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Technical Article

Designing the Active Blended Learning Integrated with Self-regulated Learning Model for Teaching Grade 8 Science

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Abstract: Active Learning (AL) is continually implemented in the educational context of Thailand. In addition, during the COVID-19 outbreak in Thailand and around the world, most teachers are forced to teach via on-line and some teachers combine on-line learning with face-to-face learning in the appropriate time that we call Blended Learning (BL). Learning on-line as well as face-to-face demand students' ability to control and monitor their teaching. In other word, students need self-regulated learning (SRL) skill. From those three key conceptions of learning, this article aims to review and analyze the literatures related to AL, BL and SRL. We selected the papers related to AL, BL and SRL from the national and international peer-reviewed publications published during 2010-2022. The teaching steps from the AL, BL and SRL literatures were analyzed by using content analysis. Then, the authors synthesize the Active Blended Learning Integrated with Self-regulated Learning (ABL-SRL) model for teaching science for grade 8 students. From the content analysis, the authors came up with five teaching steps that could be simply called as MSASA teaching steps: a) Motivation, b) Set goal, c) Active interaction, d) Sharing and e) Assessment. At final, the authors raised one lesson plan as an example of applying the MSASA teaching steps in teaching the topic of Blood circulatory system for grade 8 students. This example may guide other science teachers in creating the teaching being suitable for their students or they can apply the MSASA teaching steps in teaching science or other subjects.

Keywords: Active learning, blended learning, self-regulated learning, science

Introduction

The COVID-19 outbreak in Thailand compelled the government and related agencies to implement a social distancing strategy, which led to the lockdown of public places, including schools (Wittayarungruangsri & Dangchai, 2020). Regulation Issued under Section 9 of the Emergency Decree on Public Administration in Emergency Situations B.E. 2548 (2005) (No. 1), hosted by Thailand's Ministry of Foreign Affairs, was issued after the declaration of an emergency in all areas of Thailand from 26 March 2020 and empowers the Governor of Bangkok and all Provincial Governors to temporarily close places where large numbers of people gather and that are at risk of spreading COVID-19 (Royal Thai Government, 2020).

This policy necessitated an urgent and challenging transition for both private and public schools, which had to reconfigure instruction immediately from face-to-face to online delivery. This rapid shift presented a fundamental challenge to the core mandates of Thai education. The Basic Core Education Curriculum and the National Education Act (Ministry of Education (MOE), 1999) require schools to uphold several critical principles: a) Quality and Equity: Schools must deliver quality education with equity to all learners; b) Learner-Centered Approach (Section 22): Education must prioritize the learner as the most important factor, recognizing that every individual has the ability to learn and develop naturally to their full potential; and Integrated Learning (Section 23): Educational management must emphasize the integration of knowledge, morals, and learning processes appropriate for each level. The design of the learning process must also account for individual differences and promote critical thinking, problem-solving, and desirable virtues. Consequently, a central question arises: How can schools effectively achieve these critical educational goals and fulfill these statutory mandates during the difficult circumstances imposed by the COVID-19 pandemic?

Where the COVID-19 pandemic situation gets better, MOE encourages schools to blend on-line learning with face-to-face learning so called Blended Learning (BL). Among other subjects in the Basic Core Education Curriculum of Thailand, science plays an important role in the present and future society because science is the basis for the development of human resource for the nation, that is, Thai population should be well-rounded developed in all aspects of knowledge seeking, problem solving, rational thinking, and creativity. They should be developed to attain the ability to adapt themselves with the rapidly changing world (Department of Academic Affairs, 2008). Science learning management processes must be designed in compliance with the 21st century skill development. Teachers should be able to organize learning activities that allow students to practice, think, and solve problems. This is an important skill that will help learners reach their full potential (Khammani, 2008).

Since the COVID-19 pandemic, researchers and educators pay more attention to BL with the expectation that it has significant potential to help students learn better in this specific circumstance, particularly during the COVID-19 epidemic. However, on-line learning in BL demands heavily on students' self-regulated learning (SRL), which is one kind of learning that is very hard to cultivate in students. Another difficulty is how to transform BL to be more active through Active Learning (AL). Without careful and professional planning, BL will become active only the face-to-face learning session neglecting active on-line learning. Limited guidance is available in the literature regarding the integration of Active Learning (AL), Blended Learning (BL), and Self-Regulated Learning (SRL) into a unified teaching model. To address this gap, we propose the design of a novel framework, the Active Blended Learning Integrated with Self-regulated Learning (ABL-SRL) Model, for teaching Grade 8 science.

Literature Review

Blended Learning (BL)

Blended learning (BL) integrates online and face-to-face instruction in a carefully balanced ratio, often cited as 30:70 (online: in-person) to maximize flexibility without sacrificing personal interaction (Oliver & Trigwell, 2005). Online components can be delivered synchronously via live video conferencing tools such as Google Meet or asynchronously through learning management systems like Google Classroom or Moodle, where students work at their own pace on teacher-curated materials. Horn and Staker (2012)

identify several blended-learning models including the "rotation" model, in which students periodically switch between online and in-person stations, and the "flex" model, where core instruction occurs online but teachers provide in-person support as needed, which demonstrate how varying the online/in-person ratio can address diverse learner needs. In this study, we adopt a hybrid approach combining simultaneous online sessions (synchronous collaboration and real-time formative assessment) with self-paced online modules (asynchronous exploration, practice, and reflection), alongside traditional classroom activities. This structure not only preserves the benefits of face-to-face interaction (e.g. immediate feedback, peer collaboration, and hands-on manipulatives) but also leverages the adaptive, student-centered affordances of digital platforms to support differentiated pacing and deeper inquiry (Oliver & Trigwell, 2005; Horn & Staker, 2012).

Active Learning (AL)

Active Learning (AL) repositions students at the center of the educational process, engaging them in activities that develop higher-order thinking, problem-solving abilities, and deep understanding rather than passive content absorption. According to Bonwell and Eison (1991), AL environments feature rich teacher–student and peer-to-peer interactions, where learners collaborate to pose questions, analyze problems, and articulate solutions. In such settings, students "learn by doing," practicing communication skills through structured discussions, presentations, and reflective writing exercises that demand attentive listening and clear expression. Crucially, AL encourages learners to construct their own knowledge by integrating new information with prior understanding—whether through case studies, simulations, or problem-based tasks—while the instructor serves as a facilitator who scaffolds exploration rather than delivers lectures. As a result, students typically report increased motivation, positive attitudes toward the subject, and a sense of ownership over their learning. Finally, Bonwell and Eison (1991) emphasize that evaluating AL requires both formative self-assessment by students and summative feedback from instructors, ensuring that learners reflect on their progress and instructors continually refine active strategies for maximal impact.

Self-regulated Learning (SRL)

Self-regulated learning (SRL) is a cornerstone of lifelong education, empowering individuals to take ownership of their learning by setting goals, monitoring progress, and reflecting on outcomes (Knowles, 1975; Skager, 1978). SRL learners begin by identifying their own learning needs and planning personalized strategies, drawing on an accurate appraisal of their abilities and areas for growth (Knowles, 1975; Khamanee, 2009). As Bandura's self-efficacy theory suggests, confidence in one's capacity to learn fosters persistence and resilience, enabling learners to regulate their efforts and adapt when challenges arise (Bandura, 1977). Collaborative elements—such as peer feedback or study groups—also play a role, as socially mediated experiences enrich understanding and sustain motivation (Zimmerman & Martinez-Pons, 1986). Crucially, SRL involves ongoing self-assessment and the flexible transfer of knowledge across contexts, ensuring that skills acquired in one domain can be applied innovatively in another (Pintrich & García, 1991). Openness to new experiences and reflective practice round out this profile, as effective SRL practitioners continuously refine their approaches and embrace emerging opportunities for growth (Khamanee, 2009; Skager, 1978).

A review of the literature demonstrates existing efforts to synthesize two of these three key models: Active Learning (AL) combined with Blended Learning (BL), which is known as Active Blended Learning (ABL); AL integrated with Self-Regulated Learning (SRL); and BL integrated with SRL. The subsequent section details the specific characteristics of each combination.

Active Blended Learning (ABL)

Active blended learning (ABL) has been conceptualized as more than a simple mix of online and face-to-face modes; it requires the intentional design of structured, purposeful activities that engage students in meaningful learning across both environments and can serve as a lever for institutional pedagogical change (Armellini & Padilla Rodríguez, 2021). Empirical work across different disciplines reinforces this view, showing that when blended courses are infused with active methodologies, such as problem-based tasks, projects, and collaborative activities, students report deeper understanding, stronger links between theory and practice, and higher levels of autonomy, commitment, and achievement, although specific techniques tend to support different dimensions of learning (Ortega-Ruipérez & Correa-Gorospe, 2024). In engineering education, for example, integrating online preparation with hands-on laboratories, projects, and in-class problem-solving has been associated with higher achievement, more positive attitudes, and greater perceptions of relevance and interaction compared with more traditional formats, even as instructors must manage increased workload, group dynamics, and technological demands (Vodovozov et al., 2022). Similarly, in a university EFL context, ABL designs that combine digital resources with in-class discussions, collaborative tasks, and reflective activities have been found to enhance engagement, confidence in language use, and perceived learning, provided that active tasks are clearly structured, aligned with assessment, and supported by strong teacher scaffolding (Zhang & Fisher, 2022).

Active SRL

Across recent work on active and flipped learning, self-regulated learning (SRL) emerges as both a central outcome and a design challenge: a systematic review of flipped classrooms shows that pre-class videos, in-class activities, feedback, and digital tools can either scaffold or undermine SRL, depending on how they prompt goal setting, time management, monitoring, and reflection, while also revealing gaps around motivational regulation and inconsistent SRL measurement (Rasheed et al., 2020). Building on such evidence, a later review proposes concrete design principles for embedding SRL supports into each phase of the flipped cycle—before, during, and after class—through structured pre-class tasks, explicit strategy instruction, reflection prompts, timely feedback, and scaffolds for planning and monitoring, with the aim of making students not just active but strategically self-directed learners (Liu et al., 2024). Empirical studies in language learning contexts complement these syntheses: gamified online English courses that integrate points, badges, challenges, and interactive activities have been found to enhance learners' planning, effort regulation, and engagement when game elements are closely aligned with meaningful language tasks, suggesting that gamification can be an effective wrapper for SRL in active online environments (Waluyo et al., 2024). Similarly, research in flipped classrooms shows that students who report stronger SRL (planning, monitoring, effort regulation) and more adaptive motivational strategies tend to achieve higher academic performance, underscoring that flipped designs need to deliberately cultivate both cognitive and motivational dimensions of SRL rather than assuming they will naturally develop in active settings (Jartitngarm, 2025).

BL and SRL

Research on SRL in BL converges on the idea that strategy instruction is generally beneficial but only truly effective when tightly woven into course design and supported by explicit guidance. Systematic reviews show that interventions targeting cognitive, metacognitive, motivational, and resource-management strategies in higher-education BL environments tend to yield positive effects on academic outcomes, yet they also reveal

methodological limitations, short intervention durations, and the central role of teacher guidance and design choices in prompting students to actually deploy SRL strategies in practice (Eggers et al., 2021). A more recent review of SRL strategies in higher education BL further indicates that components such as goal setting, time management, metacognitive monitoring, and motivational regulation are consistently linked to improved performance and engagement, particularly when supports are sustained and embedded in authentic learning tasks, while calling for more rigorous and diverse experimental work (Luo & Zhou, 2024). Regarding qualitative evidence from students' perspectives, BL is experienced as providing autonomy and flexibility but also bringing risks of distraction, procrastination, and overload, leading learners to articulate a need for explicit scaffolds to help them plan, monitor, and regulate their learning across both online and face-to-face spaces, thus casting SRL in BL as a delicate balance between freedom and self-discipline (Lobos et al., 2024). Experimental work with emerging tools like generative AI reinforces this design-dependent view; for example, a guidance-based use of ChatGPT in a blended chemistry course—where students must think and respond before receiving AI hints—has been shown to foster higher SRL, stronger higher-order thinking, and richer collaborative knowledge construction than unrestricted AI use, underscoring that adding technology alone is insufficient and that structured guidance is crucial for leveraging AI as a scaffold for SRL in active blended courses (Lee et al., 2024).

While BL provides flexibility and AL fosters engagement, SRL builds learner autonomy. However, no existing instructional framework effectively synthesizes all three principles into coherent, integrated teaching steps for Grade 8 science. The proposed Active Blended Learning Integrated with Self-regulated Learning (ABL-SRL) Model addresses this gap by systematically integrating AL, BL, and SRL into a novel instructional framework.

Active Blended Learning Integrated with Self-regulated Learning (ABL-SRL) Model

From the literature review, the researchers synthesized the main characteristics of self-guided proactive learning management as shown in Table 1.

Table 1. Summary of the key characteristics of ABL-SRL.

Characteristics of AL	Characteristics of SRL	Characteristics of ABL-SRL
It fosters students' cognitive potential by cultivating higher-order thinking, problem-solving abilities, practical knowledge application, and long-term understanding.	-	**Learning aimed at developing brain potential and advanced thinking**
It's a highly interactive, collaborative learning experience where teachers and students—and students with each other—engage actively, support one another's learning, and maintain disciplined participation.	Learners identify their own learning needs, acknowledge their unique strengths, develop personalized learning plans, and exercise self-regulation.	**Interactive learning and high learning discipline (By recognizing their own learning needs, admitting one's abilities, having a self-learning plan, and self-control)**
Learners engage in independent practice to enhance their communication skills through active listening, speaking, reading, and writing.	-	**Hands-on learning and communication**
It's a learning framework that empowers students to take full ownership of the learning process.	Can learn together with others	**High-engagement learning**
Learners actively construct their own knowledge base.	Able to transfer knowledge	**Learning that focuses on building a body of knowledge**
Learners integrate information comprehensively to construct a coherent knowledge base.	Flexible, open to experience	**Learning that focuses on the integration of data and information**
Learners exhibit positive attitudes toward the subject, demonstrating high motivation and enthusiasm for their studies.	-	**Learning with a positive attitude and active motivation.**
Teachers and students collaboratively establish assessment criteria and participate in evaluating learning progress.	Self-assessment	**Assessment of collaborative learning between teachers and students**
The teacher acts as a facilitator of learning, guiding and supporting student-driven inquiry.	-	**The teacher is the facilitator of learning**

In summary, ABL-SRL consisted of the following nine important characteristics.

1. Learning aims at increasing brain capacity and advanced thinking.
2. Interactive learning and high learning discipline (Acknowledge one's own learning needs, admit one's abilities, develop a self-learning plan, and exercise self-control).
3. Hands-on learning and communication.
4. High engagement learning.
5. Learning that focuses on building a body of knowledge.
6. Learning that focuses on the integration of data and information.

7. Learning with a positive attitude and active motivation.
8. Assessment of collaborative learning between teachers and students.
9. The teacher is the facilitator of learning.

All nine important characteristics of ABL-SRL can be grouped to become the ABL-SRL teaching steps as Table 2.

Table 2. ABL-SRL teaching steps

Characteristics of AL	Characteristics of SRL
7. Learning with a positive attitude and active motivation.	**Motivation:** Present a situation that motivates learners to become more active
6. Learning that focuses on the integration of data and information. 1. Learning aimed at developing brain potential and advanced thinking. 2. Interactive learning and high learning discipline. 3. Learning that emphasizes practice and communication. 4. High engagement learning. 9. Teachers are facilitators of learning.	**Set Goals:** Establish goals and gather information **Active Interaction:** Implement highly interactive cooperative group activities
5. Learning that focuses on creating a body of knowledge	**Share Information:** Share information, communicate, and present knowledge
8. Assessment of collaborative learning between teachers and students.	**Assessment:** Assess learning outcomes

The five teaching steps of ABL-SRL can be simplified by using the initial letter of each teaching step as MSASA. MSASA refers to 1) Motivation, 2) Set goals, 3) Active interaction, 4) Sharing, and 5) Assessment.

Figure 1. MSASA teaching steps of ABL-SRL model

After that, the authors applied the MSASA teaching steps of ABL-SRL to design one lesson plan in the topic of "Circulatory System in Our Body" in science subject for Grade 8 students. The details of this lesson plan are as follows.

According to the Basic Education Core Curriculum B.E. 2551 (revised 2560), the topic of "Circulatory System in Our Body" is situated in Science Learning Area, Strand 1, Standard SC1.1 (Living Things and Life Processes) (Ministry of Education, 2008).

Standard SC1.1 Living Things and Life Processes

Understanding the basic units of living things and the relationships between the structures and functions of various systems in living things, which are interconnected; using investigative processes to seek knowledge; and applying this knowledge in practice and in caring for living things.

Learning Objectives

The learning objectives of this lesson plan are students should be able to: a) describe the structure and function of the heart, blood vessels, and blood; b) describe the function of the circulatory system using a model; and c) design trials and experiments to compare normal and post-activity heart rates.

Learning Activities

The teaching and learning activities in each step of MSASA can be illustrated as follows.

Step 1: M - Motivation (15 min)

A teacher explores students' prior knowledge of circulatory systems by using a pre-test. Students are then asked to discuss human digestion using thought-provoking questions related to the topic will be studied.

Question: How are digested nutrients transported to cells throughout the body?

Expected Answer: Through the circulatory system.

After that, the teacher presents a picture of an express way with many roads connected and a picture of blood vessels in human body. Students are stimulated to compare and contrast both systems.

Figure 1a. Express way with many connected roads
Source:
https://www.yukonlubricants.com/what-is-the-difference-o f -ex pressways /

Figure 1b. Blood vessels in human body
Source:
https://sites.google.com/site/matee47767/rabb-hmunweiyn-leuxd-mnusy/hlxd-leuxd

Then, students are requested to participate in a discussion about the similarities and differences between the transportation system and the circulatory system. The teacher asked students using these questions.

Question: Consider the images of the expressway with connected roads and the blood vessels in human body. What similarities do you notice?

Expected Answer: Roads in the transportation system are interconnected, much like blood vessels in the circulatory system that are connected.

Question: What role does a vehicle play in the road transportation system? What is the analogy in human blood vessels?

Expected Answer: Cars in the transportation system transport goods or food to homes and communities, as well as a sewage disposal system that functions similarly to blood cells in the circulatory system in transporting nutrients, oxygen gas enters the cells and removes waste and carbon dioxide.

Step 2: S - Set Goals (10 min)

The teacher gives each student one piece of Post-it paper (7.5 cm x 7.6 cm) and requests students to divide into groups of four to six. Students are required to write down their learning objectives on their "Post-it" and then the teacher distributes Activity Sheet 1: Group Task for students in each group to write down the learning goals about the circulatory system. Subsequently, the teacher uses the website lnwquiz.com to randomly select the sub-topic of circulatory system for each group of students. The total number of groups was nine.

Topic 1: Heart
Topic 2: Blood
Topic 3: Blood vessels
Topic 4: Red blood cells
Topic 5: White blood cells
Topic 6: Blood platelets
Topic 7: Functioning of the circulatory system
Topic 8: Pulse and blood pressure
Topic 9: Caring for organs in the circulatory system

Students in each group try to complete Worksheet 1: Circulatory System based on the sub-topic they randomly got. Each group of students can bring together the Activity 1: Group Task and plan together to achieve the mentioned learning goals. In completing Worksheet 1, students can explore or seek additional information from appropriate sources such as the websites, a knowledge sheet, textbooks, a library, and so on. The teacher distributes Worksheet 1: Circulatory System for students to apply knowledge gained from their search to complete the worksheet. The teacher provides feedback and supervises students during the learning activity. If students have questions or do not understand something during the activity, the teacher helps by providing clues, hints, guide or clarification.

Step 3: A - Active Interaction (35 min)

Each group of students' brainstorms and collaborates on finding information from Activity 1: Group Task and Worksheet 1: Circulatory System. To ensure collaborative work in group, students must divide and distribute the roles and responsibilities for each member in a group (e.g., "researcher," "recorder," "presenter," "timekeeper"). The teacher distributes reflection worksheet 1 to students so that they can write about what they learned about the circulatory system regarding self-control, working with peers in groups, applying knowledge gained from student performance to student learning, feedback students gain from learning, and applying knowledge in daily life. Then, each group brainstorms to share ideas and knowledge with one another in the group. After finished Worksheet 1: Circulatory System and Activity Sheet 1: Group Task, the teacher requires students to prepare the presentation together and use it to create an infographic to present to classmates. The teacher uses the Gallery Walk technique (walk, watch, exchange, and study) to promote the active presentation of knowledge and experience from learning. Each group sends two presenters to present their findings to their peers within five minutes. Other students take a role as a visitor to visit each group's presentation corner. In addition, the teacher distributes worksheets 2: What Did You Get, so students who take the role as a visitor can give a score for the presentation group during Gallery Walk. After finished each presentation, the

visitors ask questions, discuss, exchange knowledge, and share ideas and record on Worksheet 2.

Step 4: S - Share Information (40 min)

Each groups shares information about their learning with their classmates through the presentation of infographic from the Gallery Walk activity. Students write impressions and suggestions on Post-it paper and then attaching them under the infographic of that group. After that, each student re-visits and exchanges learning from the Gallery Walk and votes anonymously to work on the topic that they think is a good representation of their knowledge and that they can answer and give knowledge about it clearly and easy to understand. The teacher gives classmates an opportunity to ask questions, discuss, and suggest. The Post-it paper and group assessment form are then distributed for students to rate each group's presentation. Students and teachers count the scores and announce the three groups with the top three score. Each group of students complete Activity Sheet 3: Pulse Rate and later summarize knowledge gained from Activity Sheet 3: Pulse Rate. Finally, students bring knowledge gained from all activities to conclude and apply their knowledge to write the answers on circulatory system, draw a diagram of the circulatory system, and then accurately describe its components.

Step 5: A - Assessment (20 min)

Students are required to take a post-test on circulatory system to check whether they gain correct and more understanding about circulatory system or not. In addition, the teacher assesses students' learning from various activity sheets and worksheets completed during the learning process. In peer assessment, the teacher requests each group of students evaluates the presentations of their peers. In authentic assessment, the teacher assesses students' learning through group activities, presentations, and worksheets.

The four-scale scoring rubrics ranging from need improvement to excellent for assessing SRL is shown in Table 3.

Table 3. Scoring rubrics for assessing SRL

SRL dimension	Needs improvement (1)	Developing (2)	Proficient (3)	Excellent (4)
Goal setting & planning	Rarely sets goals; goals are vague or unrelated to the task; does not plan time or steps.	Sets simple goals but they are general or incomplete; has a rough plan but often unrealistic or incomplete.	Sets clear, task-related goals; plans main steps and allocates time reasonably, but may miss some details.	Sets specific, challenging but realistic goals; creates a detailed plan (steps, resources, timeline) and adjusts it when needed.
Use of strategies & resources	Uses few or no learning strategies; relies mainly on copying or guessing; rarely seeks help or resources.	Uses some basic strategies (e.g., rereading) but not always appropriate; occasionally uses resources when prompted.	Selects appropriate strategies (e.g., note-taking, summarizing, practice questions) and uses available resources with some independence.	Flexibly chooses and combines multiple strategies to match task demands; independently seeks and evaluates diverse resources to improve learning.
Monitoring & self-correction	Does not check understanding or	Occasionally checks work but	Regularly checks understanding and	Continuously monitors

	progress; rarely notices errors; waits for teacher to point out problems.	monitoring is superficial; recognises some errors but corrects them inconsistently.	progress during the task; notices most mistakes and attempts to correct them.	understanding and progress; identifies gaps or misconceptions early and takes effective action to correct or improve.
Reflection & motivation regulation	Does not reflect on performance; blames external factors; gives up easily when tasks are difficult.	Reflects only when prompted; comments are general (e.g., "I need to try harder"); effort drops when tasks become challenging.	Reflects on what worked and what did not; identifies a few specific changes for next time; usually persists through difficulty.	Thoughtfully evaluates strategies and outcomes; identifies clear, specific improvements; uses positive self-talk and strategy adjustment to stay motivated a

Discussion

The Active Blended Learning Integrated with Self-regulated Learning (ABL-SRL) model synthesizes core principles of Active Learning (AL), Blended Learning (BL), and Self-regulated Learning (SRL) into a coherent framework for teaching Grade 8 science. AL's emphasis on higher-order thinking, collaborative inquiry, and facilitator-guided exploration underpins the MSASA steps of Motivation, Active Interaction, and Sharing (Bonwell & Eison, 1991). BL's dual delivery of synchronous and asynchronous activities—leveraged through platforms like Google Meet and Google Classroom—provides the structural flexibility that supports self-regulated goal setting and assessment phases (Oliver & Trigwell, 2005; Horn & Staker, 2012). Meanwhile, SRL theory informs the Set Goals and Assessment stages by foregrounding learners' metacognitive planning, monitoring, and reflection processes (Knowles, 1975; Pintrich & García, 1991).

By aligning each MSASA phase with specific pedagogical mechanisms, the model offers concrete guidance for classroom implementation. For instance, the Motivation step taps AL strategies such as real-world analogies and pre-tests to activate curiosity, while the Set Goals phase draws directly on SRL practices—students articulate learning objectives and plan resources (Skager, 1978; Khamanee, 2009). Active Interaction and Sharing phases employ cooperative group tasks and gallery-walk presentations to foster peer-to-peer scaffolding and communication skills (Zimmerman & Martinez-Pons, 1986). Finally, the Assessment step integrates formative self-evaluations and instructor feedback, ensuring that learners both internalize criteria and demonstrate transfer of knowledge (Bonwell & Eison, 1991; Pintrich & García, 1991).

Initial application of the MSASA sequence to the circulatory-system lesson demonstrates its potential to deepen conceptual understanding and sustain engagement. Students moved fluidly between online research, hands-on group activities, and reflective tasks, suggesting that technology-mediated BL can enhance AL interactions when paired with explicit SRL scaffolds (Oliver & Trigwell, 2005; Horn & Staker, 2012). However, effective enactment hinges on teachers' Technological Pedagogical Content Knowledge (TPACK), as they must judiciously select platforms, design prompts, and moderate discussions to balance autonomy with support (Mishra & Koehler, 2006).

Future research should investigate the model's impact on learning outcomes and self-regulation behaviors through quasi-experimental and design-based studies, comparing ABL-SRL against traditional or single-component approaches. Scholars might also examine how TPACK-focused professional development influences fidelity of MSASA implementation, and whether the model generalizes across other science topics and grade levels. By anchoring practice in robust theory and empirical validation, the ABL-SRL model offers a scalable pathway for cultivating 21st-century competencies in diverse learning environments.

Conclusion

This study has articulated the Active Blended Learning–Self-regulated Learning (ABL-SRL) model, operationalized through five coherent MSASA teaching steps: Motivation, Set Goals, Active Interaction, Sharing, and Assessment, that integrate principles of AL, BL, and SRL. By mapping each phase to concrete pedagogical strategies such as real-world analogies to spark curiosity, goal-setting tasks to foster metacognition, collaborative group investigations, gallery-walk presentations, and combined formative and summative evaluations, the model provides teachers with a replicable scaffold for deep, student-centered engagement in Grade 8 science.

In applying MSASA to a lesson on the circulatory system, we demonstrated how synchronous online sessions, self-paced digital modules, and face-to-face interactions can coexist to support learner autonomy and conceptual understanding. Effective enactment will depend on teachers' Technological Pedagogical Content Knowledge (TPACK) to select and adapt platforms, design scaffolded prompts, and moderate peer-to-peer discourse. Institutional investment in professional learning communities, peer-coaching networks, and resource development are critical to sustaining fidelity and fostering a culture of inquiry across subjects.

Looking ahead, the next phase involves fully integrating ABL-SRL into online learning environments and empirically examining its impact on student outcomes, particularly science achievement and self-regulated learning competencies, through quasi-experimental and design-based research designs. By systematically pairing classroom innovation with rigorous evaluation, we aim to refine the model's components for diverse contexts and lay the groundwork for cultivating empowered, lifelong learners who can contribute effectively to Thailand's future human capital development.

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