

Constructivist Flipped Learning as a Recursive Knowledge Transformation Cycle

Muhamm Azzam Almubarak¹ , Ming Kir² , Abena Boateng³ 

¹ Universitas Prof Dr Hazairin SH, Indonesia

² Asia Commercial Bank, Cambodia

³ Kwame Nkrumah University of Science and Technology, Ghana

ABSTRACT

Background. Flipped learning has been widely implemented to reorganize learning activities across pre class, in class, and post class environments. However, existing models often emphasize instructional inversion and activity sequencing without adequately explaining how learners transform prior understanding into reconstructed knowledge.

Purpose. This conceptual study develops the Constructivist Flipped Learning Cycle (CFLC), an integrative theoretical model explaining knowledge transformation through cognitive and social constructivist mechanisms.

Method. The study employed a conceptual theory-building design comprising targeted literature identification, theoretical comparison, conceptual synthesis, framework development, and proposition formulation. Relevant perspectives on flipped learning, constructivism, cognitive conflict, social negotiation, knowledge reconstruction, and metacognitive reflection were integrated into a coherent explanatory model.

Results. The CFLC comprises seven interconnected stages: prior knowledge activation, exploratory pre-class engagement, cognitive conflict, social negotiation, knowledge reconstruction, authentic application, and metacognitive reflection. These stages form a recursive cycle in which reconstructed knowledge becomes prior knowledge for subsequent learning.

Novelty. The CFLC reframes flipped learning from a temporal-spatial inversion of instruction into a knowledge-transformation architecture and introduces a mechanism-based explanation linking cognitive conflict, social negotiation, and knowledge reconstruction across interconnected learning environments.

Conclusion. The CFLC provides a theoretically grounded framework for explaining how meaningful conceptual transformation may occur in flipped learning and offers testable propositions for future empirical validation across diverse educational contexts.

KEYWORDS

Cognitive Conflict; Constructivism; Flipped Learning; Knowledge Reconstruction; Social Negotiation

Citation: Almubarak, A. M., Kir, M., & Boateng, A. (2026). Constructivist Flipped Learning as a Recursive Knowledge Transformation Cycle. *Journal Of Paddisengeng Technology*, 2(3), 169-182. <https://doi.org/10.65224/jopate.v2i3.290>

Correspondence:

Muhamm Azzam Almubarak
muhazzam33@gmail.com,

Received: July 23, 2026

Accepted: September 12, 2026

Published: September 30, 2026



INTRODUCTION

The shift toward student-centered education has prompted a rethinking of how learning time, learning spaces, and student participation are organized. Flipped learning is a prominent response to this shift: it moves initial content exposure outside the classroom and sets aside class time for interactive, application-oriented activities, aiming to enhance learner autonomy and higher

thinking. Research on the design, effectiveness, and integration of technology has flourished (Shao et al., 2025).

However, popularity does not equate to conceptual completeness. Flipped learning is typically described through a simple sequence pre-class content, in class activities, post-class consolidation which departs from lecture dominated instruction but does not necessarily guarantee meaningful learning. Effects on performance and higher-order thinking are generally positive but vary widely depending on the instructional design, scaffolding, and learner characteristics (Alanazi et al., 2024; Michalsky, 2024). This variation suggests that the model's value lies less in the relocation of instruction than in the learning processes it enables.

This raises a conceptual problem, moving lectures outside class may change where information is accessed without changing how learners engage with it. Students can complete pre class materials passively and participate superficially in class, reproducing information without real conceptual change. Similarly caution that flipping's benefits may stem from the active-learning processes embedded in a design rather than from instructional inversion itself (Li et al., 2023). Structural inversion, in other words, does not guarantee epistemic transformation.

This is crucial from a constructivist perspective. Meaningful learning does not simply result from discovering information before class or participating in class activities; it requires learners to connect new information to prior understandings, confront inconsistencies, and reorganize their conceptual structures (Bryce & Blown, 2024). Cognitive conflict the discomfort that arises when new information contradicts existing beliefs has long been considered a necessary condition for this kind of conceptual change (Banat et al., 2024; Erwin et al., 2026). From this perspective, the central question shifts from when and where learning occurs to how knowledge changes as learners navigate experiences.

Constructivist principles are already linked to flipped learning, including recent designs explicitly grounded in social constructivism (Sarwar et al., 2024). The gap, then, is not an absence of connection between the two that claim would be easily contradicted by existing literature. The more consequential gap is mechanistic: existing work does not clearly explain how individual cognitive transformation and socially mediated meaning-making unfold sequentially and recursively across flipped-learning phases. Social negotiation of meaning through interaction with others central to Vygotsky's (1978) sociocultural account of learning is often assumed in flipped-classroom designs but rarely modeled as an explicit mechanism.

This gap persists partly because flipped-learning research has concentrated on outcomes, formats, tools, and comparisons with conventional instruction. Bibliometric evidence shows growth around active learning, blended learning, and disciplinary applications (Chen et al., 2023), while more recent systematic evidence still calls for clearer theoretical foundations and causal mechanisms. What remains underdeveloped is an integrative account of how learners move from an existing conception to a reconstructed one, and how that movement is distributed across preparation, disruption, interaction, application, and reflection.

This article addresses that gap by proposing the Constructivist Flipped Learning Cycle (CFLC), built on three interdependent mechanisms: cognitive conflict, social negotiation, and knowledge reconstruction. Cognitive conflict destabilizes taken-for-granted understanding; social negotiation is the process through which meanings and explanations are examined and refined through dialogue and collaboration; knowledge reconstruction is how learners reorganize prior and emerging understanding into a revised conceptual structure.

The CFLC also challenges the assumption that knowledge construction maps neatly onto the pre class/in class/post class boundary. Instead, it treats these as interconnected moments in a continuous, recursive process: prior knowledge shapes interpretation of new material, exploratory encounters generate conflict, classroom dialogue exposes competing explanations, reconstructed understanding is tested through application, and reflection consolidates or further revises it with each cycle's output becoming the next cycle's prior knowledge.

Accordingly, this conceptual article develops the CFLC as a model explaining how cognitive conflict, social negotiation, and knowledge reconstruction interact across flipped-learning environments, with three contributions: (1) reframing flipped learning from a temporal-spatial inversion toward a process-oriented model of knowledge construction; (2) specifying the cognitive and social mechanisms of conceptual transformation, rather than assuming active or collaborative activity is automatically meaningful; and (3) conceptualizing knowledge construction as a recursive cycle in which reconstructed knowledge becomes the foundation for further inquiry. The aim is a theoretically testable basis for research on not only whether flipped learning works, but how, why, and under what conditions.

THEORETICAL FOUNDATIONS

The theoretical foundation of the Constructivist Flipped Learning Cycle (CFLC) lies at the intersection of flipped learning, cognitive and social constructivism, cognitive conflict, social negotiation, and knowledge reconstruction. These perspectives are conceptually interrelated but serve distinct explanatory functions. Flipped learning essentially provides a learning architecture that redistributes learning activities across pre-class, in class, and post-class environments, while constructivism explains how learners actively develop and transform knowledge. Cognitive conflict provides the mechanisms by which existing conceptions become unstable, social negotiation explains how meaning is examined and reshaped through interaction, and knowledge reconstruction represents the reorganization of understanding that may emerge from these processes. Integrating these perspectives provides a theoretical foundation for understanding flipped learning not simply as an inversion of instructional delivery but as a potentially recursive process of conceptual transformation.

The CFLC framework was developed through a three-step conceptual mapping procedure rather than an intuitive arrangement of constructs. First, each construct identified in the literature review (prior knowledge, exploratory engagement, cognitive conflict, social negotiation, knowledge reconstruction, authentic application, and metacognitive reflection) was defined using its most theoretically established mechanism—for example, cognitive conflict as disequilibrium following (Tu et al., 2026), or social negotiation as mediated meaning-making following Vygotsky (1978). Second, for each pair of constructs, we asked whether the literature specified a functional or causal dependency—whether construct A was theorized as a necessary antecedent condition for construct B, rather than merely co-occurring with it. Third, constructs were ordered according to this dependency logic rather than by narrative convenience: prior knowledge precedes exploratory engagement because constructivist theory treats existing conceptions as the interpretive lens through which new material is encountered (Piaget, 1952); exploratory engagement precedes cognitive conflict because disequilibrium requires prior exposure to discrepant information (Gupta & Walia, 2026); cognitive conflict precedes social negotiation because the destabilization of a conception is what motivates learners to seek external validation or alternative explanations (Westbye et al., 2026); and so forth through knowledge reconstruction, authentic application, and metacognitive reflection, following the dependency chain summarized in Table 1. This procedure

treats each proposition (P1P7) not as an assumed link but as a claim requiring independent theoretical support, which is why each row of Table 1 reports both a rationale and supporting references rather than a single citation.

Table 1. Boundary Conditions and Moderating Factors in the CFLC

Proposition	Construct Transition	Boundary Condition / Moderator	Basis (Existing Citation)	Confidence
P1	Prior Knowledge → Exploratory Engagement	Activation translates into meaningful engagement only when pre-class materials require an active response, such as prediction, questioning, problem anticipation, or explanation. Passive viewing may leave relevant prior knowledge insufficiently activated.	Bransford et al. (2000) - general learning and transfer principles	Medium
P2	Exploratory Engagement → Cognitive Conflict	Cognitive conflict is productive only when discrepant information remains within learners' processing capacity. Information that is too distant from existing understanding may be dismissed as irrelevant rather than generating productive disequilibrium.	D'Mello et al. (2014) - confusion and disequilibrium dynamics	Medium
P3	Cognitive Conflict → Social Negotiation	Cognitive conflict does not automatically produce social negotiation. Learners may ignore, dismiss, discount, or reinterpret anomalous evidence to preserve existing beliefs rather than seek external clarification or resolution.	Limón (2001); Chinn & Brewer (1993)	High
P4	Social Negotiation → Knowledge Reconstruction	Knowledge reconstruction depends on the quality of dialogue and the availability of appropriate expert or peer scaffolding rather than interaction alone. Poorly mediated negotiation may leave competing conceptions unresolved.	Wood et al. (1976); Palincsar (1998)	Medium
P5	Knowledge Reconstruction → Authentic Application	Transfer is more likely when application tasks share meaningful structural features with the reconstructed concept. Superficially similar tasks may not provide sufficient evidence that conceptual reconstruction has actually occurred.	Perkins & Salomon (1989) - near and far transfer	Medium
P6	Authentic Application → Metacognitive Reflection	Reflection may remain superficial without structured prompts. Unprompted post-task reflection can focus primarily on task completion or performance rather than evaluation of conceptual understanding, strategy use, and knowledge change.	Zimmerman (2002) - self-regulated learning	Medium
P7	Metacognitive Reflection → New Prior Knowledge	Consolidation into durable prior knowledge likely requires distributed revisiting and retrieval across repeated learning cycles. A single reflective episode may be insufficient to produce stable and enduring conceptual change.	Bransford et al. (2000)	Medium
Model-level	Entire CFLC Sequence	A plausible rival explanation is that observed learning gains result from greater active-learning time-on-task rather than from the specific CFLC sequence itself. Testing the model's distinctive causal claim therefore requires research designs that hold time-on-task and instructional exposure approximately constant across conditions.	Jensen et al. (2015) - active learning and instructional comparison	High

The CFLC does not assume that progression through the cycle is automatic. Two boundary conditions are theoretically implied by the sources underpinning the model. First, cognitive conflict

does not reliably produce reconsideration (Kroupin et al., 2025): that learners frequently ignore, dismiss, or reinterpret anomalous information to preserve prior beliefs (Ludwig et al., 2021), and Limón (2001) reports mixed empirical outcomes for conflict-based interventions. The transition from P2 to P3 therefore should be read as conditional on the conflict being both salient and unresolved through avoidance—a condition the model does not yet operationalize and which future empirical work should measure directly. Second, the transition from social negotiation to knowledge reconstruction (P4) is contingent on the quality of dialogue and scaffolding rather than its mere occurrence; low-quality peer interaction or negotiation without expert mediation may leave conflicting conceptions unresolved rather than reconciled (Palincsar, 1998).

The model is also open to a rival explanation already noted in the introduction: that gains attributed to flipped-learning designs may derive primarily from increased active-learning time rather than from the specific sequential mechanism proposed here (Myagmarkhorloo et al., 2026). The CFLC's distinctive claim is not that active learning improves outcomes—a claim the model does not dispute—but that the sequence and interdependency of cognitive and social mechanisms determines whether that active engagement produces conceptual transformation rather than superficial task completion. Distinguishing between these two accounts empirically would require designs that hold time-on-task constant while varying whether the CFLC's proposed sequence (conflict → negotiation → reconstruction → application → reflection) is deliberately scaffolded or left to occur incidentally.

Flipped Learning as an Instructional Architecture

Flipped learning emerged as an alternative to conventional teacher-centered instruction by restructuring the time and place of various learning activities. In its most commonly understood form, students learn basic learning material before formal class meetings, while class time is allocated for discussion, problem-solving, collaboration, application, and other forms of active learning. Characterized the flipped classroom as a combination of computer-mediated individual instruction outside the classroom and interactive group learning inside (Le Roux & Nagel, 2018). Subsequent research has shown considerable variation in how this general architecture is implemented across disciplines, technological environments, educational levels, and pedagogical designs (Bautista & López-Costa, 2025).

However, the pedagogical significance of flipped learning cannot be reduced to simply removing lectures or instructional materials. Moving explanatory content outside the classroom creates additional learning space, but the educational value of that space depends on what students actually engage with cognitively and socially within it. Research reviews on flipped learning consistently show that flipped learning environments often incorporate active learning, collaborative activities, problem solving, technological resources, and increased opportunities for student-teacher interaction. At the same time, there is substantial variation in learning design and implementation, suggesting that the structural act of “flipping” alone does not constitute a complete theory of learning (Quandour & Dabaj, 2026).

This distinction is theoretically important. Flipped learning fundamentally addresses questions about organizing learning opportunities: What should learners encounter before class? What activities should occur during classroom interactions? What forms of consolidation or assessment should be used? These questions relate to the instructional architecture. These questions, by themselves, do not fully explain how learners interpret new information, address misconceptions, revise prior understandings, negotiate competing interpretations, or construct more sophisticated conceptual structures.

Therefore, the CFLC treats flipped learning as a possible architecture, not as a sufficient learning mechanism. Pre-class, in-class, and post-class spaces are understood as interconnected environments in which specific cognitive and social processes can be intentionally orchestrated. Pre-class activities, for example, are inherently meaningless simply because they precede classroom instruction. Passively watching a video can reproduce transmissive pedagogy in a different setting. Similarly, collaborative classroom activities do not necessarily lead to conceptual understanding

simply because students appear engaged. Therefore, the theoretical value of flipped learning depends on whether its learning architecture enables processes capable of generating meaningful knowledge transformation.

Recent efforts to integrate social constructivism with flipped classroom design reinforce the relevance of interaction, collaborative learning, and active knowledge construction in flipped environments. This research also demonstrates that constructivism and flipped learning are not new simply because they are placed together; their relationship has been explicitly explored. Therefore, an unfinished theoretical task is to more precisely explain the mechanisms through which knowledge transformation occurs in flipped learning spaces.

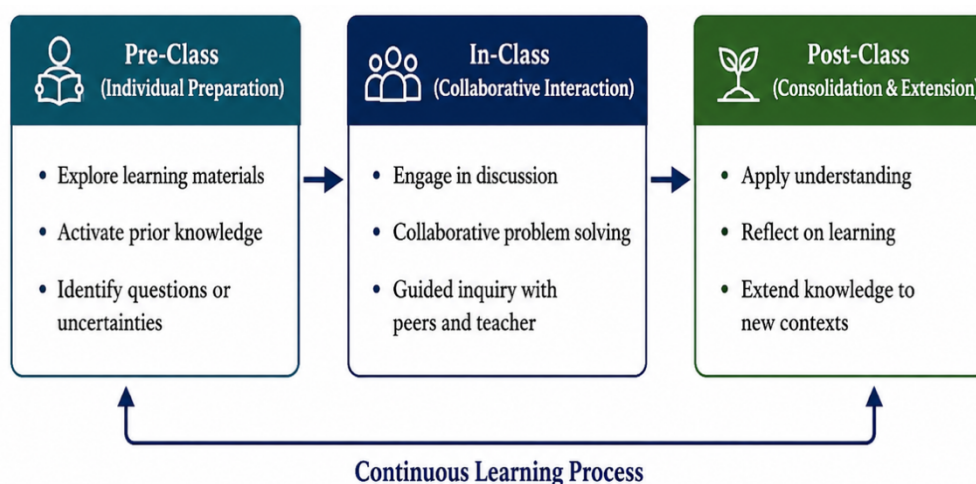


Figure 1. Flipped Learning as an Instructional Architecture

Constructivism and the Active Construction of Knowledge

Constructivism rejects the assumption that knowledge can be transmitted intact from teacher to learner; learners actively interpret new experience through existing cognitive structures and social context by Piaget, and Vygotsky, 1978 (Ramos-Vallecillo & Murillo-Ligorred, 2026; Scheiner et al., 2026). Two traditions matter here: cognitive constructivism, which focuses on change within the learner's conceptual structures, and social constructivism, which focuses on the mediated, socially situated nature of meaning-making. The CFLC treats them as complementary rather than competing.

Piaget (1952) describes cognitive development through assimilation interpreting new experience via existing structures and accommodation revising those structures when they prove inadequate. Learning is thus reorganization, not mere accumulation. For flipped learning, this means pre-class material is never encountered as cognitively neutral: the same content is interpreted differently depending on what each learner already believes, making prior knowledge a starting condition for construction rather than background noise.

Social constructivism adds mediated interaction. Vygotsky (1978) argues cognitive development is inseparable from social and linguistic processes; dialogue with teachers and peers can produce understanding that isolated individual activity cannot, captured in the zone of proximal development the gap between independent and guided performance. Scaffolding temporary support withdrawn as competence grows originates with Wood, Bruner, and Ross (1976), not Vygotsky, a distinction worth keeping precise.

Together, these traditions support the CFLC's premise that knowledge transformation requires both intrapersonal restructuring and interpersonal mediation the basis for treating cognitive conflict and social negotiation as interconnected mechanisms in the proposed cycle

Cognitive Conflict as a Mechanism of Conceptual Change

Cognitive conflict occurs when learners encounter evidence or explanations that cannot be reconciled with their existing conceptions, producing disequilibrium that may prompt

reconsideration. Deliberately inducing this conflict has long been proposed as a strategy for challenging misconceptions (Posner, Strike, Hewson, & Gertzog, 1982; Limón, 2001). The underlying mechanism can be represented as:

This is especially relevant to the CFLC: pre-class exploration lets learners externalize and test their initial understanding before classroom negotiation, rather than simply receiving established explanations. A constructivist flipped design can deliberately expose learners to anomalies, competing explanations, or cases that reveal gaps in their existing mental models.

Cognitive conflict should not be treated as automatically productive. Chinn and Brewer (1993) show that learners typically respond to anomalous data in one of several ways ignoring it, rejecting it as flawed, or reinterpreting it to preserve prior belief and only one of these responses actually produces theory change. Limón (2001) similarly documents mixed and contested outcomes for cognitive-conflict strategies. The CFLC therefore rejects the simplistic assumption that cognitive conflict conceptual change, proposing instead:

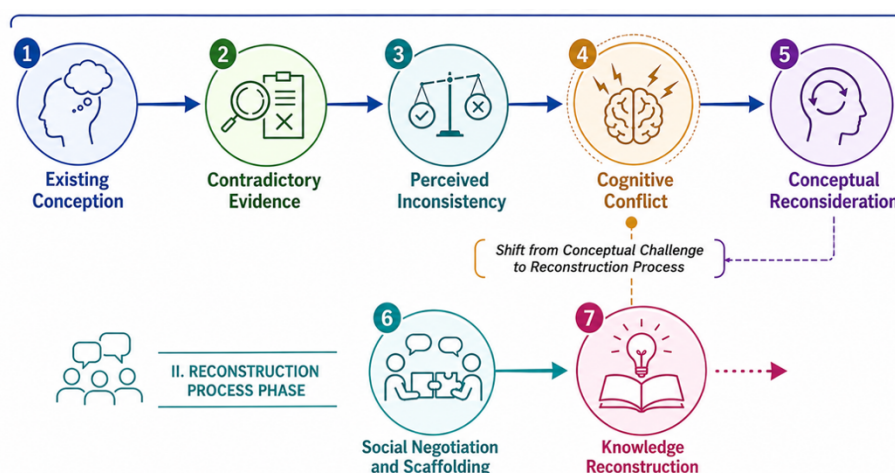


Figure 2. Alternative Integrated Processes of Cognitive

Conflict functions as a destabilizing mechanism, not a completed learning process whether reconsideration becomes reconstruction depends on subsequent opportunities to examine alternatives, articulate reasoning, and negotiate meaning. It also bridges pre class and in-class learning: unresolved questions from the pre-class phase become resources for classroom interaction rather than problems that must be resolved beforehand. Effective flipped-classroom preparation, on this view, is defined less by how much content students have “mastered” and more by the quality of the tensions and uncertainties they bring into collaborative learning.

Knowledge Reconstruction and Conceptual Transformation

Knowledge reconstruction represents the integrative mechanism through which learners reorganize prior and emerging understanding into a modified conceptual structure. It differs fundamentally from knowledge acquisition. Knowledge acquisition may refer to gaining additional information, facts, procedures, or explanations. Knowledge reconstruction implies a deeper transformation in the organization and relationships among concepts.

Within the CFLC, reconstruction emerges from the interaction of cognitive and social processes: cognitive conflict creates reasons to question existing understanding, and social negotiation supplies resources for evaluating alternatives. Reconstruction is not the endpoint, however - a revised conception must be tested through authentic application (tasks, cases, transfer problems), which can confirm the reconstruction or expose further contradictions and trigger renewed conflict. Metacognitive reflection - comparing prior and current conceptions, articulating why an earlier explanation fell short, evaluating transferability - closes this loop, echoing the broader experiential-learning cycle of concrete experience, reflection, and reapplication described by Kolb (1984).

Knowledge reconstruction is therefore recursive:

Prior knowledge → new experience → cognitive conflict → social negotiation → knowledge reconstruction → application and reflection → revised knowledge → new prior knowledge for subsequent learning

Knowledge Reconstruction and Conceptual Transformation

Prior conceptions, especially when repeatedly reinforced through experience, tend to be deeply embedded and resistant to change (Roelle & Richter, 2026). Meaningful learning therefore often requires more than adding correct information alongside a misconception it may require differentiating concepts, revising causal explanations, or replacing an inadequate structure altogether. Within the CFLC, this reconstruction emerges from the interaction of cognitive and social processes (Kostiainen et al., 2026): cognitive conflict creates reasons to question existing understanding, while social negotiation supplies resources for evaluating alternatives, and reconstruction happens when learners integrate these experiences into revised conceptual structures (Redhana et al., 2026).

Reconstruction is not the endpoint, however. A revised conception must be tested through authentic application tasks, cases, transfer problems which can confirm the reconstruction or expose further contradictions and trigger renewed conflict. Metacognitive reflection closes the loop: learners compare prior and current conceptions, articulate why an earlier explanation fell short, and assess whether the new understanding transfers to other situations, echoing the broader experiential-learning cycle of concrete experience, reflection, and reapplication (Liao & Chen, 2026). Knowledge reconstruction is therefore recursive - prior knowledge → new experience → cognitive conflict → social negotiation → knowledge reconstruction → application and reflection → revised knowledge → new prior knowledge - which is the theoretical rationale for treating constructivist flipped learning as a cycle rather than a linear sequence.

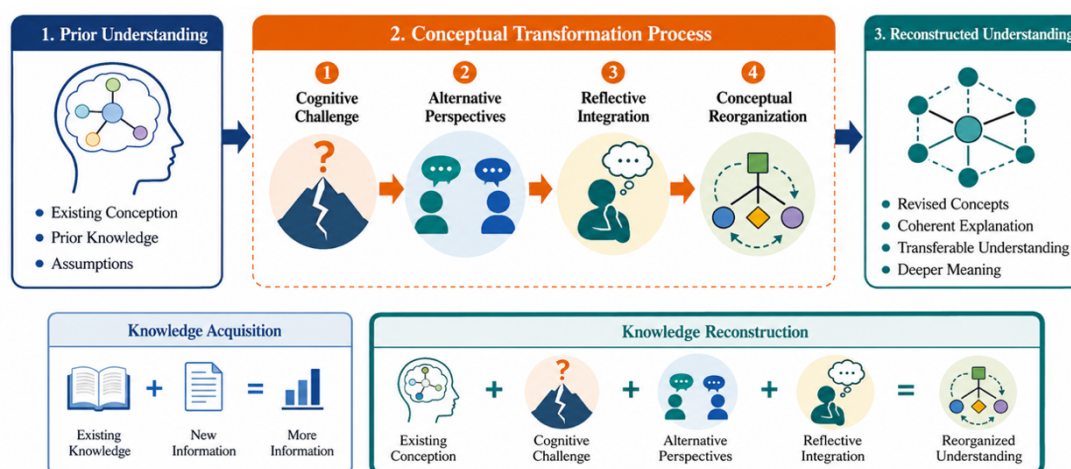


Figure 3. Conceptual Transformation

Theoretical Convergence toward the Constructivist Flipped Learning Cycle

The theoretical perspectives discussed above perform distinct but complementary functions within the proposed CFLC. Flipped learning creates an instructional architecture that distributes learning opportunities across different spaces and times. Cognitive constructivism explains why prior knowledge shapes the interpretation of new experience and why conceptual restructuring may become necessary (Kyriakopoulou & Skopeliti, 2026). Cognitive conflict explains how inconsistencies between existing conceptions and new evidence can initiate conceptual reconsideration. Social constructivism explains how dialogue, mediation, scaffolding, and interaction contribute to the development of meaning. Social negotiation specifies the interactive mechanism through which alternative interpretations are examined, while knowledge reconstruction

describes the reorganization of conceptual understanding that may emerge from these interconnected processes. Their theoretical relationship can be summarized as follows:

No.	Theoretical Foundation	Central Explanatory Function	Role in CFLC
1	 Flipped Learning	Organizes learning across pre-class, in-class, and post-class spaces	Instructional architecture
2	 Cognitive Constructivism	Explains the role of prior knowledge and conceptual restructuring	Individual knowledge construction
3	 Cognitive Conflict	Destabilizes inadequate existing conceptions	Conceptual trigger
4	 Social Constructivism	Explains socially mediated learning and scaffolding	Social foundation of meaning-making
5	 Social Negotiation	Enables competing meanings to be articulated and evaluated	Interactive transformation mechanism
6	 Knowledge Reconstruction	Reorganizes prior and emerging understanding	Conceptual transformation
7	 Metacognitive Reflection	Enables learners to monitor and consolidate conceptual change	Recursive consolidation

Figure 4. Theoretical Basis and Its Role in CFLC

CONCEPTUAL METHODOLOGY

Research Design

This study employed a conceptual theory-building design to develop the Constructivist Flipped Learning Cycle (CFLC) as an integrative model of knowledge construction in flipped learning environments. Conceptual research is appropriate when the primary objective is to synthesize existing theoretical perspectives, clarify relationships among constructs, and generate a new explanatory framework rather than test hypotheses using empirical data (Jaakkola, 2020). The study therefore integrated key concepts from flipped learning, cognitive and social constructivism, cognitive conflict, social negotiation, and knowledge reconstruction to identify theoretical relationships and formulate a coherent cyclical model. The model-building process was guided by the principle that a theoretical contribution should clarify what constructs are involved, how they are related, and why those relationships are theoretically meaningful (Whetten, 1989).

Literature Identification and Selection

Relevant literature was identified through targeted searches of major academic databases, including Scopus, Web of Science, and Google Scholar, to ensure broad coverage of theoretical and empirical scholarship related to the development of the CFLC. The search focused on combinations of keywords such as flipped learning, flipped classroom, constructivism, cognitive constructivism, social constructivism, cognitive conflict, social negotiation, knowledge reconstruction, conceptual change, and metacognitive reflection. Literature selection prioritized peer-reviewed journal articles, seminal theoretical works, systematic reviews, and highly relevant conceptual studies that contributed directly to the explanation of knowledge construction within flipped-learning environments.

The selection process followed a purposive and theory-oriented approach rather than a strictly systematic review protocol, as the objective was to identify conceptually relevant sources capable of supporting theoretical integration and model development. Sources were included when they provided clear definitions, mechanisms, relationships, or theoretical arguments relevant to the core constructs of the proposed framework. Studies were excluded when they focused primarily on technological implementation, descriptive classroom practices, or learning outcomes without

contributing meaningful theoretical insight into the processes of knowledge transformation. This approach is consistent with conceptual research, in which literature is selected for its theoretical relevance and explanatory value rather than solely through exhaustive coverage (Jaakkola, 2020; Snyder, 2019).

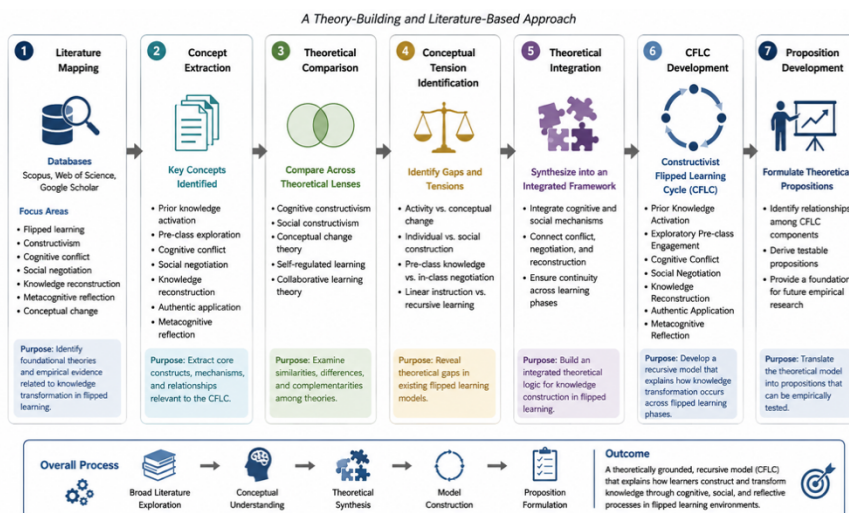


Figure 5. Conceptual methodology and theory

Framework Development

The CFLC framework was developed through an integrative theory-building process that organized the identified constructs into a coherent explanatory model. Prior knowledge activation, exploratory pre-class engagement, cognitive conflict, social negotiation, knowledge reconstruction, authentic application, and metacognitive reflection were linked according to their theoretical relationships and functions. The framework was designed as a recursive model in which reconstructed knowledge becomes prior knowledge for subsequent learning cycles. This approach is consistent with conceptual research that seeks to integrate existing constructs into a theoretically coherent and testable framework (Jaakkola, 2020; Whetten, 1989).

RESULT AND DISCUSSION

The conceptual synthesis resulted in the Constructivist Flipped Learning Cycle (CFLC), a recursive model that explains how knowledge transformation may occur across flipped learning environments. The model integrates seven interconnected stages: prior knowledge activation, exploratory pre-class engagement, cognitive conflict, social negotiation, knowledge reconstruction, authentic application, and metacognitive reflection. Rather than treating flipped learning merely as a redistribution of instructional activities, the CFLC conceptualizes learning as a continuous process in which cognitive and social mechanisms interact to transform learners' existing understanding.

The model begins with the activation of prior knowledge, which shapes how learners interpret new information during pre-class exploration. Exposure to new evidence, problems, or alternative explanations may generate cognitive conflict when existing conceptions are insufficient to explain emerging information. This conflict initiates conceptual reconsideration, which is further developed through social negotiation, dialogue, scaffolding, and collaborative meaning-making. These processes support knowledge reconstruction, in which learners reorganize prior and emerging understanding into a more coherent conceptual structure. Reconstructed knowledge is subsequently

tested through authentic application and consolidated through metacognitive reflection. The resulting understanding then becomes new prior knowledge for subsequent learning, making the CFLC recursive rather than linear.

Table 1. Theoretical Proposition Development of the Constructivist Flipped Learning Cycle

No.	Relationship between Constructs	Theoretical Rationale	Proposed Proposition
P1	Prior Knowledge Activation → Exploratory Pre-Class Engagement	Activation of prior knowledge provides a cognitive foundation for interpreting new information and increases learners' readiness to engage meaningfully with pre-class materials.	P1: Prior knowledge activation positively influences learners' engagement in exploratory pre-class learning activities.
P2	Exploratory Pre-Class Engagement → Cognitive Conflict	Exposure to new information, problems, or alternative explanations may reveal discrepancies between learners' existing conceptions and emerging evidence, thereby generating cognitive disequilibrium.	P2: Exploratory pre-class engagement positively contributes to the emergence of cognitive conflict when learners encounter information inconsistent with their prior conceptions.
P3	Cognitive Conflict → Social Negotiation	Cognitive conflict creates a need to examine competing explanations and encourages learners to articulate, compare, and reconsider their interpretations through interaction with others.	P3: Cognitive conflict positively influences learners' engagement in social negotiation when discrepant ideas require clarification and resolution.
P4	Social Negotiation → Knowledge Reconstruction	Dialogue, argumentation, peer interaction, and scaffolding enable learners to evaluate alternative perspectives and reorganize their existing conceptual structures.	P4: Social negotiation positively influences knowledge reconstruction by facilitating the evaluation and integration of alternative meanings.
P5	Knowledge Reconstruction → Authentic Application	Reconstructed knowledge becomes more meaningful when learners apply revised conceptual understanding to authentic problems, cases, or new contexts.	P5: Knowledge reconstruction positively influences learners' ability to apply knowledge in authentic and transferable learning contexts.
P6	Authentic Application → Metacognitive Reflection	Applying knowledge in meaningful contexts provides learners with evidence about the adequacy of their understanding and creates opportunities to monitor, evaluate, and regulate their thinking.	P6: Authentic application positively promotes metacognitive reflection by enabling learners to evaluate the effectiveness and transferability of their reconstructed understanding.
P7	Metacognitive Reflection → New Prior Knowledge	Reflection consolidates conceptual change and transforms reconstructed understanding into a more stable knowledge structure that becomes the basis for subsequent learning.	P7: Metacognitive reflection positively contributes to the formation of new prior knowledge for subsequent learning cycles.

The Constructivist Flipped Learning Cycle (CFLC) extends conventional flipped-learning models by emphasizing the mechanisms of knowledge transformation rather than merely the redistribution of instructional activities. Previous studies indicate that the benefits of flipped learning are strongly influenced by the quality of active-learning processes and instructional design, not simply by moving content outside the classroom (Isabel Santos & Serpa, 2020; Shanghai International Studies University & Arslan, 2020). The CFLC therefore positions prior knowledge activation, cognitive conflict, social negotiation, and knowledge reconstruction as interconnected mechanisms that explain how meaningful learning may occur.

This model is also consistent with constructivist perspectives and conceptual change. Cognitive conflict can stimulate reconsideration of prior conceptions, but it does not automatically result in conceptual change; social interaction, support, and reflection are still necessary to support knowledge reconstruction. By conceptualizing learning as a recursive cycle in which reconstructed knowledge becomes the starting point for subsequent learning, CFLC reframes flipped learning as a knowledge transformation architecture rather than simply an instructional inversion. Therefore, this

framework provides a stronger foundation for future studies to examine how and under what conditions flipped learning produces meaningful conceptual change.

CONCLUSION

This conceptual study proposes the Constructivist Flipped Learning Cycle (CFLC) as a framework for explaining how knowledge transformation occurs within flipped learning environments. The model integrates prior knowledge activation, exploratory engagement, cognitive conflict, social negotiation, knowledge reconstruction, authentic application, and metacognitive reflection into a recursive learning cycle. Rather than viewing flipped learning merely as an inversion of instructional time and space, the CFLC conceptualizes it as a knowledge-transformation architecture grounded in cognitive and social constructivist mechanisms.

As a conceptual synthesis, the CFLC has not been empirically tested; its seven propositions and the boundary conditions outlined above represent theoretical claims rather than validated findings, and their explanatory power remains to be established through empirical research. The framework nonetheless provides a theoretical basis for future empirical studies, which could operationalize each proposition into measurable constructs—for example, coding cognitive-conflict episodes from classroom discourse, or scaling perceived negotiation quality—and test them through longitudinal or quasi-experimental designs capable of tracking whether reconstructed knowledge functions as prior knowledge in subsequent learning cycles, as the model's recursive claim predicts.

ACKNOWLEDGEMENT

The authors would like to express their sincere appreciation to all colleagues who contributed to the development and completion of this study, as well as to those who supported international research collaborations. This research received no external institutional funding and was supported through personal and voluntary contributions.

ETHICAL STATEMENT

This study is a conceptual and theoretical article based exclusively on the analysis and synthesis of previously published literature. It did not involve human participants, personal data, animal subjects, or experimental interventions. Therefore, formal ethical approval and informed consent were not required. The authors conducted the study in accordance with established principles of research integrity, proper citation, transparency, and responsible scholarly practice.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES

During the preparation of this manuscript, the authors used ChatGPT as an AI-assisted tool to support language refinement, improve clarity, and assist with the organization of selected sections. The authors critically reviewed, verified, and edited all AI-assisted content and take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

AUTHORS' CONTRIBUTION

Author 1: Writing review and editing; Supervision; Conceptualization.

Author 2: Data curation; Research; Literature investigation.

Author 3: Data curation; Research; Reference management, Methodology; Formal analysis; Writing original draft.

REFERENCES

- Alanazi, A. A., Osman, K., & Halim, L. (2024). Effect of scaffolding strategies and guided discovery on higher-order thinking skills in physics education. *Eurasia Journal of Mathematics, Science and Technology Education*, 20(9), em2496. <https://doi.org/10.29333/ejmste/14980>
- Banat, A., Wahyuni, E., Erwin, E., Siti Aisyah Hanim, S. A., & Mudinillah, A. (2024). Impact of Using Online Learning Platforms on Student Engagement. *Journal Emerging Technologies in Education*, 2(1), 110121. <https://doi.org/10.70177/jete.v2i1.800>
- Bautista, G., & López-Costa, M. (2025). Smart learning spaces considering the integration of the pedagogical, environmental and digital dimensions: A systematic review. *Learning Environments Research*, 28(3), 455472. <https://doi.org/10.1007/s10984-025-09551-2>
- Bryce, T. G. K., & Blown, E. J. (2024). Ausubel's meaningful learning re-visited. *Current Psychology*, 43(5), 45794598. <https://doi.org/10.1007/s12144-023-04440-4>
- Chen, H., Sun, D., Yang, Y., Looi, C.-K., & Jia, F. (2023). Detecting and visualizing research trends of blended learning: A bibliometric analysis of studies from 2013-2022. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(10), em2336. <https://doi.org/10.29333/ejmste/13592>
- Erwin, Degeng, M. D. K., Degeng, I. N. S., & Praherdhiono, H. (2026). The effectiveness of collaborative blended learning on mastery of instructional media concepts. *Multidisciplinary Reviews*, 9(12), 2026497. <https://doi.org/10.31893/multirev.2026497>
- Gupta, R. K., & Walia, Y. (2026). A biopsychosocial perspective of cognitive conflict: Interacting dimensions and theoretical propositions. *Acta Psychologica*, 264, 106586. <https://doi.org/10.1016/j.actpsy.2026.106586>
- Isabel Santos, A., & Serpa, S. (2020). Flipped Classroom for an Active Learning. *Journal of Education and E-Learning Research*, 7(2), 167173. <https://doi.org/10.20448/journal.509.2020.72.167.173>
- Kostiainen, E., Nousiainen, T., & Näykki, P. (2026). From a bitter start to meaningful learning in online teacher education. *Scandinavian Journal of Educational Research*, 70(1), 3249. <https://doi.org/10.1080/00313831.2025.2459404>
- Kroupin, I., Davis, H. E., & Henrich, J. (2025). Beyond Newton: Why assumptions of universality are critical to cognitive science, and how to finally move past them. *Psychological Review*, 132(2), 291310. <https://doi.org/10.1037/rev0000480>
- Kyriakopoulou, N., & Skopeliti, I. (2026). What Can Young Children Really Do? Pre-Service Teachers' Contradictory Beliefs and Implications for Professional Teacher Education. *Education Sciences*, 16(6), 861. <https://doi.org/10.3390/educsci16060861>
- Le Roux, I., & Nagel, L. (2018). Seeking the best blend for deep learning in a flipped classroom viewing student perceptions through the Community of Inquiry lens. *International Journal of Educational Technology in Higher Education*, 15(1), 16. <https://doi.org/10.1186/s41239-018-0098-x>
- Li, R., Lund, A., & Nordsteien, A. (2023). The link between flipped and active learning: A scoping review. *Teaching in Higher Education*, 28(8), 19932027. <https://doi.org/10.1080/13562517.2021.1943655>
- Liao, Y.-S., & Chen, M.-J. (2026). Constructing and reinterpreting the meaning of curriculum evaluation: An exploratory study using Generative Learning Theory. *Professional Development in Education*, 123. <https://doi.org/10.1080/19415257.2026.2653009>
- Ludwig, T., Priemer, B., & Lewalter, D. (2021). Assessing Secondary School Students' Justifications for Supporting or Rejecting a Scientific Hypothesis in the Physics Lab. *Research in Science Education*, 51(3), 819844. <https://doi.org/10.1007/s11165-019-09862-4>
- Michalsky, T. (2024). Metacognitive scaffolding for preservice teachers' self-regulated design of higher order thinking tasks. *Heliyon*, 10(2), e24280. <https://doi.org/10.1016/j.heliyon.2024.e24280>

- Myagmarkhorloo, C., Ganzorigt, B.-U., & Habók, A. (2026). Student engagement and self-regulated learning across standard and AI-enhanced flipped learning: A within-subjects longitudinal study. *Frontiers in Psychology*, 17, 1936442. <https://doi.org/10.3389/fpsyg.2026.1936442>
- Quandour, N., & Dabaj, F. (2026). Bridging Design and Practice: Evaluating an ADDIE-Based Selective Flipped Learning Framework for Sustainable Pedagogical Change in Engineering Education. *Sustainability*, 18(9), 4452. <https://doi.org/10.3390/su18094452>
- Ramos-Vallecillo, N., & Murillo-Ligorred, V. (2026). Prosignification in Art Education: Project-Based and Meaningful Learning Towards Active Learning. *Encyclopedia*, 6(4), 86. <https://doi.org/10.3390/encyclopedia6040086>
- Redhana, I. W., Suardana, I. N., & Sudria, I. B. N. (2026). A socio-cognitive conflict-integrated challenge-based learning model to improve scientific argumentation skills and scientific literacy. *Pedagogical Research*, 11(1), em0253. <https://doi.org/10.29333/pr/17917>
- Roelle, J., & Richter, T. (2026). Maintaining the outcomes of meaningful learning: Where are we and where do we need to go? An introduction to the special issue on lasting learning. *Learning and Instruction*, 102, 102277. <https://doi.org/10.1016/j.learninstruc.2025.102277>
- Sarwar, M. N., Maqbool, M. A., Ullah, S., Rana, A. S., Khan, S. U., Ibrahim, A. A., Alam, K., Zafar, S., Ullah, Z., & Nazar, M. F. (2024). Fostering Conceptual Understanding of Photocatalysis for Sustainable Development: A Social Constructivism Flipped-Classroom Model. *Sustainability*, 16(23), 10324. <https://doi.org/10.3390/su162310324>
- Scheiner, T., Aspbury-Miyaniishi, E., & Jazby, D. (2026). Beyond traditional cognitivist boundaries: Reconceptualizing teacher noticing through 4E cognition. *Teaching and Teacher Education*, 180, 105606. <https://doi.org/10.1016/j.tate.2026.105606>
- Shanghai International Studies University, & Arslan, A. (2020). Instructional Design Considerations for Flipped Classroom. *International Journal of Progressive Education*, 16(6), 3359. <https://doi.org/10.29329/ijpe.2020.280.3>
- Shao, J., Abdul Rabu, S. N., & Chen, C. (2025). The impact of gamified interactive e-books incorporating metacognitive reading strategies on Chinese elementary students' mathematical reading comprehension, word problem-solving performance, and general reading motivation. *Education and Information Technologies*, 30(16), 2289322929. <https://doi.org/10.1007/s10639-025-13660-z>
- Tu, K., Lai, Q., Zhan, J., & Zhan, Z. (2026). Enhancing STEM preservice teachers' interdisciplinary teaching competence and instructional design innovation ability through cognitive conflict in community of practice. *Asia Pacific Journal of Innovation and Entrepreneurship*, 20(2), 94113. <https://doi.org/10.1108/APJIE-07-2025-0093>
- Westbye, A. K., Eriksen, H., & Blikstad-Balas, M. (2026). When AI only asks: How question-driven dialogue shapes prewriting in the classroom. *Frontiers in Education*, 11, 1740044. <https://doi.org/10.3389/feduc.2026.1740044>

Copyright Holder :

© Muhammm Azzam Almubarak et al. (2026).

First Publication Right :

© Journal of Paddisengeng Technology

This article is under:

