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Applying The Flipped Classroom Model In Grade 10 Physics Teaching Using Ispring Suite To Develop Students' Self-Study Competence

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Abstract
This study presents the findings of research on the use of iSpring Suite to develop students' self-study competence in Grade 10 Physics teaching through the application of the flipped classroom model. The study employed theoretical research methods to synthesize the theoretical foundations of self-study competence and to establish its components together with assessment criteria across four performance levels. In addition, pedagogical experimentation and student surveys were conducted to evaluate the effectiveness of the proposed teaching process. The results indicate that students' self-study competence improved following the learning intervention. Students also reported that learning with iSpring Suite enhanced their learning autonomy, interaction, and engagement compared with traditional teaching methods. The findings suggest that iSpring Suite is an effective instructional tool for fostering students' self-study competence in Grade 10 Physics teaching.

Keywords: *iSpring Suite; self-study competence; flipped classroom model; Grade 10 Physics.*

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I. Introduction

In the context of digital transformation and educational innovation, the flipped classroom model has been widely recognized as an effective instructional approach that promotes students' self-study competence, critical thinking, and collaborative skills (Bishop & Verleger, 2013; Zainuddin & Perera, 2019). Furthermore, the 2018 General Education Curriculum identifies self-study competence as one of the core general competencies that should be developed in students (Ministry of Education and Training, 2018). In addition, iSpring Suite enables teachers to design interactive e-learning materials by integrating videos, quizzes, and immediate feedback, thereby facilitating students' pre-class self-study activities and enhancing the effectiveness of classroom instruction (Tran Thi Thanh Trang, 2023). However, previous studies have primarily focused either on the application of the flipped classroom model or on the development of e-learning materials as separate approaches, whereas limited attention has been paid to integrating the flipped classroom model with iSpring Suite in high school Physics teaching. Therefore, this study was conducted to apply the flipped classroom model using iSpring Suite in Grade 10 Physics teaching with the aim of developing students' self-study competence.

This study addresses the following research questions:
1. How can the flipped classroom model using iSpring Suite be designed and implemented to develop students' self-study competence?
2. To what extent does the application of the flipped classroom model using iSpring Suite improve students' self-study competence?

II. Methodology

Self-Study Competence
Competence

Competence is regarded as a central concept in educational reform based on the competency-based approach to learners' development. According to the 2018 General Education Curriculum, competence is defined as "an individual's attribute formed and developed through innate qualities as well as learning and training processes, enabling individuals to integrate knowledge, skills, and other personal attributes such as interests, beliefs, and willpower to successfully perform specific activities and achieve desired outcomes under particular conditions" (Ministry of Education and Training, 2018).

Nguyen Cong Khanh and Dao Thi Oanh (2019) defined competence as the ability to master a system of knowledge, skills, and attitudes, and to appropriately integrate and apply these elements in order to successfully accomplish tasks or effectively solve problems encountered in life.

Self-Study Competence

The concept of self-study competence is commonly approached from the perspectives of self-regulated learning and self-directed learning. Zimmerman (1986) defined self-regulated learning as a process in which learners actively initiate, regulate, and sustain their cognitive, motivational, and behavioral processes within specific learning contexts. He argued that no learning environment can, by itself, guarantee effective learning unless learners are able to regulate their own learning activities.

Garrison (1997) further developed this perspective by arguing that self-directed learning involves not only independence in selecting learning content and strategies but also the ability to monitor, regulate, and evaluate one's own learning process. He emphasized that placing excessive emphasis on external influences while overlooking learners' internal self-regulatory capacity may reduce the effectiveness of self-directed learning in educational practice.

Components of Self-Study Competence

Based on a synthesis of previous domestic studies and the requirements of the 2018 General Education Curriculum, Nguyen Hoang Trang (2023) and Ngo Trong Tue et al. (2024) proposed that students' self-study competence can be conceptualized as comprising the following fundamental components:

Table 1. Components and Assessment Criteria for Self-Study Competence

Components of Self-Study Competence	Performance Indicators
1. Identifying Learning Objectives	- Identify the intended learning objectives. - Identify the learning tasks through the iSpring Suite lessons provided by the teacher, including viewing online lessons, conducting virtual or simulation-based experiments, and completing self-study worksheets. - Identify the objectives of each assigned learning task.
2. Planning and Adjusting Learning Plans	- Develop a learning plan and allocate time appropriately for studying theoretical content, practicing Physics problem-solving, and reviewing lessons. - Proactively adjust the learning plan when encountering difficulties in solving Physics problems or learning new content.
3. Implementing the Learning Plan	- Use information technology tools, such as iSpring Suite lessons and online experiments, to complete Physics learning tasks assigned by the teacher. - Solve Physics problems through online activities. - Record self-study outcomes, including theoretical knowledge, problem-solving results, and experimental findings, in the self-study worksheets provided by the teacher.
4. Self-Evaluation and Adjustment	- Evaluate learning outcomes through interactive exercises and feedback provided by iSpring Suite. - Identify personal strengths and areas for improvement in understanding theoretical concepts and solving Physics problems. - Identify the causes of errors, such as misconceptions or inappropriate application of formulas. - Evaluate the effectiveness of self-study through in-class self-assessment activities. - Adjust learning strategies, problem-solving approaches, and the use of technology to enhance the effectiveness of self-study.

The four performance levels of self-study competence are defined as follows:
Level 1: Unable to demonstrate the behaviors described in the assessment criteria for self-study competence.
Level 2: Able to demonstrate the behaviors described in the assessment criteria for self-study competence with support.
Level 3: Able to independently demonstrate the behaviors described in the assessment criteria for self-study competence.
Level 4: Able to consistently and proficiently demonstrate the behaviors described in the assessment criteria for self-study competence.

Accordingly, self-study competence is a multidimensional construct comprising multiple components that collectively reflect the entire learning process, from identifying learning objectives and planning to implementing learning activities, as well as self-evaluation and adjustment. Clearly defining these components provides an important foundation for designing instructional activities, developing assessment instruments, and organizing Physics instruction at the upper secondary school level.

Flipped Classroom Model and Instructional Procedure

According to Bergmann and Sams (2012), the flipped classroom is an instructional model in which students engage with lesson content before class through videos or other learning materials, while class time is devoted to application-oriented activities such as problem-solving, hands-on practice, experiments, and discussions. In this model, the teacher no longer serves as the primary transmitter of knowledge but instead acts as a facilitator, guide, and mentor throughout students' learning process. The flipped classroom model increases opportunities for teacher–student interaction, facilitates personalized learning support, and promotes students' proactivity, responsibility, and self-study competence.

According to Lo and Hew (2017), the flipped classroom instructional procedure consists of two phases: out-of-class learning and in-class learning. During the out-of-class phase, students watch instructional videos and complete online learning activities, enabling them not only to acquire knowledge but also to practice what they have learned and receive immediate feedback, thereby enhancing the effectiveness of self-study at home. However, this approach requires teachers to make substantial efforts in developing parallel instructional materials for both learning phases, while also requiring students to possess sufficient self-study competence and learning habits to complete the assigned out-of-class activities responsibly.

During the in-class phase, instruction is organized around three core activities: a brief review of the pre-class learning content, supplementary instruction on concepts not fully addressed before class, and inquiry-based activities focused on real-world problems. A distinctive feature of this phase is that students are engaged in authentic contexts, through which they progress through four successive processes: activating prior knowledge, observing teacher demonstrations, applying knowledge to investigate the problem, and sharing and discussing their approaches with peers.

Instructional Procedure for the Flipped Classroom Model Supported by iSpring Suite to Develop Students' Self-Study Competence

Based on the instructional procedure proposed by Lo and Hew (2017), the flipped classroom model can be organized into two sequential and closely interconnected phases: out-of-class self-study and interactive in-class learning. Building upon this framework, this study proposes an instructional procedure for implementing the flipped classroom model supported by iSpring Suite to develop students' self-study competence, as illustrated below:

Table 2. Instructional procedure for implementing the flipped classroom model supported by iSpring Suite to develop students' self-study competence

Phase	Activity	Teacher's Role	Students' Activities	iSpring Suite Support
Phase 1. Pre-class self-study	1. Learning orientation and preparation	Introduce the learning objectives, assign learning tasks, design interactive digital learning materials, and guide students in accessing and completing pre-class learning activities.	Access the digital learning materials, identify the learning objectives and assigned tasks, and prepare for self-study.	iSpring Suite is used to develop multimedia learning materials, including instructional videos, interactive content, self-study worksheets, and formative assessments through the Record Video, QuizMaker, and Interaction tools.
	Self-study	Guide students in completing the assigned learning tasks and encourage them to engage in independent learning.	Study the learning materials, watch instructional videos, complete self-study worksheets, take notes, and prepare questions for in-class discussion.	Interactive multimedia lessons developed with iSpring Suite enable students to learn at their own pace.
	3. Self-assessment and feedback	Design formative assessments to evaluate students' understanding before class and identify common learning difficulties.	Complete online quizzes, receive immediate feedback, and identify their strengths and weaknesses in the learning process.	QuizMaker provides automatic scoring, instant feedback, and stores students' learning results.
	4. Learning data analysis and instructional preparation	Analyze students' learning reports, identify misconceptions, and adjust the instructional plan for in-class learning activities.	Complete all assigned pre-class learning tasks within the required timeframe.	Learning analytics and performance reports generated by iSpring Suite support teachers in planning classroom instruction.
Phase 2. Interactive in-class learning	Activity 1. Warm-up and knowledge consolidation	Conduct warm-up activities to stimulate students' interest and organize collaborative groups; answer students' questions; use digital learning materials developed with iSpring Suite to review students' work, clarify misconceptions, and reinforce knowledge through instructional videos or simulation-based demonstrations.	Participate in the warm-up activities, work in groups, compare their answers, ask questions, observe instructional videos or simulations, discuss with peers, and revise misconceptions.	Teachers use electronic lessons, instructional videos, simulations, and interactive questions developed with iSpring Suite to review students' work and reinforce learning.

	Activity 2. Problem exploration and solving	Assign authentic learning tasks, guide and facilitate group discussions, and provide support when necessary.	Analyze the given problems, collaborate with group members, apply prior knowledge, and propose appropriate solutions.	
	Activity 3. Presentation and discussion	Organize group presentations, facilitate classroom discussions, provide feedback, and summarize the key learning points.	Present group findings, exchange ideas, answer questions, engage in peer discussion, and refine their solutions based on feedback from the teacher and classmates.	
	Activity 4. Assessment and self-reflection	Assess students' learning outcomes, collaborative skills, and knowledge application; administer a paper-based formative assessment, provide feedback, and guide students in reflecting on their learning.	Complete the paper-based assessment, evaluate their own learning outcomes, reflect on the learning process, and identify strategies for improvement in future learning.	

The proposed instructional procedure highlights the use of learning analytics generated by iSpring Suite to establish a close connection between the pre-class self-study phase and the interactive in-class learning phase. Based on these learning data, teachers can analyze students' learning outcomes, identify areas in which students experience difficulties, and adjust instructional activities accordingly, thereby supporting the development of students' self-study competence.

III. Results

Participants, instructional content, and data collection

The study was conducted with 39 Grade 10 students from the High School of Education, Can Tho University, during the second semester of the 2025–2026 academic year. The instructional intervention was implemented following the instructional procedure for the flipped classroom model supported by iSpring Suite, as described in Section 2.1.5.

The instructional content consisted of two lessons: (1) *Momentum* and (2) *The Law of Conservation of Momentum*.

To evaluate the development of students' self-study competence, the study employed the self-study competence assessment rubric presented in Table 1. To reflect the diversity of students' academic abilities, purposive sampling was used to select four students representing four achievement levels (excellent, good, average, and low) for an in-depth analysis of changes in their self-study competence throughout the learning process.

Students' self-study competence was assessed using multiple sources of evidence, including learning outcomes recorded in iSpring Suite, students' learning products, classroom participation, responses to the teacher's questions, self-assessment tasks, and interview responses. The use of multiple sources of evidence enhanced the trustworthiness of the self-study competence assessment.

Results of the pedagogical experiment

The teacher implemented the instructional intervention over two consecutive lessons, with each lesson consisting of two classroom periods. Prior to the intervention, students participated in a training session to familiarize themselves with the use of iSpring Suite.

The findings from the four selected students are presented below.

Table 3. Assessment Results of the Self-Study Competence of the Four Selected Students

Components of Self-Study Competence	Performance Indicators	**Self-Study Competence Levels of the Four Selected Students**							
		Student 1		**Student 2**		**Student 3**		**Student 4**	
		9.3/10		8.3/10		6.3/10		4.8/10	
		Lesson 1	Lesson 2	Lesson 1	Lesson 2	Lesson 1	Lesson 2	Lesson 1	Lesson 2
1. Identifying Learning Objectives	- Identify the intended learning objectives.	3	4	3	3	2	3	1	2
	- Identify the learning tasks through the iSpring Suite lessons provided by the teacher, including viewing online lessons, conducting virtual or simulation-based	4	4	3	4	2	2	1	2

	experiments, and completing self-study worksheets.								
	-Identify the objectives of each assigned learning task.	3	4	3	3	2	3	2	2
2. Planning and Adjusting Learning Plans	- Develop a learning plan and allocate time appropriately for studying theoretical content, practicing Physics problem-solving, and reviewing lessons.	3	4	2	3	2	3	2	3
	- Proactively adjust the learning plan when encountering difficulties in solving Physics problems or learning new content.	3	3	3	3	2	2	1	2
3. Implementing the Learning Plan	- Use information technology tools, such as iSpring Suite lessons and online experiments, to complete Physics learning tasks assigned by the teacher.	3	4	3	4	3	2	1	1
	- Solve Physics problems through online activities.	4	3	3	2	2	2	1	2
	- Record self-study outcomes, including theoretical knowledge, problem-solving results, and experimental findings, in the self-study worksheets provided by the teacher.	4	4	3	4	1	3	2	2
4. Self-Evaluation and Adjustment	- Evaluate learning outcomes through interactive exercises and feedback provided by iSpring Suite.	3	3	2	3	3	3	1	1
	- Identify personal strengths and areas for improvement in understanding theoretical concepts and solving Physics problems.	3	4	3	3	2	2	1	2
	- Identify the causes of errors, such as misconceptions or inappropriate application of formulas.	3	4	3	4	1	2	1	2
	- Evaluate the effectiveness of self-study through in-class self-assessment activities.	3	4	3	4	2	3	1	3
	- Adjust learning strategies, problem-solving approaches, and the use of technology to enhance the effectiveness of self-study.	2	4	3	4	2	3	1	3

The assessment results indicate that the self-study competence of all four students showed an overall improvement following the learning process supported by iSpring Suite. This improvement was particularly evident in the components of learning goal setting, learning planning, and self-evaluation and regulation, where most performance indicators were maintained or improved from Lesson 1 to Lesson 2. Notably, the average- and low-achieving students (Students 3 and 4) demonstrated marked progress in indicators related to evaluating their own learning outcomes, identifying the causes of errors, and adjusting their learning strategies.

For the component of implementing the learning plan, several performance indicators received lower scores in Lesson 2 than in Lesson 1. This result can be attributed primarily to the greater complexity of the second lesson, which required higher-order application of knowledge and the integration of multiple learning resources and support tools to complete the assigned tasks. Therefore, the observed changes in scores reflect the increased complexity of the learning tasks rather than a decline in students' self-study competence.

Overall, the assessment results suggest that implementing the flipped classroom model supported by iSpring Suite contributed to the development of students' self-study competence, particularly in the areas of learning goal setting, learning planning, self-evaluation, and regulation of the learning process.

Student 4 did not complete all assigned self-study tasks and learning products in iSpring Suite before attending class. Nevertheless, during the in-class learning activities, the student actively responded to the teacher's questions, completed the self-assessment tasks, and engaged in self-evaluation. Consequently, the teacher obtained sufficient evidence to assess the student's progress according to the performance indicators specified in the self-study competence assessment rubric.

The teacher conducted semi-structured interviews with the four selected students using the same question: "After learning with iSpring Suite, what changes have you experienced in your learning?"

Student 1 (semester Grade Point Average in Physics: 9.3/10; excellent achievement) reported that learning with iSpring Suite brought about several positive changes. The student became more proactive in learning by reviewing lessons at any time, completing practice exercises, and observing virtual experiments, which facilitated a better understanding of the lesson content. In addition, the student reported improvements in self-study competence, particularly in planning and managing learning time, as well as reviewing theoretical knowledge and practicing exercises independently when encountering difficult content. The student also indicated enhanced digital skills and greater interest in learning Physics.

Student 2 (semester Grade Point Average in Physics: 8.3/10; good achievement) stated that learning with iSpring Suite helped shift the student's learning approach from dependence on the teacher to greater autonomy. The student became more capable of managing learning progress independently, thereby improving self-study competence.

Student 3 (semester Grade Point Average in Physics: 6.3/10; average achievement) reported becoming more confident and proactive in learning. The student indicated improvements in using digital technology effectively, searching for information efficiently, and developing self-discipline and creativity. These changes were accompanied by noticeable improvements in learning outcomes.

Student 4 (semester Grade Point Average in Physics: 4.8/10; low achievement) stated that Physics performance had been consistently low during the first semester, with most test scores ranging from 4 to 5 out of 10. However, after learning with iSpring Suite, the student became more motivated to study and made greater efforts to improve learning performance.

The learning products of the four selected students are presented in Appendix B. Although Student 4 demonstrated considerable effort throughout the intervention, the student had not yet developed effective self-study strategies and initially experienced difficulties in using the software. The teacher therefore provided additional guidance during classroom activities. While the student was able to complete the assigned paper-based learning tasks, performance on the iSpring Suite platform remained limited.

Overall, the findings suggest that the use of iSpring Suite contributed to the development of self-study competence for most students. However, the extent of improvement varied among students and appeared to depend on their initial level of self-study competence as well as their degree of engagement in the learning process.

IV. Conclusion And Discussion

Self-study competence is one of the essential competencies that students need to develop for lifelong learning. This study presented the concept of self-study competence and its four components: learning goal setting, learning planning and adjustment, implementing the learning plan, and self-evaluation and regulation. In addition, an instructional procedure consisting of two phases—pre-class learning and in-class learning—was developed based on the flipped classroom model supported by iSpring Suite.

The proposed instructional procedure was implemented in two Grade 10 Physics lessons with 39 students at the High School of Education, Can Tho University, Vietnam. The findings indicate that students showed positive engagement in learning and demonstrated improvements across the components of self-study competence. These results suggest that integrating digital technologies such as iSpring Suite into pre-class learning activities can effectively support students in setting learning goals, planning and managing their learning, studying independently through learning materials and note-taking, and evaluating their own learning outcomes. Such experiences can foster the gradual development of self-study competence and better prepare students for independent learning in subsequent grades.

This study has several limitations. First, the analysis focused primarily on the learning process and performance of four purposively selected students rather than the entire participant group. Second, quantitative evidence, such as the pre-test and post-test results of all 39 students, was not included in this article. Therefore, future studies should involve longer intervention periods and larger sample sizes to provide more robust evidence regarding the effectiveness of the proposed instructional approach. In addition, several students suggested that future learning activities should include a greater variety of practical exercises to better support the development of self-study competence.

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Appendix A. Students receiving training on the use of iSpring Suite

Appendix B. Learning Products of the Four Selected Students