

UNSEEN BARRIERS IN INVERTEBRATE PRACTICALS: STUDENTS' COGNITIVE, LOGISTICAL, AND AFFECTIVE EXPERIENCES

HAMBATAN TAK TERLIHAT DALAM PRAKTIKUM LAPANGAN INVERTEBRATA: PENGALAMAN KOGNITIF, LOGISTIK, DAN AFEKTIF MAHASISWA

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Abstract

Lecturers often overlook obstacles in the practical learning process. These obstacles in the practical process are dynamic elements that the lecturer has designed. As a result of the overlooked obstacles, students feel unfairly treated during the practical process. Therefore, this research aims to explore students' subjective experiences in order to uncover the obstacles and dynamics involved in the practical process. A qualitative approach was used to gather data from 73 students through open-ended questionnaires. Data were analyzed using thematic analysis, with validation through peer debriefing techniques and inter-coder agreement to ensure validity. The research results identified four themes: (1) the density of class material and the need for pre-practical guidance; (2) obstacles due to geographical distance and group discrimination; (3) the affective transformation of students and the importance of the lecturer's presence in the field; and (4) damage to documents on devices and bias in grading penalties. These findings demonstrate that lecturers have overlooked obstacles in the practical process. This indicates that these obstacles will lower confidence in the classroom due to the inability to engage in the practical process. As a recommendation, lecturers need to implement a process-oriented assessment rubric, provide logistical flexibility for field assignments, and offer space for offline report writing.

Keywords: invertebrate practicum, field-based learning; student experiences, assessment fairness

Abstrak

Hambatan dalam proses pembelajaran praktikum sering kali luput dari pengamatan dosen, padahal hambatan dalam proses praktikum ini merupakan dinamika dari proses yang dirancang oleh dosen. Akibat dari hambatan yang terabaikan mahasiswa seringkali merasa mendapat ketidakadilan selama proses praktikum. Oleh karena itu penelitian ini bertujuan mengeksplorasi pengalaman subjektif mahasiswa guna mengungkap hambatan dan dinamika dalam proses praktikum. Pendekatan kualitatif digunakan untuk menghimpun data dari 73 mahasiswa melalui kuesioner pertanyaan terbuka. Data tekstual dianalisis menggunakan metode analisis tematik, dengan validasi temuan melalui teknik peer debriefing dan kesepakatan antar-kodifikasi untuk menjamin keabsahan data. Hasil penelitian mengidentifikasi empat tema utama: (1) kepadatan materi kelas dan kebutuhan bimbingan pra-praktikum; (2) hambatan jarak geografis serta diskriminasi internal kelompok; (3) transformasi afektif mahasiswa dan pentingnya kehadiran dosen di lapangan; serta (4) kerusakan dokumen digital pada gawai dan bias keadilan penalti nilai. Temuan ini membuktikan bahwa terdapat hambatan dalam proses proses praktikum yang selama ini tidak teramati oleh dosen. Hal ini menunjukkan bahwa hambatan tersebut akan menurunkan kepercayaan diri sosial dalam kelas karena ketidak mampuan untuk mengikuti secara maksimal proses praktikum. Sebagai rekomendasi praktis, dosen perlu menerapkan rubrik penilaian berorientasi proses, memberikan fleksibilitas logistik penugasan lapangan, serta menyediakan ruang untuk membuat laporan secara offline.

Kata kunci: praktikum invertebrata, pembelajaran lapangan, pengalaman mahasiswa, keadilan penilaian

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Introduction

Direct interaction with nature is essential for studying biology, particularly the invertebrate group. Learning activities that are limited to the classroom often have limitations in depicting the richness of diversity (Tamba et al., 2020) and the structural details of a specimen (Nur'aeni et al., 2022). The process of learning about invertebrates should not rely solely on theoretical memorization because students are at risk of misunderstanding the authentic structure of animals (Firda et al., 2026). Therefore, practical-based learning is necessary as a bridge between abstract concepts and the physical reality of specimens. Through direct observation, students can construct their own knowledge more deeply (Pye, 2025). However, the implementation of invertebrate practicals has three special characteristics. First, students will learn directly at the beginning to explore the animals' natural habitat. Second, direct interaction with various invertebrate animals often triggers barriers such as phobias, fear, or disgust. Third, the availability of specimens in nature is highly dependent on ecological factors that are completely beyond the students' control. Unique characteristics will also pose obstacles in the learning process, but so far, practical session challenges have mostly gone unreported.

In addition to having special characteristics, the implementation of practical work faces various technical and emotional challenges. Students often face challenges, ranging from the readiness of observation materials (Meitri & Darmayanti, 2025) and the availability of supporting tools (Prayunisa & Marzuki, 2024) to mental readiness when having to interact directly with live animals. Various challenges ultimately impact the quality of students' learning. Cognitively, logistical and technical obstacles often break students' focus (Sweller, 1988), so the energy that should be used to dive into the material is instead drained to solve operational issues. Meanwhile, from an affective perspective, mental unpreparedness such as fear or disgust toward specimens can trigger academic anxiety that hinders students' active participation (Downing et al., 2020). If left unaddressed, the accumulation of cognitive

and emotional burdens poses a risk of diminishing students' learning motivation (Qin et al., 2025). Unfortunately, students often fail to openly communicate the various obstacles they encounter during the practical process to their lecturers at the end of the semester.

Obstacles in practical sessions are often unnoticed by the supervising lecturers, who instead focus solely on achieving final cognitive scores. This will impact the lecturers who are unaware of the dynamics of the learning process in the field (Hornstein, 2017). Supervising lecturers often overlook understanding the obstacles faced by students from sociological, geographical, and technical perspectives in the field. On the other hand, students also cannot freely express their obstacles because the rigid evaluation instrument in the form of closed questionnaires does not provide space for opinions (Boysen, 2015). A limited understanding of the dynamics of this experience ultimately makes the design of practical sessions less inclusive.

The invertebrate course clearly demonstrates the impact of the less inclusive practical design. Because the laboratory does not provide the specimens needed for the practical, students are required to locate them in nature. The process of searching for specimens demands high geographical mobility from each individual. Students who live in suburban areas or do not have access to private vehicles ultimately face challenges. Such conditions often trigger social exclusion within study groups. Phenomena like this are one of the realities that have long been overlooked in the learning process. In addition to mobility barriers, students also face obstacles in the process of preparing practical reports that are required to be submitted online. The limited ownership of devices such as laptops forces some students to complete all their reports using smartphones. The process of compiling complex practical reports on mobile devices often causes formatting malfunctions. These technical obstacles, if left unaddressed, will affect students' performance and ultimately lower the quality of their academic output because the reports they compile do not meet the provided rubric.

In addition to bearing the technical and logistical burdens in the field, the academic quality of students is also greatly influenced by their mental condition during lectures. The affective dimension plays a crucial role considering that direct interaction with invertebrate organisms in the wild often triggers psychological responses such as phobias, fear, or disgust. This issue becomes even more sensitive when the assessment rubric imposes rigid penalty points for students who fail to identify certain specimens. Unfortunately, these students often fail to communicate their various emotional obstacles, both during the learning process and at the end of the semester. However, communicating obstacles fosters a more comfortable educational ecosystem (Scheerens et al., 2005). Neglected grievances can lead to impacts on academic vulnerability and bear psychological burdens (Wang et al., 2025). Conversely, when complaints are heard, students will experience positive effects, as they are able to reduce academic anxiety (Juhász et al., 2024; Sari & Hidayati, 2020; Rastogi et al., 2025). By wisely understanding these aspects, lecturers can create a healthy, inclusive, and student-comfort-oriented academic atmosphere.

The research begins by emphasizing the significance of valuing students' perspectives in the learning process. This research qualitatively explores students' subjective experiences to uncover various previously overlooked obstacles. This exploration focuses on mapping the gaps in tools, logistical obstacles, and the dynamics of assessment fairness specifically in invertebrate practicals. By understanding the obstacles faced by lecturers, it is hoped that a learning space can be created that is not only academically adaptive but also more empathetic and centered on the needs of students as learners.

Methods

Research Design

This study uses a qualitative approach with an exploratory, descriptive design. The qualitative approach was chosen to explore the subjective experiences of students during the lecture process (Creswell, 2014). The use of this exploratory design is to capture the phenomena that occur during the learning process, both during lectures and invertebrate practicals. This exploratory design aims to capture three interrelated dynamics, starting from cognitive aspects such as fluctuations in working memory load. Infrastructure obstacles, including disparities in access, limitations in students' personal transportation, and technical issues with laptops in scientific reporting. Affective barriers include students' emotional fluctuations, ranging from academic anxiety and psychological resistance to the development of scientific resilience in the natural environment.

Research Participants

Setting this research was conducted in the Biology Education Study Program, Borneo Tarakan University. The research participants consisted of 73 students who were selected using a purposive sampling technique. The inclusion criteria for participants are (1) being registered as active students and (2) having attended all theoretical lectures and field practical activities in the Invertebrate course fully until the end of the semester. The demographic profiles of 73 participants were collected to provide contextual background for the evaluation narratives they provided. The recorded demographic parameters include gender, semester status, residential area zoning (distance from campus), and accessibility to private transportation. The detailed demographic distribution of the participants is presented in Table 1.

Table 1. Demographic data of all participants involved

Demographic Characteristics	Category	Frekuensi (f)	Persentase (%)
Gender	Woman	61	83.56
	Man	9	12.33
Semester	Semester II	73	100,00
Residential Zoning	Suburban Area (> 15 Km)	5	6.85

Demographic Characteristics	Category	Frekuensi (f)	Persentase (%)
Access to Private Vehicles	City Center Area / Near Campus (< 15 Km)	68	93.15
	Having a Personal Motorcycle	51	69.86
	Does Not Have a Vehicle	22	30.14
Access Laptop	Having Your Own Laptop	44	60.27
	Doesn't have a laptop of their own	29	39.73

Demographic data provides an overview of how students' life backgrounds influence the content of their evaluation narratives. The fact that 39.73% of students do not own a personal laptop closely relates to the technical constraints in report preparation. These administrative obstacles become an additional burden that affects the achievement of optimal academic performance. Vehicle ownership data also reflect student mobility, with 69.86% of students owning a motorcycle. This issue is felt more acutely by 6.85% of students who live in the suburbs, with a travel distance of more than 15 kilometers to campus. These limitations are reflected in complaints about delays in arriving at the location, minimal contributions to group work, and the emergence of anxiety due to fear of being perceived as passive by peers. The characteristics of the students, all of whom are in their second semester with a female majority of 83.56%, provide important context for their attitude changes. Students recounted their struggles in overcoming feelings of embarrassment and fear toward animals such as worms or centipedes.

Data Collection Instrument

Data collection in the research used an open-ended questionnaire (Albudaiwi, 2017). The process of developing this supporting instrument is designed through several stages to ensure the depth of data without limiting the freedom of students' opinions. The initial draft of the questions was developed based on a preliminary study consisting of informal observations of student complaints throughout the first half of the semester, which were then synthesised with a literature review on the theory of workload and assessment fairness. To maintain consistency with the goal of free exploration, the cognitive-pedagogical, infrastructural, and

ffective-psychological dimensions that were mapped are not positioned as rigid category boundaries. These dimensions act as guiding prompts so that students still have ample discretion to share experiences beyond those categories. This supporting instrument consists of four (4) main prompt questions arranged as follows: First, the Cognitive and Conceptual Understanding Dimension: "Describe the experiences and obstacles you encountered while following the material explanation in class before going to the field!". Second, the Infrastructure and Field Constraints Dimension: "What was your experience like when you had to search for invertebrate specimens in the wild?" Describe the technical challenges, distance, or interactions with your group members!". Third Dimension: Affective and Psychological Conditions: "What did you feel emotionally or psychologically when you had to interact directly with invertebrate animals, and what was the role of the lecturer in the field?". Fourth Dimension: Assignment and Evaluative Assessment: "Describe the challenges you faced in preparing the practical report and your views on the grading system, including any fines or penalties applied!". The data collection process was conducted online at the end of the even semester using the Google Forms platform. The choice of timing at the end of the semester is intended so that students can provide a comprehensive evaluation of the entire course sequence from start to finish. Furthermore, the use of anonymous online questionnaires aims to reduce conflict factors.

Data Analysis Technique

The qualitative data obtained were analyzed using thematic analysis based on the six-phase framework by Braun & Clarke (2006). The first phase, familiarizing with

data, was carried out by reading the transcripts of 73 students' responses to understand the context and emotional nuances of the participants. The second phase, generating initial codes, involves labeling keywords and specific phrases relevant to the obstacles and experiences of students during the practicum. The third phase, searching for themes, is carried out by grouping initial codes with similar meanings into temporary sub-themes. The fourth phase, reviewing themes, focuses on cross-evaluating sub-themes with all raw data to ensure that the themes accurately represent the dominant voice of the population. The fifth phase, defining and naming themes, produces four main theme formulations that represent the essential findings of the research. The sixth phase, producing the report, is the stage of uniting those themes with verbatim quotes from participants to contrast them with previous literature.

To avoid researcher subjectivity bias and ensure the trustworthiness of the findings, data validity testing was conducted by adopting three criteria, namely credibility, transferability, and confirmability (Lincoln & Guba, 1985; Owen et al., 2008). First, the credibility criterion is met through peer debriefing techniques and inter-coder agreement to minimise single interpretations during the coding process in phases two and three. Second, the transferability criterion is achieved by providing a thick description of the geographical and socio-ecological context, as well as the dynamics of invertebrate learning. The researcher presents the geographical, socio-ecological context, and dynamics of invertebrate learning in detail so that the results of this study can be applied or transferred by readers to similar course characteristics. Third, an audit trail ensures the confirmability criterion. All records, from raw data and coding history to the process of forming the theme matrix, are transparently documented to ensure that the findings purely originate from participants,

not from the researcher's one-sided opinions or assumptions.

Research Ethics

The research was conducted in compliance with ethical standards to protect the rights of participants. The ethical procedures in this research include voluntary participation without coercion, where students are given an explanation at the beginning regarding the purpose of the research and have the full right to choose to contribute or withdraw without any consequences, anonymized identities replaced with a coding system to minimize students' reluctance and anxiety, and the protection of grade independence by providing a written guaranty that anything written in the questionnaire will not affect the final course grade at all.

Result and Discussion

Before elaborating on the findings in depth, it is necessary to explain the process of extracting textual data from 73 students until the formation of a theme hierarchy in this study. Based on the thematic analysis procedure (Braun & Clarke, 2006), the emergence of themes is based on an inductive process. This process begins with the open coding stage on the participants' response transcripts to capture units of meaning from specific complaints. For example, the direct quote, "Actually, it's already beneficial and clear, sir, but in my opinion, every teacher explains a bit too fast, and for someone like me who finds it a bit difficult to digest, it becomes a bit confusing," is simplified to a basic code that addresses teaching rhythm and the urgency of visualization. If the code has a close meaning, it is aggregated and developed into four empirical sub-themes that represent the field's reality. Next, the empirical sub-themes are hierarchically organized into themes. Structurally, the mapping results from sub-themes to major themes are outlined in Table 2.

Table 2. Thematic Analysis Findings Matrix of Invertebrate Learning Evaluation

No	Main Theme	Sub-Theme	Category Code	Verbatim Student Quotes
1	Class Material Pace and Guidance	1.1. Rhythm of Material Delivery	a. The explanation of the material was too fast. b. Difficulty in instantly digesting information.	Actually, it was already good and clear, sir, but in my opinion, each time you explained, it was a bit fast,

No	Main Theme	Sub-Theme	Category Code	Verbatim Student Quotes
	Needs Before Practicum		Cognitive confusion during theoretical classes.	and for someone like me who finds it a bit difficult to digest, it became a bit confusing.
		1.2. Pre-Practicum Instructional Gap	a. Lack of specificity in morphology material before fieldwork. b. The need for visual media/concrete examples of observations before being released independently.	Maybe you could explain the material in more detail regarding animal morphology and anatomy first, so that it can be understood before being practiced, making the practical sessions easier to carry out...
2	Obstacles in Specimen Search and Distance Barriers Accompanied by Group Discrimination	2.1. Specimen Barriers & Physical Fatigue	a. The weekend break time has been used up. b. Physical exhaustion from searching for animals all the way to the forest/beach. c. Unpredictable extreme weather.	...sir, I'm a bit tired from searching for animals every weekend hehe, but it was quite fun going to the forest for a month. "Overall, it was fun, especially the practicals, but the difficult part was finding the animals, especially on holidays when it was crowded.
		2.2. Geographic Inequality & Facilities	a. The residence is very far from the campus area. b. Do not own a private vehicle (motorcycle). c. Double mobility barriers and group contribution limitations.	I'm sorry... my friend is often late because the distance from his house to the campus is far, and most of them live in Juata... and I'm having trouble finding that animal because I don't have a motorcycle.
3	Changes in Student Attitudes and the Importance of Faculty Guidance in the Field	3.1 Transformative Learning	a. Reducing phobias/disgust toward animals. b. The loss of a sense of pride (falling into a ditch/gutter). c. Emotional satisfaction from the adventure of science.	...that at first I was very squeamish about centipedes, but during this practical session, I suddenly became brave, haha... "What I gained... was overcoming the embarrassment of entering ditches, exploring people's trenches to complete the practical materials, but still being happy despite that.
		3.2 Field Mentoring Expectations	a. The hope is that the lecturer will accompany us to the original habitat. b. The need for physical validation of the struggle to hunt for samples.	...in terms of practical work, I feel very happy, sir, going on adventures to find animals... but honestly, if next semester your class has practical work again... you can join the search HEHEHE
4	Technology Issues and the Need for Fairer Task Assessment	4.1 Technological & Device Barriers	a. Do not have a laptop device. b. Forced to type a scientific report on a mobile phone (HP).	...for the lab report, it's actually quite difficult for me since I don't have a laptop because I have to type it out, even tho I ended

No	Main Theme	Sub-Theme	Category Code	Verbatim Student Quotes
			c. The writing format is messy due to the limitations of the device.	up doing it on my phone, the result is still messy, sir...
	4.2	Malfunction of the Digital Document System	a. Bug in the PDF-based report template. b. The appearance of "ghost pages and photos" automatically. c. The basic theory structure collapses/shifts when edited.	...the criticism comes from the lab report because honestly, when I was working on the lab report from your report template, suddenly there was a ghost photo and it couldn't be deleted... so maybe the suggestion for the next report template is to use a Word format...
	4.3	Perception of Regulatory Justice Value	a. Disappointment with the instant grading penalty system. b. Natural factors (animal scarcity) beyond the control of students. c. The maximum effort in the search is not valued numerically.	...the teacher does not accept the reasons behind us/some groups not bringing or obtaining the practical materials and immediately getting point deductions... even tho there is a huge struggle behind it...

The selection of learning process evaluations based on open-ended questions can reach the depth of empirical dimensions that are often overlooked by metric-scale quantitative questionnaires. The findings of this study identify four main themes that affirm that students' learning experiences in the Invertebrate course are a complex configuration involving cognitive acceleration in the classroom, socio-logistical realities in the field, affective transitions, and technical-administrative assignment constraints.

Class Material Pace and Guidance Needs Before Practicum

The results indicate that the majority of students feel burdened by the lecturer's teaching method, which is too fast. The explanation of the material being too fast makes it difficult for students to understand the material presented by the lecturer (Pritchett & Beatty, 2015). If left unaddressed, this will cause mental fatigue in students as they struggle to understand the heavy material along with the complex scientific terms. The nature of the invertebrate course, with its scientific terms and the complex body structures of animals, inherently demands high concentration.

According to the cognitive load theory (Sweller, 2011), information presented beyond the brain's capacity will cause cognitive confusion. As a result, students find it difficult to instantly digest information in class, leading to confusion when they have to apply it directly in practical sessions.

The difficulty in understanding the theory in this class is exacerbated by the lack of preparation before the practical session begins. Students complained that they felt immediately "set free" in the open to search for samples. With the absence of a connection between theory and practice, students may lose their learning direction (Jawed et al., 2025). Therefore, the findings of this research emphasize the importance of gradual guidance at the beginning of the lectures (Vygotsky, 1978). Students explicitly requested a detailed explanation of body shape and animal anatomy a week before their field trip. Providing supporting media such as identification videos or showing examples of preserved specimens in the laboratory has proven to reinforce understanding (Guo et al., 2025). Visual media like these videos is needed to help students find animals in their natural habitats.

This study employs a combination of classroom theory, laboratory practicals, and

independent field research activities to conduct invertebrate lectures. Theoretical concept learning about the morphology, anatomy, and taxonomy of phyla is conducted in the classroom during the first half of each session using the lecture-discussion method. The search for specimens is conducted by each group of students, which will later be used in the practical learning process. However, a lecturer does not accompany the students every time they search for specimens in the field. The high frequency of field trips ultimately leads to the accumulation of physical fatigue among students. Furthermore, students find the theoretical material insufficient for observing specimens during practical sessions, despite having learned the basic concepts in class. This is what causes cognitive confusion during practical sessions.

Obstacles in Specimen Search and Distance Barriers Accompanied by Group Discrimination

Invertebrate practicals pose challenges that extend beyond academic issues to encompass social problems and students' physical conditions. Research findings confirm that searching for animal samples on weekends drains students' energy and rest time. Research shows that learning activities directly in nature are indeed exciting, but they require significant physical sacrifices (Jafarpoor et al., 2021; Kolb, 2015). However, a critical finding in this research is the disparity in facilities and living distances among students. The independent field sample search outside of campus hours actually carries the assumption that all students have the same economic conditions and facilities. However, the actual situation contradicts this assumption. Students who live far from campus and those who do not have a personal motorcycle face difficulties. Students have difficulty with mobility to search for animals or gather with their group.

Issues like this are rarely addressed in conventional practical evaluations, where the assessment often focuses solely on the final outcome in the form of report completeness without considering the obstacles faced by students (Ramírez-Castañeda et al., 2022). The inability in terms of transportation and distance creates a domino effect that

negatively impacts the student's position in the eyes of their group. Distance and the lack of motor vehicles often cause students to arrive late. These limitations trigger anxiety among students because they fear being labeled as lazy, passive, or considered a burden within their group (Aggarwal & O'Brien, 2008; Habelrih & Hicks, 2015; Hakim et al., 2025). The results of this study indicate that field assignments not designed with consideration for fairness aspects risk unintentionally causing exclusion for students (Pokorny et al., 2016).

The actual situation reveals discrepancies that diverge from the common beliefs regarding student mobility. Although theoretically, students with long commutes ideally choose to live near campus or have a private vehicle, the results of this study capture the phenomenon of vulnerable students. Family financial constraints are the main reason why some students from suburban areas still choose to live far from campus to reduce the increasingly high rent for boarding rooms in the campus area. Dependence on carpooling among friends severely limits their mobility on weekends. This inequality in access to transportation and financial resources, in the literature on educational justice, is identified as a form of structural barrier that is often invisible yet significantly limits students' academic participation in unscheduled extracurricular activities (Pokorny et al., 2016; Ramírez-Castañeda et al., 2022).

Changes in Student Attitudes and the Importance of Faculty Guidance in the Field

Physical constraints and limited facilities in the practical process are challenges faced by students. However, this practical activity has proven to bring positive changes to the attitudes and mentality of the students (Miocic et al., 2020). The direct experience of going into natural habitats such as ditches, rivers, and forests forced students to step out of their comfort zones. The research results show that students successfully shed their sense of pride and were able to reduce their phobias toward animals. The success in overcoming this fear directly boosts the students' self-confidence in their own abilities (Bandura, 1977; Job, 2024; Mekonnen, 2025). Another finding in

this study is the strong desire of students for the supervising lecturer to accompany them directly in the field. Supervision by lecturers will make it easier for students if they encounter difficulties while in the field. The physical presence of the lecturer in the field is considered not a supervisor but a supporter who provides psychological safety. When lecturers actively participate in the search process, students feel that their hard work is recognized and appreciated. Informal interactions outside the classroom effectively break down the rigidity between professors and build learning relationships based on empathy.

Technology Issues and the Need for Fairer Task Assessment

The final theme in this research discusses the issue of damage to PDF-based digital report templates. So far, there has been an assumption that Generation Z is a generation skilled in using technology, but this finding contradicts that (Hendrawan et al., 2024). Students face technical difficulties, such as the appearance of "ghost pages or photos" and the disarray of text layout when they edit assignments via their phones. These technical difficulties become an administrative burden, especially for students who only use their phones to prepare reports. The preparation of scientific reports using only a mobile phone is a form of obstruction from a system that unintentionally discriminates against students' academic performance (Ng et al., 2017). In addition to the issue of gadgets, this research captures criticism from students regarding the rule of "direct grade penalties if they fail to bring animal specimens". The assessment system should value the learning process more, rather than just looking at the final product (Ismail et al., 2022; Othman et al., 2024). The difficulty in finding specimens is a factor beyond the students' control, and the rule of grade reduction for not bringing samples constitutes a violation of the principle of fair assessment (Tripp et al., 2019). Such a system indirectly triggers various stress effects due to receiving punishment or even falsifying data to avoid it.

Overall, this research contributes to two important aspects: theoretical and

practical. In terms of theoretical contributions, the results of this research improve understanding of cognitive load theory and the scaffolding framework within the context of field practicums. Moreover, these results also demonstrate that instructional barriers in higher education do not exist in isolation but rather interact systemically with aspects of socio-economic justice and students' digital inclusion. Practically, these findings provide a framework for lecturers to redesign the invertebrate course through three concrete interventions: first, integrating pre-practical guidance based on macro-laboratory visualization to mitigate cognitive confusion. Second, reforming the traditional assessment system toward process-based assessment by eliminating value-penalty regulations that are biased by environmental and ecological factors. Third, designing an alternative digital reporting format that is mobile-friendly to bridge the disparity in device ownership among vulnerable student groups.

Conclusion

This research finds that many factors influence the success of invertebrate lectures. Systemically, the interaction between students' cognitive load due to the fast teaching pace of lecturers without a foundation of pre-practical visual understanding is problematic. Logistical-geographical disparities trigger the risk of social exclusion for students without personal vehicles because they feel left out of the group. In addition, it is necessary to have faculty supervision to manage animal phobias when in the field. Additionally, the requirement to submit practical reports online adds to the burden for students who do not have access to devices like laptops. These findings carry crucial theoretical and practical implications that field-based learning designs should not assume the homogeneity, economic capabilities, or technological access of students. In practical-based learning, sensitivity to educational equity is necessary to reduce the impact of social injustice. Therefore, as a recommendation for the future teaching of this course, it is suggested that the instructor provide guidance a week before going to the field to explain in detail the morphological

parts of the animals that will be observed. Combining group members based on the geographical proximity of their homes and ownership of motorcycles. Changing the evaluation rubric from being too rigid to a process-based assessment and removing the penalty for not bringing specimens. And providing space for students who do not have computer devices to create physical lab reports.

Statement on the Use of AI in the Writing Process

During the process of drafting this manuscript, the author used Quillbot to improve the language and sentence structure. After using the tool/service, the author reviewed and edited the content of the manuscript as needed and is fully responsible for the entire content of this article.

Conflict of Interest Statement

The authors declare that there are no financial interests or personal relationships that could or potentially influence the research results reported in this article.

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References

Aggarwal, P., & O'Brien, C. L. (2008). Social loafing on group projects: Structural antecedents and effect on student satisfaction. *Journal of Marketing Education*, 30(3), 255–264. <https://doi.org/10.1177/0273475308322283>.

Albudaiwi, D. (2017). Survey: Open-Ended Questions. In *The SAGE Encyclopedia of Communication Research Methods*, 1716–1717. <https://doi.org/10.4135/9781483381411.n608>.

Bandura, A. (1977). *Self-Efficacy: The exercise of control*. <https://api.semanticscholar.org/CorpusID:142746089>.

Boysen, G. A. (2015). Uses and misuses of student evaluations of teaching: The interpretation of differences in teaching evaluation means irrespective of statistical information. *Teaching of Psychology*, 42(2), 109–118. <https://doi.org/10.1177/0098628315569922>.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706QP0630A>.

Creswell, J. W. (2014). *Research design qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

Downing, V. R., Cooper, K. M., Cala, J. M., Gin, L. E., & Brownell, S. E. (2020). Fear of negative evaluation and student anxiety in community college active-learning science courses. *CBE Life Sciences Education*, 19(2), 1–16. <https://doi.org/10.1187/CBE.19-09-0186>.

Firda, A., Rikizaputra, Afidah, M., Awal, R., & Sari, E. (2026). Analisis Miskonsepsi tentang jaringan hewan dan tumbuhan pada siswa SMAN 6 Pekanbaru. *Jurnal Karya Ilmiah Multidisiplin*, 6(1), 46–53. <https://doi.org/https://doi.org/10.31849/jurkim.v6i1.31722>.

Guo, Y. Y., Cai, H., Bramley, G. L. C., Atkins, H. J., Li, B., & Theodossiades, S. (2025). A review of artificial intelligence in herbarium specimen image analysis. *Artificial Intelligence Review*, 58(12), article number 402. <https://doi.org/10.1007/S10462-025-11408-2>.

Habelrih, E. A., & Hicks, R. E. (2015). Psychological well-being and its relationships with active and passive procrastination. *International Journal of Psychological Studies*, 7(3), 25–34. <https://doi.org/10.5539/ijps.v7n3p25>.

Hakim, N., Maghfira, I. K., Wirayudha, P. B., Rauzatul, C., Salsabila, U. F. Z., &

- Riamanda, I. (2025). Coping strategies of students experiencing social anxiety in the academic context. *Jurnal Psikologi Terapan*, 8(1), 1–12. <https://ojs.unimal.ac.id/jpt/article/view/22046>.
- Hendrawan, K., Mardi, & Susita, D. (2024). From digital natives to agile learners: Rethinking digital skills among generation Z. *International Journal of Human Capital Management*, 8(2), 88–99. <https://journal.unj.ac.id/unj/index.php/i/jhcm/article/view/60297>.
- Hornstein, H. A. (2017). Student evaluations of teaching are an inadequate assessment tool for evaluating faculty performance. *Cogent Education*, 4(1), article 1304016. <https://doi.org/10.1080/2331186X.2017.1304016>.
- Ismail, S. M., Rahul, D. R., Patra, I., & Rezvani, E. (2022). Formative vs. summative assessment: impacts on academic motivation, attitude toward learning, test anxiety, and self-regulation skill. *Language Testing in Asia*, 12(1), article number 40. <https://doi.org/10.1186/S40468-022-00191-4>.
- Jafarpour, H., Hosseini, M., Sohrabi, M., & Mehmannaevazan, M. (2021). The effect of direct observation of procedural skills/mini-clinical evaluation exercise on the satisfaction and clinical skills of nursing students in dialysis. *Journal of Education and Health Promotion*, 10(1), 74. https://doi.org/10.4103/JEHP.JEHP_618_20.
- Jawed, M., Ali, K., & Ahmed, T. (2025). Exploring the connection between presence and absence of krashen's theory on learner's input and affective filters: a triangulation approach. *Journal of Arts and Linguistics Studies*, 3(2), 1811–1839. <https://doi.org/10.71281/jals.v3i2.305>.
- Job, L. P. (2024). Breaking the silence: Overcoming fear and building confidence in english speaking-a personal journey. *The Academic*, 2(10), 197–201. <https://doi.org/10.5281/zenodo.14101411>.
- Juhász, Á., Sebestyén, N., Árva, D., Barta, V., Pártos, K., Vokó, Z., & Rákossy, Z. (2024). We need better ways to help students avoid the harms of stress: Results of a meta-analysis on the effectiveness of school-based stress management interventions. *Journal of School Psychology*, 106, 101352. <https://doi.org/10.1016/J.JSP.2024.101352>.
- Kolb, D. A. (2015). *Experiential learning: Experience as the source of learning and development*. Pearson Education, Inc.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic Inquiry*. Sage Publications, Inc.
- Meitri, I. D. A. K., & Darmayanti, N. W. S. (2025). Identifikasi kesulitan guru dalam mengajar praktikum. *Wahana Chitta Jurnal Pendidikan*, 7(1), 42–48. <https://jurnal.markandeyabali.ac.id/index.php/wahanachitta/article/view/325>.
- Mekonnen, L. (2025). Improving students' self-confidence in learning through action research: Presentation skills in focus Improving students' self-confidence in learning. *Indonesian Journal of Classroom Action Research*, 3, 26–36. <https://doi.org/https://doi.org/10.53866/ijcar.v3i1.753>.
- Miocic, I., Vukovic, M. B., & Ledic, J. (2020). The positive attitude approach for teaching in higher education: An untrodden path for policy and practice. *European Journal of Education*, 55(4), 560–572. <https://doi.org/https://doi.org/10.1111/ejed.12420>.
- Ng, S. F., Hassan, N. S. I. C., Nor, H. M. N., & Malek, N. A. A. (2017). The relationship between smartphone use and academic performance: A case of students in a Malaysian Tertiary Institution. *Malaysian Online Journal of Educational Technology*, 5(4), 58–70. <https://doi.org/https://mojet.net/index.php/mojet/article/view/110>.
- Nur'aeni, A. L., Sholihah, R. N., Riandi, & Widodo, A. (2022). Analisis inovasi

- media gambar pada materi keanekaragaman hayati menggunakan aplikasi inaturalist. *BIODIK: Jurnal Ilmiah Pendidikan Biologi*, 8(4), 133–138.
<https://doi.org/10.22437/bio.v8i4.19115>.
- Othman, A., Osman, K., & Othman, N. (2024). Assessment value: A Systematic literature review on assessment as, for and of learning in school. *International Journal of Academic Research in Progressive Education and Development*, 13(1), 995–1013.
<https://doi.org/10.6007/ijarped/v13-i1/20725>.
- Owen, J. A. T., Ellis, C., & Goffman, E. (2008). Naturalistic Inquiry. In *The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications, Inc.
<https://doi.org/10.4135/9781412963909.n280>.
- Pokorny, H., Holley, D., & Kane, S. (2016). Commuting, transitions and belonging: the experiences of students living at home in their first year at university. *Higher Education*, 74(3), 543–558.
<https://doi.org/10.1007/S10734-016-0063-3>.
- Prayunisa, F., & Marzuki, A. D. (2024). Analisis Kesulitan dalam pelaksanaan praktikum IPA SD dan IPA Terpadu SMP. *NUSRA : Jurnal Penelitian Dan Ilmu Pendidikan*, 5(3), 1145–1151.
<https://doi.org/10.55681/nusra.v5i3.3133>.
- Pritchett, L., & Beatty, A. (2015). Slow down, you're going too fast: Matching curricula to student skill levels. *International Journal of Educational Development*, 40, 276–288.
<https://doi.org/https://doi.org/10.1016/j.ijedudev.2014.11.013>.
- Pye, J. (2025). Direct observations of practice in social work education: the role of professional autonomy in policy enactment. *Social Work Education*, 44(6), 1454–1470.
<https://doi.org/10.1080/02615479.2024.2400205>.
- Qin, Z., Yang, G., Lin, Z., Ning, Y., Chen, X., Zhang, H., & Wong, C. U. I. (2025). The impact of academic burnout on academic achievement: a moderated chain mediation effect from the Stimulus-Organism-Response perspective. *Frontiers in Psychology*, 16, 1–12.
<https://doi.org/10.3389/FPSYG.2025.1559330>.
- Ramírez-Castañeda, V., Westeen, E. P., Frederick, J., Amini, S., Wait, D. R., Achmadi, A. S., Andayani, N., Arida, E., Arifin, U., Bernal, M. A., Bonaccorso, E., Sanguila, M. B., Brown, R. M., Che, J., Condori, F. P., Hartiningtias, D., Hiller, A. E., Iskandar, D. T., Jiménez, R. A., ... Tarvin, R. D. (2022). A set of principles and practical suggestions for equitable fieldwork in biology. *Proceedings of the National Academy of Sciences*, 119(34), 1–9.
<https://doi.org/10.1073/PNAS.2122667119>.
- Rastogi, S., Gupta, S., Deepak, D., Mishra, B. N., Gore, R., & Singh, V. (2025). A systematic literature review on anxiety among undergraduate students: causes and coping strategies. *Annals of Neurosciences*, 33(4), 507–522.
<https://doi.org/10.1177/09727531251366078>.
- Sari, I. K., & Hidayati, E. (2020). Cognitive reconstruction to reduce anxiety in grade VI elementary schools. *Jurnal Psikologi Integratif*, 8(1), 29–40.
<https://doi.org/https://doi.org/10.14421/jpsi.v8i1.1969>.
- Scheerens, J., Glas, C., & Thomas, S. M. (2005). *Educational evaluation, assessment, and monitoring*. Swets & Zeitlinger Publishers.
- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257–285.
[https://doi.org/10.1016/0364-0213\(88\)90023-7](https://doi.org/10.1016/0364-0213(88)90023-7).
- Sweller, J. (2011). Cognitive load theory. *Psychology of Learning and Motivation - Advances in Research and Theory*, 55, 37–76. <https://doi.org/10.1016/B978-0-12-387691-1.00002-8>.
- Tamba, Y. R., Napitupulu, M. A., & Sidabukke, M. (2020). Analisis kesulitan belajar siswa pada materi

- hewan invertebrata di kelas X. *Jurnal Pelita Pendidikan*, 8(1), 80–88. <https://doi.org/10.24114/jpp.v8i1.11321>.
- Tripp, T. M., Jiang, L., Olson, K., & Graso, M. (2019). The fair process effect in the classroom: Reducing the influence of grades on student evaluations of teachers. *Journal of Marketing Education*, 41(3), 173–184. <https://doi.org/10.1177/0273475318772618>.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press.
- Wang, J., Wang, Z., Yang, Y., Wang, T., Lin, H., Zhang, W., Chen, X., & Fu, C. (2025). Academic burden and emotional problems among adolescents: A longitudinal mediation analysis. *Journal of Adolescence*, 97(4), 989-1001. <https://doi.org/10.1002/JAD.12471>.