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# A Grounded Theory Analysis of Blended Learning as a Dual Stimulus for Critical Thinking and Self-Regulated Learning

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**Abstract:** This qualitative case study explores the intricate relationship between self-regulated learning (SRL) and critical thinking in a blended learning environment. Using a case study approach, the research aims to develop a substantive theory that explains the pedagogical mechanisms underlying the effectiveness of this modality. Data was collected from 34 participants through a 55-item SRL questionnaire, student interviews, and document analysis of critical thinking test results based on Ennis's indicators. The study followed the core procedures of grounded theory, including open, axial, and selective coding. The findings led to the development of the Integrated Critical Stimulation conjecture, which posits that blended learning is a uniquely synergistic approach that effectively fosters critical thinking. This synergy is a "dual stimulus," where the face-to-face component provides crucial scaffolding and real-time feedback, and the online component offers a space for autonomous practice and deep reflection. The study's most significant finding is that this synergy is particularly effective for students with moderate SRL abilities, who benefit from the balanced support and autonomy the blended model provides. The conjecture suggests that a deliberate and strategic integration of modalities, tailored to student characteristics, is key to developing critical thinking skills.

**Keywords:** Blended Learning, Critical Thinking, Self-Regulated Learning

## A. Introduction

In the current educational landscape, a central challenge for university educators is the effective development of critical thinking skills, a competency widely regarded as essential for success in the 21st century (Sinaga et al., 2023). This imperative has fueled a long-standing debate over the optimal pedagogical approach, particularly concerning the merits of traditional face-to-face instruction versus the flexibility of fully online learning. While both methods have demonstrated success, their application has often been viewed as a binary choice, with face-to-face learning valued for its direct interaction and online learning for its accessibility and self-paced nature (Garrison & Kanuka, n.d., 2004).

Traditional face-to-face instruction has long been regarded as a standard for promoting critical thinking. This model, characterized by direct interaction between instructors and students, is celebrated for its ability to facilitate real-time Socratic dialogue, group discussions, and immediate feedback (Garrison & Kanuka, n.d., 2004). Face-to-face settings can provide a structured environment that is crucial for cognitive development, especially for students who may struggle with independent learning (Cheung et al., 2023). The physical presence of an instructor allows for the explicit modeling of critical thinking processes and provides the necessary scaffolding to guide students through complex reasoning tasks. This direct, in-person support is often cited as a significant advantage, enabling students to develop the foundational skills necessary for higher-order thinking (Anwar et al., 2020).

In contrast, fully online learning environments offer unparalleled flexibility and access. Early skepticism about online learning's capacity to foster critical thinking has been challenged by studies demonstrating its potential (Garrison, 2011). Asynchronous discussion forums, for instance, provide a space for students to reflect on and articulate their thoughts more carefully than they might in a real-time discussion (Steenkamp & Brink, 2024; Wang et al., 2025; Yeong, 2021). The self-paced nature of online courses can also empower highly motivated students to delve more deeply into topics; however, a significant body of research points to challenges. Students in purely online settings, particularly those with low to moderate self-regulated learning (SRL) abilities, can struggle with the lack of structure and direct social cues (Stevens & Borup, 2015). This can lead to what we term "Cognitive Fragmentation," where students engage in superficial content consumption without engaging in deep, critical thinking (Anwar et al., 2020; Pantiwati et al., 2023).

As a promising alternative, blended learning strategically combines the strengths of both modalities while mitigating their weaknesses (McCarthy & Palmer, 2023). Proponents of blended learning argue that it leverages the strengths of both traditional and online environments while mitigating their weaknesses (Garrison & Kanuka, n.d., 2004). Studies have shown that blended learning can be as effective as, and in some cases, more effective than traditional methods for improving critical thinking skills (Sinaga et al., 2023; Sunubi & Bachtiar, 2022). The theoretical foundations of blended learning often draw from social constructivism, suggesting that learning is a social process in which knowledge is co-constructed through interaction (Vygotsky, 1978). In a blended model, this co-construction co-occurs in both the physical classroom and the digital space. However, existing literature often describes the benefits of blended learning in broad terms without a detailed framework to explain the underlying mechanisms of its success, especially concerning specific student characteristics like SRL. The current body of research on blended learning and critical thinking has primarily focused on comparing outcomes without deeply exploring the synergistic process by which the two modalities interact (Anwar et al., 2020).

This article aims to bridge this gap by introducing the "Integrated Critical Stimulation" conjecture. This framework posits that blended learning is not merely a compromise but a synergistic approach that creates a balanced environment of external support and autonomous exploration. We argue that this synergy is a "dual stimulus," where the face-to-face component provides crucial scaffolding and real-time feedback, and the online component offers a space for autonomous practice and deep reflection. The conjecture suggests this mechanism is particularly effective for students with moderate SRL abilities. Our framework provides a direct counterpoint to "Cognitive Fragmentation." While fragmentation arises from insufficient structure and social interaction in purely online settings, our conjecture proposes that the scaffolding and autonomy inherent in the blended model directly address this challenge. By framing "Integrated Critical Stimulation" as a solution to this problem, we provide a more precise, more powerful theoretical explanation for how a strategic integration of learning modalities can foster higher-order thinking skills. This article addresses the shortcomings of the existing literature by offering a comprehensive framework for understanding the mechanisms at play. Our purpose is to introduce the Integrated Critical Stimulation conjecture and apply it to explain how a deliberate integration of face-to-face and online components creates optimal conditions for developing robust and consistent critical thinking skills.

## B. Methods

This study adopts a qualitative, case study approach to develop the "Integrated Critical Stimulation" conjecture, which links students' self-regulated learning (SRL) abilities with their critical thinking skills. To explore this relationship without predetermined assumptions, we employed a grounded theory methodology. This approach enables a theory to emerge directly from the data, offering a rich and nuanced understanding of the phenomenon.

### Participants and Data Collection

Data were collected from 34 undergraduate students enrolled in a required course, "Critical Reading," delivered in a blended format at a public university. This course was offered through the English Department. The participants had an average age of 19.4 years (ranging from 18 to 22), reflecting a predominantly second-year student cohort. The sample was relatively balanced in terms of gender, comprising 18 female and 16 male students. This study focused exclusively on students enrolled in one specific blended learning section. The overall course enrolment comprised 99 students across three concurrent sections within the English Department (these included a purely online section, a purely face-to-face section, and the blended section. The 34 participants represent a convenience sample taken entirely from Class C. The first phase of data collection involved using a 55-item SRL questionnaire to categorize these participants into three distinct groups: high, moderate, and low SRL levels. This

initial quantitative step provided a foundational understanding of the participants' self-regulation capacities, which then informed the subsequent qualitative research. For the qualitative phase, data were primarily gathered through semi-structured student interviews and an analysis of student-generated documents. The interviews involved a purposeful sample of 15 students (five from each of the high, moderate, and low SRL groups) to ensure balanced representation. These interviews delved into students' perceptions of the blended learning environment, their strategies for self-regulation, and their experiences with critical thinking tasks in both online and face-to-face settings. Document analysis involved examining student reflections, discussion forum transcripts, and responses to essential assessments of thinking. These documents were interpreted qualitatively to understand how students approached and articulated their thoughts, rather than merely focusing on their scores.

**Data Analysis**

A grounded theory approach, involving open, axial, and selective coding, was systematically applied (Strauss & Corbin, 2008). Open coding involves precisely identifying and labeling key concepts and patterns within the qualitative data, such as "time management," "goal setting," "evaluating evidence," and "real-time feedback." Axial coding would then connect these initial codes into broader categories (e.g., "SRL strategies," "critical thinking behaviors," "contextual factors" and explore the relationships between them. This iterative process of constant comparison would reveal how these concepts interact with each other. Finally, selective coding would focus on integrating the most relevant core concepts to develop the central theoretical framework—the "Integrated Critical Stimulation" conjecture explaining how the core concepts, stemming from students' SRL and critical thinking abilities, are integrated to form a comprehensive explanation of how blended learning effectively fosters critical thinking. The use of qualitative data analysis software, such as NVivo 15, would facilitate the management and visualization of these complex connections between codes and categories.

1. Open Coding: Uncovering the Building Blocks

The initial phase, open coding, involved a thorough exploration of qualitative data related to students' SRL levels and their critical thinking abilities. Our goal was to identify and label key concepts and patterns that emerged naturally from the data, without being influenced by any pre-existing theoretical frameworks. We carefully read and analyzed student reflections, discussion transcripts, and interview notes to identify relevant information. In this process, every piece of data relevant to students' SRL and critical thinking was assigned a label or code. These codes were not based on our initial hypotheses but were direct representations of concepts found in the data. For instance, a student's statement about scheduling time for homework might be

coded as "time management," while a comment about questioning a source's credibility might be coded as "evaluating evidence." Detailed field notes were maintained to document the context and meaning behind each code, ensuring that our interpretations remained consistent with the empirical data. This meticulous process yielded a series of initial codes that serve as the foundation for the subsequent stages of analysis.

2. Axial Coding: Connecting the Concepts

Following open coding, we proceeded to axial coding, a more intensive stage that focused on understanding how the concepts identified in the previous phase relate to and interact with one another. The central goal was to develop a deeper, more nuanced understanding of the phenomenon by systematically reorganizing the data and identifying patterns of relationships. During this stage, we linked the initial codes into broader categories. For example, the codes "time management," "goal setting," and "self-monitoring" were grouped under the higher-level category of "SRL strategies." We then examined how these categories influenced critical thinking behaviors, as represented by codes such as "argument analysis" and "synthesizing information." We also considered how contextual factors—such as the learning modality (online vs. face-to-face) and instructor feedback—affected these relationships. This process helped us to map out the structure and dynamics of how SRL and critical thinking intersect. The output of axial coding was a set of integrated concepts and identified relationships that form a more detailed representation of our findings.

3. Selective Coding: Developing the Core Conjecture

The final analytical stage, selective coding, centered on selecting, integrating, and developing the most relevant core concepts from the data. The primary objective was to create a focused and coherent theoretical framework the "Integrated Critical Stimulation" conjecture that is firmly grounded in empirical evidence. In this stage, we identified the key concepts that had the highest significance in explaining the relationship between SRL and critical thinking. We selected categories that emerged as central to our axial coding, such as "scaffolding from face-to-face interaction," "autonomy from online flexibility," and "balanced environment." We then deepened our understanding of the relationships among these concepts, explaining how they work together to create the unique synergy we observed. The final output of this process is a substantive theory, or conjecture, which is systematically structured and directly derived from the data. This theory is visualized through a selective coding paradigm diagram, which illustrates how the core concepts stemming from students' SRL and critical thinking abilities are integrated to form a comprehensive explanation of how blended learning effectively fosters critical thinking.

## C. Results and Discussion

The analysis revealed that the blended learning environment functioned as a "dual stimulus," with each modality playing a distinct but complementary role. The face-to-face component served as a vital scaffolding mechanism, providing the structured, real-time feedback and direct interaction that guided students' initial critical thinking efforts (Reiser, 2004). Interview data consistently showed that students valued this in-person guidance for "getting started" and "making sure I was on the right track." For instance, a student with a moderate SRL score reflected, "The lecturer's direct feedback on my initial thoughts for question #6 was a game-changer. She didn't give me the answer but helped me see *how* to construct a counter-argument." Analysis of their critical thinking test results confirmed this. On open-ended questions like #6 and #10 (which required constructing arguments and identifying assumptions), students' initial written responses were often superficial. However, after an in-class Socratic discussion, their subsequent reflections and revised answers showed a marked improvement in logical depth and complexity. One student's initial response to question #10 was simply, "The author just assumes people are good." Their revised response, however, demonstrated a much deeper ability to identify implicit beliefs: "The essay assumes that a desire for mutual benefit primarily drives cross-cultural interactions and that rational communication can overcome deeply rooted conflicts, which might not always be true." This suggests that real-time feedback in a physical classroom provides a crucial catalyst, helping students with SRL build the foundational skills needed for critical analysis.

Conversely, the online component provided a space for autonomous practice and deep reflection (Şener & Mede, 2023). A student with a high score on the initial factual questions (#1-5) noted, "In the classroom, the quick questions and debate with others forced me to think on my feet. But online, I could sit with a difficult question, check my sources, and write a much more thoughtful answer." This sentiment was echoed by other moderate SRL students who described using asynchronous online materials and discussion forums to "think things through at my own pace" and "take my time to evaluate the arguments." Analysis of their responses revealed that they scored highly on these factual and explanatory questions after having a chance to review the content online. This autonomous practice, absent the pressure of immediate in-person response, was essential for internalizing critical thinking processes and developing self-regulated learning habits (Masaki, 2023). The synergy of "Integrated Critical Stimulation" occurs in the continuous loop between these two stimuli: the in-class scaffolding prevents "cognitive fragmentation." At the same time, the online autonomy fosters self-driven, deep engagement. As one student summarized, "It's like the classroom builds the road, and the online part is where you learn to drive on it."

The qualitative analysis, supported by NVivo, provided a detailed understanding of

these relationships between SRL, critical thinking, and the blended learning environment. Figure 1 (Axial Coding Diagram) illustrates the axial coding paradigm, showing how initial open codes such as "Elementary clarification," "Basic support," "Inference," "Advance Clarification," and "Strategy and Tactics" were connected to form broader categories. These categories, in turn, were linked to the core phenomenon of "Optimal Critical Thinking Level" and influenced by the causal condition of "Moderate SRL Level" within the "Online Learning, Critical Thinking Test, Interview". The diagram highlights that student with moderate self-regulated learning in online classes demonstrated good critical thinking abilities, capable of identifying main ideas, summarizing arguments, evaluating the credibility of sources, making inferences, and forming well-considered judgments. However, their self-initiated drive varied, and they sometimes required additional encouragement in the online learning environment to maximize analytical depth, consistency in information cross-checking, or to produce more innovative solutions. However, their self-initiated drive varied. They sometimes required encouragement in the online environment to maximize analytical depth, cross-checking consistency, or to produce more innovative solutions, thus underscoring the necessity of the "dual stimulus."

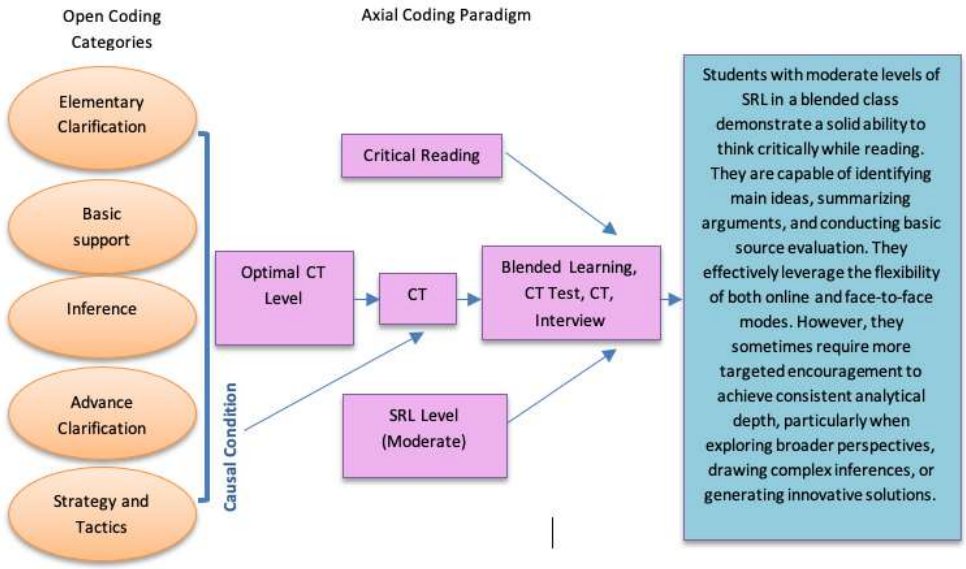


**Figure 1. Axial Coding Diagram: The Link Between Students with Moderate SRL and Critical Thinking Ability in a Blended Learning**

Crucially, our findings show that this synergistic effect is most pronounced for students with moderate SRL abilities. Students with moderate SRL capacities demonstrated a significant improvement from their initial attempts on critical thinking questions. For instance, their initial written response to question #10, which asks about underlying assumptions, was often superficial. One student's initial thought was simply, "The author just assumes people are good." However, after an in-class Socratic discussion and subsequent asynchronous reflection, their revised

response demonstrated a much deeper ability to identify implicit beliefs, stating, "The essay assumes that a desire for mutual benefit primarily drives cross-cultural interactions and that rational communication can overcome deeply rooted conflicts, which might not always be true." This dynamic, where the in-class scaffolding prevents "cognitive fragmentation" while the online autonomy fosters self-driven, deep engagement, was a consistent pattern. Students with low SRL, however, often found the online component too unstructured, leading to low scores on both complex and straightforward questions due to a lack of engagement. In contrast, while students with high SRL benefited from the blended approach, their pre-existing skills meant the effect was less transformative, as they could effectively self-regulate their learning in any modality. The Integrated Critical Stimulation conjecture offers a novel contribution to the existing literature by moving beyond a simple comparison of learning modalities to explain the underlying mechanism of blended learning's effectiveness. Previous research has shown mixed results, with some studies suggesting blended learning can be less effective than traditional methods for developing critical thinking (Anwar et al., 2020; Fitria et al., 2023; Haftador et al., 2023; Sahi, 2025). Our findings provide a more nuanced explanation for these results, suggesting that such outcomes may be a consequence of not adequately considering the students' SRL capacities. The observed improvement of students with moderate SRL on challenging questions such as their ability to distinguish cultural exchange from appropriation (question #9) or to analyze underlying assumptions (question #10)—demonstrates that the synergy between in-person and online components is a powerful catalyst for cognitive growth.

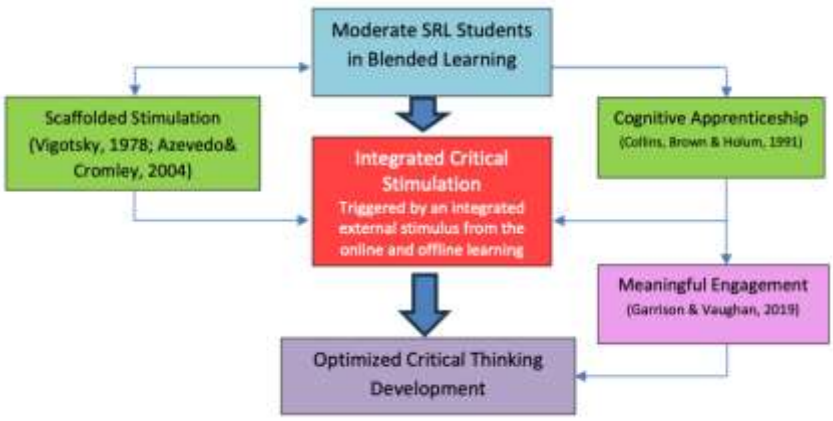


**Figure 2. Integrated Critical Stimulation Conceptual Diagram**

This conjecture is supported by more recent studies that also find positive outcomes for critical thinking in blended environments. For instance, research has found that blended learning significantly improved students' mathematical critical thinking (Haka et al., 2020), and other research highlighted the role of blended learning in fostering creative problem-solving and critical thinking (Nisrina & Verawati, 2024; Oktavia et al., 2021, 2025; Sinaga et al., 2023). Our research extends these findings by

providing a theoretical framework that explains *why* and *for whom* these benefits are most likely to occur. The Integrated Critical Stimulation model suggests that success is not merely due to the presence of both modalities, but from their strategic integration to provide a balanced environment of structured support and autonomous exploration. The development of critical thinking, as our findings reveal, is deeply intertwined with metacognitive skills. These researchers found that blended models integrating literacy and character education can enhance both metacognitive skills and critical thinking (Diastuti et al., 2024; Pantiwati et al., 2023; Wantu et al., 2025; Widiana et al., 2024).

Our study's focus on SRL as a key mediating factor aligns perfectly with this perspective. The practical implications of this research are significant for educators and curriculum designers. To maximize the development of critical thinking, instructors should design blended courses with a deliberate focus on this synergy. The face-to-face component should be used to provide structured, guided activities and immediate feedback on complex, abstract tasks (e.g., questions #6, #10, #12), where direct interaction is invaluable. Conversely, the online component should be used for independent, reflective work and collaborative discussions on more structured content (e.g., questions #1-5) to foster autonomy. Furthermore, a diagnostic assessment of students' SRL abilities at the beginning of a course could help instructors tailor their support and intervention strategies to better meet the needs of students at different SRL levels. While this study is limited by its qualitative, case-study design, the theoretical model it generates provides a strong foundation for future quantitative research to test its hypotheses and further refine our understanding of this critical relationship.

## D. Conclusions

This study aimed to explore the development of critical thinking skills in a modern educational context and has concluded that blended learning is not merely a compromise between online and traditional methods, but a uniquely powerful and synergistic approach. Through the development of the "Integrated Critical Stimulation" conjecture, we have provided a theoretical framework to explain this synergy. Our findings, grounded in a qualitative analysis of student interviews and critical thinking assessments, demonstrate that the success of blended learning hinges on its ability to provide a balanced environment of external support and autonomous practice. This dual stimulus is particularly effective for students with moderate self-regulated learning (SRL) abilities, who require both the scaffolding of a physical classroom and the flexibility of an online environment to transition from passive participation to self-driven critical inquiry. Ultimately, our research underscores that effective pedagogy is not about choosing one modality over another, but about strategically integrating the strengths of both to create a dynamic learning ecosystem responsive to student characteristics.

The "Integrated Critical Stimulation" conjecture offers significant implications for both pedagogy and theory, while also pointing to important limitations and avenues for future research. Pedagogically, the conjecture guides educators to design blended courses by leveraging the unique strengths of each modality: face-to-face time should be dedicated to high-level, interactive activities like Socratic discussions, structured debates, and collaborative problem-solving to provide crucial immediate feedback and social support, particularly for students with moderate Self-Regulated Learning (SRL), while the online component should facilitate independent content delivery, preliminary analysis, and reflective assignments to build autonomy. Explicit scaffolding and diagnostic assessment of SRL in the online environment are also recommended to tailor support. Theoretically, this research advances the understanding of blended learning by providing a mechanistic explanation the Integrated Critical Stimulation conjecture of how the two modalities interact, mediated by student SRL, offering a more nuanced model that accounts for previously mixed findings and highlights the necessity of integrating student characteristics into learning design frameworks. However, this study, being a qualitative case study, is limited by its small, specific sample, which restricts the generalizability of the findings, and the reliance on a single questionnaire for SRL assessment. Future research should therefore prioritize a quantitative, quasi-experimental study to statistically test the Integrated Critical Stimulation conjecture across different SRL levels in varying course modalities, replicate the study in diverse disciplines and educational contexts to confirm its broader applicability, and conduct longitudinal studies to understand the long-term development of both critical thinking and self-regulation within blended environments.

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