before interpretation, in order to limit confirmation bias. Together, these trustworthiness strategies protected the study against methodological threats and produced findings that were empirically rich and theoretically relevant.

RESULTS

Research Findings-quantitative Data Analysis

> Is there a significant difference in learning outcomes between students receiving Meaningful, Mindful, and Joyful Learning (MMJ) instruction and those taught using the lecture method?

The comparison of pretest and posttest mean scores shows that both groups had relatively equivalent initial abilities (a difference of only 1.56 points): the control group averaged 57.13 and the experimental group 55.57 on the pretest (Table 1).

Based on Table 1, the two groups started with nearly the same initial ability (only 1.56 points difference in the pretest). After the intervention, the experimental group scored much higher on the posttest, with a mean of 12.28 points higher than that of the control group.

Following the MMJ-based learning intervention, the experimental group's posttest scores increased substantially (12.28 points higher than the control group), indicating a positive effect of MMJ on learning outcomes. An independent samples t-test (Table 2) confirmed that there was no significant difference in pretest scores ($p = 0.060$), but a statistically significant difference in posttest scores was found ($t(98) = -12.80$; $p < 0.001$).

> How large is the effect of MMJ-based learning on improving elementary students' learning outcomes across subjects?

The effect size, calculated using Cohen's d, was 0.87, categorised as large (Cohen, 2013). This indicates that MMJ not only achieved statistical significance but also carried strong practical significance in the elementary school learning context.

The effect size of 0.87 suggests that MMJ-based learning had a strong practical impact on improving students' learning outcomes. The analysis of the pretest-posttest score difference (Table 4) also revealed that the experimental group improved by 22.26 points, nearly three times the improvement of the control group, which increased by only 8.42 points.

The experimental group's improvement of 22.26 points, almost triple that of the control group, was consistent across all measured subjects.

> How does the distribution of students' achievement categories and grouping strategies influence the effectiveness of MMJ implementation?

The distribution of students' scores at each assessment stage (Table 5) shows that, prior to the intervention, the majority of

students fell within the Middle Range Marks (MRM) and Low Range Marks (LRM) categories. After MMJ implementation, the proportion of experimental group students achieving High Range Marks (HRM ≥ 70) increased dramatically to 84% in the posttest, while the proportion in LRM dropped to just 2%.

Table 1
Mean pretest and posttest scores of controls and experimental groups

Test Stage (Type)	Mean Control	Mean Experimental	Mean Difference
Pretest (Diagnostic)	57.13	55.57	1.56
Posttest (Summative)	65.55	77.83	12.28

Table 2
Independent samples t-test results

Test Stage	t(98)	p-value	Remarks
Pretest	1.90	0.060	Not significant
Posttest	-12.80	< 0.001	Significant (experimental group higher)

Table 3
Effect size

Statistic	Value	Category (Cohen, 2013)
Cohen's d	0.87	Large

Table 4
Pretest–posttest score differences

Group	Pretest Score	Posttest Score	Difference
Control	57.13	65.55	8.42
Experimental	55.57	77.83	22.26

Table 5
Distribution of student score categories at each test stage

Test Type	Group	HRM (≥70)	MRM (50–69)	LRM (<50)
Pretest	Control	14%	46%	40%
	Experimental	12%	44%	44%
Formative 1	Control	20%	50%	30%
	Experimental	38%	46%	16%
Formative 2	Control	26%	52%	22%
	Experimental	56%	38%	6%
Posttest	Control	42%	48%	10%
	Experimental	84%	14%	2%

Table 6
Grouping strategies and collaboration preferences

Student Grouping Criteria	Frequency	Percentage
Based on academic interest	3	6%
Based on intellectual ability	9	18%
Based on seating position	36	72%
Other strategies	2	4%
Preferred Group Size	Frequency	Percentage
Pairs (2 students)	4	8%
Medium group (4–6 students)	44	88%
Large group (6–8 students)	2	4%
Teacher Approach to Group Formation	Frequency	Percentage
Teacher randomly selects	41	82%
Teacher and students decide together	9	18%
Students choose themselves	0	0%

From a grouping strategy perspective, data in Table 6 indicate that most students (72%) were grouped by seating position, with a strong preference for medium-sized groups of 4-6 members (88%). The majority of teachers (82%) formed groups randomly to maintain balanced ability levels and avoid bias. Such balanced grouping strategies contributed to effective learning interactions and supported the success of MMJ implementation.

Qualitative Data Analysis Process: Tiered Coding

Qualitative data were analysed alongside data collection using Constructivist Grounded Theory methods (Charmaz, 2014), in three stages of tiered coding: initial coding, focused coding, and theoretical coding. This effort aimed to extract and construct the theoretical categories which illustrate how students' cognitive flexibility is constructed in MMJ-based learning.

During the first cycle of coding, the qualitative data from student interviews, reflection journals, classroom observations, and learning artifacts were reviewed line by line to code emergent patterns in how students initially engaged with and transformed their mathematical thinking. Special attention was paid to restructuring, contextual use of strategies, peer influence, emotional reactions, and meta-awareness in tasks on tables, graphs, estimates, and comparisons.

One student, in a reflection journal after having done an activity based around population data on insects within the school yard, wrote:

> At first, I only made a table. But then I saw my friend do a bar graph, so I tried it. It was more aesthetically pleasing and made it easier to compare.

This excerpt was given the initial codes "uncertain first attempt," "based on peer's

model," and "new strategy for clarity." These codes demonstrate a mathematical reformulation (induced by peer modelling) and an adaptive change of strategy to improve data communication.

Another student said during a group discussion session:

> I had an idea, but it didn't come out so great. My friend had a better idea, so we combined those two. It turned out great!

Examples of initial codes were "flexibility in group decision-making," "combining strategies," and "willingness to change plans." The quotations illustrate the emergence of cooperative stance-taking, which implicitly requires negotiation and fusion of mathematical ideas and reveals both reasoning and flexibility.

The following learning moment was noted from observation field notes:

> Student A began by sketching a basic table to express categories of plants. After getting some feedback, she created a colored bar graph to depict which plant was most prevalent.

The initial codes were "revised after feedback," "visual clarity through colour," and "improved data interpretation." This shift demonstrates purposeful strategy adjustment, as learners used mathematical tools not only to meet task demands but also to increase accuracy and their audience's comprehension, which are key indicators of flexible thinking.

Across the three data sources, initial codes coalesced around common behaviours, including experimenting with different ways of representing data, emulating peers and making adaptations, reflecting on errors and shifting approach, and representing ideas visually (color or diagram).

These first-order codes were then collapsed into focused categories such as 'Strategic flexibility in data representation', 'Peer-influenced adaptive thinking', 'Reflective decision-making in mathematics tasks', and 'Emotional triggers for productive change'. The preliminary phase of coding thus showed that, for elementary students, mathematical flexibility developed through a process of exploring, reflecting, and learning socially. Instead of following a "cookbook" approach, students discovered various methods for structuring, displaying, and communicating mathematical information, especially in context.

This iterative coding process also highlights the role that MMJ principles play in supporting students' capacity to iterate on ideas and respond creatively to learning difficulties, both of which are foundational to cognitive flexibility. From the various first-level codes, focused coding was used to emphasise recurring and theoretically meaningful themes within the data sources. This permitted the construction of broader, cross-contextual categories.

Table 7 presents excerpts from student interviews and written reflections, which were analysed using the three coding phases:

Table 7
Tiered coding process

Transcript Segment	Initial Coding	Focused Coding	Theoretical Coding
I enjoy learning by creating my own story problems.	Confidence in learning	Free exploration	Positive Emotion as a Driver of Exploration
When I got it wrong, I tried again using my friend's way.	Reflecting on mistakes	Productive collaboration	Meaningful Learning as a Trigger for Initiation
Playing math games makes me excited to learn.	Collaborating with peers	Free exploration	Safe Learning Environment for Cognitive Exploration
I combined my ideas with a friend's during group work.	Free experimentation	Strategy adaptation	Positive Emotion as a Driver of Exploration
Sometimes I imagine a problem happening in real life.	Variety in thinking	Productive collaboration	Reflection as a Mechanism for Strategy Adaptation
Visual explanations help me think of alternative ways.	Variety in thinking	Self-reflection	Social Interaction Reinforces Flexibility
I like creating and exchanging problems with classmates.	Collaborating with peers	Contextual connection	Positive Emotion as a Driver of Exploration
I reflected on my mistake and corrected it the next time.	Connecting to real life	Contextual connection	Reflection as a Mechanism for Strategy Adaptation
I used the teacher's method but modified it slightly.	Building personal meaning	Confidence	Meaningful Learning as a Trigger for Initiation
I usually ask a friend first when confused, then try alone.	Building personal meaning	Meaningful learning	Positive Emotion as a Driver of Exploration
I feel smart when I solve problems in my own way.	Creative problem-solving	Creativity and variation	Social Interaction Reinforces Flexibility
Real-life examples from the teacher help me understand.	Knowledge transfer from discussion	Contextual connection	Social Interaction Reinforces Flexibility
I enjoy learning when topics relate to my hobbies.	Connecting to real life	Contextual connection	Social Interaction Reinforces Flexibility
I used cartoon stories and I like to write about problems.	Knowledge transfer from discussion	Creativity and variation	Reflection as a Mechanism for Strategy Adaptation

Table 7 (*continued*)

Transcript Segment	Initial Coding	Focused Coding	Theoretical Coding
If I'm confused, I compare my method to my friend's.	Reflecting on mistakes	Creativity and variation	Social Interaction Reinforces Flexibility
Fun topics make me smile while learning.	Interest through context	Intrinsic motivation	Social Interaction Reinforces Flexibility
Sometimes I can solve problems because I've seen them before.	Variety in thinking	Self-reflection	Social Interaction Reinforces Flexibility
Outdoor learning helps me think more freely.	Connecting to real life	Strategy adaptation	Reflection as a Mechanism for Strategy Adaptation
I feel more confident sharing my ideas in group work.	Exploring new strategies	Creativity and variation	Meaningful Learning as a Trigger for Initiation
When allowed to choose methods, I feel more motivated.	Reflecting on mistakes	Self-reflection	Positive Emotion as a Driver of Exploration
I feel valued when the teacher asks for my opinion.	Confidence in learning	Meaningful learning	Safe Learning Environment for Cognitive Exploration
I realise sometimes my way is more effective.	Collaborating with peers	Self-reflection	Reflection as a Mechanism for Strategy Adaptation
I'm starting to like math because of story-based tasks.	Positive emotional engagement	Strategy adaptation	Meaningful Learning as a Trigger for Initiation
I used to fear mistakes, but now I enjoy exploring new ways.	Creative problem-solving	Contextual connection	Meaningful Learning as a Trigger for Initiation
I like exploring before deciding on a solution.	Increased motivation	Meaningful learning	Social Interaction Reinforces Flexibility
After discussions, I can think of more than one solution.	Confidence in learning	Creativity and variation	Positive Emotion as a Driver of Exploration
Sometimes I learn from my friend's mistakes.	Increased motivation	Confidence	Social Interaction Reinforces Flexibility
I prefer open-ended problems.	Interest through context	Contextual connection	Social Interaction Reinforces Flexibility
With more freedom, I become more creative.	Exploring new strategies	Self-reflection	Social Interaction Reinforces Flexibility

Table 7 (*continued*)

Transcript Segment	Initial Coding	Focused Coding	Theoretical Coding
Real-world examples make learning come alive.	Increased motivation	Meaningful learning	Meaningful Learning as a Trigger for Initiation
I enjoy expressing myself through math stories.	Connecting to real life	Creativity and variation	Safe Learning Environment for Cognitive Exploration
Learning with songs helps me remember better.	Free experimentation	Free exploration	Meaningful Learning as a Trigger for Initiation
I'm proud when my idea is used by the group.	Exploring new strategies	Intrinsic motivation	Safe Learning Environment for Cognitive Exploration
Hands-on activities help me understand more.	Exploring new strategies	Self-reflection	Social Interaction Reinforces Flexibility
I plan my steps before solving a problem.	Reflecting on mistakes	Strategy adaptation	Meaningful Learning as a Trigger for Initiation
Sometimes I combine two methods to find the answer.	Positive emotional engagement	Confidence	Positive Emotion as a Driver of Exploration
I feel more motivated with unique challenges.	Collaborating with peers	Productive collaboration	Social Interaction Reinforces Flexibility
I discovered new methods while doing homework.	Connecting to real life	Creativity and variation	Social Interaction Reinforces Flexibility
I realise I've grown I used to know only one way.	Connecting to real life	Contextual connection	Positive Emotion as a Driver of Exploration
I revise my answers when they don't feel right.	Variety in thinking	Meaningful learning	Positive Emotion as a Driver of Exploration
If the topic is fun, I want to keep learning.	Knowledge transfer from discussion	Meaningful learning	Social Interaction Reinforces Flexibility
I like brainstorming before starting an assignment.	Connecting to real life	Creativity and variation	Social Interaction Reinforces Flexibility

Categories and the Dynamics of Flexible Thinking

The iterative tiered coding process, including initial, focused, and theoretical coding, resulted in categories that describe how elementary students develop flexible thinking within the Meaningful, Mindful, and Joyful (MMJ) learning framework. Interview transcripts, written reflections, classroom observations, and learning artifacts were systematically coded line by line to detect fine-grained patterns in students' cognitive, affective, and social engagement with mathematical tasks.

Open-ended data submitted by students during the first round of coding revealed active mathematical reasoning, specifically in representation, comparing numbers, and finding patterns. One student wrote in a reflection journal:

> At first, I was a little lost on how to graph one. I only made a table. But then I saw my friend's graph and gave it a try. It turned out to be clearer.

This excerpt was coded as "confusion in initial strategy," "peer modelling" and "strategic shift for clarity." In a group interview, another student said:

> We were figuring out what chart to use. My idea didn't go very well, but then my friend gave me a different idea and we combined them. The final graph looked better.

This excerpt was coded as "peers influence adaptation," "idea integration," and "collaborative negotiation of mathematical representation." These instances suggest that students were becoming increasingly aware of how to tailor their mathematical approaches to communicate quantitative information more effectively, such as in the task of establishing a data representation.

In the focused coding phase, recurring patterns formed general categories that emerged from different types of learning situations. Codes such as "self-reflection," "contextual connection" and "strategy add resilience" began to represent the cognitive processes by which students experimented with divergent mathematical representations (i.e., moving from tables to bar graphs or infographics). These activities were typically prompted by meaningful content associations or by feedback during peer interactions. Emotional motivation also proved to be just as important for students' continued willingness to try new strategies, based on expressions of happiness, curiosity, or assurance.

Theoretical coding then elaborated on these conceptual categories to form a fuller account of how flexible thinking is socially and emotionally mediated. For example, themes included "Positive Emotion as a Driver of Exploration" and "Social Interaction Reinforces Flexibility" which highlight how emotional safety and peer talk help students take intellectual risks when solving problems. One student stated,

> I like graphs because I can represent numbers and pictures together, it's more fun and easier for everyone to understand,..

This statement indicated not only a successful outcome but also a growing metacognitive ability to judge how effectively mathematical thinking is communicated.

The cognitive changes were significant, but they also depended on meaningful contexts for learning. In real-environment activities (e.g., counting litter or measuring rainfall), students could recognise the purpose of mathematical tools. Statements such as "We counted the trash and made a chart so that other people can see which one there's more of," showed that students saw mathematics as more than procedural, serving communicative and social purposes in their lives. These results led us to the theoretical category of "Meaningful Learning as a Trigger for Idea Shift."

Taken together, these emergent categories show the dynamics of flexible thinking among elementary students, whose mathematical understanding is co-constructed through reflection, collaboration, and emotional engagement. Table 8 synthesises these findings, mapping how initial student expressions were developed into conceptual and theoretical categories that form the basis for a grounded understanding of flexible thinking in the MMJ learning environment.

Table 8
Summary of tiered coding

Initial Coding	Focused Coding	Theoretical Coding	Frequency
Exploring new strategies	Self-reflection	Social Interaction Reinforces Flexibility	2
Connecting to real life	Creativity and variation	Social Interaction Reinforces Flexibility	2
Variety in thinking	Self-reflection	Social Interaction Reinforces Flexibility	2
Collaborating with peers	Free exploration	Safe Learning Environment for Cognitive Exploration	1
Collaborating with peers	Productive collaboration	Social Interaction Reinforces Flexibility	1
Increased motivation	Confidence	Social Interaction Reinforces Flexibility	1
Increased motivation	Meaningful learning	Meaningful Learning as a Trigger for Initiation	1
Increased motivation	Meaningful learning	Social Interaction Reinforces Flexibility	1
Interest through context	Confidence	Social Interaction Reinforces Flexibility	1
Interest through context	Intrinsic motivation	Social Interaction Reinforces Flexibility	1
Knowledge transfer from discussion	Contextual connection	Social Interaction Reinforces Flexibility	1
Knowledge transfer from discussion	Creativity and variation	Reflection as a Mechanism for Strategy Adaptation	1

Table 8 (*continued*)

Initial Coding	Focused Coding	Theoretical Coding	Frequency
Knowledge transfer from discussion	Meaningful learning	Meaningful Learning as a Trigger for Initiation	1
Positive emotional engagement	Confidence	Positive Emotion as a Driver of Exploration	1
Positive emotional engagement	Strategy adaptation	Meaningful Learning as a Trigger for Initiation	1
Reflecting on mistakes	Creativity and variation	Social Interaction Reinforces Flexibility	1
Reflecting on mistakes	Productive collaboration	Meaningful Learning as a Trigger for Initiation	1
Reflecting on mistakes	Self-reflection	Positive Emotion as a Driver of Exploration	1
Variety in thinking	Meaningful learning	Positive Emotion as a Driver of Exploration	1
Variety in thinking	Productive collaboration	Reflection as a Mechanism for Strategy Adaptation	1
Free experimentation	Strategy adaptation	Positive Emotion as a Driver of Exploration	1
Free experimentation	Free exploration	Meaningful Learning as a Trigger for Initiation	1
Free experimentation	Strategy adaptation	Meaningful Learning as a Trigger for Initiation	1
Connecting to real life	Contextual connection	Social Interaction Reinforces Flexibility	1
Collaborating with peers	Self-reflection	Reflection as a Mechanism for Strategy Adaptation	1
Confidence in learning	Creativity and variation	Positive Emotion as a Driver of Exploration	1
Confidence in learning	Free exploration	Positive Emotion as a Driver of Exploration	1
Confidence in learning	Meaningful learning	Safe Learning Environment for Cognitive Exploration	1
Connecting to real life	Contextual connection	Positive Emotion as a Driver of Exploration	1
Connecting to real life	Contextual connection	Reflection as a Mechanism for Strategy Adaptation	1
Connecting to real life	Creativity and variation	Safe Learning Environment for Cognitive Exploration	1
Building personal meaning	Meaningful learning	Positive Emotion as a Driver of Exploration	1
Collaborating with peers	Contextual connection	Positive Emotion as a Driver of Exploration	1
Connecting to real life	Strategy adaptation	Reflection as a Mechanism for Strategy Adaptation	1

Table 8 (*continued*)

Initial Coding	Focused Coding	Theoretical Coding	Frequency
Creative problem-solving	Contextual connection	Meaningful Learning as a Trigger for Initiation	1
Creative problem-solving	Creativity and variation	Social Interaction Reinforces Flexibility	1
Exploring new strategies	Creativity and variation	Meaningful Learning as a Trigger for Initiation	1
Exploring new strategies	Intrinsic motivation	Safe Learning Environment for Cognitive Exploration	1
Building personal meaning	Confidence	Meaningful Learning as a Trigger for Initiation	1

Conceptual Model: The Cycle of Developing Flexible Thinking

The results of the coding analysis and data categorisation from interview transcripts and student reflections reveal that flexible thinking does not emerge instantly but rather develop through a series of dynamic and contextual learning experiences. Based on the dominant focused and theoretical coding patterns identified in Table 7 and Table 8, the development of flexible thinking is conceptualised as a reflective learning cycle supported by the Meaningful, Mindful, and Joyful Learning (MMJ) approach.

This cycle illustrates the close interaction between cognitive processes (thinking strategies), affective aspects (emotional engagement), and social dimensions (collaborative interaction), all of which play a significant role in facilitating students' ability to think flexibly, creatively, and adaptively.

The model consists of five interconnected phases, as shown in Figure 1.

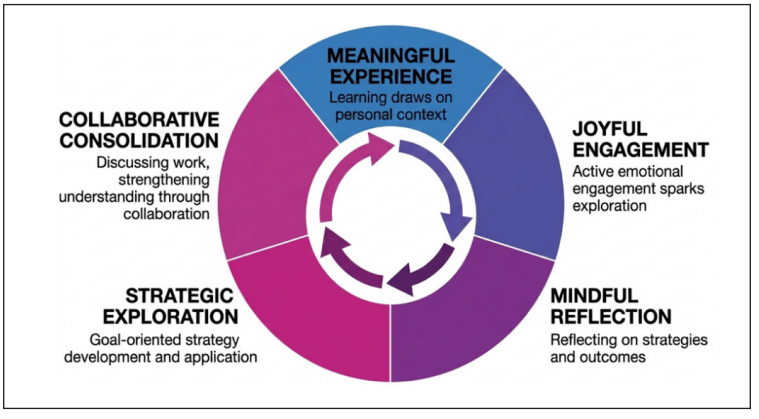

Figure 1. Conceptual model: The cycle of developing flexible thinking through MMJ learning

Meaningful Experience

This is the first level of pupil involvement with personally meaningful and 'situated' content. Meaning making begins when students experience the learning content as related to their life world. Categories such as contextual connection and building personal meaning suggest that flexible thinking is initially prompted by meaningful, activity-based learning opportunities.

Joyful Engagement

Engagement should be seen not only as a cognitive process but also as an emotional one. Students are more likely to take risks when they feel joy and interest and are unhampered by fear of failure. The categories positive emotional engagement and intrinsic motivation demonstrate the importance of affective aspects in fostering the courage to rethink.

Mindful Reflection

This stage occurs when students reflect on the strategies they employed, identify errors, and try other methods. Self-reflection and strategy adaptation are important categories illustrating this metacognitive activity. Reflection also allows students to attend to their own thinking and creates an opportunity for cognitive flexibility.

Strategic Exploration

After reflection, students are willing to try and adjust different problem-solving strategies. This is a period of active, creative exploration that welcomes uncertainty. Free experimentation, creative problem solving, and creativity and variation are categories that show how flexible thinking develops through safe exploration.

Collaborative Consolidation

In this phase, students interact with their peers, take part in group discussions, and give feedback on the strategies of others. Cooperation is how students solidify and broaden their knowledge. It is argued here that the categories of productive collaboration and social interaction reinforce flexibility, showing how flexible thinking is socially and mutually constituted in meaningful social interaction.

This model is also recursive: once students complete one cycle of learning, they may be able to enter a new cycle at a more advanced level. Accordingly, with MMJ learning as the learning context, students' flexible thinking is supported to grow continuously through an iterative approach.

DISCUSSION

The results of the present study confirm the importance of the MMJ approach for promoting cognitive flexibility while also enhancing academic performance among elementary students. Quantitatively, an independent samples t-test of the pretest scores showed no significant difference between the control and experimental groups ($t(98) = 1.90$, $p = 0.060$), indicating that the initial performance of both groups was similar. At the posttest, however, there was a significant difference ($t(98) = -12.80$,

$p < 0.001$): the experimental group had a mean score of 77.83, which was 12.28 points higher than the control group's mean of 65.55.

The learning gains of the experimental group were also apparent in the students' grade categories. Before the intervention, most students were in the middle range marks (MRM) and low range marks (LRM) categories. After MMJ was introduced, the proportion of students in the high range marks category (HRM ≥ 70) increased sharply to 84%, and the proportion in LRM decreased to only 2%. This difference was clear in comparison with the control group, of which only 42% reached HRM and 10% remained in LRM. The comparison of pretest-posttest gains were also favorable: the experimental group improved by 22.26 points, compared with 8.42 points for the control group, with an effect size of Cohen's $d = 0.87$ (large category; Cohen, 2013). These results suggest that MMJ was consistently and practically beneficial for improving learning achievement across all five subjects examined: Science, Mathematics, Indonesian Language, Civic Education, and Arts & Culture.

The numerical outcomes are consistent with the qualitative findings, which demonstrate how the MMJ approach embeds cognitive, affective, and social components in learning (Garzón et al., 2020). Data collected during coding also provided qualitative evidence that meaningful, contextually grounded learning drives flexible thinking among students. Content related to daily life, such as household activities, personal interests, and daily habits, motivated learners to develop a range of problem-solving strategies (Christoffels et al., 2015; Erarslan, 2023). This is in line with Froiland and Worrell (2016), who found that when tasks are contextually related, cognitive engagement increases and learners gain more personal meaning. Similar reasoning is reflected in recent work in Indonesian primary education, where a digitally mediated problem-based learning model was developed to embed local cultural values, make learning more relevant to students' lived contexts, and strengthen higher-order thinking, such as computational thinking (Mardhatillah et al., 2026). Taken together, these studies suggest that anchoring learning tasks in students' own cultural and everyday contexts is a productive condition for flexible, adaptive thinking.

Grouping arrangements also contributed to the success of MMJ. The analysis indicated that most students (72%) were grouped by seating position and that groups of 4-6 students were the most preferred size (88%). The majority of teachers (82%) assembled groups randomly, balanced by ability, to avoid favouritism. This also reflects the literature that emphasises heterogeneous grouping as a way to support the flow of ideas and improve collective thinking capability (Jalaluddin et al., 2020**;** Sakr et al., 2016; Zhao et al., 2021).

Affective engagement also had a strong impact on promoting cognitive apprenticeship. Positive emotions, energy, and psychological safety provided a

supportive milieu for second-order thinking. This is in line with the findings of De Neve et al. (2023) and Martin and Collie (2019), who found that warm teacher-student relationships increase intrinsic motivation and willingness to take intellectual risks.

Metacognitive awareness was further enhanced by the self-reflection that MMJ makes possible. Students who could examine errors, compare strategies, and evaluate the effectiveness of their actions improved their metacognitive awareness, consistent with Iskandar and Pahlevi (2021) and Rudolph et al. (2024). A nonthreatening and unhurried context, as reported by Tang and He (2022), also supported students' exploration and sharing of ideas.

These findings extend prior to work in several important ways. First, whereas earlier studies have generally examined meaningful, mindful, or joyful learning as isolated interventions (Bakosh et al., 2016; Garzón et al., 2020; Salmawati, 2023), the present results show that their combined implementation produced a considerably larger practical effect (Cohen's d = 0.87) than is typically reported for single-component interventions in elementary settings, suggesting that the three dimensions operate synergistically rather than merely additively. Second, the convergence between the quantitative gain scores and the qualitative coding categories, particularly Positive Emotion as a Driver of Exploration and Social Interaction Reinforces Flexibility, provides direct process-level evidence for why the intervention worked, not merely that it worked. This addresses a gap noted by Diamond (2013) and Gabrys et al. (2018), who called for research linking affective and social mechanisms to measurable cognitive flexibility outcomes among young learners.

Third, the achievement gains were consistent across all five subjects rather than confined to a single content area, supporting the claim that cognitive flexibility functions as a transferable skill rather than a subject-specific competency (Wang et al., 2024). This cross-subject consistency is theoretically significant because it suggests that the MMJ cycle cultivates a generalisable disposition toward flexible thinking rather than subject-bound procedural learning. At the same time, the qualitative data revealed that this flexibility was not uniformly distributed among students: those in medium-sized, teacher-balanced groups (4-6 members) reported markedly higher engagement, echoing prior findings that heterogeneous grouping amplifies opportunities for perspective exchange (Sakr et al., 2016; Zhao et al., 2021). Taken together, these results position MMJ not simply as an instructional technique but as a structural condition, one that combines content relevance, reflective practice, emotional safety, and social interaction, that jointly enables both academic achievement and the sustained development of cognitive flexibility in elementary classrooms.

In summary, the findings of this study, namely the statistical analyses of overall scores and group differences together with the qualitative findings, show that MMJ is an effective teaching approach that improves learning outcomes and supports students'

flexible thinking. The model developed in this work is a reflective, contextual learning cycle that combines instructional content, authentic context, positive emotions, conscious reflection, supportive environments, and meaningful social interaction. Integrating these components contributes to elementary education theory and also provides a practical reference for teachers designing more adaptive and holistic learning.

CONCLUSION

This study provides empirical and process-level evidence that the Meaningful, Mindful, and Joyful (MMJ) learning approach improves both academic achievement and cognitive flexibility among elementary school students. Students taught through MMJ achieved significantly higher posttest scores than those taught through traditional lecture-based instruction, with a large effect size (Cohen's d = 0.87). The qualitative findings further showed that this improvement developed through a recursive cycle of meaningful experience, joyful engagement, mindful reflection, strategic exploration, and collaborative consolidation. Taken together, these findings indicate that MMJ is an effective, replicable pedagogical approach for elementary education, and they support its continued use and further investigation in future research.

IMPLICATION OF THE STUDY

This section discusses the theoretical and practical significance of the research for elementary education. Theoretically, it contributes to the knowledge base by showing how the Meaningful, Mindful and Joyful (MMJ) learning model promotes cognitive flexibility, uniting cognition with affect and social aspects in a five-phase learning cycle. Practically, MMJ offers a replicable, interdisciplinary model that improves academic achievement and prepares students for flexible thinking. Its focus on relevance, affective engagement, and reflective practice can guide teacher education, curriculum development, and classroom practice. Policymakers could be encouraged to integrate MMJ concepts into competency-based curricula to support integrated and holistic learning and to better prepare students for complex problems.

LIMITATION AND RECOMMENDATION FOR FUTURE RESEARCH

The study used a quasi-experimental design without full randomisation, so causal inference may be constrained; the six-week intervention was implemented in a single school within one geographical region, and findings may have limited generalisability. The sample size (n = 50 per group) was determined by the number of intact classrooms available at the participating school rather than by an a priori power analysis; future studies should establish the required sample size through a priori power analysis to ensure adequate statistical power. Although the pretest difference between groups was not statistically significant (p = .060), the value approached significance; an ANCOVA controlling for

pretest scores would have provided a more robust comparison and is recommended for future replications of this design. The six-week intervention period may not have captured the long-term maintenance of the effects of the MMJ approach. Future studies should use longer-term controlled designs, larger samples, greater cultural inclusion, a wider range of socio-economic backgrounds, and digitally enhanced MMJ practices. More in-depth investigation of teacher professional development to support MMJ implementation may also improve scalability and impact.

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