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Critical Thinking in Agricultural Engineering Education: Pedagogical Approaches in the Vietnamese Context

ABSTRACT

While national reforms encourage the integration of critical thinking in Vietnamese universities, limited empirical research guides lecturers at agricultural institutions in how to conceptualise and apply critical thinking to their teaching. This study aimed to gain insight into educational pedagogies that engineering lecturers employed to support their students in improving critical thinking. Utilising a qualitative approach, the researcher conducted six in-depth, semi-structured interviews with lecturers from two programmes at an agricultural university in southern Vietnam. Obtained data, processed through the thematic coding method, revealed that lecturers applied three key pedagogies to foster students' critical thinking: pedagogy for how to think, pedagogy for the enrichment of knowledge, and challenge-based pedagogy. These pedagogies do not simply comprise techniques but also the strategies or principles for their practice. While focused on agricultural engineering education, the study findings offer transferable implications for lecturers across disciplines and policymakers in higher education on how to foster critical thinking through disciplinary reflection and context-based pedagogy. The study also recommends further research involving students' perspectives in order to fully comprehend how learners experience these pedagogies in practice.

KEYWORDS

critical thinking, pedagogical approaches, agricultural engineering education, Vietnamese higher education

INTRODUCTION

With the spread of digitalisation, integrating critical thinking into higher education programmes is increasingly essential. Critical thinking refers to making reflective and purposeful judgements about what to believe or do, which is supported by a set of cognitive skills, for instance, analysis, interpretation, inference, explanation, evaluation, and monitoring and correcting one's own reasoning (Facione 2000). However, critical thinking involves not only a set of skills but also dispositions and a critical spirit. Critical dispositions, such as openness, complexity, reflexivity, dialogue, independence, and agency, stand as tendencies of individuals, whereas critical spirit refers to the ethical and formative thought that guides action, engagement, and behaviour in the real world (Adams and Barnett 2022). The concurrent implementation of these critical domains allows individuals to apply knowledge to new contexts, consider different perspectives, evaluate evidence, and remain willing to change their thinking (Thonney, Joseph, and Montgomery 2019).

In agricultural education, critical thinking can provide significant benefits to students in both learning and post-graduation work. In learning, critical thinking is pivotal for agricultural students as they adapt to a new learning environment, especially in digitally equipped contexts (Hysaj and Hamam 2023). While students in agricultural majors may need a set of critical skills aligned with their

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discipline, the role of critical thinking for them is not different than it is for students from other programmes, as it facilitates the development of abilities, such as analysis, evaluation, and interpretation, in order to improve learning in different contexts (Bellaera, Weinstein-Jones, Ilie, and Baker 2021). In the workplace, critical thinking assists agricultural graduates in managing and solving problems (Indrašienė et al. 2020). As professional environments become increasingly digitalised, critical thinking helps graduates use digital tools effectively and enhances productivity (Daum 2025).

In Vietnam, responding to global digitalisation in 2005, the government initiated significant reforms in higher education to promote market orientation. The first action was Resolution 14/2005/NQ-CP, which guided the renovation of higher education so that it met international standards (Hayden and Le-Nguyen 2020). Subsequently, the government introduced the Education Development Strategy 2011–2020 (Thu Vien Phap Luat 2012) and the Higher Education Qualifications of the Vietnamese Qualification Framework (Thu Vien Phap Luat 2020) to emphasise market-orientated curricula that cultivate both technical and soft skills, with a specific focus on critical thinking. These policies guided higher institutions, including agricultural universities nationwide, to reform the curricula, teaching pedagogies, and facilities so that they support students in accumulating essential skills for both learning effectiveness and employability (Tho 2016). Of these skills, cultivating students' critical thinking is one key focus of the reform agendas (Nhat, Lien, Tinh, Hang, and Trang 2018).

In response to government directives, Vietnamese higher education institutions, including agricultural universities, have made efforts to incorporate critical thinking into their curricula and teaching practices. As Kieu (2023) remarked, critical thinking is a core teaching objective in Vietnam's agricultural universities, and lecturers serve as the central figures in the development of critical thinking among students (182–87). However, significant challenges remain. As explored by Behar-Horenstein and Niu (2011), the enhancement of critical thinking among students has a significant relationship to the pedagogical strategies and techniques that lecturers apply. Hence, well-managed pedagogies could lead to the improvement of critical thinking among students. Nonetheless, many lecturers in agricultural institutions currently rely on inadequate teaching strategies. This situation originates from insufficient guidance for university lecturers on how to design effective pedagogies to foster students' critical thinking (Van-Le and Chong 2024). As a result, graduates often demonstrate weak critical thinking (Bosma, Phung, Le, Ngo, Tran, Pham, and Wals 2016).

To further elaborate, existing literature demonstrates the lack of guidance for Vietnamese lecturers in agricultural institutions to formulate the disciplinary and contextual teaching pedagogies that support students in developing critical thinking. Discipline-relevant understanding of what critical thinking entails is crucial for lecturers to construct suitable pedagogies (Tan 2017). Additionally, students from different cultural contexts may demonstrate critical thinking in unique ways (Lun, Fischer, and Ward 2010). Hence, a pedagogical approach developed in one cultural context may not always be transferable across cultures (Schendel, McCowan, Rolleston, Adu-Yeboah, Omingo, and Tabulawa 2020). This underscores the need for lecturers in Vietnamese agricultural engineering education to conceptualise and implement their own pedagogies that effectively support students' critical thinking in both disciplinary and cultural contexts. Thus, further studies addressing these gaps would be beneficial to provide the knowledge needed to design effective pedagogies that support students' critical thinking to lecturers in agricultural institutions in Vietnam.

For those reasons, the study aimed to discover insights into the teaching pedagogies of lecturers from agricultural engineering education in Vietnam. Particularly, the study explored how agricultural engineering lecturers conceptualise and implement pedagogical approaches that bolster critical thinking in ways suited to the agricultural discipline and cultural context of Vietnam, as

recommended by Duncan, Haas, and Ricketts (2016). To support the research design and implementation, one research question guided this study:

What are the teaching pedagogies that lecturers from agricultural engineering education in an agricultural university in Vietnam employ to foster critical thinking in students culturally and disciplinarily?

By exploring how agricultural engineering lecturers develop and implement teaching practices that foster critical thinking, this study highlights how disciplinary and institutional contexts influence teaching and learning effectiveness. The findings of this study align with the first Grand Challenge promoted by the scholarship of teaching and learning (SoTL), which promotes strategies to cultivate critical thinking in distinct higher education contexts (Scharff et al. 2023). Also, using Vietnamese context, the study illustrates practical ways to nurture critical thinking. These insights contribute to existing literature on fostering critical thinking across different cultural contexts, aligning with one of the important goals of SoTL (Chng, Mårtensson, and Leibowitz 2020).

LITERATURE REVIEW

This section reviews a number of previous research studies in order to present the theoretical perspectives of the key domains of this study. The three main domains are: (1) concepts of critical thinking, (2) devices for teaching pedagogies for critical thinking, and (3) cultural and disciplinary considerations in constructing pedagogies for critical thinking.

Concepts of critical thinking

Critical thinking is conceptualised in various ways. According to Facione (1990), critical thinking comprises a set of cognitive skills, such as analysing, interpreting, inferring, explaining, evaluating, monitoring, and correcting one's reasoning. These cognitive skills can be developed through lecturers' guidance, which helps extend individuals' ability to think critically (Facione 2000). Critical thinking, by its nature, consists not only of cognitive skills but also critical dispositions and a critical spirit. In other words, cognitive skills alone do not constitute critical thinking; it also includes attitudinal orientation, which shapes how individuals engage in critical thinking, and the ethical or moral orientation, which guides its application with fairness, reasoning, and judgement (Facione 2000). Within this concept, the critical dispositions, including openness, complexity, reflexivity, dialogue, autonomy, and agency, represent attitudinal tendencies of thought, while critical spirit is the ethical and formative orientation towards the real-world practice (Adams et al. 2022). When applying critical thinking, individuals first draw on dispositions as attitudinal habits, followed by critical spirit as an ethical orientation, before engaging cognitive skills in practice.

Devices for teaching pedagogies for critical thinking

Teaching pedagogy refers to the teaching approach employed by lecturers to facilitate students' acquisition of knowledge, skills, and attitudes. It is a complex and multifaceted process that supports students' engagement and success in learning (Loughran 2013). Loughran identified three essential criteria that a pedagogy must embody: making students aware of their learning, helping them gain valuable experiences, and allowing them to apply knowledge and skills in real contexts. In fostering critical thinking, a pedagogy must not only include these elements but also build the connection between lecturers' strategies and students' engagement (Song 2016). Accordingly, a pedagogy supporting students' critical thinking should convey explicit strategy from lecturers on how to employ suitable techniques, and students should be positioned as active agents, as critical thinking cannot be developed through memorisation alone. Additionally, a well-integrated critical thinking

pedagogy should equip students with the cognitive skills, the dispositions, and the moral orientation that motivate students to think critically (Andreucci-Annunziata, Riedemann, Cortés, Mellado, del Río, and Vega-Muñoz 2023; Holma 2015).

Cultural and disciplinary consideration in constructing pedagogies for critical thinking

A growing number of studies recommend that a pedagogy should be neither transferable across cultural norms nor uniformly applicable across disciplines. Firstly, cultural context plays an important role in designing pedagogical approaches. As Tan (2017) presented, pedagogical approaches that are effective in one sociocultural context may produce different results in another. For example, although problem-based learning is widely effective in fostering critical thinking, Schendel et al. (2020) found that it had limited effectiveness in some African contexts. This highlights the need for lecturers to adopt or design contextually appropriate pedagogies that are consistent with students' cultural norms. Secondly, the designation of pedagogical approaches must take into account the nature of the learning discipline. As Moore (2011) pointed out, the development of critical thinking varies and is substantially influenced by the epistemology of disciplines. In this regard, the same pedagogical approaches implemented in distinct courses or learning programmes may result in different outcomes. For instance, in the sciences, which demand objectivity and empirical evidence, critical thinking centres on analysing and evaluating hypotheses and assumptions (Forawi 2016), whereas in history, critical thinking emphasizes explaining events by collecting information to answer how, what, and why questions (Moore 2011).

In Vietnam, where the traditional Confucian education system emphasizes respect for authority, rote learning, and exam outcomes (Ho, Martinsson, and Olsson 2022), bolstering students' critical thinking requires culturally responsive pedagogy. Although not always an explicit objective, integrating critical thinking into teaching techniques is urgently needed. The strategies for integration of critical thinking into pedagogies should reflect cultural norms and disciplinary contexts to effectively foster students' critical thinking. Nonetheless, existing literature lacks guidance for lecturers on how to design pedagogies that meet these needs. This is evident in Vietnam, especially in agricultural education. Therefore, it's crucial to understand how Vietnamese agricultural lecturers develop pedagogical approaches that foster critical thinking within their students' cultural and institutional realities.

METHODOLOGY

Research approach

The present study utilised a basic qualitative approach. According to Teherani, Martimianakis, Stenfors-Hayes, Wadhwa, and Varpio (2015), basic qualitative design offers undeniable advantages for exploring complex phenomena within natural settings and allows researchers to gain rich and contextual understanding of participants' experiences. Particularly, it emerges as one of the effective approaches for gaining insights into lecturers' experiences within their teaching contexts (Goodson and Walker 1988).

Research location

The researcher conducted this study at an agricultural university located in southern Vietnam. This university is recognised for aligning curricula and teaching methods with national innovation strategies to meet market demands. Currently, this university offers 30 programmes across 15 faculties, including the faculty of agronomy and the faculty of fisheries. The bachelor of science in

agronomy programme is housed within the faculty of agronomy, while the aquaculture-seafood science programme is under the purview of the faculty of fisheries.

Research instrument

The current study employed semi-structured interviews to capture participants' perspectives and interpret the deeper meanings behind their experiences while maintaining limited control over responses (McIntosh and Morse 2015). Thus, the researcher deemed this instrument highly suitable for this study, which aimed to gain in-depth insights from participants on integrating critical thinking into teaching pedagogies.

Research participants

The researcher selected potential participants via purposive sampling. The researcher distributed a set of criteria, based on guidance from Gentles, Charles, Ploeg, and McKibbon (2015), to potential candidates in order to reach the most qualified participants. Thus, qualified participants should satisfy these two criteria: (1) Having an explicit understanding of critical thinking skills. This criterion sets the expectation that the participants adequately understand the characteristics and dispositions of critical thinking; (2) Having at least three years' experience in teaching critical thinking to students.

Lecturers received a critical thinking checklist (Community Tool Box n.d.; see Appendix A), which was created by the University of Kansas, to ensure that they meet the criteria. The checklist contains four key theme questions: What is critical thinking? Why is critical thinking important? Who can (and should) learn to think critically? And how do you help people learn to think critically? The researcher compared responses to the original list to check their alignment with key concepts of critical thinking. This process helped confirm that the six lecturers (five males, one female) met the criteria of the study.

Table 1. The demographic information of participants

Participants	Programmes	Genders	Teaching experience
A1	Agronomy	Male	20 years
A2	Agronomy	Female	10 years
A3	Agronomy	Male	12 years
F1	Aquaculture-seafood	Male	26 years
F2	Aquaculture-seafood	Male	20 years
F3	Aquaculture-seafood	Male	18 years

Note: A1, A2, and A3 are lecturers from Agronomy, while F1, F2, and F3 are lecturers in aquaculture-seafood science.

Although six participants is a small sample size, it was sufficient to ensure the credibility of the data. The employment of in-depth semi-structured interviews allowed the researcher to dig deeply into the learning context as well as participants' perspectives (Gentles et al. 2015). Moreover, the researcher selected participants through purposive technique with clearly established criteria, particularly through a critical thinking checklist. The critical thinking checklist ensured that participants had a clear understanding of critical thinking and adequate experience fostering it. To meet the established criteria, the researcher checked that participants' expertise aligned with the current study.

Procedure of data collection

After receiving approval from Chiang Mai University Research Ethics on November 14, 2021, the researcher sent invitation letters to three faculties within the university: faculty of agronomy, faculty of fisheries, and faculty of food science and technology. These letters outlined the study's objectives and participant selection criteria. By January 2022, researchers had all the replies from the heads of three faculties. The head of the faculty of food science and technology declined to join the study, whereas the heads of the faculties of agronomy and fisheries agreed to participate. Each faculty sent a list of five participants to the researchers. By mid-January 2022, researchers had sent the critical thinking checklist and informed consent form to these ten candidates. However, only six faculty members met the established criteria. Three were from the science in agronomy programme, and the others were from the aquaculture-seafood science programme. Their teaching experience varied from 10 to 26 years. Due to the COVID pandemic, the researcher conducted the interviews online via the Zoom platform. Each interview lasted about 55 to 65 minutes and was recorded. The researcher took notes during the interviews as well. The first interview took place on February 5, 2022, and the last interview was completed by the end of March 2022.

Data analysis

The researcher first transcribed the interviews in Vietnamese and then translated them into English. They analysed the transcripts using thematic analysis, aided by the framework suggested by Braun and Clarke (2006). Accordingly, the analysis followed six steps: (1) acquainting oneself with the data, (2) generating preliminary codes, (3) looking for themes, (4) going over the themes, (5) clarifying the themes, and (6) reporting the findings.

The coding started with a line-by-line reading of the first transcript. The researcher highlighted the phrases and sentences relevant to the research question with descriptive codes, for example, "students' debate," "learning from experts' speeches," and "feedback as a form of question to raise CT." These codes were then grouped into broader categories that reflect pedagogical strategies. After coding the first transcript, a codebook was developed from established codes and used as the framework to code subsequent transcripts.

The researcher employed the MAXQDA version 2021 as an auxiliary tool to improve coding performance. Themes were perceived as "established" when the research consistently observed them across multiple interviews and when rich narrative evidence supported them. The project achieved thematic saturation when no new themes emerged after coding the fifth transcript. Coding the final transcript confirmed the rigour of data analysis and indicated that the thematic structure was sufficient to address the study's research questions. After coding all remaining transcripts, the researcher doubled-checked codes to ensure they were correctly placed under the appropriate categories. In this process, they removed any irrelevant phrases in the codes.

To ensure the credibility of the coding outcomes, the researcher sent the established thematic structure to two experts, the researcher's supervisor and co-supervisor at Chiang Mai University, for thorough review. Their feedback led to clarification of theme boundaries. Finally, the researcher used the revised structure as the analytical framework to interpret the findings. For the sake of consistency and transparency, the themes presented in the findings section correspond directly to those developed in this analysis. The researcher carefully maintained the link between analysis and interpretation throughout.

FINDINGS

The obtained data revealed three major themes, which are the key pedagogies that lecturers used to support students in improving critical thinking. Those themes are how to think, enrichment of knowledge, and challenge-based pedagogy. These themes are grounded in participants' narratives and reflect how lecturers implemented and enacted their pedagogies to foster critical thinking within the agricultural discipline and cultural norms of Vietnam.

Table 2. Sample of the themes, subthemes and codes to draw up the findings

Themes	Subthemes	Codes	Quotations
Pedagogies for how to think	Using questions	Using questions for CT students' debate	"I like to ask questions . . . Students have to think, analyse, and analyse . . ." "I let them debate . . . this process allows them to evaluate and reflect."
	Teamwork	Arranging students in groups	"I put students into groups . . . they solve problems through interaction and express their opinions openly . . ."
		Extending discussion on social media platforms	"I also use digital platforms such as Zalo and Facebook for group discussions . . ."
		Benefits of collaborative work	"They use their own thinking to evaluate and reflect on others' answers . . ." "Students exchange ideas . . . they not only develop critical thinking skills but also reduce their shyness . . ."
	Giving feedback	Navigating students with feedback	"I give feedback not to give answers but to guide their thinking . . ."
		Feedback as a form of question	"Feedback is in the form of a question to raise students . . ."
Pedagogy for the enrichment of knowledge	Importance of knowledge	Knowledge assist to improve CT	"I think students encounter problems in CT as they lack knowledge . . ."
		Broaden logical and reasoning ability	". . . a certain knowledge related to the field of their studies, they have more information to draw logical and reasonable . . ."
	Engaging in seminars and workshops	Learning from experts' speeches	". . . workshop or seminars help enrich their knowledge and critical thinking skills . . ."
		Summarizing what they learn	"I ask students to write reports and present their ideas . . ."

	Reading and writing for CT	Engaging in reading articles Summarizing the ideas and arguments in writing. Writing for broadening perspectives.	"Every week, reading materials are shared online for students to summarise . . ." "Students need to summarise to understand the content . . ." ". . . helps them organise their ideas critically and logically . . ." "Writing helps them think critically and understand different perspectives . . ."
	Engaging in field-trips	Understanding real demands Linking theories and reality.	". . . field trips provide students with practical knowledge . . ." "Building actual understanding by combining classroom theory with real working nature . . ."
Challenge-based pedagogy	Engaging in competitions	Kinds of competitions. Altering competition tasks as classroom assessments. Competitions' activities for CT. Support from lecturers as supervisors.	"I encourage students to participate in startups or IT competitions . . . organised by university . . ." "Those who join the competitions can submit their competitive works instead of assignments as other students . . . ." "Competitions provide a great opportunity to develop CT in a number of activities . . ." "Students are closely supervised during competitions . . . ensuring students get on the right track of their work . . ."
	Challenge-based tasks	Giving challenging tasks as choices. Openness to get out limits for CT.	"I offer two options . . . second option is an open-ended question to stimulate deeper thinking . . ." ". . . second option is not a demand but students select it based on their interest and openness . . ." "Not all students . . . only those who manage their time well and are interested to participate . . ."
	Limits of the pedagogy	Depending on students' will and traits	

Note: CT is an abbreviation for critical thinking.

Pedagogy for how to think

This pedagogy reflects lecturers' strategies for helping students get used to critical thinking through experience. Within this pedagogy, the interviewees used three teaching approaches: using questions, using teamwork, and feedback.

Using questions

Lecturers' preferred techniques to promote students' critical thinking included asking questions. Utilising this technique, lecturers posed questions rooted in either real learning problems or theoretical problems in order to prompt students to use their cognitive thinking skills, such as

analysing, interpreting, and inferencing, which are crucial to assist them to address the problems effectively.

> Recently, we have been required to apply active teaching methods that get students more involved in learning activities compared to traditional methods, and I prefer to ask questions of the students. By using this method, students have to think, browse for information, and analyse questions and information . . . (A3)

Through this technique, interviewees also encouraged students to engage in debating about each other's ideas and concepts. This enabled students to expand their critical thinking by evaluating and reflecting on others' ideas before correcting their own thoughts.

> I allow students not only to answer my questions directly but also to engage in arguing and debating each other's ideas and concepts . . . this encourages them to evaluate and reflect on others' answers, using their own thinking before coming up with reasoning and logical solutions to learning issues . . . (F2)

Using teamwork

Lecturers also preferred to use teamwork in order to bolster students' ability to think critically. They divided students into groups and assigned specific topics. Students engaged in discussions for about 15–30 minutes before presenting their solutions in public. This technique motivated students to use evaluation and analysis skills to figure out the problems and to utilise inference skills to propose possible solutions. Additionally, this method also encouraged less confident students to overcome shyness to interact with others.

> I often put students into groups and assign each group a specific topic. Students have to interact with each other to figure out problems as well as solutions for about 15 to 30 minutes before presenting in public. This collaborative approach allows students not only to develop various critical thinking skills through the exchange of each other's ideas but also to overcome shyness . . . (A1)

Lecturers not only implemented teamwork in the classroom but also leveraged social media platforms, such as Zalo and Facebook, to facilitate idea exchange among students.

> To increase interaction among students and to facilitate idea exchange, I also utilise digital platform, like Zalo and Facebook for group discussion . . . (F1)

Providing feedback

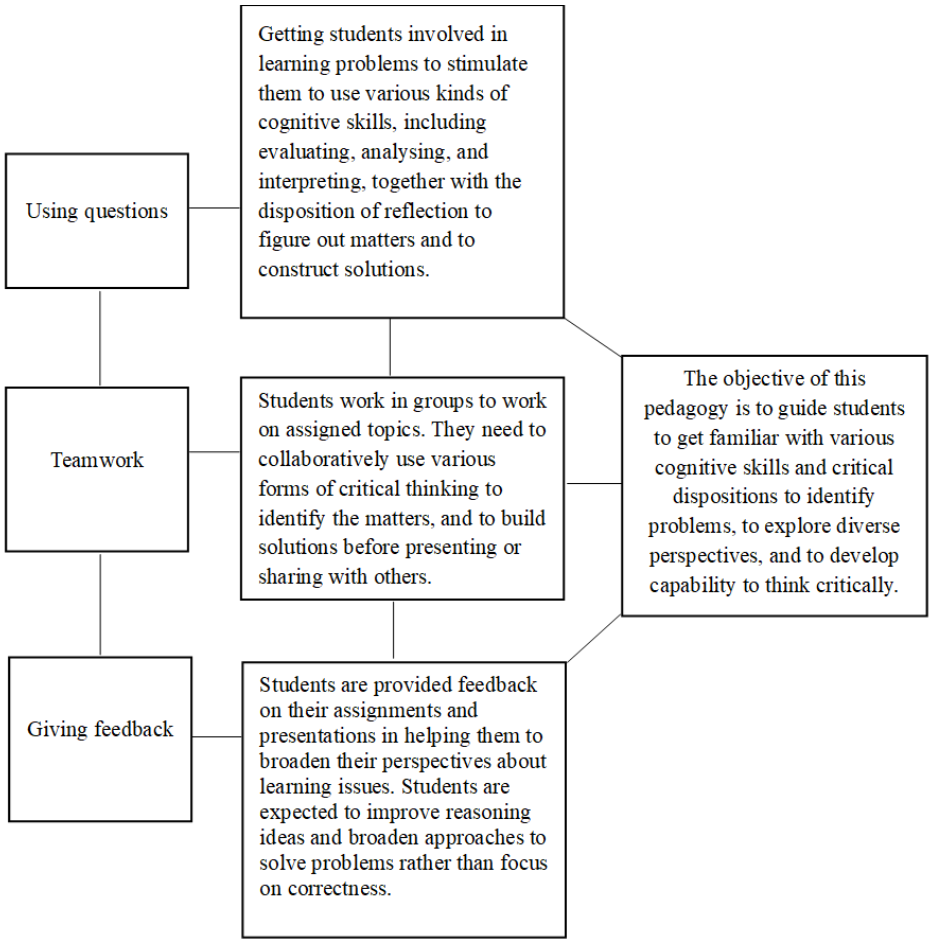
Lecturers also highlighted the use of feedback as an effective way to assist students in thinking critically. With this method, lecturers provided feedback to students based on their presentation work and completed homework tasks. This enabled students to reflect on what they had done and on lecturers' recommendations before making self-corrections.

> To enhance their critical thinking, I give instructions that encourage students to explore multiple approaches to solving problems, broadening their horizons and helping them develop diverse perspectives . . . (F3)

The lecturers avoided giving direct answers about right or wrong but instead provided case-by-case feedback to support students in concurrently monitoring and correcting their work. This support enabled students to delve into multiple aspects of learning issues.

> To foster the development of critical thinking skills, I make it a point to offer feedback to my students on their assignments. Instead of solely focusing on the accuracy of their work, I collaborate with them to enhance their ideas and thought processes . . . (A2)

Figure 1. Portfolio of pedagogy for how to think for improving students' critical thinking



Note: Figure 1 illustrates the strategies and techniques that lecturers implemented within the pedagogy of how to think to improve students' critical thinking. Questions are used to engage students in learning problems, prompting them to analyse, evaluate, and interpret the information. Teamwork encourages collaborative learning, allowing students to discuss, reflect, and construct arguments together. Feedback focuses on guiding reasoning rather than correctness, supporting students in refining their critical thought. These approaches together help students to get used to various cognitive skills, critical dispositions, and critical spirit through active and reflective learning.

Pedagogy for the enrichment of knowledge

Lecturers perceived a lack of foundational knowledge as the main barrier to developing students' critical thinking. To address this, lecturers employed various activities, including attending

seminars or workshops, engaging in writing and reading, and participating in field trips, in order to help students expand their knowledge, which they believed would enhance critical thinking skills.

Getting students involved in seminars or workshops

Lecturers highly appreciated the value of seminars and workshops in promoting critical thinking. They argued that by engaging in these activities, students are expected to open their minds, pay attention, and engage in reflection to enhance knowledge, which acts as a foundation for improved critical thinking.

> I regularly took students to seminars or workshops at least twice per semester and required them to submit a report or summary of their learning. This not only encouraged students to pay attention and be mindful of what they were exposed to, but it also helped enrich their knowledge and critical thinking skills . . . (F1)

To make this method effective, lecturers encouraged students to summarise and present in the class what they learned from these academic events.

> To ensure students to pay attention at seminars or workshops, I encourage students to write reports on what they learned, and motivate them to present their ideas in class . . . (A2)

Reading and writing

Lecturers in the study often encouraged students into reading and writing in order to strengthen their critical thinking skills. To facilitate this approach, lecturers shared instructional materials for upcoming lessons through social media platforms, for instance Facebook and Zalo. They shared materials that aligned with topics for the next class weekly.

> I use social media, like Facebook and Zalo, to share weekly reading materials, and then students need to summarise to understand their contents in preparation for the next class . . . (F1)

Instructors also required students to write a summary of each reading material. This activity was intended to help students better retain what they read. Through this dual-faceted activity, lecturers viewed that students could boost their knowledge, which in turn enhanced their ability to reason about learning matters.

> I require students to summarise what they gain from reading materials in writing assignments. I believe writing is the best way to help them remember what they read longer and is sufficient to assist them in being critical and reasonable in arranging ideas in writing . . . (A3)

Field-trips

Lecturers emphasised that participation in field trips was a powerful method to bolster students' critical thinking by developing knowledge of real-working contexts. Field trips conducted by lecturers typically involved visits to large engineering or agricultural product corporations within the city. Lecturers witnessed that by participating in field trips, students could cultivate fundamental

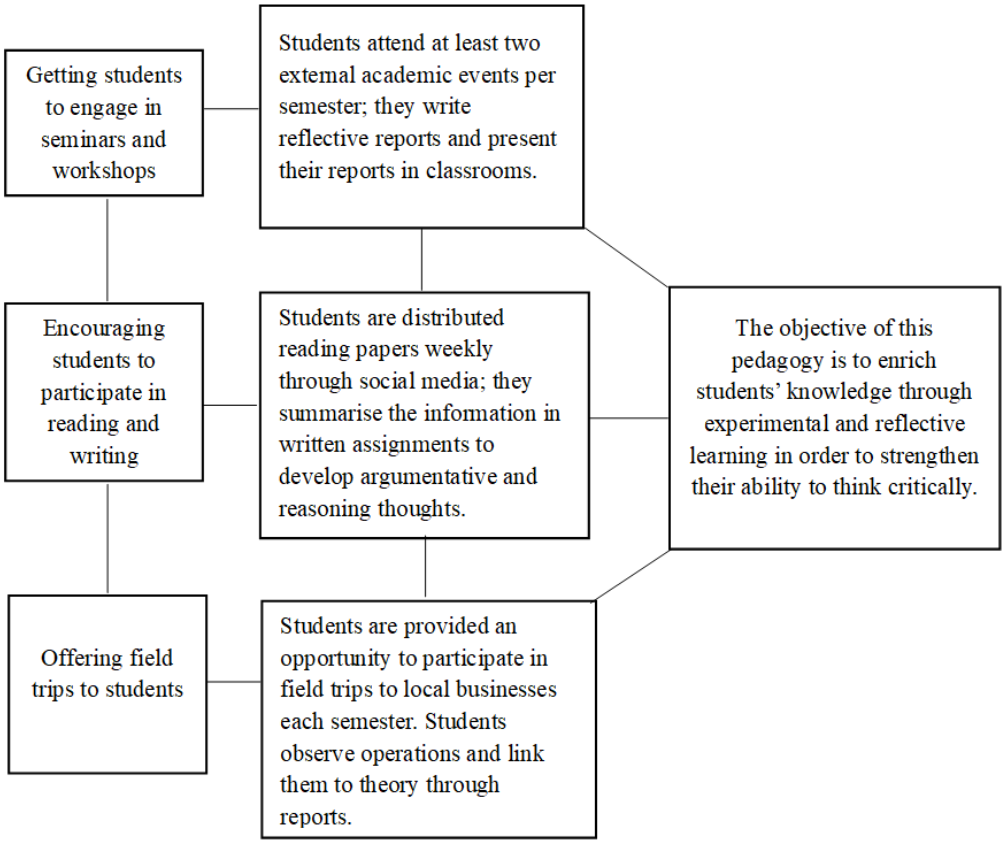
knowledge relevant to their field. To reinforce engagement, students wrote reports summarising their learning experiences.

> I organise field trips each semester to help my students gain practical exposure and develop a deeper understanding of their educational programmes. The companies we visit are usually large corporations related to the students' educational programmes. To ensure maximum benefit, I link the company's business characteristics to the learners' educational programme. As a crucial component of the learning process, I require students to write reports summarising their experiences during the field trips. I have observed that field trips provide students with practical knowledge, enabling them to be more reflective and critical in comparing theoretical concepts and real-world applications . . . (A3)

Lecturers perceived that observing real working nature allows students to reflect on their experiences and bridged the gap between theory and real working inquiry, enabling them to form an actual understanding of the field.

> By reflecting on the connections between practical experience and theoretical concepts, they can build up actual understanding of their field, which is helpful to them in thinking critically to solve the problems . . . (F2).

Figure 2. Portfolio of pedagogy for enrichment of knowledge to increase students' critical thinking



Challenge-based pedagogy

Lecturers also stimulated students to participate in challenging activities, including competitions and challenging tasks, as one of the pedagogical approaches to help students improve their critical thinking. Instructors designed these challenges to push students beyond their usual learning, requiring them to use various forms of critical thinking to solve problems and construct solutions.

Limitation of this technique

This approach involves students engaging in competitions and challenging assignments. However, the lecturers perceived that this method might not suit all students. Thus, lecturers said that they used this pedagogy to assist students who could manage their time and were willing to take on challenges.

> Although I do encourage students to engage in competitions and challenging tasks, I do not think all students will benefit from this approach. I witnessed that only a few students can manage their time and have an interest in getting involved in challenging tasks or competitions. I cannot require all students to participate, as I am not allowed to do so . . . (F2)

When using this pedagogy, lecturers did not demand students win prizes but instead used competitions and challenging tasks as opportunities for students to improve both knowledge and critical thinking.

> To use competition as part of pedagogy, I did not focus on having students win the prize. Instead, I aimed to challenge them to develop their knowledge and thinking skills . . . (F3)

Encourage students to join the competitions

Lecturers often motivated students to join competitions, such as startup and IT contests, which were organised by faculties or at the university level. Lecturers considered activities, such as preparing and defending proposals, crucial for the development of a number of cognitive critical skills. Moreover, during competitions, students worked with lecturers as project supervisors. This collaboration enhanced their reflective ability, a critical disposition that guides them in applying cognitive skills when preparing and defending proposals.

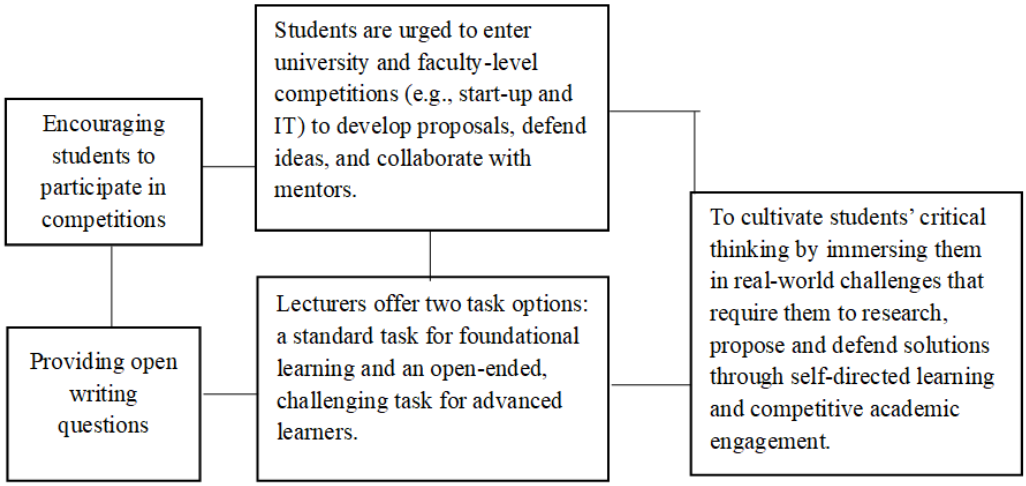
> I urge students to participate in competitions, especially the start-up competition held annually by the university or the IT competition organised by our faculty. Participating in these competitions is a great opportunity for students to develop critical thinking, as they receive great support from us. I notice that students who participate in these competitions significantly improve their critical thinking compared to others. During competitions, students have to create and defend proposal. These activities require students to use various skills to search for information, identify the learning issue, gather theories to support their arguments, and defend their proposals . . . (A1)

Having students participate in challenging tasks

Lecturers preferred to give students two choices for weekly assignments. They designed the first choice for all students and with the aim to check that students retained what they studied in class. The second, a challenging open-ended question, helped students gain a deeper understanding of the subject matter by applying various cognitive skills within critical thinking to address learning tasks.

> One option is to provide students with challenging questions, and if they are not ready, they can choose other options. I believe that by participating in challenging tasks, students are pushed beyond their limits to deepen their critical thinking . . . (F1)

Figure 3. Portfolio of challenge-based pedagogy for improving students' critical thinking



Note: Figure 3 illustrates the strategies and techniques to improve students' critical thinking within challenge-based pedagogy. The pedagogy includes two techniques: participating in competitions and doing challenging tasks, which are mostly open-ended questions. Both techniques aim to push students beyond their limits to improve critical thinking.

DISCUSSION

This study shed light on the pedagogies that foster critical thinking in agricultural universities in Vietnam. The use of the qualitative approach captured various facets of the pedagogies devised by agricultural lecturers (Ulmer, Kuby, and Christ 2020). The pedagogies were approaches in which students gradually developed skills through interactive engagement between lecturers and students, rather than a purely technical transmission of knowledge (Gray 2025). The pedagogies employed by lecturers not only involved students' cognitive skills but also their dispositions and ethical orientation (Andreucci-Annunziata et al. 2023; Holma 2015).

The pedagogy for how to think reflects lecturers' intentional efforts to introduce foundational critical thinking to students through structured questions, teamwork, and feedback, which have been used in social sciences, such as business, and English, to enhance students' critical thinking (Snyder and Snyder 2008; Zou, Xie, and Wang 2023). According to Snyder et al. (2008), the use of questions raises students' critical disposition of autonomy, dialogue, and agency, helping them to be active, independent, and central in learning. These dispositions form the basis to utilise cognitive skills, such as analysing and interpreting, in order to understand learning matters before applying inferencing skills to develop solutions. Also, through peer debates, students can learn from others through reflection, and this enables students to be active in evaluation and self-correction skills, which are

defined as core cognitive skills (Facione 1990). Furthermore, lecturers also broadened students' critical thinking by putting them in groups to share ideas with one another. Teamwork, whether organised in the classrooms or via digital platforms, such as Zalo and Facebook, not only fosters students' cognitive skills, including evaluation, analysis, and inference or reorganisation of information (Agbi and Yuangsoi 2022), but also exposes students to the use of critical dispositions. Through collaborative work, students become more independent in dialogue and reflection, two key critical dispositions (Adams et al. 2022). Furthermore, when using feedback to enhance critical thinking, lecturers gave clues and information that guided students on how to solve learning issues. This method significantly enhances students' cognitive engagement while also fostering the development of various critical dispositions (Zou et al. 2023). As stated in the findings, feedback helps students to broaden their perspectives for reasoning ideas, and this comes to be critical spirit, as categorised by Adams et al. (2022).

Using the pedagogy for enrichment of knowledge, lecturers considered that knowledge relevant to the field of agricultural education is pivotal for students to think critically (Halpern 2022). Hence, the techniques within this pedagogy bolster students' knowledge surrounding agricultural education. One key technique within this pedagogy is to engage students in seminars and workshops. This method assists students in enriching knowledge through the openness and reflection, which are the critical dispositions stated in the framework of Adams et al. (2022). On the other hand, getting students to read and write helps them infer concepts and evaluate theories (Çavdar and Doe 2012; Tung and Chang 2009). The more students engage in writing and reading activities, the more they employ the disposition of openness and reflection in order to broaden their knowledge-based learning disciplines (Yanchar, Slife, and Warne 2008). In addition, lecturers recruited students to participate in the field trips, and their strategy aligns with the findings of Kisida, Bowen, and Greene (2016), These trips provided opportunities for students to apply a number of cognitive skills, including interpreting, evaluating, and reasoning, in order to compare visual and contextual information to classroom theories. This comparison requires students to apply dispositions of reflection and autonomy, as described by Adams et al. (2022), to reconcile theoretical knowledge and real-world demand (Zhang, Fan, Xia, Guo, Jiang, and Yan 2017). Based on the nature of this pedagogy, this study recommends that lecturers in other disciplines consider knowledge enhancement to support students in improving critical thinking.

The challenge-based pedagogy includes two key techniques: involving competitions and challenging tasks. Lecturers viewed this pedagogy as a way to push students beyond their limits in order to boost critical thinking. When participating in competitions, for instance startup and IT contests, students must use various cognitive skills, such as evaluation, analysis, and explanation, in order to prepare and present their proposals. The strategy that lecturers applied in this technique aligns with the findings of Hambali, Wahyuni, and Rizal (2024), which indicate that learning-based competitions help students foster critical thinking in various ways. While students received supervision from lecturers to reflect and revise their work, they mainly worked independently. Hence, participation in competitions supports students in developing autonomy and reflection, which are forms of critical dispositions identified by Sosu (2012) and Adams et al. (2022). Similarly, engaging in challenging tasks helps students bolster a wide range of cognitive skills associated with critical thinking (Hambali, Wahyuni, and Rizal 2024). Also, according to Schmidt (2017), challenging tasks in STEM education, including agricultural education, not only support students in improving cognitive skills but also equip them with decision-making, a form of critical spirit, which drives students towards fair, sustainable, and positive solutions that can benefit the community. However, the implementation of this pedagogical approach is often limited to students with strong self-regulation

and self-efficacy, potentially excluding less confident students. This limitation is believed to be rooted in Vietnamese cultural norms of collectivism and respect for authority. Influenced by these cultural traits, many students are accustomed to a lecturer-centric orientation of their learning rather than self-regulation (Ho et al. 2022). Thus, they struggle to exercise enough autonomy to participate in competitions or challenging tasks.

CONCLUSION AND LIMITATIONS

This study involved a small sample size of six faculty members. While it met the qualitative standards of data rigour, this limits the study's generalisability. Additionally, the study did not incorporate student perspectives, which are important to explore how pedagogical approaches are experienced in practice. Future research could include students' voices in order to comprehend how they perceive the effectiveness of pedagogical approaches in fostering critical thinking.

Despite the limitations, this study successfully shed light on the teaching pedagogies used by lecturers in an agricultural university in Vietnam in order to foster students' critical thinking. The findings revealed that lecturers employed three key pedagogies: (1) pedagogy for how to think, (2) pedagogy for knowledge enrichment, and (3) challenge-based pedagogy. They implemented these pedagogies in a way that was responsive to their disciplinary and cultural contexts. Rather than representing solely techniques, these pedagogies comprise disciplinary and context-specific strategies designed to promote students' critical thinking through learning engagement.

Based on the findings, this study suggests a number of implications for multiple stakeholders. For lecturers, particularly in agricultural education and related STEM fields, the study offers a pedagogical framework that can be adapted to develop students' critical thinking in cultural and discipline-specific contexts. Policymakers at higher education institutions across the country may utilise this study as a resource for formulating policies that help faculty members design suitable pedagogies to promote students' critical thinking. Furthermore, by distributing empirical evidence on integrating critical thinking into pedagogical design in a specific discipline and cultural context, this study contributes to the national framework on competency-based education in Vietnam.

CONFLICTS OF INTERESTS

The author disclosed no conflict of interest in this study.

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APPENDIX A

Critical thinking checklist

What is critical thinking?

___You know that critical thinking is the process of examining, analyzing, questioning, and challenging situations, issues, and information of all kinds.

___You know the elements of critical thinking:

- Problem/goal identification
- Diagnosis
- Exploration
- Action
- Reflection
- Repeat the process

___You know the goals of critical thinking:

- Finding the truth
- Considering the context
- Understanding assumptions
- Creating alternative approaches

Why is critical thinking important?

You understand that:

___It identifies bias

___It's oriented towards the problem, issue, or situation that you're addressing

___It brings in other necessary factors

___It considers both the simplicity and the complexity of its object

___It gives you the most nearly accurate view of reality

___It is most likely to get you the results you want

Who can (and should) learn to think critically?

___You know that most people can and should learn to think critically

___You know that the many adults who have the capacity for critical thinking, but who haven't been taught and lack the experiences to learn on their own are both most in need of, and most receptive to, learning critical thinking.

How to help others learn to think critically?

___You know that learning critical thinking is an irreversible, often frightening process that requires support.

___You understand how to be a facilitator of critical thinking:

- Affirm learners' self-worth
- Listen attentively to learners
- Show your support for critical thinking efforts
- Reflect and mirror learners' ideas and actions
- Motivate people to think critically, but help them to understand when it's appropriate to voice critical ideas and when it's not.
- Regularly evaluate progress with learners
- Be a critical teacher
- Make people aware of how they learn critical thinking

- Model critical thinking

___You know how to encourage the critical stance (i.e., applying critical thinking to whatever you encounter):

- Help learners recognize and examine their own assumptions
- Examine information for accuracy, assumptions, biases, or specific interests
- Consider the context of what you're looking at

___You know how to facilitate problem solving using critical thinking

- Identify the assumptions behind the problem
- Challenge those assumptions
- Imagine alternatives to what you started with
- Critique those alternatives
- Reframe the problem and solution

Source: Community Tool Box. n.d. "Section 2. Thinking Critically." https://ctb.ku.edu/en/table-of-contents/analyze/analyze-community-problems-and-solutions/think-critically/checklist.

Method researcher used this critical thinking checklist

Participants received the completed critical thinking checklist by email or via an online form along with clear instructions for completing the following two tasks:

Self-Assessment (quantitative data)

Participants were asked to check (✓) each item they felt they understood. To ensure broad participation, they were asked to check at least two items in each section of the checklist.

Written Short Answer (qualitative data)

After completing the checklist, participants were asked to select four checked items and briefly explain them in their own words. Participants were requested to select at least one item from each section for this task. This step verified the accuracy and depth of their conceptual understanding of their perspectives about critical thinking and how they engage in helping others to think critically.

Note: This checklist is only used to reach the most qualified participants who met the setting criteria of the current study.

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