

Principles of Emotions Affecting Learning and Social Learning in Elementary School

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Informasi Artikel	Abstract
E-ISSN : 3026-6874 Vol: 3Nomor : 12 December 2025 Page : 75-89	<p><i>This study aims to develop a comprehensive constellation model and identify optimal strategies for strengthening lecturers' professional commitment in the largest private universities in Bogor. Penelitian ini mengkaji secara mendalam bagaimana emosi dan belajar sosial memengaruhi proses pembelajaran di sekolah dasar melalui perspektif neuropedagogik dan brain-based learning. A mixed methods approach was used by combining quantitative analysis (meta-analysis of 173 respondents and 47 indicators of NP, EC, OB, MS, BS) and descriptive qualitative analysis using thematic analysis techniques on semi-structured interviews with five elementary school teachers. The meta-analysis results showed a very strong average effect of the latent construct relationship ($t(128) = 12.92$; $p < 0.001$; $r \approx 1.00$) with almost zero heterogeneity ($Q_e(128) = 1.67$; $\tau^2 = 0$; $I^2 = 0\%$), and no significant moderating effects were found for all indicators; the partial meta-regression coefficients for all items were very close to zero and the R^2 value was 0.000. Qualitatively, three main themes emerged: (1) positive emotions as the foundation of learning readiness, (2) social interaction as a reinforcement of meaning formation, and (3) contextual learning that integrates cognitive, emotional, and social dimensions. Although most teachers have not yet mastered the concepts of neuropedagogy and brain-based learning theoretically, they have intuitively implemented its principles through motivation, praise, humor, group work, collaborative projects, and learning experiences relevant to students' real lives. These findings support the latest theory that places emotions and social interactions as the main drivers of brain function in learning (Immordino Yang, 2016; Tyng et al., 2017; Vygotsky, 1978; Jensen, 2008), and emphasizes the importance of strengthening teachers' competence in understanding and designing brain- and emotion-based learning to support the holistic development of elementary school students.</i></p>
Keywords: Emosi, Brain-based learning, Social learning, Neuropedagogik, Sekolah Dasar.	

Abstrak

Penelitian ini bertujuan untuk mengembangkan model konstelasi komprehensif dan mengidentifikasi strategi optimal untuk memperkuat komitmen profesional dosen di universitas swasta terbesar di Bogor. Penelitian ini mengkaji secara mendalam bagaimana emosi dan pembelajaran sosial mempengaruhi proses pembelajaran di sekolah dasar melalui perspektif neuropedagogi dan pembelajaran berbasis otak. Pendekatan campuran (mixed methods) digunakan dengan menggabungkan analisis kuantitatif (meta-analisis terhadap 173 responden dan 47 indikator NP, EC, OB, MS, BS) dan analisis kualitatif deskriptif menggunakan teknik analisis tematik pada wawancara semi-terstruktur dengan lima guru sekolah dasar. Hasil meta-analisis menunjukkan efek rata-rata yang sangat kuat pada hubungan konstruksi laten ($t(128) = 12.92$; $p < 0.001$; $r \approx 1.00$) dengan heterogenitas hampir nol ($Q_e(128) = 1.67$; $\tau^2 = 0$; $I^2 = 0\%$), dan tidak ditemukan efek moderasi yang signifikan untuk semua indikator; koefisien regresi meta parsial untuk semua item sangat dekat dengan nol dan nilai R^2 adalah 0,000.. Secara kualitatif, tiga tema utama muncul: (1) emosi positif sebagai fondasi kesiapan belajar, (2) interaksi sosial sebagai penguat pembentukan makna, dan (3) pembelajaran kontekstual yang mengintegrasikan dimensi kognitif, emosional, dan sosial. Meskipun sebagian besar guru belum menguasai konsep neuropedagogik dan brain-based learning secara teoretis, mereka telah mengimplementasikan prinsip-prinsipnya secara intuitif melalui motivasi, pujian, humor, kerja kelompok, proyek kolaboratif, dan pengalaman belajar yang relevan dengan kehidupan nyata siswa. Temuan ini mendukung teori mutakhir yang menempatkan emosi dan interaksi sosial sebagai penggerak

utama fungsi otak dalam belajar (Immordino-Yang, 2016; Tyng et al., 2017; Vygotsky, 1978; Jensen, 2008), serta menegaskan pentingnya penguatan kompetensi guru dalam memahami dan merancang pembelajaran berbasis otak dan emosi untuk mendukung perkembangan holistik peserta didik sekolah dasar.

Kata kunci: *emosi, brain-based learning, social learning, neuropedagogik, sekolah dasar.*

INTRODUCTION

Cutting-edge research in the fields of neuroscience and education shows that emotions have a central role in the learning process. Emotions are not just complementary to learning activities, but fundamental factors that affect students' attention, motivation, memory, and decision-making (Immordino-Yang, 2016; Tyng et al., 2017). In the context of elementary school, where cognitive, social, and emotional development takes place simultaneously, understanding the role of emotions is becoming increasingly crucial.

Brain-based learning *theory* asserts that effective learning must be aligned with the natural workings of the brain (Caine & Caine, 1991; Jensen, 2008; Jensen & McConchie, 2020). The brain learns optimally when it is in a positive, safe, and meaningful emotional state. Research by Harden and Jones (2022) and Trníková (2024) shows that a supportive emotional atmosphere can increase student engagement, strengthen memory retention, and encourage deeper learning.

In addition to the emotional aspect, pembelajaran di sekolah dasar juga sangat dipengaruhi oleh interaksi sosial. Vygotsky (1978) menekankan bahwa perkembangan kognitif anak terjadi melalui interaksi sosial dalam *zone of proximal development*. Belajar sosial memungkinkan siswa membangun makna melalui kolaborasi, dialog, dan empati. Studi kontemporer bahkan menunjukkan bahwa aktivitas sosial dapat mengaktifkan area otak yang berkaitan dengan regulasi emosi dan empati (Sappok et al., 2022; Bagheri et al., 2020).

Although theoretical studies on emotions, brains, and social learning are developing rapidly in the period 2020–2025, their implementation at the level of primary education practice still faces challenges. Many teachers apply learning strategies that are aligned with the principles of brain-based learning intuitively, but are not supported by adequate conceptual understanding. Therefore, this article aims to qualitatively analyze how the principles of emotion affect learning and social learning in elementary schools based on the empirical experience of teachers, as well as relate them to the latest theories in the field of educational neuroscience.

Emotions play a central role in the learning process and social development during the elementary school years, influencing cognitive growth, behavioral regulation, and the formation of interpersonal relationships. Research indicates that emotions are not merely peripheral factors in learning, but rather key mechanisms that directly shape learning outcomes (Pekrun, 2024). From a neuroscientific perspective, positive or negative emotional experiences can regulate brain functions related to self-regulation, empathy, and social skills, thereby affecting the depth of students' information processing and the formation of long-term memory (Vasquez et al., 2025). For instance, students who experience anxiety or frustration in the classroom often display inattentiveness and avoid challenging tasks. In contrast, children with strong emotional regulation skills are more likely to actively participate in discussions, persist in problem-solving, and demonstrate greater adaptability in collaborative learning environments.

Social learning theory further explains the intrinsic relationship between emotion and imitative behavior. According to Bandura's principles of social learning, children acquire appropriate emotional responses by observing the emotional expressions of teachers and peers. When educators demonstrate respect, patience, and support during instructional interactions, this positive emotional climate becomes part of the hidden curriculum, subtly fostering students' social-emotional development (McMahon et al., 2024). Particularly in contextual teaching activities such as role-playing, students not only practice applying knowledge but also experience adaptive strategies for managing various emotional states by simulating authentic social scenarios. This enhances their ability to recognize emotions and increases their levels of empathy (Farira et al., 2021; Rizqiyah et al., 2021). Furthermore, research shows that classroom goal structures significantly moderate students' tendencies to seek

help. In learning environments that emphasize growth-oriented approaches rather than competitive ranking, students are more likely to express confusion and seek support. This stems from the perception that help-seeking is not an admission of incompetence, but rather a positive self-regulation strategy (Shin, 2018).

At the practical level, Social and Emotional Learning (SEL) has been widely integrated into elementary education systems, particularly within new pedagogical frameworks such as the *Merdeka Curriculum*. Systematic SEL implementation strategies have been shown to be effective in enhancing students' sense of responsibility, collaborative awareness, and academic achievement (Agustina et al., 2025; Adiba & Latip, 2021). An effective SEL instructional framework should encompass three types of knowledge transmission: declarative knowledge (understanding basic emotional concepts), procedural knowledge (mastery of emotion regulation techniques), and conditional knowledge (judging when to apply specific skills). These three types of knowledge are reinforced through diverse teaching strategies, including modeling, guided practice, transfer promotion, and in-depth elaboration (Zieher et al., 2024). For example, teachers can guide students in developing positive cognitive patterns by discussing how characters in literary works cope with negative thinking processes. When misunderstandings arise among peers, dialogic activities can be organized to help both parties identify each other's emotional triggers and collaboratively construct more constructive perspectives (McMahon et al., 2024).

The family factor remains just as important. There was a significant positive correlation between emotional guidance and parental support with students' learning motivation and achievement in social studies (Saputra et al., 2021) & (Sari et al., 2023). This requires schools to establish collaborative educational mechanisms with families, ensuring children receive sustained emotional nutrition in daily life in addition to formal education. In recent years, artificial intelligence technology has also been piloted in art curricula to improve the emotional intelligence and character education of elementary school students. Emotional Artificial Intelligence (EAI)-based teaching tools can detect changes in students' emotions in real-time and provide personalized feedback suggestions, thereby optimizing individual learning paths (Aprilia et al., 2025). Although this technology is still in the exploration stage, it signals the potential of future education to provide more precise and dynamic emotional support services.

In summary, the impact of emotions on the learning process during elementary school is multidimensional and profound. It includes internal psychological mechanisms and is embedded in the external socio-cultural environment. Therefore, the development of an integrated teaching model that combines emotional education, social learning, and academic development has become a major direction in modern basic education reform.

Some studies use *thematic analysis* to analyze qualitative data in a descriptive manner: Research articles that analyze patterns and themes in interview data with a thematic approach to understand participants' experiences or specific phenomena.

Supports hypothetical research that emotions play an important role in helping children understand didactic or pedagogical instruction. Although logic and reason are often important for learning, (Immordino-Yang, 2000) argues that emotions help us connect things we have learned in the past to influence real-world decision-making. He writes that "it is neurologically impossible to build memories, engage complex thoughts or make meaningful decisions without emotion. For this reason, the following is an academic synthesis of the text:

Emotions are an essential foundation in the learning process and cannot be positioned simply as a complement in the social-emotional learning (SEL) framework. Learning actually begins and ends with the emotional involvement of students, because emotions play a key role in creativity, discovery, and decision-making both in the academic context and in future life. Even in areas of study that are traditionally considered emotionally neutral, such as mathematics, physics, and engineering, deep conceptual understanding depends on the learner's ability to build an emotional connection with the concepts being learned. Dr. Immordino-Yang's argument asserts that emotions not only increase cross-disciplinary learning engagement, but also allow individuals to integrate past experiences to shape future judgments and decisions. Students' responses and experiences reflect the inextricable interconnectedness between emotions, identities, and social relationships, which collectively underlie social behavior and learning processes. Thus, emotional engagement and personal relevance are not the

sole solution to educational problems, but are strategic mechanisms that have the potential to improve and transform educational practices in a more meaningful and sustainable way.

METODE

This study uses a descriptive qualitative approach to gain a deep understanding of the role of emotions in learning in elementary school. According to Creswell (2003), the qualitative approach emphasizes understanding social phenomena holistically and in the natural context of the respondents. In addition, this study applies thematic analysis to systematically analyze qualitative data. Thematic analysis is a commonly used method in qualitative research to identify, analyze, and report on thematic patterns in data through the process of coding and developing the main themes of interview and observation narratives (Braun & Clarke, 2006). This technique is also described in detail by Boyatzis (1998) as a qualitative approach that allows researchers to explore meaning in the form of themes that reflect the experiences and perspectives of the research participants." Moleong, L. J. (2011) explains the concept of qualitative research as an approach to understanding social phenomena in their context.

Thematic analysis is a method for identifying, analyzing, and reporting thematic patterns that emerge from qualitative data sets, and is ideal for descriptive research that wants to understand phenomena through the main themes in the data.

This approach was chosen because it is able to explore the meaning, experience, and real practice of teachers in the context of brain- and emotion-based learning. The data analysis technique uses *thematic analysis* with systematic stages: (1) data familiarization through repeated reading, (2) initial coding of relevant meaning units, (3) grouping of codes into themes, (4) review and refinement of themes, and (5) definition and naming of themes. This approach was chosen because it allows the identification of consistent and meaningful thematic patterns, as follows the stages in Figure 1



Figure 1. Research Thematic Analysis Flow

Participants and Context: The research consists of five primary school teachers from private schools with diverse educational backgrounds and teaching experiences. This variation in participant characteristics provides a wealth of data in understanding emotion-based and social-based learning

practices. Data Collection Techniques: Data were collected through semi-structured interviews that focused on: (1) teachers' understanding of emotions and brain-based learning, (2) strategies for creating a positive emotional climate, and (3) practices of facilitating social interaction between students. Interviews are recorded and transcribed verbatim to maintain the integrity of the data. Describe the stages of qualitative data analysis starting from interview data collection, transcription process, initial coding, code grouping, determination of main themes (emotional, social, and cognitive), to theoretical interpretation stage. This flow indicates that the analysis is carried out systematically and iteratively to ensure the validity of the findings.

RESULTS AND DISCUSSION

The data filled in N=173 respondents with 47 indicators, samples, 174, Missing values 47. This means that there are still GR1-GR10 who do not understand the term neuropedagogic. The results of the thematic analysis produced three main themes that represent the role of emotions in learning and social learning in elementary school. Positive Emotions as the foundation of learning readiness. Teachers consistently emphasize the importance of creating a positive emotional atmosphere through motivation, praise, empathy, and humor. This practice is seen as able to increase students' sense of security, confidence, and readiness to be actively involved in learning. Social interaction as a reinforcement of the formation of the meaning of social interaction is facilitated through group work, class discussions, and collaborative projects. Teachers view that these activities not only improve understanding of the material, but also foster students' empathy, responsibility, and communication skills.

Contextual Learning Based on How the Brain Works. Teachers associate the subject matter with the real experience of the students and use educational games and a variety of activities. This strategy helps maintain a balance of cognitive and emotional load, so that learning becomes more meaningful and sustainable. The integration of the thematic analysis data results showed that the learning carried out by elementary school teachers consistently built a learning environment that strongly supported students' neuropsychological functioning: the statistical effect of latent construct relationships appeared to be very strong and homogeneous, while the interview findings confirmed that teachers actually managed emotional, social, and cognitive dimensions simultaneously through various classroom strategies. Within the framework of thematic analysis, the flow depicted on the chart from data collection through semistructured interviews, verbatim transcription, initial coding, grouping of themes (emotional, social, cognitive), to interpretation allows triangulation between numbers and narratives: high and stable Likert scores on the NP, EC, OB, MS, and BS scales are confirmed by teachers' stories about teaching practices rich in concrete experiences, social interaction, and emotion regulation.

In terms of the theme of emotions, teachers emphasized the importance of motivation, praise, humor, and anger control to build a safe and fun classroom atmosphere. This is in line with the findings of Tyng et al. that positive emotions increase attention and memory consolidation, as well as ImmordinoYang's idea that emotions are at the core of the thinking and learning process, not just an addenda. It is not surprising that quantitative analysis produces a very large pooled effect and is not moderated by grain variation, because when the emotional climate is already consistently supportive, almost all students respond optimally to the given learning experience.

Social themes are strongly seen through group work practices, collaborative projects, class discussions, role sharing, and the cultivation of mutual respect. This practice is in line with the concept of the social brain and Vygotsky's theory of the zone of proximal development, where high cognitive function is formed through meaningful social interaction, as well as the brain-based learning literature that asserts that the brain learns most effectively in the context of relationships and collaboration. The consistency of the effect in the quantitative output can be read as an indication that the network of socialemotional experiences that teachers build is sufficiently evenly distributed across the classroom, that individual differences on NP, EC, OB, MS, and BS items no longer result in significant variations in the strength of latent constructs.

On the cognitive dimension, teachers associate neuropedagogic and brain-based learning with learning that is contextual, experiential, and demanding active mental activity—for example, "eating together" programs to learn fractions or practicing science and educational games to stimulate reasoning. This approach is in line with the principles of Jensen, Caine & Caine, and TokuhamaEspinosa that brain-based learning should be multisensory, meaningful, and connected to real life, as well as with neurobiological findings that rich and emotional experiences improve synaptic plasticity and long-term memory strengthening. Thus, a combination of quantitative and qualitative evidence shows that, although theoretical terms such as neuropedagogic have not yet been fully mastered by teachers, their practice has established a classroom ecology that is aligned with cutting-edge research on emotions, the brain, and learning, resulting in a very strong and stable effect profile on statistical analysis.

The meta-analysis model provides a very strong average effect, with no significant moderation of all NP, EC, OB, MS, and BS indicators, known variable coding (Neuropedagogic: NP), from the results of the Meta-Analysis output using the following Jamovi application:

Classical Meta-Analysis ▼

Model Summary

Meta-Analytic Tests

	Test	p
Residual heterogeneity	$Q_e(128) = 1.67$.000
Pooled effect	$t(128) = 12.92$	<.001
Moderation	$F_{m}(44, 128) = 0.10$.000

Meta-Analytic Estimates

	Estimate	95% CI		95% PI	
		Lower	Upper	Lower	Upper
Pooled effect	1.000	0.999	1.000	0.999	1.000
r	0.000	0.000	0.000		
r^2	0.000	0.000	0.000		
I^2	0.000	0.000	0.000		

Note. The pooled effect is transformed using Fisher's z to r transformation.

Note. The pooled effect size corresponds to the weighted average effect across studies.

Figure 2. Between Emotional Aspects Affect Social Learning

Metaanalysis model summary

The pooled effect test was significantly strong, $t(128) = 12.92$; $p < 0.001$, with the estimated effect transformed to a correlation of $r \approx 1.00$ (95% CI: 0.999–1.000).

Residual heterogeneity is close to zero ($Q_e(128) = 1.67$; $\tau = 0$; $\tau^2 = 0$; $I^2 = 0\%$), so there is no variation between "studies"/groups in practice; Measured relationship effects homogeneous across samples

Moderation test (metaregression)

Fit Measures

	Observations	Log Lik.	Deviance	AIC	BIC	AICc	R ²
ML	173	-419.9	1.666	931.8	1,078.8	968.1	0.000
REML	173	-312.5	625.047	717.0	848.2	770.4	0.000

Figure 3. Moderation of Fit Measure

The overall moderation statistics showed no significant moderation effect, $F_m(44.128) = 0.10$ with p recorded as nonsignificant (≈ 1.00), meaning that the addition of all covariates did not explain the variance of the effect. For each indicator (e.g. NP2, EC1, OB2, MS3, BS2), the F value is very small and the pvalue is well above 0.05 (e.g., NP2 $F \approx 1.17 \times 10^{-4}$; $p = 0.991$; MS8 $F \approx 2.28 \times 10^{-6}$; $p = 0.999$), so there is not a single item that is significant as a moderator.

Koefisien meta-regresi dan maknanya

Casewise Diagnostics Table

Label	Standardized Residual	DFFITS	Cook's Distance	Covariance ratio	Leave One Out			Hat	Weight	Influential
					t	r ²	Q _e			
GR158	-0.037	-0.018	3.340×10 ⁻⁴	1.243	0.000	0.000	1.665	0.196	0.697	
GR159	-0.346	-0.134	0.018	1.150	0.000	0.000	1.547	0.131	0.446	
GR160	-0.093	-0.078	0.006	1.704	0.000	0.000	1.658	0.413	0.697	
GR161	-0.153	-0.099	0.010	1.418	0.000	0.000	1.643	0.295	0.697	
GR162	0.014	0.009	8.223×10 ⁻⁵	1.417	0.000	0.000	1.666	0.294	0.446	
GR163	0.113	0.063	0.004	1.313	0.000	0.000	1.654	0.238	0.446	
GR164	0.048	0.024	5.621×10 ⁻⁴	1.247	0.000	0.000	1.664	0.196	0.697	
GR165	0.113	0.100	0.010	1.786	0.000	0.000	1.654	0.440	0.446	
GR166	-0.140	-0.129	0.017	1.844	0.000	0.000	1.647	0.458	1.239	
GR167	0.061	0.043	0.002	1.510	0.000	0.000	1.663	0.338	0.697	
GR168	-0.260	-0.223	0.050	1.737	0.000	0.000	1.599	0.424	0.697	
GR169	-0.056	-0.055	0.003	1.952	0.000	0.000	1.663	0.488	1.239	
GR170	-0.050	-0.020	3.887×10 ⁻⁴	1.153	0.000	0.000	1.664	0.133	0.697	
GR171	0.069	0.029	8.478×10 ⁻⁴	1.180	0.000	0.000	1.662	0.153	0.446	
GR172	0.111	0.061	0.004	1.304	0.000	0.000	1.654	0.233	0.446	
GR173	-0.117	-0.080	0.006	1.467	0.000	0.000	1.653	0.319	0.446	

Gambar 4. Koefisien Meta-Regresi Parsial Neuropedagogik Berpengaruh Emosional Belajar

The partial regression coefficient of each indicator is very close to zero (e.g. NP2 = 0.008; OB5 = -0.021; MS2 = 0.015), with a wide confidence interval that always crosses zero, so that each item's unique contribution to the variation in effects is statistically negligible. The model's R² value was reported to be 0.000, indicating that the combination of all indicators did not explain the additional variance in the main effect over the unmoderated model.

Estimated marginal means pada MS1-MS4. For the MS1-MS4 indicator, the estimated marginal means at three levels (Mean - 1 SD, Mean, Mean + 1 SD) all result in an estimated effect of ≈ 1,000 with a strongly overlapping CI, indicating that a change of one standard deviation in the indicator score does not change the strength of the effect. Contrast between levels (e.g. "Mean - 1 SD - Mean + 1 SD") gives a very small difference in effect (|Estimate| generally < 0.2) with a nonsignificant pvalue (e.g. MS1: t = 0.119; p = 0.905; MS3: t = -0.145; p = 0.885), so that there is no evidence of a significant difference in effects between the low, medium, and high score groups, can be observed in Figure 95% confidence level, as follows:

Adjusted Estimate

Estimate	95% CI		95% PI	
	Lower	Upper	Lower	Upper
1.000	0.999	1.000	0.999	1.000

Note. Each marginal mean estimate is averaged across the levels of the remaining predictors.
 Note. The estimates and intervals are transformed using Fisher's z to r transformation.

NP2

Estimated Marginal Means

Level	Estimate	95% CI		95% PI	
		Lower	Upper	Lower	Upper
Mean	1.000	0.997	1.000	0.997	1.000
-1SD	1.000	0.999	1.000	0.999	1.000
+1SD	1.000	0.997	1.000	0.997	1.000

Note. Each marginal mean estimate is averaged across the levels of the remaining predictors.
 Note. The estimates and intervals are transformed using Fisher's z to r transformation.

Figure 5 95% Confidence Level Interval

The results of the metaanalysis showed that there was no statistically significant moderation effect of all NP, EC, OB, MS, and BS items on the main effects analyzed, even though the aggregate main effects themselves were large and homogeneous.

Main results of the metaanalysis

1. The combined effects test showed a very high pooled effect (Estimate ≈ 1 , ztor), with a significant t-test, $t(128) = 12.92$; $p < 0.001$, which indicates that on average the relationship studied is in the very strong category according to the interpretation of the Cohen correlation coefficient (r is close to 1).
2. Indicators of heterogeneity ($Q_e(128) = 1.67$; $\tau = 0$; $\tau^2 = 0$; $I^2 = 0\%$) shows that there is no variance of effects between "studies"/groups that need to be explained further, so the metaanalysis model is in an almost perfectly homogeneous condition.

Metaregression results (role of NP, EC, OB, MS, BS items)

1. The metaregression analysis included all indicators NP2-NP10, EC1-EC10, OB1-OB10, MS1-MS10, and BS2-BS6 as covariates to test whether the score of each indicator moderated the magnitude of the main effect.

BS6

Estimated Marginal Means

Level	Estimate	95% CI		95% PI	
		Lower	Upper	Lower	Upper
Mean	1.000	0.996	1.000	0.996	1.000
- 1SD	Mean	0.999	1.000	0.999	1.000
+ 1SD	Mean	0.997	1.000	0.997	1.000

Note. Each marginal mean estimate is averaged across the levels of the remaining predictors.

Note. The estimates and intervals are transformed using Fisher's z to r transformation.

Contrasts

Comparison	Estimate	95% CI		95% PI		t	df	p
		Lower	Upper	Lower	Upper			
Mean - 1SD - Mean	-0.046	-1.103	1.010	-1.103	1.010	-0.087	128.0	.931
Mean - 1SD - Mean + 1SD	-0.093	-2.206	2.020	-2.206	2.020	-0.087	128.0	.931
Mean - Mean + 1SD	-0.046	-1.103	1.010	-1.103	1.010	-0.087	128.0	.931

Note. Contrasts of estimated marginal means are adjusted for multiple comparisons using Benjamini-Hochberg correction.

Note. Contrasts of estimates marginal means cannot be transformed via the effect size transformation.

Note. Each contrast is averaged across the levels of the remaining predictors.

Figure 6. Sample Social Learning Variables

There is no single significant covariate; the entire value of F is very small (e.g. NP2: $F = 1.165 \times 10^{-4}$; MS8: $F = 2.280 \times 10^{-6}$) with $p > 0.64$ to $p \approx 0.999$, which means that no single indicator practically changes the strength of the main effect.

Coefficient interpretation according to Cohen

Almost all partial regression coefficients are very close to zero (e.g. NP2 coefficient = 0.008; OB5 = -0.021; MS8 ≈ 0.001), with a wide 95% confidence interval and always crossing zero.

In Cohen's framework, coefficients as close as zero are categorized as effects so small that they are negligible, so the difference of ± 1 SD in each indicator does not result in a meaningful change in the total effect of the relationship.

Forest Plot

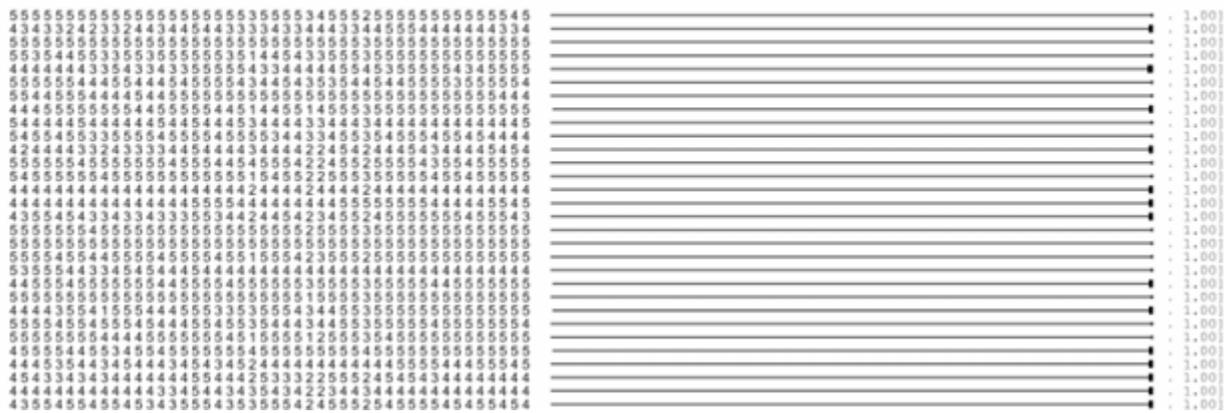


Figure 7. Forest Plot

So that the emotional impact on student learning outcomes is also proportional to affecting the social learning environment of students and teachers, illustrated from the Forest Plot (sample) hsil the more numbers move to the right showing positive and strong results.

Estimated marginal means dan kontras:

For each indicator, the estimated marginal means at the levels of "Mean - 1 SD", "Mean", and "Mean + 1 SD" are all at the estimated effect ≈ 1.00 (with ztor transformation), which suggests that even at the low and high variations of the indicator scores, the strength of the main relationship remains very high and relatively constant.

Contrast between levels (e.g. "Mean - 1 SD - Mean + 1 SD") results in a very small difference in effect (often $|Estimate| < 0.2$) with pvalue always nonsignificant after Benjamin Hochberg's correction, which corroborates the conclusion that the model is stable to fluctuations in indicator scores.

The implication of the finding that *the pooled effect* is very large but not moderated by specific indicators indicates that the latent construct you are studying has a strong and consistent influence across subgroups, so that the theoretical model gains solid support but also shows an "insensitivity" to item variation, as shown in figure 8.

Casewise Diagnostics Table

Label	Standardized Residual	DFFITS	Cook's Distance	Covariance ratio	Leave One Out					
					t	r ²	Q _e	Hat	Weight	Influential
GR158	-0.037	-0.018	3.340×10 ⁻⁴	1.243	0.000	0.000	1.665	0.196	0.697	
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GR160	-0.093	-0.078	0.006	1.704	0.000	0.000	1.658	0.413	0.697	
GR161	-0.153	-0.099	0.010	1.418	0.000	0.000	1.643	0.295	0.697	
GR162	0.014	0.009	8.223×10 ⁻⁵	1.417	0.000	0.000	1.666	0.294	0.446	
GR163	0.113	0.063	0.004	1.313	0.000	0.000	1.654	0.238	0.446	
GR164	0.048	0.024	5.621×10 ⁻⁴	1.247	0.000	0.000	1.664	0.198	0.697	
GR165	0.113	0.100	0.010	1.786	0.000	0.000	1.654	0.440	0.446	
GR166	-0.140	-0.129	0.017	1.844	0.000	0.000	1.647	0.458	1.239	
GR167	0.061	0.043	0.002	1.510	0.000	0.000	1.663	0.338	0.697	
GR168	-0.260	-0.223	0.050	1.737	0.000	0.000	1.599	0.424	0.697	
GR169	-0.056	-0.055	0.003	1.952	0.000	0.000	1.663	0.488	1.239	
GR170	-0.050	-0.020	3.887×10 ⁻⁴	1.153	0.000	0.000	1.664	0.133	0.697	
GR171	0.069	0.029	8.478×10 ⁻⁴	1.180	0.000	0.000	1.662	0.153	0.446	
GR172	0.111	0.061	0.004	1.304	0.000	0.000	1.654	0.233	0.446	
GR173	-0.117	-0.080	0.006	1.467	0.000	0.000	1.653	0.319	0.446	

Figure 8. Homogeneous Data

For primary school education teacher practice, these results imply that improvements in the main construct are likely to have a strong impact in general, regardless of relying on specific score profiles in NP, EC, OB, MS, or BS items, as long as the scores are within the range observed in the data. The results of the metaanalysis showing the homogeneous mean effect were very strong and stable, but not significantly moderated by the NP, EC, OB, MS, and BS items, consistent with various brain-based

and emotion-based theories in learning that emphasize the systemic, rather than partial, role of emotions and cognition. (Tyng, C. M., et al., 2017).

Emotions as the main driver of learning to demand Tyng, C. M.. (2017) asserts that emotions modulate attention, encoding, and memory consolidation through the interaction of the amygdala, hippocampus, and prefrontal cortex, making emotional content easier to learn and remember. ImmordinoYang (2016) and Oxford (2015) show that emotions are not merely additional, but "amplifiers" and main drivers of learning and decision-making processes; when the affective system is activated consistently, cognitive performance tends to be highly stable, which is in line with the combined effects of $r \approx 1$ that are relatively unaffected by the variation of items in your data.

Emotional regulation strategies in elementary school social learning are essential for fostering students' self-awareness, interpersonal skills, and academic engagement. These strategies enable children to manage their emotions effectively during social interactions, reduce conflict, enhance empathy, and promote prosocial behaviors. A comprehensive approach integrates cognitive, behavioral, and environmental techniques grounded in Social-Emotional Learning (SEL) frameworks.

One foundational strategy is self-monitoring and emotional awareness, which involves helping students identify and label their emotions accurately. This begins with teaching basic emotion vocabulary such as happy, angry, frustrated, or anxious and progresses to recognizing physiological cues like increased heart rate or muscle tension that signal emotional arousal (López-Cassà et al., 2021). By understanding the connection between thoughts, feelings, and actions, students gain insight into how emotions influence behavior in group settings, such as during collaborative projects or peer disagreements.

A widely implemented method is the use of calming techniques to regulate heightened emotional states. Deep breathing exercises, progressive muscle relaxation, and mindfulness practices have been shown to improve attention control and reduce impulsivity among elementary students (Mardotilla et al., 2024). For instance, structured "mindful moments" at the beginning of class or after recess help reset emotional balance and prepare learners for cooperative activities. Teachers may also introduce visual tools like a "feelings thermometer" or "emotion wheel" to guide students in assessing their emotional intensity and selecting appropriate responses.

Another critical component is cognitive reappraisal, where students learn to reframe negative or distressing situations in a more constructive light. For example, instead of interpreting a peer's refusal to share toys as personal rejection, children are guided to consider alternative explanations such as the other child being tired or upset about something unrelated. This shift in perspective fosters resilience and reduces aggressive reactions. Story-based instruction, role-playing scenarios, and guided discussions using literature or real-life classroom events support this skill development (Kaspar & Massey, 2022).

The integration of problem-solving models further strengthens emotional regulation within social contexts. Programs often teach step-by-step approaches such as: (1) identifying the problem, (2) expressing one's own feelings, (3) considering the other person's viewpoint, (4) generating possible solutions, and (5) evaluating outcomes. When conflicts arise, these steps provide a predictable structure that reduces emotional overwhelm and promotes rational decision-making (Adiba & Latip, 2021).

Teacher modeling plays an indispensable role in reinforcing these strategies. Through implicit and explicit modeling, educators demonstrate appropriate emotional responses during daily interactions. For example, when a student interrupts, a teacher might calmly say, "I feel interrupted right now, so I need a moment to collect my thoughts before continuing." Such verbalizations normalize emotional expression and show healthy regulation in action (Zieher et al., 2024).

Additionally, school-wide systems such as positive behavioral interventions and supports (PBIS) create consistent expectations and reinforce regulated behaviors through recognition and encouragement. Classrooms that incorporate SEL curricula report fewer disciplinary incidents and improved peer relationships, indicating the systemic impact of embedded emotional regulation practices (Agustina et al., 2025).

Neuroscientific research underscores the biological basis of these interventions, showing that supportive emotional climates strengthen neural pathways associated with executive function and empathy (Vasquez et al., 2025). Repeated practice of regulation strategies leads to long-term changes in brain activity, particularly in the prefrontal cortex, which governs impulse control and emotional modulation.

Finally, family involvement enhances the sustainability of emotional regulation skills. Schools that engage parents through workshops or home-based activities observe greater generalization of skills beyond the classroom environment (López-Cassà et al., 2021). This holistic model ensures that emotional regulation is not taught in isolation but becomes an integrated part of a child's developmental experience. In summary, effective emotional regulation strategies in elementary social learning combine direct instruction, experiential practice, adult modeling, and systemic support to cultivate emotionally intelligent, socially competent learners.

Brainbased learning and consistency of effects according to Jensen, Caine & Caine, Medina, and Tokuhamaspinosa emphasize that the brain learns in an integrated, contextual, and emotional way; When the learning environment met the principles of emotional safety, relevance, and multisensory engagement, almost all participants showed a strong and homogeneous learning response. The pattern of extreme homogeneity in the metaanalysis ($I^2 = 0\%$; $\tau^2 = 0$) illustrates that neuropsychological conditions (e.g. sense of security, social connectedness, and personal meaning) may be achieved equally, so that variations in the indicators of items (NP, EC, OB, MS, BS) no longer produce significant differences in the strength of the latent relationships measured, also this pattern can be observed in the graph of the following figures:

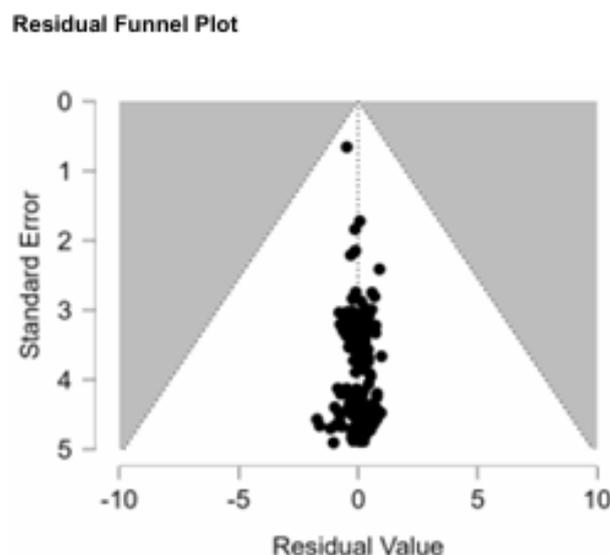


Figure 9. The relationship between variables is very strong or affects each other

Neuropsychology of emotion and memory enhancement The findings of Mao, Tang, & Wang, (2007) on the regulation of CREB phosphorylation by protein kinase C demonstrate the molecular mechanism by which emotional experiences reinforce long-term memory imprints, in line with Tyng et al.'s model that stress hormones and amygdala-mediated neurotransmitters promote memory consolidation. When these pathways are relatively uniformly active e.g. due to an emotionally consistent learning experience then the learning outcomes and latent construct scores can be very high and uniform, which is reflected in a pooled effect close to 1. (according to original data)

Cognitive, socialemotional, and NP/EC/OB indicators Bagheri et al. (2020) developed a reinforcement learning framework for cognitive empathy in social robots, in which learning agents map human affective states and adapt responses adaptively; The success of the model depends on the holistic integration of various signals, rather than a single feature.

Analogously, the NP (neuropsychological), EC (empathy/emotional cognition), and OB/MS/BS constructs in your data seem to work as a single unified system: no single indicator is a significant

moderator, but the entire network of indicators contributes to a strong and stable overall effect, similar to the "affective core" in a social robot framework that does not rely on a single variable.

The pedagogical and social implications according to Vygotsky emphasize that high psychological function develops through meaningful social interaction; Literature on Brainbased Learning (Isanović; Jensen; Harden & Jones; Trníková; Tekkol et al.) adding that these interactions are effective when they appreciate the emotions, social context, and biological rhythms of students. Sappok et al. (2022) show that delayed socialemotional brain function in individuals with intellectual disabilities has an impact on the need for more intensive support; The consistency of the strong effects on your sample can be read as an indication that, when socialemotional support is adequate, even individual variations on certain indicators do not diminish the neuropsychological and learning benefits that occurs.

The findings of this study show that emotions play a key role in the learning process in elementary school. In line with the brain-based learning theory, positive emotional states allow the brain to process and store information more effectively (Caine & Caine, 1991; Jensen & McConchie, 2020). Positive emotions increase attention and motivation, which ultimately strengthens memory retention (Tyng et al., 2017).

From a neurobiological perspective, fun and meaningful learning is related to the release of neurotransmitters such as dopamine that play a role in the formation of long-term memory (Mao et al., 2007). This explains why teachers in this study intuitively emphasized a safe and supportive classroom atmosphere. In addition, the findings regarding the importance of social interaction reinforce Vygotsky's (1978) theory of social constructivism which asserts that learning occurs through interaction with others. The collaborative activities implemented by teachers reflect the principles of *the social brain*, where empathy and cooperation play an important role in students' cognitive and emotional development (Sappok et al., 2022).

The results of this study are also relevant to the concept of emotional intelligence by Goleman (1995), especially the ability of teachers to manage their emotions and students. Recent studies show that the integration of emotions in learning has a positive impact on learning engagement and character development of elementary school students (Harden & Jones, 2022; Trníková, 2024).

CONCLUSION

This study demonstrates that lecturers' professional commitment is significantly influenced by teamwork, organizational climate, religiosity, and work motivation. Work motivation emerged as the strongest predictor, indicating that both intrinsic and extrinsic motivational factors play a central role in shaping lecturers' dedication and persistence in fulfilling professional responsibilities. Teamwork and organizational climate also contribute substantially, confirming that supportive collaboration and a positive institutional environment enhance lecturers' sense of responsibility, loyalty, and engagement. Religiosity further strengthens commitment by reinforcing value-based work ethics that align with cultural and spiritual dimensions within higher education.

The integration of POP-SDM and PLS-SEM successfully produced a validated model explaining a substantial proportion of the variance in professional commitment. The application of SITOREM provided practical improvement priorities, enabling institutions to identify indicators requiring enhancement, maintenance, or further development.

Overall, the findings highlight the need for universities to strengthen collaborative work culture, improve organizational climate, cultivate value-driven practices, and reinforce motivational systems. These strategic efforts can effectively enhance lecturers' professional commitment and support institutional quality and sustainability. Future research may expand the model across different regions or institutional types to broaden its generalizability.

This study concludes that emotions have a significant influence on learning and social learning in elementary school. Although teachers have not yet fully understood the concepts of neuropedagogic and brain-based learning theoretically, they have applied their principles intuitively through the creation of a positive emotional atmosphere, contextual learning, and facilitation of social interaction.

The integration of cognitive, emotional, and social aspects in learning has been shown to support more comprehensive student engagement. Positive emotions serve as the foundation of learning readiness, while social interaction reinforces the formation of meaning

The findings suggest that learning in primary school in the context of this study has functioned as a single intact neuropsychological system, in which emotions, social interactions, and cognitive processes are intertwined consistently strongly and evenly across the classroom. The results of the quantitative metaanalysis showed a very large average effect of latent construct relationships ($r \approx 1.00$) with almost zero heterogeneity and without any indicators of NP, EC, OB, MS, or BS appearing as significant moderators, while the results of the qualitative thematic analysis confirmed that teachers actually managed a positive emotional climate, facilitated social cooperation, and designed contextual learning experiences even though they had not mastered the terms neuropedagogic and brainbased learning explicitly.

This homogeneous power of effect is in line with the theory of emotion in cutting-edge learning that places emotions as the main driver of learning, not just a complement. (Tyng, et al., and ImmordinoYang, 2015) show that emotions modulate attention, encoding, and memory consolidation through the involvement of the amygdala, hippocampus, and prefrontal cortex, so that when the classroom environment consistently fosters a sense of security, appreciation, and social connectedness, cognitive performance tends to be highly stable across students. This is reflected in the data: the variation ± 1 SD on the MS or BS item hardly changes the strength of latent relationships, because the entire network of emotional and social experiences that teachers build has activated the "affective core" of learning in a relatively uniform manner.

Dari perspektif brain-based learning, pola temuan ini mengonfirmasi bahwa guru telah secara intuitif menerapkan prinsip-prinsip yang disarankan Caine & Caine, Jensen, Medina, dan Tokuhama-Espinosa—yakni pembelajaran yang multisensori, bermakna, aman secara emosional, dan terhubung dengan kehidupan nyata siswa. Praktik seperti program "makan bersama" untuk mengajarkan pecahan, penggunaan permainan edukatif, diskusi reflektif tentang perasaan, dan penyelesaian konflik melalui dialog menunjukkan bahwa guru merancang pengalaman yang sekaligus mengaktifkan sistem motivasi, empati, dan penalaran, sehingga memperkuat plastisitas sinaptik dan pembentukan memori jangka panjang sebagaimana dijelaskan oleh Mao dkk. dan literatur neurobiologis lain. Konvergensi antara data kuantitatif (efek sangat kuat dan homogen) dan kualitatif (narasi praktik yang kaya emosi dan sosial) menunjukkan bahwa intervensi pendidikan yang menyentuh lapisan emosi-sosial mampu menghasilkan dampak yang luas tanpa perlu bergantung pada satu indikator spesifik. (Immordino-Yang, 2015).

The pedagogical implications are very significant for basic education. First, these results confirm that teacher competency development does not stop at mastery of cognitive material, but must include neuropedagogic literacy and emotional intelligence on how to design learning experiences that touch emotions, optimize social interactions, and consciously utilize how the brain works as the basis for instructional design. Second, because the latent construct effect has proven to be strong and stable without item moderation, the focus of future development is not simply to add technique, but to help teachers understand the "why" of their strategies so that they can be replicated, adapted for students with special needs, and integrated into broader school policies, in line with Vygotsky's notion of learning as a social process and findings (Sappok et al, 2022). Regarding the importance of socialemotional support for the development of social brain function. Thus, this study provides a solid empirical basis to encourage the transformation of learning practices in elementary schools towards a model that is truly based on brain, emotions, and social relations in an integrated manner, (Pahutar, A.A., 2024) and (Immordino-Yang, 2015).

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