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Research Article

Effects of a CLW-STREAM Model in Enhancing Grade 10 Students' Innovative Thinking Skills and Value Awareness of Local Wisdom

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Abstract: This study aimed to: (1) develop the CLW-STREAM model, which systematically integrates Science, Technology, Recreation, Engineering, Arts, and Mathematics (STREAM), creativity-based learning, which promotes learners' generation of original ideas, flexible problem solving, and meaningful creation through active exploration and imagination, and local wisdom–based learning, which draws on community knowledge, cultural practices, and local ways of life to connect learning with students' social and cultural contexts; and (2) examine changes in students' innovative thinking skills and awareness of the value of local wisdom before and after learning through the CLW-STREAM model. The model was piloted with 39 Grade 10 students in the 2023 academic year, and subsequently evaluated in the 2024 academic year 2024 with 34 Grade 10 students. The research procedure followed the ADDIE model and employed a mixed-methods research design. Data were analyzed using descriptive statistics (mean and standard deviation), E1/E2 efficiency indices, and a dependent-samples t-test. The results indicated that the CLW-STREAM model achieved an efficiency rating of 87.86/87.26, exceeding the established criterion of 80/80. The students' posttest scores for innovative thinking skills and value awareness of local wisdom were significantly higher than their pretest scores at the .05 level. These findings suggest that CLW-STREAM is an effective instructional innovation for enhancing Grade 10 students' innovative thinking skills and strengthening their value awareness of local wisdom.

Keywords: Science, Technology, Recreation, Engineering, Art and Mathematics (STREAM), creativity-based learning (CBL), local wisdom, CLW-STREAM model, innovative thinking skills, value awareness of local wisdom

Introduction

Thailand's education policy, guided by the National Education Plan B.E. 2560–2579 (2017–2036), places primary emphasis on developing students into high-potential national human resources who possess essential skills and knowledge and who can engage in continuous lifelong self-development (Office of the Education Council, Ministry of Education, 2017). Accordingly, building key 21st century competencies has become central to educational reform, particularly the promotion of innovation and creative thinking skills, the cultivation of Thai and global citizenship awareness, and the development of self-worth and recognition of local contexts as major affective goals (Office of the Basic Education Commission, 2017). Educational provision, therefore, must holistically balance the cognitive, psychomotor, and affective domains to ensure learners are prepared to navigate rapid changes in the contemporary world.

Nevertheless, the quality of Thai education continues to face challenges in enabling learners to achieve these intended outcomes, especially in relation to innovative thinking skills and the practical application of knowledge. Prior research indicates that many students still lack the ability to analyze, synthesize, and create independently (Gulgate, 2020). Classroom observations in a physics unit on force and the laws of motion identified several patterns that reflected the underlying problem. During inquiry- and design-based activities, students relied substantially on teacher direction when planning and constructing artifacts, often requiring step-by-step support rather than independently generating ideas. They also demonstrated difficulty in linking physics concepts to concrete everyday experiences, particularly when asked to explain force and motion in familiar situations. Furthermore, in collaborative tasks, students frequently reproduced teacher-modeled examples instead of developing original solutions, suggesting limitations in innovative thinking and applied understanding. A preliminary assessment supported these observations, showing that 78.5% of students scored below the moderate level in innovative thinking skills and did not meet school-level expectations. At the same time, insufficient emphasis on value awareness of local wisdom remains a critical issue because it weakens the connection between school learning and community and cultural contexts (Chanthrasa, 2017). The marginalization of local culture and wisdom may further reduce learners' motivation to preserve and develop their cultural heritage (Tasamee, 2024), thereby hindering the formation of citizens with an authentic understanding of their social foundations.

To address these dual challenges, i.e. limited innovative capacity and limited cultural value awareness, this study integrates three key approaches. First, it adopts STREAM learning management, an extension of STEM education that adds Arts (A) and Recreation (R) to balance learning experiences, enhance intrinsic motivation, and foster students' creativity (Bequette & Bequette, 2012; Meekarnmark, 2009). Second, it incorporates Creativity-based Learning (CBL), which emphasizes intensive engagement in creative thinking through varied learning activities (Ruchaipanit, 2015), thereby addressing a potential limitation of STREAM in producing authentic innovation within Thai educational contexts. Third, it integrates local wisdom by linking learning content to students' cultural contexts, particularly through activities involving the design and construction of local-wisdom toys. This approach is expected to make physics concepts more tangible while simultaneously strengthening students' value awareness of their local heritage, aligning with affective learning goals (Krathwohl et al., 1964; Chanthrasa, 2017).

On this basis, we aim to design and develop the Creative Local Wisdom-based STREAM (CLW-STREAM) instructional model, which synergistically combines interdisciplinary integration (STREAM), creativity-based pedagogy, and cultural foundations. This study therefore investigates the effects of the CLW-STREAM model on Grade 10 (Matthayomsuksa 4) students' innovative thinking skills and value awareness of local wisdom, with the aim of producing a high-quality and efficient instructional innovation that can inform science teaching practices and sustainably strengthen essential competencies among Thai learners.

Research Objectives

The research objectives were: (1) to develop the CLW-STREAM instructional model for Grade 10 students and to determine the model's efficiency based on the prescribed E1/E2 criterion; and (2) to compare the pretest and posttest scores of Grade 10 students' innovative thinking skills and value awareness of local wisdom of students who learned through the CLW-STREAM model.

Research Hypotheses

H1 (Model efficiency): The CLW-STREAM instructional model demonstrates an efficiency level (E1/E2) not lower than the criterion of 80/80.

H2 (Innovative thinking skills): After instruction, students learned through the CLW-STREAM instructional model show significantly higher innovative thinking skills than before instruction.

H3 (Value awareness of local wisdom): After instruction, students learned through the CLW-STREAM instructional model show significantly higher value awareness of local wisdom than before instruction.

Conceptual Framework

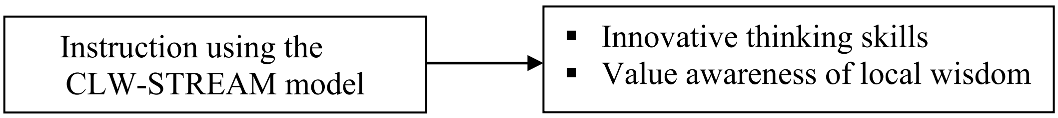

Figure 1. Conceptual Framework.

Figure 1 presents the conceptual framework of the study. It illustrates that instruction using the CLW-STREAM model is the main instructional intervention and is expected to affect two learning outcomes: innovative thinking skills and value awareness of local wisdom. The framework is based on the assumption that the integration of STREAM, creativity-based learning, and local wisdom–based learning can promote students' creative and innovative capacities while strengthening their recognition of the importance and value of local wisdom in everyday life and community contexts.

Literature Review

CLW-STREAM Instructional Model

The CLW-STREAM instructional model refers to a STREAM-based instructional model that integrates creativity-based learning and local wisdom (Creative Local Wisdom-based STREAM: CLW-STREAM). It is a systematic instructional framework that synthesizes three core concepts: (1) STREAM education refers to Science, Technology, Recreation, Engineering, Arts, and Mathematics, where R (Recreation) is defined as purposeful play and recreational activities designed to enhance learners' motivation and enjoyment; (2) CBL refers to Creativity-based Learning; and (3) LWBL refers to Local Wisdom-based Learning. This integration results in an instructional innovation that connects six disciplines (STREAM) while actively stimulating students' creativity through the design and construction of traditional local toys that transmit and extend local wisdom, grounded in Grade 10 physics content on force and the laws of motion. The CLW-STREAM instructional model comprises five components, as detailed below.

Component 1: Concepts and Principles

This model is derived from the integration of three instructional approaches: (1) STREAM education (Science, Technology, Recreation, Engineering, Arts, and Mathematics), (2) Creativity-based Learning (CBL), and (3) Local Wisdom-based Learning.

STREAM education refers to interdisciplinary learning that integrates six fields—science, technology, recreation, engineering, arts, and mathematics—through the development of local-wisdom toy products that draw on knowledge from all six domains.

CBL refers to student-centered learning that emphasizes fostering creativity through diverse activities, such as imaginative expression, drawing, storytelling, painting and coloring, sculpting, handicrafts, artifact design, and creative problem-solving practice.

Local Wisdom-based Learning refers to instruction that uses local wisdom, specifically traditional games and folk toys, as a driving context for learning. These activities are explicitly connected to physics content on force and the laws of motion and aligned with learning objectives specified in Thailand's Basic Education Core Curriculum. This approach is intended to help students develop holistic connections between disciplinary knowledge and local cultural wisdom.

Component 2: Objectives

The CLW-STREAM instructional model aims to develop Grade 10 students' innovative thinking skills, value awareness of local wisdom, and learning-activity satisfaction in Physics 1, specifically the unit on force and the laws of motion.

Component 3: Instructional Procedures

The instructional procedures of the CLW-STREAM model consist of six steps (SICTSA), described as follows.

Step 1: Stimulate creativity through local problem situations

The teacher first assesses students' prior knowledge using a pretest to determine readiness for new content. If foundational knowledge is insufficient, targeted remediation is provided. The lesson is then introduced by presenting a real-life problem situation situated in the local context through applied toy media (e.g., real objects, photographs, video clips). Guiding questions are used to arouse curiosity and inspire students to propose creative approaches to problem solving.

Step 2: Identify and understand the problem

Students initially identify problems within the presented situation individually. They then form groups of 5–6 based on shared interests in similar problems. Each group member presents the problem of interest, after which the group selects a common local problem and collaboratively investigates information from multiple sources to achieve a thorough understanding. All members are expected to participate actively in information seeking.

Step 3: Create the solution design

Each group collaboratively generates creative solutions by designing a problem-solving approach, specifying procedures, goals, timelines, and a systematic approach to testing ideas. The teacher may invite selected groups to present their proposed solutions and provides formative feedback to strengthen the design. Throughout the process, the teacher acts as a learning facilitator, offering ongoing guidance and support until groups produce workable designs. Students may draw upon artistic processes to enhance the creativity and quality of their products.

Step 4: Test, evaluate, and improve

Groups test and evaluate whether their solutions or created artifacts/products effectively address the identified problem and meet the intended goals. Students jointly reflect on test results and brainstorm revisions to improve the effectiveness and quality of their solutions or products, iterating until the goals are achieved.

Step 5: Share creatively

Each group presents its process and outputs using appropriate and engaging media and technologies (e.g., PowerPoint, infographics, mind maps). Presentations should cover background, conceptual rationale, design, testing, evaluation, revision, and potential applications. After presentations, classmates discuss, critique, and provide constructive feedback to further refine solutions or products. This process supports learning from others' perspectives and develops students' capacity to offer creative, respectful critique. The teacher also provides opportunities for aesthetic appreciation and enjoyment by allowing students to engage in play using the created products.

Step 6: Apply knowledge

Students apply learned concepts in contexts related to the lesson through varied activities (e.g., additional worksheets or exercises). The teacher monitors students' ability to transfer and apply knowledge to ensure accurate concept construction and meaningful learning. Learning outcomes are assessed through authentic assessment, such as observation of behavior and hands-on performance and evaluation of worksheets and activity records. Finally, students complete a posttest to examine individual learning progress.

Component 4: Measurement and Evaluation

Assessment in the CLW-STREAM model combines authentic assessment (e.g., worksheets, student work, artifacts/products, and observation) with research instruments assessing innovative thinking skills, a questionnaire on value awareness of local wisdom, and a questionnaire on satisfaction with learning activities. Both quantitative and qualitative data are used to provide a comprehensive evaluation of learning outcomes.

Component 5: Supporting Factors for Implementation Success

Supporting factors include personal factors, such as clearly defined teacher and student roles, and environmental factors, such as the availability of locally relevant media/resources, adequate time and space for experimentation and presentation, and support from community networks and local scholars/knowledge holders.

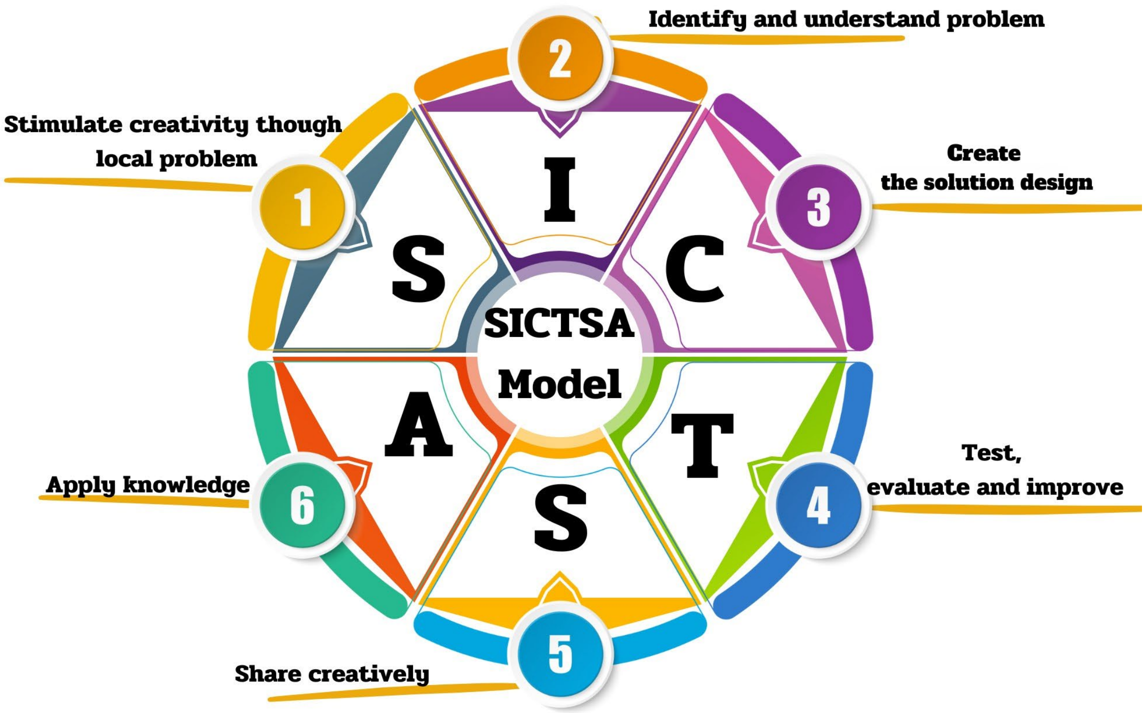

Figure 2. Instructional Procedures of the CLW-STREAM Model.

Innovative Thinking Skills

Innovative thinking skills refer to students' ability to clearly frame a problem, generate novel and valuable ideas/approaches, collaborate creatively with others, and further develop, test, and refine those ideas into a functional solution or usable artifact within the context of the Grade 10 Physics 1 unit on force and the laws of motion. This construct comprises five components:

Problem identification: The ability to clearly determine the goals and constraints of a problem, to discriminate among relevant information, and to systematically cite appropriate sources.

Generation of novel ideas: The ability to propose multiple alternatives or ideas by integrating knowledge across disciplines and to provide a logical rationale supporting the proposed ideas.

Creative collaboration and communication: The ability to communicate new ideas effectively to others, demonstrate openness to diverse perspectives, and work collaboratively as a team to co-create innovation.

Development and implementation: The ability to plan and construct a prototype or product based on the proposed idea, taking into account quality and safety criteria, and to document the work in a systematic sequence.

Testing, evaluation, and improvement: The ability to plan tests, collect and interpret data, compare alternatives, and make iterative improvements to the innovation until the intended goals are achieved.

Students' innovative thinking skills were assessed through two sources of evidence: (1) the activity worksheet "My Local-Wisdom Toy for Sustaining Local Heritage" and (2) the self-reflection worksheet on students' own knowledge construction. Students wrote reflective responses addressing the five components of innovative thinking that led to the creation of the local-wisdom toy product. Performance was scored using an analytic rubric with four levels: 4 = Excellent, 3 = Good, 2 = Fair, and 1 = Needs Improvement. The researcher then totaled the scores, calculated the mean, and interpreted the results against the established criteria.

Value Awareness of Local Wisdom

Value awareness of local wisdom refers to students' affective responses that reflect their recognition, perceived importance, acceptance, or understanding of the value of local knowledge, abilities, ways of thinking, lifestyles, customs, traditions, and culture. It comprises three levels:

Value recognition (Perception): Recognizing the importance of local wisdom and its relevance to physics principles or real-life contexts. Indicator: The student can explain which physics concept(s) the local wisdom relates to and how.

Response/Participation: Willingness to participate in activities and to utilize local learning resources in learning and task completion. Indicator: The student participates consistently and regularly uses local examples to support learning.

Valuing and commitment: Pride in and acceptance of local wisdom, commitment to preservation and dissemination, and appropriate application of local wisdom. Indicator: The student demonstrates concrete intentions to sustain and communicate local wisdom.

Students' value awareness of local wisdom was measured using a 30-item situational instrument designed to cover a range of affective behaviors. Scoring followed a three-level affective behavioral rubric (Gulgate, 2020, p. 119): 3 points for valuing, 2 points for responding, and 1 point for recognition/perception. After scoring, mean scores were calculated and interpreted according to the following criteria: 2.50–3.00 (valuing), 1.50–2.49 (responding), and 1.00–1.49 (recognition/perception).

Methodology

This study was organized into four phases guided by the ADDIE model, a systematic framework for developing educational innovations through cyclical design, implementation, and continuous revision. ADDIE comprises five major stages: (1) Analysis, to identify learners' problems and needs, contextual conditions, and constraints; (2) Design, to specify behavioral learning outcomes, assessment criteria, and instructional strategies; (3) Development, to construct and test a prototype educational innovation; (4) Implementation, to conduct instruction in authentic settings with appropriate support systems; and (5) Evaluation, including both formative and summative evaluation, with feedback used to refine subsequent iterations. The ADDIE framework emphasizes logical alignment among objectives, content, pedagogy, and assessment, as well as the use of empirical evidence to improve instructional effectiveness and efficiency in real-world contexts (Branch, 2009).

Research Design and Procedures

Phase 1: Analysis (A) - Baseline Study and Needs Analysis

In this phase, the researcher collected and analyzed data to understand the current situation, key problems, and priority needs for instructional improvement. Both quantitative and qualitative information regarding issues and needs related to STEM-oriented instruction and creativity-focused learning in Physics 1 for Grade 10 students was first gathered from teachers and students. A formal needs analysis was then conducted to identify teacher and student requirements for the development of the CLW-STREAM instructional model. Data were obtained through survey instruments and qualitative interviews with teachers and experts, generating a foundational evidence base to inform a model design that directly addresses the identified problems.

Phase 2: Design and Development (D&D) - Model Construction and Validation

Based on the baseline findings, the researcher developed the CLW-STREAM instructional model, an accompanying implementation manual, and lesson plans aligned with the model. Development was informed by a synthesis of STREAM pedagogy, Creativity-based Learning (CBL), and Local Wisdom-based Learning. The preliminary model, manual, and lesson plans were reviewed by experts for appropriateness, alignment, feasibility, and utility. The researcher also calculated the Index of Item–Objective Congruence (IOC) to ensure content validity and to provide empirical evidence of quality prior to field implementation.

Phase 3: Implementation (I) - Pilot Trial and Efficiency Testing

In this phase, the CLW-STREAM instructional model, having been validated by experts, was piloted with a small-group trial to determine the model's instructional efficiency using the E1/E2 indices. The obtained efficiency values were compared with the established criterion of 80/80 (Hypothesis H1), representing process performance and final learning outcomes. Findings from the pilot were used to revise and strengthen the model and implementation manual to enhance completeness and practical usability.

Phase 4: Evaluation (E) - Outcome Evaluation and Hypothesis Testing

In the final phase, the researcher examined the primary outcomes of the study in accordance with the stated objectives, using a predominantly quantitative approach to test the research hypotheses. Specifically, the study compared students' innovative thinking skills (H2) and value awareness of local wisdom (H3) before and after instruction using the CLW-STREAM model. A dependent-samples t-test was employed to determine whether the developed model produced statistically significant improvements in these targeted skills and attributes.

Population and Sample

The population comprised Grade 10 students at Pracharat Thammakhun School in the 2023 and 2024 academic years. Samples were defined by phase, using different selection procedures as follows:

Expert panel: Five experts were selected through purposive sampling to evaluate the appropriateness of the model and research instruments.

Efficiency testing group (2023): Thirty-nine Grade 10 students participated in determining the model's E1/E2 efficiency indices.

Outcome evaluation group (2024): Thirty-four Grade 10 students participated in the main implementation. One classroom was selected using cluster random sampling from classes with no statistically significant differences in prior achievement, and the selected class received instruction using the CLW-STREAM model.

Research Instruments

Research instruments were grouped into two categories:

Development instruments: the CLW-STREAM instructional model, the implementation manual, and lesson plans for Physics 1 (force and the laws of motion).

Data-collection instruments: (a) a questionnaire on baseline problems and preliminary needs; (b) expert evaluation forms for the model and instruments; (c) an innovative thinking skills assessment; and (d) a value awareness of local wisdom assessment. The IOC of all instruments was ranged from 0.80 to 1.00 that was acceptable. Cronbach's alpha coefficients for the questionnaire on baseline problems and preliminary needs were .92 for the teacher version and .93 for the student version. The innovative thinking rubric demonstrated an inter-rater reliability coefficient of .87, while the rubric assessing value awareness of local wisdom demonstrated an inter-rater reliability coefficient of .89.

Data Analysis

The efficiency of the lesson plans based on the CLW-STREAM model was determined by calculating the mean percentage scores obtained from in-class learning activities (E1) and the posttest (E2). Students' innovative thinking skills and value awareness of local wisdom were analyzed in terms of mean and standard deviation (SD). Paired-samples t-tests were then employed to examine differences between the pretest and posttest scores for innovative thinking skills and value awareness of local wisdom.

Results

The study evaluated the instructional efficiency of the CLW-STREAM model against the 80/80 criterion by analyzing the mean percentage scores from in-class learning activities (E1) and the mean percentage scores from the posttest (E2). The results are presented in Table 1.

Table 1. Efficiency indices (E1/E2) of the CLW-STREAM instructional model in Physics 1 (Force and the Laws of Motion) for Grade 10 students (n = 39)

Lesson Plan	Topic	E1 (Mean %)	E2 (Mean %)
1	Force	86.92	
2	Resultant force	86.92	
3	Mass, force, and laws of motion	88.46	**87.26**
4	Friction	87.95	
5	Gravitational force between masses	87.95	

6	Applications of the laws of motion	88.97
Overall mean		**87.86**

As shown in Table 1, the CLW-STREAM instructional model implemented with 39 Grade 10 students in Semester 2 of the 2023 academic year achieved an efficiency level of 87.86/87.26, which meets the established criterion of 80/80. This indicates that the CLW-STREAM model demonstrates instructional efficiency consistent with the prescribed standard.

Comparison of Innovative Thinking Skills

The difference of students' innovative thinking skills across the first and final lesson plans is shown in Table 2.

Table 2. Comparison of mean innovative thinking skills scores between Lesson Plan 1 and Lesson Plan 6 (n = 34).

Pair	n	Mean difference	SD	*t*	df	p
Lesson Plan 1-Lesson Plan 6	34	4.941	1.705	16.903	33	.000

As indicated in Table 2, the students' innovative thinking skills scores, derived from performance assessments of student work completed under the CLW-STREAM lesson plans for Grade 10 students in the 2024 academic year, showed a statistically significant increase from the first lesson plan to the final lesson plan ($t = 16.903$, $p < .05$). In other words, students demonstrated significantly higher innovative thinking skills by Lesson Plan 6, supporting the conclusion that the CLW-STREAM model effectively enhanced innovative thinking skills.

Comparison of Value Awareness of Local Wisdom

Differences in students' value awareness of local wisdom before and after the intervention were examined using the Wilcoxon signed-rank test. Results are presented in Table 3.

Table 3. Wilcoxon signed-rank test results for students' value awareness of local wisdom (n = 34)

Comparison	Ranks	n	Mean rank	Sum of ranks	Z	Asymp. Sig. (2-tailed)
Pretest – Posttest	Negative ranks	0	0.00	0.00	-5.087	.000
	Positive ranks	34	17.50	595.00		
	Ties	0				
	Total	**34**				

The Wilcoxon signed-rank test indicated that students' posttest scores for value awareness of local wisdom were significantly higher than their pretest scores at the .05 level (Asymp. Sig. = .000, $p < .05$). These results suggest that the CLW-STREAM model effectively increased students' value awareness of local wisdom.

Discussion

The research findings can be discussed in relation to the study objectives as follows.

1) Instructional efficiency of the CLW-STREAM model (E1/E2)

The CLW-STREAM instructional model achieved an efficiency index of 87.86/87.26, clearly exceeding the established benchmark of 80/80. Attainment of this criterion indicates that the model demonstrates high quality in both the process dimension (E1) and the outcome dimension (E2). This level of efficiency is attributable to an instructional design that systematically emphasizes participation, creativity, and contextual learning grounded in local wisdom throughout the six SICTSA procedures. In particular, integrating Recreation (R) with Creativity-based Learning (CBL) appears to enhance learners' motivation and enjoyment, enabling them to achieve strong performance during learning activities and subsequently on the posttest. These findings align with research-and-development principles for constructing robust instructional models and are consistent with the arguments advanced by Ditsiri (2020) and Chanintharaphum (2020), who suggest that active-learning designs with clearly specified components and ongoing evaluation using E1/E2 constitute key mechanisms for achieving empirically demonstrable effectiveness and high levels of quality assurance.

2) Development of innovative thinking skills

The findings confirm that the CLW-STREAM model is effective in significantly improving students' innovative thinking skills, as evidenced by post-instruction scores that were clearly higher than pre-instruction scores. This improvement can be attributed to the design of hands-on, project-based tasks centered on local-wisdom toys, which provided meaningful challenges consistent with Beers (2011). Moreover, the model's emphasis on CBL, consistent with the perspectives of Guilford (1967) and Torrance (1974), encouraged students to practice structured thinking through the process of designing and constructing innovations. These results align with active learning approaches and interdisciplinary knowledge integration, consistent with findings reported by Jitsopha (2021) and Chaichuai, Somnate, and Intanam (2022). Importantly, using local wisdom as the learning context enabled students to connect physics concepts with their lived experiences, fostering meaningful learning as proposed by Ausubel (1968), and thereby supporting deeper and more durable understanding.

3) Development of value awareness of local wisdom

The results also indicate that the CLW-STREAM model successfully enhanced students' value awareness of local wisdom. Post-instruction scores were significantly higher than pre-instruction scores, with students progressing from the "recognition" level prior to instruction to the "valuing" level following instruction. This affective development can be explained by the model's emphasis on tangible engagement with traditional toys, which provided concrete experiences that supported reflection on cultural value and consolidation of knowledge linked to physics concepts. This pattern is consistent with the affective domain development framework proposed by Krathwohl, Bloom, and Masia (1964). The findings further corroborate the proposition that curricula integrating local knowledge can strengthen cultural awareness, in line with Bishop and Glynn (2016) and Hattie and Donoghue (2016), who argue that learning connected to community culture fosters positive dispositions and a stronger sense of belonging to one's roots, an essential foundation for sustainable development in the future.

Conclusion

This study developed and evaluated the effectiveness of the CLW-STREAM instructional model, a STREAM-based approach integrating creativity-based learning and local wisdom. The results indicate that: (1) the model achieved an instructional efficiency index of 87.86/87.26, surpassing the established 80/80 criterion; (2) students' innovative thinking skills were significantly higher after instruction than before instruction ($p < .05$); and (3) students' value awareness of local wisdom increased significantly from pretest to posttest ($p < .05$). Overall, CLW-STREAM represents an effective instructional innovation for enhancing students' innovative thinking skills and strengthening their value awareness of local wisdom.

Recommendations

Recommendations for Practice

Teachers may adopt the development approach used in this study, STREAM instruction integrated with creativity-based learning and local wisdom, as a guiding framework for designing or adapting instructional models suited to their own classroom contexts. The CLW-STREAM model may also be implemented directly, provided that adequate preparation is undertaken in advance, including ensuring students' readiness; organizing learning activities; preparing supporting documents, instructional media, and required materials/equipment; and securing appropriate technological resources.

Recommendations for Future Research

Future studies should implement the CLW-STREAM model with clearly defined target populations to further verify the robustness and generalizability of the findings, as well as to examine its effects on additional outcomes representing other essential competencies. In addition, further research should explore the development of an integrated curriculum grounded in the Creative Local Wisdom-based STREAM approach, with particular attention to curriculum management, through more in-depth investigation.

Limitations

The present study was limited by its use of a one-group pretest–posttest design. Without a control group, it is difficult to determine whether the improvements in innovative thinking skills and value awareness of local wisdom resulted solely from the CLW-STREAM model or were influenced by other factors, such as maturation, prior learning experiences, or events occurring during the intervention. In addition, repeated exposure to the assessment instruments may have produced testing effects. As a result, the study provides preliminary evidence of effectiveness, but causal conclusions should be drawn cautiously. The findings are also limited in generalizability because the study involved only one group within a specific context. Future studies should include a comparison group, larger samples, and broader educational settings.

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