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The Effectiveness of the 5Ps Model as an Active Learning Approach for Enhancing Learning Outcomes and Knowledge Construction among Thai Secondary Students

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Abstract

To move beyond passive knowledge transfer, instructional design must enable learners to construct knowledge autonomously while addressing individual differences. This study aimed to: 1) develop an instructional model integrating Social Constructivism with Learning Styles to enhance learning outcomes and students' knowledge construction abilities, and 2) evaluate its systemic effectiveness. Using a research and development (R&D) framework, the investigation involved 102 Grade 8 students from four regions of Thailand, selected via multi-stage random sampling. Research instruments comprised the 5Ps Model, lesson plans, an achievement test, and a knowledge construction assessment. Data analyses utilized means, standard deviations, paired-samples t-tests, one-sample t-tests, one-way ANOVA, Wilcoxon signed-rank tests, Cohen's d, and Cohen's dz. Results indicated that the developed model was structurally valid and content-consistent. Students' post-test scores surpassed their pre-test scores significantly ($p < .05$), demonstrating a large effect size. Additionally, students' knowledge construction scores significantly exceeded the 70% proficiency threshold, with no significant regional variations observed in post-test outcomes. Qualitative interview data indicated that the model promoted active learning, knowledge co-construction, and the translation of concepts into real-world situations. The findings demonstrate that integrating Social Constructivism with flexible learning activity design systematically supports deep learning in diverse classroom contexts.

Keywords: social constructivism, learning styles, learning outcomes, knowledge construction

1. Introduction

Modern educational mandates require a pivot from traditional knowledge transmission to cultivating advanced cognitive capacities, including analytical thinking, complex problem-solving, and real-world application (APEC, 2024; Wang, Chen, Yu, Liu, & Jing, 2024). Yet, classrooms across many developing nations, particularly within Southeast Asia, continue to rely on conventional, teacher-centered practices (Falasi, 2024; UNESCO, 2023). This reliance on rote memorization and passive transmission of content deprives learners of the agency required for autonomous knowledge construction (Falasi, 2024). This global-local disconnect is prominently reflected in recent international benchmarks, such as the OECD's PISA 2022 results, which reveal a critical, declining trajectory in students' higher-order reasoning and their capacity to extrapolate classroom knowledge into complex real-world environments (OECD, 2023a), particularly in social studies, where students are required to engage in analysis, discussion, and the construction of meaning from complex social situations (Alongi, Heddy, & Sinatra, 2016).

Within this educational framework, Social Studies can serve as a sample subject for developing social and intellectual skills, moving beyond passive learning to foster analytical perspectives for solving real-world problems.

Effective pedagogy in this discipline demands active student participation, as learners best develop cognitive competencies and meaningful outcomes through enjoyable, experiential learning (Gürdoğan Bayır, 2016; Cristol, Michell, & Gimbert, 2010). Large-scale meta-analytic evidence confirms that active instruction yields significantly higher learning achievements than traditional lecturing in humanities and social sciences (Kozanitis & Nenciovici, 2023), while classroom action research demonstrates that active techniques effectively connect learners with contemporary events, fostering participation, critical thinking, and empathy required for daily social life (Sağlamgöncü & Deveci, 2023). Consequently, educational systems must prioritize competencies beyond content knowledge, including critical thinking, collaboration, communication, and creativity (Bialik & Fadel, 2015).

To meet these demands, teachers' capacity to adapt instructional practices and engage in continuous professional learning remains paramount (OECD, 2019b). Such professional adaptive capacity enables educators to implement learner-centered instructional strategies that foster the competencies required in contemporary society. Empirical evidence from secondary education settings indicates that learner-centered and active learning pedagogies significantly enhance students' 21st-century competencies, particularly critical thinking, digital literacy, collaboration, and higher-order reasoning skills (Garcia & Espacio, 2025; Mestiola, Naquita, & Tantengco, 2018).

From a constructivist perspective, knowledge construction is grounded in two theoretical foundations. The first is cognitive constructivism, which emphasizes learners' biological maturation and mental structures. The second is social constructivism, which views learning as a process that develops through social mediation and interaction (Al-Abdulkareem & Hentschke, 2014). In addition, learners do not construct knowledge in isolation; rather, their understanding is often influenced by the social and cultural contexts in which they live and learn (Fernando & Marikar, 2017).

In this context, Vygotsky's (1978) concept of Social Constructivism has been accepted as a key foundation for active learning. It views knowledge not as being directly transmitted from a teacher, but as arising from a process of meaning construction through social interaction, discussion, and collaborative reflection (Amineh & Asl, 2015; Loyens & Gijbels, 2008). The key mechanisms of this concept include the Zone of Proximal Development (ZPD) and scaffolding, which help learners develop a more complex understanding through interaction with teachers or more knowledgeable individuals (Daniels, 2001; Shabani, Khatib, & Ebadi, 2010; Wood, Bruner, & Ross, 1976). However, providing comprehensive individualized scaffolding in large classrooms with high levels of individual differences among learners remains a significant limitation in practice (Walker, 2010).

To address this, Learning Styles offer a framework for designing more diverse and flexible learning activities, aiming to respond to the differences in learners' perceptions, information processing, and participation styles (Curry, 1981; Keefe, 1979; Tomlinson, 2017) rather than individual learning styles. While Fleming and Mills' (1992) framework describes how learners may access learning through different pathways, such as sight, hearing, reading, writing, and practicing, scholars caution against rigidly matching instructional styles to fixed learner traits (Coffield, Moseley, Hall, & Ecclestone, 2004; Pashler, McDaniel, Rohrer, & Bjork, 2008). As a result, this research does not use the concept of this approach to classify learners, but rather as a mechanism for designing diverse learning activities and materials to provide learners with opportunities to access content and participate in knowledge construction through various learning styles.

Drawing from these theoretical underpinnings, integrating Social Constructivism with Learning Styles facilitates instructional management within highly diverse classrooms. Flexible activities actively engage learners through collaborative discussion, deliberate practice, and reflection, thereby driving the processes of knowledge construction and deep learning. Furthermore, this approach enhances the efficacy of group-level scaffolding, reducing sole reliance on individualized instruction (Erbil, 2020; Ramaila, 2025).

Although previous research has extensively studied Social Constructivism and Learning Styles theory, most studies have focused on examining the components of both concepts separately. Crucially, limited research has described the mechanisms for integrating these two concepts into a systemic instructional model for secondary school classrooms in Thailand. Therefore, this research focuses on developing an instructional model integrating Social Constructivism and Learning Styles to enhance learning outcomes and promote students' capacity to construct knowledge independently, as well as examining the effectiveness of the developed instructional model in school contexts across various regions of Thailand. Consequently, implementing such a model presents a challenge for teachers, especially in a rapidly changing world where learning must be flexible, and teachers must act as facilitators. However, it has been found that teachers in Thailand still lack certain 21st-century competencies, particularly in learning management and technology literacy (Nukaew, Poolsuwan, & Jermtaisong, 2021). This requires teachers to consider learners' diverse needs, abilities, and levels of development and to employ a range of teaching methods and

instructional media to support effective learning (Tomlinson, 2017), within each student's Zone of Proximal Development (ZPD).

Based on the conceptual integration of Social Constructivism and Learning Styles, this study established two primary research objectives: 1) To develop an instructional model based on Social Constructivism and Learning Styles aimed at enhancing students' learning outcomes and promoting autonomous knowledge construction capabilities. 2) To examine the effectiveness of the instructional model based on Social Constructivism and Learning Styles in enhancing students' learning outcomes and promoting autonomous knowledge construction capabilities through three specific dimensions: (a) Comparing students' learning outcomes before and after participating in the instructional model based on Social Constructivism and Learning Styles; (b) Comparing students' autonomous knowledge construction capabilities against the 70% criterion after learning through the instructional model based on Social Constructivism and Learning Styles; (c) Examining the consistency of the model's effectiveness across distinct geographical regions to ensure its contextual applicability and equity.

2. Method

The investigation executed a four-phase Research and Development (R&D) framework:

Phase 1: Needs and Context Analysis (R1). The researchers coupled a needs analysis with a systematic literature review focusing on constructivist learning environments and diverse learning preferences. Methodological triangulation, integrating national curriculum standards, regional student performance reports, and existing empirical studies, served to analyze situational challenges and construct a robust conceptual framework.

Phase 2: Design and Development (D1). This phase established the components of the instructional model based on the analysis results. The four systemic components comprised: 1) principles of the model, 2) objectives, 3) instructional process, and 4) outcomes of the model. Then, the researchers engineered tools to support the instructional model, including a user manual, lesson plans, and learning materials aligned with the model. All tools underwent content validity assessment by 15 experts, comprising independent academics and university professors specializing in curriculum and instruction, measurement and evaluation, and educational technology. Content validity metrics obtained from the Index of Item-Congruence (IOC) and the Content Validity Index (CVI) yielded values between 0.80–1.00. Subsequent pilot testing with a non-sample cohort of Grade 8 students in Social Studies at a secondary school indicated that: 1) the quantitative analysis of the learning outcome test yielded item difficulty values (p) between 0.42–0.86, discrimination values (r) between 0.45–0.75, and a Cronbach's alpha reliability coefficient of 0.87; and 2) a rubric-based performance instrument consisting of three components and eight indicators of students' abilities to construct knowledge was rated as good, reflecting content validity and appropriateness for real-world deployment. To mitigate evaluator bias and ensure objectivity in assessment, the inter-rater reliability was calculated using Cohen’s kappa coefficient based on trial evaluations by independent assessors, yielding a value of 0.84, demonstrating high scoring agreement among evaluators.

Phase 3: Implementation (R2). This phase involved a 12-hour field experiment using a one-group pretest-posttest design. The population of the study consisted of Grade 8 students currently studying in public schools under the Office of the Basic Education Commission throughout Thailand in the 2025 academic year. The sample comprised 102 students selected through a multi-stage random sampling design.

To ensure a balanced regional representation and sufficient statistical power for parametric statistics, the sample was distributed across four regional school groups: Central Region (n = 35), Northern Region (n = 20), Southern Region (n = 28), and Northeastern Region (n = 19). Inclusion criteria specifically selected classrooms with similar basic characteristics that followed the same national core Social Studies Curriculum. Schools undergoing major administrative restructuring or those with overlapping experimental activities were excluded (exclusion criteria) to control for potential confounding variables and threats to the internal validity of the experiment. It is important to note that the sample sizes within the regional cohorts represent naturally occurring, intact classroom sizes in those respective regional schools.

While acknowledging the inherent limitations regarding internal validity in a one-group pretest - posttest design, this architecture remains methodologically viable for evaluating initial field effectiveness and practical feasibility of innovative curricular models, an empirical approach recently suggested by Subandiyah, Supratno, Ramadhan, Raharjo, and Nasrullah (2024) for differentiated learning interventions. To reduce potential confounding variables, all participating classrooms followed the same Grade 8 national core Social Studies curriculum and used the same 5Ps lesson structure, learning materials, and assessment instruments. The intervention was implemented within a

compact 12-hour period to minimize time-related effects, such as exposure to external learning experiences or changes in school activity. Schools with overlapping experimental activities or major administrative changes were also excluded. Although these controls could not eliminate all threats to internal validity, they helped ensure greater consistency in the implementation across the four regional contexts.

In terms of research ethics, although this action research was not required to undergo formal approval by a human research ethics committee, the researchers maintained strict ethical standards and safety oversight processes. Prior to the commencement of the study, the researchers obtained formal permission from the administrators of the participating schools. Furthermore, informed consent was obtained from classroom teachers and students to ensure the utmost confidentiality of all student identities and that all participants had the right to withdraw from the research at any time.

Phase 4: Data Analysis and Final Revision (D2). Quantitative data were analyzed using paired-samples t-tests to compare learners' pre-test and post-test learning outcome scores, one-sample t-tests to compare learners' knowledge construction capacity scores with the predetermined 70% criterion, and one-way ANOVA to examine differences in post-test learning outcome scores across regions. The homogeneity of variance assumption was assessed using Levene's test. When this assumption was violated, Welch's ANOVA and the Brown–Forsythe test were employed as robust alternatives to conventional one-way ANOVA. The Kruskal–Wallis test was additionally conducted as a nonparametric robustness check. Statistical significance was determined at the .05 level. Cohen's d was also calculated to determine the magnitude of the effect size. Because some regional datasets showed significant deviations from normality, Wilcoxon signed-rank tests were additionally performed to verify the robustness of the paired-samples t-test results.

Qualitative data gathered through semi-structured interviews with teachers and students after the implementation of the instructional model served to capture participant perspectives on the learning process, learner participation, and knowledge construction. All interview data were transcribed verbatim and analyzed using content and thematic analysis based on the approach of Braun and Clarke (2006). The analysis was conducted in six steps: (1) familiarization with the data, (2) initial coding, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) synthesizing and reporting the findings.

To minimize research bias and enhance the trustworthiness of the qualitative findings, the semi-structured interviews were conducted by the researchers and trained research assistants. The interviews were scheduled immediately after the completion of the instructional implementation to obtain timely feedback on learners' experiences and classroom participation. In addition, triangulation across data sources was employed by comparing information obtained from teachers, students, and classroom observations. Member checking was also used to verify the accuracy of key findings and to enhance the credibility and consistency of the qualitative analysis. The qualitative findings were then integrated with the quantitative results to inform the final revision and refinement of the 5Ps Model.

3. Results

3.1 Instructional model based on Social Constructivism and Learning Styles

3.1.1 Development of the 5Ps Model Based on Social Constructivism and Learning Styles

Integrating Social Constructivism and Learning Styles, the model aims to enhance students' learning outcomes and knowledge construction capabilities. The synthesis of relevant theories, instructional principles, and classroom contexts resulted in the development of the 5Ps Model, also referred to as the Quintuple P Model.

Social Constructivism underpinned the design of learning activities that emphasize social interaction, collaborative learning, knowledge sharing, problem-solving, and scaffolding. These principles guided the creation of learning conditions in which students construct knowledge actively through interactions with peers, teachers, learning materials, and authentic situations. Reflection and discussion were embedded within the learning process to help students examine their understanding and connect new knowledge with prior experiences.

Concurrently, the framework operationalized Learning Styles to support the design of diverse learning media, activities, and participation formats. This deployment addressed individual learner variations by providing multiple pathways for students to engage in the learning process. The integration of varied learning activities, such as discussions, visual media, practical exercises, collaborative tasks, and presentations, this approach creates a more flexible and dynamic learning environment tailored to diverse classroom contexts.

Consequently, the 5Ps Model operates as a systematic learning process that promotes active participation,

collaborative knowledge construction, independent learning, and higher-order thinking. The model integrates four main components: principles, objectives, instructional process, and outcomes. These components interlock to steer classroom implementation and support student growth in both learning outcomes and knowledge construction capabilities.

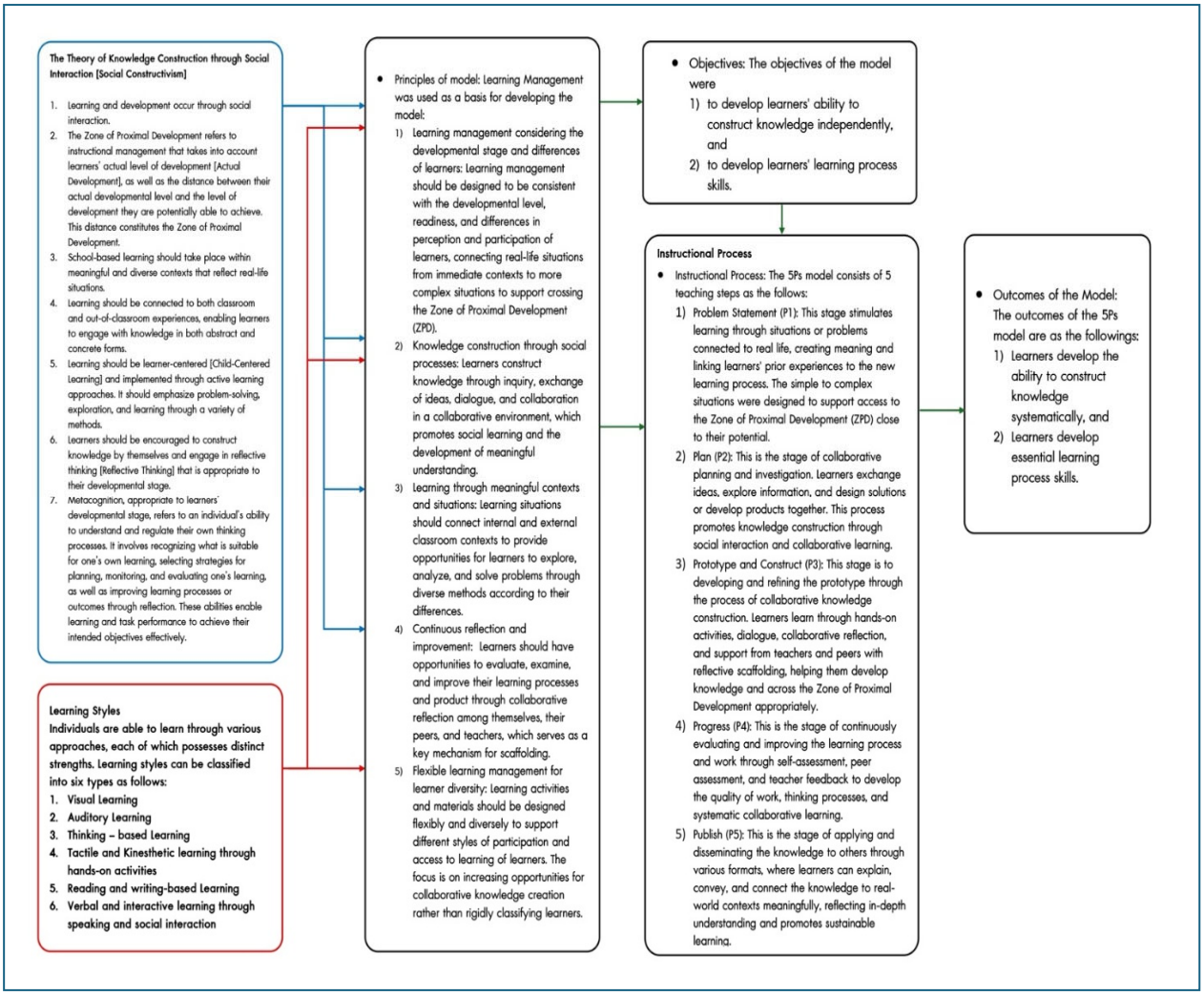


Figure 1. 5Ps Model (Quintuple P)

Figure 1 maps out the structural configuration of the 5Ps Model, encompassing its foundational principles, objectives, instructional procedures, and outcomes. To delineate operational mechanics, Figure 2 displays the sequential learning trajectory of the 5Ps Model, highlighting student engagement, knowledge co-construction via interaction, and contextual application.

As illustrated in Figure 2, the instructional framework unfolds through five sequential phases: Problem Statement, Plan, Prototype, Progress, and Publish. During the Problem Statement phase, learners identify and analyze the core problem they intend to investigate. In the second stage, the Planning phase, students collaboratively formulate learning strategies, develop conceptual frameworks, and evaluate potential solutions. Next, in the Prototyping phase, learners actively engage in constructing, testing, and refining initial outputs or artifacts based on their proposed designs. The fourth stage, the Progress phase, emphasizes continuous improvement, critical reflection, peer feedback, and ongoing development. Finally, the Publishing phase, which concludes the cycle, provides students with opportunities to present, defend, and communicate their final learning outcomes.

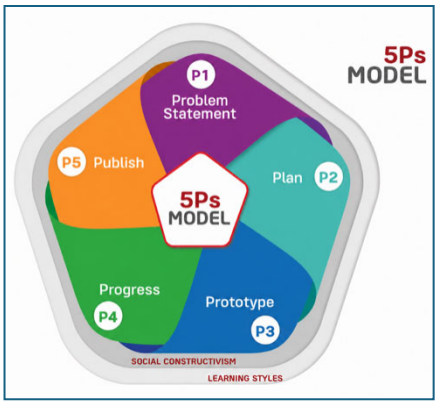


Figure 2. Instructional Process of the 5Ps Model (Quintuple P Model)

This instructional sequence operationalizes the integration of Social Constructivism and Learning Styles by embedding active participation, collaborative dialogue, meaning-making, reflection, and real-world application within meaningful contexts.

3.1.2 Evaluation of the Suitability of the Instructional Model

To evaluate the suitability of the instructional model, 15 experts assessed the 5Ps Model and its accompanying instructional tools across five dimensions: usefulness, feasibility, appropriateness, accuracy, and content alignment. The evaluation was conducted using a five-point rating scale. The aggregate evaluation across the five dimensions yielded an overall mean score of 4.54 out of 5.00, indicating a high level of suitability. This quantitative result demonstrates that the experts considered the model and its instructional tools appropriate for classroom implementation and adequately aligned with the intended learning outcomes and objectives for knowledge construction.

3.2 The Results of the Study on the Effectiveness of the 5Ps Model in Promoting Learning Outcomes and Knowledge Construction Capacity

3.2.1 Analysis of Learning Outcome Scores of Target Students from Four Regions

Before conducting inferential analyses, the normality assumption for the paired difference scores between pretest and posttest learning outcomes was assessed using the Shapiro–Wilk test. The null hypothesis posits that the difference scores are normally distributed.

Table 1. Shapiro–Wilk Test for Normality of Pretest and Posttest Score Differences

Paired Difference Scores (Post-test − Pre-test) by Region	Statistic (W)	*p*-value
Central	.909	.007*
Northern	.843	.004*
Southern	.940	.108
Northeastern	.928	.158

Note. $p < .05$ indicates a significant deviation from normality.

As detailed in Table 1, the paired difference scores for the Southern Region (W = .940, p = .108) and Northeastern Region (W = .928, p = .158) conformed to the normality assumption. Conversely, the data for the Central Region (W = .909, p = .007) and Northern Region (W = .843, p = .004) significantly violated the normality assumption. To ensure statistical rigor, the investigation proceeded with paired-samples t-tests while executing Wilcoxon signed-rank tests as a nonparametric robustness check to verify the robustness of the parametric outputs.

Table 2. Comparison of Pretest and Posttest Learning Outcome Scores Across Four Regions

Region	Time	n	M	SD	Mean Difference	t	df	*p*-value	Cohen's d_z	Wilcoxon |z|	Wilcoxon *p*
Central	Before	35	5.114	1.255	0.943	4.910	34	< .001	0.830	3.771	< .001
	After	35	6.057	0.906							
Northern	Before	20	3.400	1.314	2.500	6.455	19	< .001	1.443	3.823	< .001
	After	20	5.900	1.651							
Southern	Before	28	3.179	1.679	2.642	6.853	27	< .001	1.295	4.216	< .001
	After	28	5.821	1.020							
Northeastern	Before	19	4.000	1.000	1.947	4.105	18	< .001	0.942	3.103	.002
	After	19	5.947	2.041							

Note. Mean Difference = Posttest − Pretest. The paired-samples t-test was used as the main analysis, and the Wilcoxon signed-rank test was used to confirm the robustness of the results. Wilcoxon |z| refers to the absolute value of the standardized Wilcoxon statistic. $p < .05$.

Table 2 presents the regional comparisons of students' learning outcomes before and after the implementation of the 5Ps Model, where paired-samples t-tests indicated significant posttest gains across all cohorts. Specifically, Central Region classrooms demonstrated a positive shift from pretest baselines (M = 5.114, SD = 1.255) to posttest outcomes (M = 6.057, SD = 0.906), t (34) = 4.910, p < .001, yielding a mean increase of 0.943 points with a substantial effect size (d_z = 0.830). Northern classrooms demonstrated an increase, climbing from pre-test marks (M = 3.400, SD = 1.314) to post-test levels (M = 5.900, SD = 1.651), t (19) = 6.455, p < .001, which marked a mean increase of 2.500 points and a very large effect size (d_z = 1.443).

Southern students demonstrated a significant increase, with posttest scores (M = 5.821, SD = 1.020) exceeding pretest scores (M = 3.179, SD = 1.679), t (27) = 6.853, p < .001, indicating a mean increase of 2.642-points (d_z = 1.295). Similarly, students in the Northeastern region showed a significant increase from the pretest (M = 4.000, SD = 1.000) to the posttest (M = 5.947, SD = 2.041), t (18) = 4.105, p < .001, resulting in a mean increase of 1.947 points (d_z = 0.942).

Non-parametric Wilcoxon signed-rank tests suggested the robustness of these parametric estimates, demonstrating consistent statistical significance differences across all regional datasets: Central (|z| = 3.771, p < .001), Northern (|z| = 3.823, p < .001), Southern (|z| = 4.216, p < .001), and Northeastern (|z| = 3.103, p = .002). In sum, the 5Ps Model drove significant academic development across all geographical settings, with the Southern Region yielding the highest raw mean expansion (mean difference = 2.642) and the Northern Region exhibiting the largest effect size (d = 1.443), thereby providing evidence of the model's effectiveness and adaptability across different regional contexts.

To visually present the differences between pre-test and post-test learning outcome scores across the four regions, the grouped score distributions are presented in Figure 3.

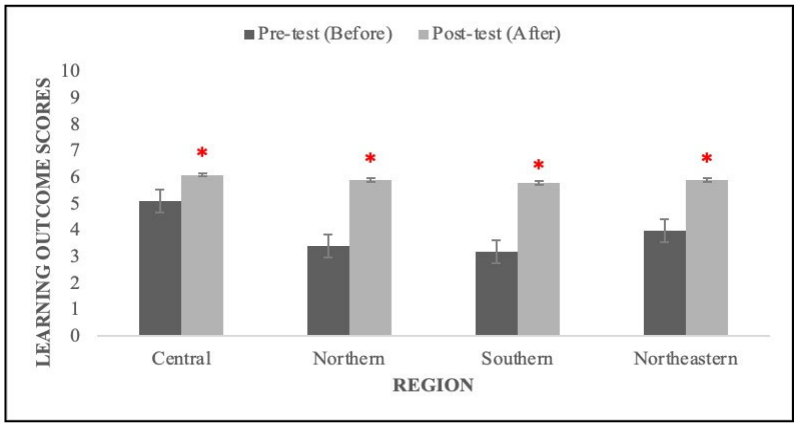


Figure 3. Comparison of Pretest and Posttest Learning Outcome Scores Using the 5Ps Model Across Four Regions

To assess whether geographical variations significantly influenced post-intervention performance, a one-way analysis of variance (ANOVA) was conducted to compare the posttest learning outcome scores across the four regional settings. This analysis determined the consistency of the model's efficacy when deployed across distinct socio-educational contexts.

Table 3. One-way ANOVA Results Comparing Posttest Learning Outcome Scores Across Four Regions

Source	SS	df	MS	F	*p*	η^2
Between Groups	0.907	3	0.302	0.162	.922	0.005
Within Groups	182.740	98	1.865			
Total	183.647	101				

Note. SS = Sum of Squares; df = Degrees of Freedom; MS = Mean Square; η^2= Eta-squared.

As detailed in Table 3, the one-way ANOVA indicated that posttest learning outcome scores did not differ significantly across the four geographical regions, $F(3, 98) = 0.162$, $p = .922$, $\eta^2 = .005$. The negligible effect size indicates that regional differences accounted for only 0.5% of the outcome differences. There weren't any statistically meaningful differences in posttest scores across the four regions. Nevertheless, this lack of difference does not provide proof that the regions are equivalent.

Table 4. Homogeneity of Variance and Robustness Tests for Regional Posttest Comparisons

Test	Statistic	Value	df1	df2	p-value	Effect size
Levene's test	F	5.530	3	98	.002	
Welch's ANOVA	F	0.306	3	42.96	.821	
Brown–Forsythe test	F	0.132	3	51.35	.941	
Kruskal–Wallis test	χ^2	1.133	3		.769	Rank $\varepsilon^2 = .011$

As detailed in Table 4, Levene's test was statistically significant, $F(3, 98) = 5.530$, $p = .002$, indicating a violation of the homogeneity-of-variance assumption. Therefore, Welch's ANOVA was conducted as a robustness analysis and revealed no statistically significant difference in post-test learning outcome scores across the four regions, $F(3, 42.96) = 0.306$, $p = .821$. The Kruskal–Wallis test also yielded a non-significant result, $\chi^2(3) = 1.133$, $p = .769$, rank $\varepsilon^2 = .011$. Taken together, these analyses provide consistent evidence that posttest learning outcome scores did not differ significantly across the four regions. The Brown–Forsythe test also yielded a non-significant result, $F(3, 51.35) = 0.132$, $p = .941$.

3.3 Comparison of Learners' Knowledge Construction Capacity with the 70% Criterion

To evaluate whether students attained the mandated proficiency standard, post-intervention knowledge construction scores were benchmarked against a predetermined 70% criterion, equivalent to 16.80 points out of a 24-point maximum. One-sample t-tests isolated and analyzed the performance of each regional cohort independently, with metrics structured in Table 5.

Table 5. Results of the One-sample t-test Comparing Learners' Knowledge Construction Capacity Scores with the 70% Criterion

Region	n	Criterion (70%)	M	SD	t	df	*p*-value	Cohen's d
Central	35	16.80	19.89	2.68	6.821	34	< .001	1.153
Northern	20	16.80	20.55	2.21	7.582	19	< .001	1.695
Northeastern	19	16.80	21.00	1.60	11.452	18	< .001	2.627
Southern	28	16.80	19.64	2.79	5.388	27	< .001	1.018

Note. The criterion score was set at 16.80 points, representing 70% of the total score of 24 points. $p < .05$.

Table 5 outlines the results of the one-sample t test comparing students' knowledge construction scores against the 16.80-point proficiency benchmark. The empirical outputs show that cohorts across all four geographical regions significantly outperformed the target criterion. Specifically, Central Region participants achieved a mean score of 19.89 (SD = 2.68), surpassing the benchmark substantially, $t(34) = 6.821$, $p < .001$, with a large effect size ($d = 1.153$). Similarly, students in the Southern Region obtained a mean score of 19.64 (SD = 2.79), which was significantly higher than the benchmark, $t(27) = 5.388$, $p < .001$ ($d = 1.018$). The Northeastern Region recorded the highest mean score (M = 21.00, SD = 1.60) and exceeded the criterion by 4.20 points, $t(18) = 11.452$, $p < .001$, demonstrating an exceptionally robust effect size ($d = 2.627$). Northern classrooms mirrored this exceptional development, securing a mean score of 20.55 (SD = 2.21), which systematically exceeded the benchmark, $t(19) = 7.582$, $p < .001$ ($d = 1.695$).

Overall, these findings indicate that students across all four regions performed significantly above the established proficiency benchmark, with large to very large effect sizes. The results provide evidence that the 5Ps Model was associated with high levels of knowledge construction across the participating regional contexts.

3.4 Results of Interviews with Teachers and Learners

The thematic synthesis of semi-structured interview data indicated that the 5Ps Model catalyzed active learning, social-interaction-driven knowledge construction, and immersive participation within real-world learning contexts. The analysis extracted three core themes:

Theme 1: Active Knowledge Construction through Collaborative Learning

Educators reported that the 5Ps Model facilitated autonomous knowledge co-construction by fostering student engagement in peer discussions, conceptual synthesis, and collaborative problem-solving—particularly during the prototyping and hands-on phases. These activities allowed learners to link theoretical concepts directly to their immediate daily lives and community realities. Additionally, students engaged in metacognitive reflection and peer monitoring, which deepened conceptual understanding and sharpened analytical capacities. The narrative accounts also indicated a pedagogical shift in teachers' role, from knowledge transmitters to facilitators of active learning, consistent with the core principles of Social Constructivism.

Theme 2: Flexible Learning Participation Across Diverse Learning Preferences

Students indicated that the diversification of learning pathways, including visual media, targeted dialogue, artifact design, and kinesthetic tasks, enhanced their classroom engagement and perceived conceptual retention compared to traditional lecture-based instruction. Collaborative problem-solving and structured peer dialogue allowed learners to actively negotiate meaning and derive personal relevance from the curriculum. These findings suggest that incorporating diverse learning activities allows educators to provide students with multiple opportunities to engage with and co-construct knowledge within heterogeneous classroom settings.

Theme 3: Development of Higher-Order Thinking and Real-World Application

The interview transcripts indicated that this instructional strategy supported the development of students' higher-order reasoning, strategic planning, problem-solving, and creative execution, specifically when tackling authentic real-world problems. Consequently, learners articulated their reasoning more clearly and exhibited heightened enthusiasm toward contextualized tasks. Conversely, the qualitative feedback highlighted implementation challenges, including student apprehension during public presentation phases and structural time constraints across specific instructional steps. These nuances underscore the critical need to calibrate activity durations and student readiness levels to the specific constraints of each classroom context.

4. Discussion

This study demonstrates that the developed 5Ps Model was associated with improved learning outcomes and learners' capacity for self-regulated knowledge construction. Importantly, this efficacy stems not merely from isolated learning activities, but from the systemic integration of Social Constructivism and Learning Styles. This theoretical and instructional integration enables learners to construct meaning through social interaction, reflection, and real-world application. These findings align with Vygotsky (1978), and Amineh and Asl (2015), who assert that knowledge is constructed through processes of social interaction and cultural mediation rather than through the passive reception of direct instruction.

The expert evaluation of the developed model indicated that the model showed strong alignment with Social Constructivism, particularly regarding social interaction, active knowledge construction, and scaffolding, core components of the Zone of Proximal Development (ZPD) framework (Vygotsky, 1978; Daniels, 2001; Shabani et al., 2010). Each phase of the 5Ps Model serves as a procedural mechanism that drives learners from initial understanding to deeper meaning-making. Furthermore, this pedagogical model addresses a critical curricular gap identified by Al-Abdulkareem and Hentschke (2014), who noted that standard textbook content frequently may not adequately support the dynamics of autonomous knowledge construction. The 5Ps framework addresses this limitation by providing educators with a clear, actionable methodology to transform static content into a more experiential and collaborative learning environment. This shift strongly resonates with Jonassen (1999), who emphasized that meaningful learning must empower learners to independently explore real-world contexts.

Significantly, incorporating Learning Styles was intended not to categorize learners into rigid cognitive profiles, but to diversify sensory and instructional pathways through visual media, structured dialogue, tactile prototyping, and socio-collaborative tasks. This aligns with the perspectives of Fleming and Mills (1992), Keefe (1979), and Curry (1981), who posit that differences in information perception and processing are vital factors in learning efficacy. Theoretically, this approach mitigates the constraints of crowded classrooms where individualized scaffolding can be difficult to implement. By distributing multimodal learning activities across collaborative teams, the model facilitates group-level scaffolding, consistent with the perspectives of Erbil (2020) and Ramaila (2025). Furthermore, qualitative findings reveal that the effectiveness of the 5Ps is associated with learning processes that enable students to co-construct meaning through discussion, reflection, and collaborative practice across diverse social contexts.

The experimental results further revealed that learners across all regions achieved statistically significant improvements in posttest learning outcomes compared with their pretest scores, with a large effect size. The 5Ps Model demonstrated a strong capacity to foster deep learning through continuous engagement and reflection. Because activities within each phase allow learners to anchor new experiences to their prior knowledge through inquiry, prototyping, and ongoing reflective evaluation, the model may facilitate meaningful knowledge integration and reduce unnecessary cognitive demands. These findings are consistent with Ounraun and Onthanee's (2023) finding that instructional approaches linking real-world scenarios with collaborative reflection effectively promote analytical processing and practical application of knowledge.

The absence of statistically significant regional differences in posttest outcomes, $F(3, 98) = 0.162$, $p = .922$, $\eta^2 = .005$, suggests that learners' performance was broadly comparable across the four regional cohorts under the study conditions. However, a non-significant result does not establish equivalence among the regions. Therefore, these findings indicate that no statistically detectable regional differences were identified within the present sample rather than providing definitive evidence of regional equivalence.

Regarding autonomous knowledge construction, students across all regions performed significantly above the 70% proficiency threshold, indicating strong achievement in knowledge construction. This pattern was evident during the Prototype and Progress phases, in which students refined their ideas and considered feedback from their peers. This iterative process aligns with the scaffolding mechanisms of Wood et al. (1976) and Daniels (2001), where external support acts as a cognitive catalyst rather than an intellectual substitute. Crucially, this approach addresses concerns regarding peer-assessment highlighted by Fernando and Marikar (2017). While Fernando and Marikar cautioned against the use of peer grading because of potential subjective biases and vested interests among students, the 5Ps Model positions the 'Progress' phase strictly around formative and collaborative peer-feedback aimed at refining student artifacts rather than assigning grades. This structural choice ensures that social exchange expands cognitive frameworks and profound meaning-making (Cutcliffe, Batorowicz, Johnson, Cantrell, & McLean, 2024) while maintaining a clear distinction between formative peer feedback and formal assessment.

However, implementing this approach in the classroom presents challenges for teachers, particularly regarding the shift in instructional roles. Some teachers may find constructivist pedagogy difficult to operationalize, while others might misinterpret the theory as minimizing the teacher's role in the learning process (Al-Abdulkareem & Hentschke, 2014). Consequently, the effectiveness of the 5Ps Model depends not only on its procedural clarity, but also on the teachers' capacity to scaffold learning, provide appropriate instructional guidance, and facilitate meaningful knowledge construction within authentic learning contexts.

Although the four regions of Thailand are culturally diverse, basic education management across all regions is grounded in the indicators and standards of the Basic Education Core Curriculum, as well as core subjects from the educational standards within the eight main learning areas (Ministry of Education, 2008). Nevertheless, students still learn about their local communities through the local curriculum.

Importantly, basic education management emphasizes a learner-centered learning approach through core subjects within the educational standards of the eight main learning areas. This aligns with the principles of the 5 Ps Model, which highlights learning management that accounts for actual development according to individual student differences across various subjects, alongside learning through self-knowledge construction. Consequently, learning management utilizing the 5 Ps Model promotes student learning outcomes to fulfill the core curriculum outcomes, consistent with Ponomariovienė and Jakavonytė-Staškuvienė (2022), who stated that participatory learning in cognitive and communicative processes contributes more to student development than rote learning of subject matter. This approach is also reflected in international educational frameworks, including the Lithuanian curriculum framework, which promotes the systematic integration of these core competencies across all subjects.

The uniform performance across cohorts suggests that the 5Ps Model has potential for structural adaptability across distinct socio-cultural and institutional contexts. Although these findings do not indicate the immediate elimination of broader educational disparities, they suggest that the model can support consistent learning opportunities when implemented through constructivist principles and multimodal engagement. This finding has important implications for the Thai educational contexts, where regional disparity in education quality remains a persistent systemic challenge (OECD, 2023b).

These contributions should be interpreted in light of the study's inherent design limitations. The one-group pretest-posttest design limits the ability to control for threats to internal validity, while the 12-hour instructional period does not permit an assessment of long-term knowledge retention. Additionally, despite facilitating multi-modal activity design, the direct causal relationship between learning styles and raw achievement remains a subject of intense academic debate (Coffield et al., 2004; Pashler et al., 2008). Consequently, future research should deploy randomized controlled trials, examine learning outcomes longitudinally, and extend the 5Ps Model to other disciplines and educational levels to examine the generalization and boundary conditions of the proposed instructional approach.

The 5Ps framework conceptualizes interaction as extending beyond human instructors and peers, reflecting Vygotsky's broader view of social mediation. In light of recent advances in AI, future research should enhance the Prototype and Progress phases by integrating AI as a cognitive catalyst to generate high-value alternatives for conceptual refinement. This direction mirrors empirical findings in creative design disciplines: Khan, Shokrizadeh, and Cheng (2025) observed that AI supports divergent thinking by facilitating research, stimulating creative inspiration, generating alternative options, and facilitating execution. Similarly, Wang, Lu, Ponsa i Campanyà, Chen, and Chen (2025) introduced 'AIdeation,' illustrating how human-AI co-creation significantly widens the scope of concept exploration during early stages of design.

The broadly comparable performance across cohorts provides preliminary evidence that the 5Ps Model may be applicable across different regional settings. This finding has potential implications for the Thai educational context, where regional disparities in educational quality remain a persistent challenge (OECD, 2023b). Nevertheless, the broader applicability of the model should be confirmed through larger, multi-site studies. These findings should also be interpreted in light of the methodological and theoretical limitations presented in Section 5.

5. Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. First, the one-group pretest–posttest design did not include a control or comparison group. Consequently, the observed improvements cannot be attributed exclusively to the 5Ps Model because alternative explanations, including maturation, testing effects, external learning experiences, and increased teacher or researcher attention during the intervention, cannot be completely ruled out. Therefore, the findings should be interpreted as preliminary evidence of the model's effectiveness rather than definitive evidence of a causal relationship.

Second, the intervention was implemented within a relatively short period of 12 instructional hours, and the post-test was administered immediately after its completion. This duration was sufficient to examine immediate changes but did not allow for determining whether improvements in learning outcomes, knowledge construction, and higher-order thinking would be sustained over time or transferred to other learning contexts. Future studies should include delayed posttests and longitudinal follow-up assessments to examine the durability and transferability of these outcomes.

Third, the regional subsamples were relatively small and unequal, particularly in the Northeastern (n = 19) and Northern (n = 20) regions. These sample characteristics may reduce the precision and statistical power of

comparisons between regions. Although Welch's ANOVA and the Kruskal–Wallis test supported the robustness of the findings, future research should include larger and more balanced regional samples drawn from multiple schools and classrooms. Finally, the application of learning styles should be interpreted as a flexible framework for diversifying instructional activities rather than as evidence that learners possess fixed learning-style categories, given the continuing theoretical debate surrounding this concept (Coffield et al., 2004; Pashler et al., 2008).

6. Recommendations

Rather than merely replicating the procedural phases of the 5Ps Model, practical implementation requires a fundamental pedagogical shift from didactic knowledge transmission towards fostering an immersive, collaborative learning environment. Educators must prioritize environments in which students critically analyze information, negotiate ideas, and co-construct meaning through continuous social interaction. Concurrently, the integration of learning styles serves not as a deterministic categorization tool, but as a heuristic framework for multimodal activity design. This structural strategy successfully expands the reach of social constructivist scaffolding, making it logistically viable in overcrowded, heterogeneous classrooms.

Future inquiries should evaluate the model's scalability and effectiveness across different academic disciplines, diverse educational levels, and digitally mediated learning environments. Moreover, rigorous randomized controlled trials with longitudinal follow-up are critical for verifying the structural stability and long-term sustainability of the observed pedagogical outcomes.

The 5Ps Model offers instructional designers a practical framework for addressing student diversity at scale. Rather than building materials tied to a single subject's content delivery, developers can apply the sequence across different fields. Structuring teacher guides and digital courseware around these five stages ensures that multimodal activities and collaborative scaffolding are systematically integrated into the curriculum design.

7. Conclusion

This study demonstrates that the systematic development of the 5Ps Model, which integrates Social Constructivism with Learning Styles, enhanced students' learning outcome and fostered students' capacity for autonomous knowledge construction within four participating regions. This effectiveness reflects a profound pedagogical paradigm shift from passive reception to active knowledge construction, achieved through social interaction, peer exchange, and real-world application. Consequently, this transformation promotes deep learning, critical analysis, and authentic meaning-making. These findings align with the active learning policies of the Office of the Basic Education Commission [OBEC] (2022), which emphasize student-led discovery of meaning through real-world experiences. They also align with the OECD Learning Compass 2030 framework (OECD, 2019a), which aims to strengthen students' analytical and problem-solving skills to navigate future change and complexity.

Accordingly, the 5Ps Model applies broadly across school subjects. It empowers teachers to design structured and sequential learning activities that foster analytical thinking and problem-solving skills. Ultimately, this enables students to construct knowledge independently and apply these competencies in real-world contexts. Therefore, grounding instructional design in rigorous theoretical foundations and learner-centered implementation serves as a vital catalyst for stabilizing pedagogical quality and ensuring equitable learning opportunities across diverse educational contexts.

References

Al-Abdulkareem, R., & Hentschke, G. C. (2014). Textbooks and constructivist pedagogy in Saudi Arabian school classrooms. *Journal of Curriculum and Teaching, 3*(2), 13–24. https://doi.org/10.5430/jct.v3n2p13

Alongi, M. D., Heddy, B. C., & Sinatra, G. M. (2016). Real-world engagement with controversial issues in history and social studies: Teaching for transformative experiences and conceptual change. *Journal of Social Science Education, 15*(2), 26–41. https://doi.org/10.4119/UNIBI/jsse-v15-i2-1479

Amineh, R. J., & Asl, H. D. (2015). Review of constructivism and social constructivism. *Journal of Social Sciences, Literature and Languages, 1*(1), 9–16. Retrieved from https://www.semanticscholar.org/paper/Review-of-Constructivism-and-Social-Constructivism-Amineh-Asl/38903f4a7255496f75124d639e14e9b810c17370

APEC. (2024). *Challenges, opportunities and trends of digitalization in education in the Asia-Pacific region*. APEC Secretariat. Retrieved from https://www.apec.org/docs/default-source/publications/224_hrd_challenges-opportunities-and-trends-of-digitalization-in-education-in-the-asia-pacific-region.pdf

Bialik, M., & Fadel, C. (2015). *Skills for the 21st century: What should students learn?* Center for Curriculum Redesign.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Coffield, F., Moseley, D., Hall, E., & Ecclestone, K. (2004). *Learning styles and pedagogy in post-16 learning: A systematic and critical review*. Learning and Skills Research Centre. Retrieved from https://www.voced.edu.au/content/ngv:13692

Cristol, D., Michell, R., & Gimbert, B. (2010). Citizenship education: A historical perspective (1951–present). *Action in Teacher Education, 32*(4), 61–69.

Curry, L. (1981). Learning preferences in continuing medical education. *Canadian Medical Association Journal, 124*, 535–536.

Cutcliffe, K., Batorowicz, B., Johnson, R., Cantrell, K., & McLean, T. (2024). Socially distant social constructivism: Transitioning visual arts pedagogies online during COVID-19. *Studies in Art Education, 65*(1), 81–98. https://doi.org/10.1080/00393541.2023.2285208

Daniels, H. (2001). *Vygotsky and pedagogy*. Routledge. https://doi.org/10.4324/9780203469576

Erbil, D. G. (2020). A review of flipped classroom and cooperative learning method within the context of Vygotsky theory. *Frontiers in Psychology, 11*, Article 1157. https://doi.org/10.3389/fpsyg.2020.01157

Falasi, M. (2024). Innovative pedagogies: A comparative analysis of traditional and modern teaching methods. *Academy of Educational Leadership Journal, 28*(S1), 1–2. Retrieved from https://www.abacademies.org/articles/innovative-pedagogies-a-comparative-analysis-of-traditional-and-modern-teaching-methods.pdf

Fernando, S. Y. J. N., & Marikar, F. M. M. T. (2017). Constructivist teaching/learning theory and participatory teaching methods. *Journal of Curriculum and Teaching, 6*(1), 110–122. https://doi.org/10.5430/jct.v6n1p110

Fleming, N. D., & Mills, C. (1992). Not another inventory, rather a catalyst for reflection. *To Improve the Academy, 11*(1), 137–149. https://doi.org/10.1002/j.2334-4822.1992.tb00213.x

Garcia, R. V., & Espacio, N. B. (2025). Teaching practices in social sciences and acquisition of 21st century skills of senior high school students. *International Journal of Science, Architecture, Technology, and Environment, 2*(5), 132–209. https://doi.org/10.63680/pluhij656jhg6hthh

Gürdoğan Bayır, Ö. (2016). The role of social studies course in creating society with skilled citizens: Pre-service elementary teachers express their views. *Turkish Online Journal of Qualitative Inquiry, 7*(4), 493–520. https://doi.org/10.17569/tojqi.39722

Jonassen, D. H. (1999). Designing constructivist learning environments. In C. M. Reigeluth (Ed.), *Instructional-design theories and models: A new paradigm of instructional theory* (Vol. 2, pp. 215–239). Lawrence Erlbaum Associates.

Keefe, J. W. (1979). Learning style: An overview. In J. W. Keefe & O. B. Kiernan (Eds.), *Student learning styles: Diagnosing and prescribing programs* (Vol. 1, pp. 1–17). National Association of Secondary School Principals.

Khan, A. U., Shokrizadeh, A., & Cheng, J. (2025). Beyond automation: How designers perceive AI as a creative partner in the divergent thinking stages of UI/UX design. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (pp. 1–12). Association for Computing Machinery. https://doi.org/10.1145/3706598.3713500

Kozanitis, A., & Nenciovici, L. (2023). Effect of active learning versus traditional lecturing on the learning achievement of college students in humanities and social sciences: A meta-analysis. *Higher Education, 86*(6), 1377–1394. https://doi.org/10.1007/s10734-022-00977-8

Loyens, S. M. M., & Gijbels, D. (2008). Understanding the effects of constructivist learning environments: Introducing a multi-directional approach. *Instructional Science, 36*, 351–357.

https://doi.org/10.1007/s11251-008-9059-4

Mestiola, R. A., Naquita, G. P., & Tantengco, N. S. (2018). Enhancing social studies teaching for 21st century learners in secondary education. *HONAI: International Journal for Educational, Social, Political and Cultural Studies, 1*(2), 83–100.

Ministry of Education. (2008). *Basic education core curriculum B.E. 2551 (A.D. 2008)*. The Agricultural Co-operative Federation of Thailand.

Nukaew, S., Poolsuwan, S., & Jermtaisong, R. (2021). Post COVID-19 competencies of teachers. In A. B. D. Nandiyanto, T. I. B. Manullang, R. Maryanti, A. Machmud, A. Ana, & A. D. Minghat (Eds.), *COVID-19: From health, education, economic, to science and technology in South East Asia and India* (pp. 155–166). Nova Science Publishers.

OECD. (2019a). *OECD Learning Compass 2030: A series of concept notes*. Retrieved from https://www.oecd.org/content/dam/oecd/en/about/projects/edu/education-2040/1-1-learning-compass/OECD_Learning_Compass_2030_Concept_Note_Series.pdf

OECD. (2019b). *TALIS 2018 results (Volume I): Teachers and school leaders as lifelong learners*. OECD Publishing. https://doi.org/10.1787/1d0bc92a-en

OECD. (2023a). *PISA 2022 results (Volume I and II) – Country notes: Thailand*. Retrieved from https://www.oecd.org/en/publications/pisa-2022-results-volume-i-and-ii-country-notes_ed6fbcc5-en/thailand_6138f4af-en.html

OECD. (2023b). *PISA 2022 results (Volume I): The state of learning and equity in education*. OECD Publishing. https://doi.org/10.1787/53f23881-en

Office of the Basic Education Commission. (2022). *Guidelines for active learning management to promote learner competencies in the 21st century*. Ministry of Education.

Ounraun, W., & Onthanee, A. (2023). An instructional model development based on social constructivism and authentic learning approaches to enhance differentiated instruction capacity for student teachers. *Journal of Education and Innovation, 25*(1), 222–237. Retrieved from https://so06.tci-thaijo.org/index.php/edujournal_nu/article/view/247948

Pashler, H., McDaniel, M., Rohrer, D., & Bjork, R. A. (2008). Learning styles: Concepts and evidence. *Psychological Science in the Public Interest, 9*(3), 105–119. https://doi.org/10.1111/j.1539-6053.2009.01038.x

Ponomariovienė, J., & Jakavonytė-Staškuvienė, D. (2022). Developing general and subject competences of primary school pupils in the context of integrated education: The case of one Lithuanian school. *Journal of Education Culture and Society, 13*(2), 659–680. https://doi.org/10.15503/jecs2022.2.659.680

Ramaila, S. (2025). Unveiling the potential: A systematic review on harnessing the affordances of differentiated instruction. *Journal of Teaching and Learning, 19*(2), 41–56. https://doi.org/10.22329/jtl.v19i2.8561

Sağlamgöncü, A., & Deveci, H. (2023). The use of active learning techniques in teaching current events in social studies courses: An action research. *Education and Science, 48*(213), 169–203. https://doi.org/10.15390/EB.2023.11723

Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky's zone of proximal development: Instructional implications and teachers' professional development. *English Language Teaching, 3*(4), 237–248. https://doi.org/10.5539/elt.v3n4p237

Subandiyah, H., Supratno, H., Ramadhan, R., Raharjo, R. P., & Nasrullah, R. (2024). Bridging the gap in learning: Differentiated learning to enhance the students' reading comprehension of explanatory texts and writing skills. *Journal of Curriculum and Teaching, 13*(4), 148–158. https://doi.org/10.5430/jct.v13n4p148

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms* (3rd ed.). ASCD.

UNESCO. (2023). *Global education monitoring report 2023, Southeast Asia: Technology in education – A tool on whose terms*. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000387214

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Walker, R. A. (2010). Sociocultural issues in motivation. In P. Peterson, E. Baker, & B. McGaw (Eds.), *International encyclopedia of education* (3rd ed., pp. 712–717). Elsevier.

https://doi.org/10.1016/B978-0-08-044894-7.00629-1

Wang, C., Chen, X., Yu, T., Liu, Y., & Jing, Y. (2024). Education reform and change driven by digital technology: A bibliometric study from a global perspective. *Humanities and Social Sciences Communications, 11*, Article 256. https://doi.org/10.1057/s41599-024-02717-y

Wang, W.-F., Lu, C.-T., Ponsa i Campanyà, N., Chen, B.-Y., & Chen, M. Y. (2025). AIdeation: Designing a human-AI collaborative ideation system for concept designers. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (pp. 1–28). Association for Computing Machinery. https://doi.org/10.1145/3706598.3714148

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17*(2), 89–100. https://doi.org/10.1111/j.1469-7610.1976.tb00381.x

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