



Preliminary Evaluation of Biology Experimental Teaching in Grade 7 Natural Science

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ABSTRACT: This exploratory study aims to design and conduct an initial evaluation of experimental practice-based biology lesson plans for Grade 7 Natural Science, which are aligned with Vietnam's 2018 General Education Curriculum. Surveys were combined with document analysis and data processing using Jamovi 2.6.44 to obtain preliminary expert assessments. Findings from eight participating experts indicated that the developed lesson plans were generally rated as appropriate, pedagogically sound, and scientifically feasible for classroom application. The study also identified several limitations and proposed suggestions to enhance the organisation and effectiveness of experimental practice activities at the Secondary School level. These initial results provide valuable reference materials for teachers seeking to innovate teaching methods, strengthen hands-on experimental learning, and foster students' scientific competencies in accordance with competency-based education reform.

KEYWORDS: Experimental practice, Grade 7, Natural Science, Lesson plan, Competency-based education.

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Introduction

A key innovation of Vietnam's 2018 General Education Program (GEP) was the introduction of Natural Science as a compulsory subject at the Secondary School level, aiming to develop students' scientific competencies through observation, experimentation, and application of knowledge (Ministry of Education and Training, 2018). Practical laboratory work in Biology is an essential means of implementing this orientation. Previous studies have shown that inquiry-based or group-based experimental lessons can improve students' interest, competencies, and learning outcomes (Xu & Julian, 2020). However, when practical activities lack clear guidance or real-world connections, students may experience stress or fail to achieve meaningful educational benefits (Oliveira & Bonito, 2023). If experiments are performed mechanically without contextual understanding, practice-based learning loses its pedagogical value (Sotiriou et al., 2017) and may even diminish students' confidence in the approach (Shana & Abulibdeh, 2020). In Vietnam, recent research has emphasised the development of pedagogical competencies for teachers of Natural Science. Vu and Nguyen (2024) noted that teachers face challenges in designing practical activities suitable for the new curriculum.

Meanwhile, Chu et al. (2018) reported that integrated teaching promotes problem-solving skills but remains theoretical. Additionally, Byukusenge et al. (2022) observed that virtual laboratories can alleviate equipment shortages but require careful pedagogical design. From then on, the Preliminary Evaluation of Biology Experimental Teaching in Grade 7 Natural Science was conducted to meet the reform requirements of the 2018 General Education Program, while also assessing its suitability and applicability in actual teaching practice at lower secondary schools.

Research Aim and Research Questions

This study aimed to conduct a preliminary evaluation of experimental Biology teaching in Grade 7 Natural Science, focusing on its potential effects on students' cognitive competencies, practical skills, and learning attitudes at the Secondary School level. Based on this objective, the study addressed the following research questions: (1) To what extent were the Grade 7 Biology practical lesson plans, designed with a competency-based orientation, suitable for the curriculum content and the psychological characteristics of students? (2) How did experts assess these lesson plans' scientific rigour and pedagogical quality? (3) How were the feasibility and applicability of the lesson plans evaluated under actual teaching conditions in Secondary Schools?

Methodology

Research participants: The study involved six experts from secondary schools, all of whom had extensive experience teaching biology and Natural Science.

Document analysis: This method was employed to collect, synthesise, and analyse documents related to experimental teaching, the 2018 GEP, and prior studies, thereby establishing the theoretical foundation for the research.

Data collection and analysis. Survey data were gathered via Google Forms. A 5-point Likert scale was used to quantify the experts' evaluations regarding the experimental lesson plans' quality, suitability, scientific rigour, and feasibility. The scale was divided into five equal intervals, calculated as $(5 - 1)/5 = 0.8$, corresponding to: $1.0 \leq M < 1.8$ = Strongly disagree; $1.8 \leq M < 2.6$ = Disagree; $2.6 \leq M < 3.4$ = Neutral; $3.4 \leq M < 4.2$ = Agree; and $4.2 \leq M \leq 5.0$ = Strongly agree (Narli, 2010; Yavuz et al., 2013). The collected data were analysed using descriptive statistics, including mean (M) and standard deviation (SD), to reflect the consensus degree among experts for each evaluation criterion.

Research Results

The survey included general information about the experts and their evaluations of the lesson plans' suitability, pedagogical and scientific quality, and feasibility. Feedback on strengths, weaknesses, and suggestions was also collected.

Among the six participating experts, five were male (83.3%) and one female (16.7%). Most experts had over ten years of teaching experience (83.3%), and one had less than ten years (16.7%). This suggests that the participants had substantial expertise in teaching and educational research.

Suitability of the Lesson Plans

The mean scores for the suitability of the lesson plans with the 2018 GEP ranged from 4.50 ± 0.22 to 4.83 ± 0.17 , indicating consistently positive evaluations among experts (Table 1). Criterion Q15 received the highest score (4.83 ± 0.17), while Q11 and Q13 also strongly agreed (4.67 ± 0.21). All criteria were rated "Strongly agree," demonstrating overall positive feedback.

Table 1

Experts' Evaluation of the Suitability of the Lesson Plans

Code	Content	Mean $\pm$ SE	Evaluation Level
Q11	The lesson content was suitable for the learning outcomes required by the 2018 GEP	4.67 ± 0.21	Strongly agree
Q12	The experimental knowledge and content ensured scientific accuracy	4.50 ± 0.22	Strongly agree
Q13	The learning objectives were clear, specific, and measurable	4.67 ± 0.21	Strongly agree
Q14	The lesson content and teaching activities were linked to students' real-life contexts	4.50 ± 0.22	Strongly agree
Q15	The experimental activities were integrated with interdisciplinary knowledge (Physics, Chemistry, Biology)	4.83 ± 0.17	Strongly agree

Note: $1.0 \leq M < 1.8$: Strongly disagree; $1.8 \leq M < 2.6$: Disagree; $2.6 \leq M < 3.4$: Neutral; $3.4 \leq M < 4.2$: Agree; $4.2 \leq M \leq 5.0$: Strongly agree.

Pedagogical and Scientific Quality

Mean pedagogical and scientific quality scores ranged from 4.33 ± 0.49 to 4.83 ± 0.17 (Table 2). Criteria Q21 and Q22 both received a score of 4.67 ± 0.21 , indicating strong agreement on the coherence and logic of the lesson structure. Criterion Q23, with the highest score (4.83 ± 0.17), reflected expert recognition of the active, student-centred approach.

Table 2

Experts' Evaluation of the Pedagogical and Scientific Quality in Design

Code	Content	Mean $\pm$ SE	Evaluation Level
Q21	The teaching activities were arranged in a reasonable and logical sequence	4.67 ± 0.21	Strongly agree
Q22	The time allocation for each activity (theory-practice) was appropriate	4.67 ± 0.21	Strongly agree
Q23	The teaching methods and techniques promoted students' active participation and self-directed learning.	4.83 ± 0.17	Strongly agree
Q24	There was a reasonable integration between theoretical and practical/experimental Biology activities	4.33 ± 0.49	Strongly agree
Q25	The experimental activities ensured safety and developed students' practical skills	4.33 ± 0.49	Strongly agree
Q26	Learning materials, equipment, and experimental tools were adequately and appropriately prepared	4.33 ± 0.49	Strongly agree

Note: $1.0 \leq M < 1.8$: Strongly disagree; $1.8 \leq M < 2.6$: Disagree; $2.6 \leq M < 3.4$: Neutral; $3.4 \leq M < 4.2$: Agree; $4.2 \leq M \leq 5.0$: Strongly agree.

Feasibility and Practical Applicability

The mean scores for feasibility and applicability ranged from 4.50 ± 0.22 to 4.83 ± 0.17 (Table 3). All criteria were rated "Strongly agree," indicating that experts considered the lesson plans feasible and practical for actual teaching conditions.

Table 3

Experts' Evaluation of Feasibility and Practical Applicability

Code	Content	Mean $\pm$ SE	Evaluation Level
Q31	The lesson plans could be implemented under the typical facilities available in lower secondary schools	4.50 ± 0.22	Strongly agree
Q32	The content and activities were suitable for the psychological characteristics and academic level of Grade 7 students	4.50 ± 0.22	Strongly agree
Q33	The activities had the potential to stimulate students' interest and learning motivation	4.50 ± 0.22	Strongly agree

Q34	The lesson plans demonstrated creativity and innovation compared to traditional teaching methods	4.67±0.21	Strongly agree
Q35	The practical/experimental activities contributed to the development of students' competencies in exploring the living world and problem-solving skills	4.83±0.17	Strongly agree

Note: $1.0 \leq M < 1.8$: Strongly disagree; $1.8 \leq M < 2.6$: Disagree; $2.6 \leq M < 3.4$: Neutral; $3.4 \leq M < 4.2$: Agree; $4.2 \leq M \leq 5.0$: Strongly agree.

Discussion

The findings suggest that the Grade 7 experimental Biology lesson plans aligned well with the competency-based orientation of Vietnam's 2018 GEP (Ministry of Education and Training, 2018). Experts emphasised the interdisciplinary integration evident in the plans, which is consistent with the findings of Nguyen and Do (2024). The lesson plans also ensured scientific accuracy and safety, which aligns with recommendations from Millar (2004) and Abrahams and Reiss (2012), who noted that scientifically sound experiments deepen students' conceptual understanding rather than promoting rote performance.

Regarding pedagogical design, the lesson plans' logical sequencing and student-centred orientation (Q21-Q23) reflected the active learning principles described by Nguyen (2020). Including appropriate materials, attention to experimental safety, and integrating theory and practice (Pham et al., 2023) contributed to the positive expert evaluations. Regarding feasibility, experts confirmed that the lesson plans could be implemented using existing school resources, aligning with the conclusions of Nguyen and Duong (2022). The activities were considered engaging and appropriate for the psychological characteristics of Grade 7 students (Kong, 2021), incorporating innovative teaching approaches that enhanced student motivation (Nguyen & Pham, 2025).

Overall, the lesson plans were recognised as scientifically sound, practical, and consistent with current educational reforms. They effectively integrated theory with experimentation, promoted active learning, and contributed to the development of students' core competencies, including critical thinking, collaboration, and an appreciation for nature. However, several limitations were noted. Some experiments required equipment that was not readily available in disadvantaged schools. Time allocation between theoretical and experimental components was occasionally insufficient, and differentiation for students with diverse abilities required further attention. Therefore, experts proposed the following improvements: (1) Increase teacher flexibility in adapting experimental activities to local conditions; (2) Differentiate learning tasks based on students' abilities and interests; and (3) Rebalance the time between theoretical and practical phases to enhance learning effectiveness.

Conclusions

This preliminary study found that the Grade 7 experimental Biology lesson plans were positively evaluated for suitability, pedagogical and scientific quality, and feasibility. The plans reflected the

competency-based orientation of Vietnam's 2018 GEP and were consistent with actual classroom conditions. Experts noted that the lessons were practical, easy to implement, and supported students' critical thinking and practical skills. Despite minor limitations in equipment, timing, and differentiation, the plans were considered feasible and potentially applicable for teaching Natural Science at the Secondary School level.

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References

- Abrahams, I. Z., & Reiss, M. (2012). Practical work: Its effectiveness in primary and secondary schools in England. *Journal of Research in Science Teaching*, 49(8), 1035-1055. <https://doi.org/10.1002/tea.21036>
- Byukusenge, C., Nsanganwimana, F., & Tarmo, A. P. (2022). Effectiveness of virtual laboratories in teaching and learning biology: A review of literature. *International Journal of Learning, Teaching and Educational Research*, 21(6), 1-17. <https://doi.org/10.26803/ijlter.21.6.1>
- Chu, V. T., Dao, T. V. A., & Nguyen, T. T. C. (2018). Developing students' problem-solving capacity through the teaching of natural science in secondary schools in Vietnam. *American Journal of Educational Research*, 6(6), 741-748. <https://doi.org/10.12691/education-6-6-24>
- Kong, Y. (2021). The role of experiential learning on students' motivation and classroom engagement. *Frontiers in Psychology*, 12, Article 771272. <https://doi.org/10.3389/fpsyg.2021.771272>
- Millar, R. (2004). *The role of practical work in the teaching and learning of science*. University of York, Department of Educational Studies.
- Ministry of Education and Training (MOET). (2018a). *General education program - Natural science curriculum* (Promulgated with Circular No. 32/2018/MOET). Ministry of Education and Training, Vietnam.
- Ministry of Education and Training (MOET). (2018b). *General education chapter* (Circular No. 32/2018/MOET). Ministry of Education and Training, Vietnam.
- Narli, S. (2010). An alternative evaluation method for Likert-type attitude scales: Rough set data analysis. *Scientific Research and Essays*, 5(6), 519-528.
- Nguyen, T. H., & Do, H. T. (2024). Implementing integrated teaching of natural sciences in junior high schools and proposing some solutions in teacher training. *Journal of Education*, 24(18), 47-52.
- Nguyen, T. N. B., & Duong, T. T. (2022). Current status of teaching equipment in secondary schools - Ba Ria City, Ba Ria-Vung Tau Province. *Journal of Education*, 108-112.
- Nguyen, T. T. H. (2020). Developing self-study capacity for primary school students in teaching practical biology. *Vietnam Journal of Educational Sciences*, 25-30.
- Nguyen, T. H., Le, T. H., & Pham, H. A. (2025). Measures to improve teacher training quality through innovative teaching methods. *Hanoi Pedagogical University 2 Scientific Journal: Educational Science Special Issue*, 1(04), 58-64.

- Oliveira, H., & Bonito, J. (2023). Practical work in science education: A systematic literature review. *Frontiers in Education*, 8, Article 1151641. <https://doi.org/10.3389/feduc.2023.1151641>
- Pham, T. H. T., Nguyen, T. H., Hoang, T. T., Ha, V. D., Nguyen, T. N., & Nguyen, T. T. (2023). Using experiments to develop students' natural exploration capacity in teaching the topic "Photosynthesis" (Natural Science 7). *Journal of Education*, 23(6), 26-31.
- Shana, Z., & Abulibdeh, E. S. (2020). Science practical work and its impact on students' science achievement. *Journal of Technology and Science Education*, 10(2), 199-215. <https://doi.org/10.3926/jotse.888>
- Sotiriou, S., Bybee, R. W., & Bogner, F. X. (2017). PATHWAYS - A case of large-scale implementation of evidence-based practice in scientific inquiry-based science education. *International Journal of Higher Education*, 6(2), 8-19. <https://doi.org/10.5430/ijhe.v6n2p8>
- Vu, C. T., & Nguyen, Y. C. (2024). Some studies on professional development activities for teachers of natural sciences. *Journal of Education*, 24(7), 30-36. <https://tcgd.tapchigiaoduc.edu.vn/index.php/tapchi/article/view/1629/761>
- Xu, Y., & Julian, M. (2020). The effect of inquiry-based learning on students' science achievement and motivation. *Journal of Education and Learning*, 14(6), 406-415. <https://doi.org/10.5539/jel.v14n6p406>
- Yavuz, G., Günhan, B. C., Ersoy, E., & Narli, S. (2013). Self-efficacy beliefs of prospective primary mathematics teachers about mathematical literacy. *Journal of College Teaching & Learning*, 10(4), 279-287. <https://doi.org/10.19030/tlc.v10i4.8124>