Position Paper: Integrating Inquiry-Based Learning Pedagogy in Information Technology

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Abstract: This position paper examines the implementation of Inquiry-Based Learning (IBL) in Information Technology (IT) education, focusing specifically on a first-year database unit. Traditional pedagogical approaches, which predominantly rely on lectures and textbooks, often hinder student engagement and motivation. The paper identifies the challenges inherent in current IT educational practices and proposes IBL as an effective pedagogical alternative. IBL fosters active learning and critical thinking, thereby enhancing students' grasp of real-world applications. The proposed trial of IBL in an introductory database course aims to assess both student outcomes and instructor experiences. The benefits of IBL, including increased student engagement and improved knowledge retention, are examined, as well as challenges related to time management, group dynamics, and technical issues. The paper concludes with a call for extended exploration and broader adoption of IBL methods in first-year IT courses, promoting a necessary shift in educational practices to address student needs better.

1 INTRODUCTION

Information Technology (IT) education plays a critical role in preparing students for the ever-evolving demands of the digital world. Traditionally, IT education has relied on structured, teacher-centred approaches that emphasise lectures and standardised assessments. While these methods have proven effective in delivering foundational knowledge, they often fall short in fostering the deeper skills required for real-world problem-solving and innovation(Schuh, 2004). With the growing need for students to not only understand theoretical concepts but also to apply their knowledge in practical contexts, Inquiry-Based Learning (IBL) presents a promising alternative.

IBL is a pedagogical approach that encourages students to actively engage with the learning process by investigating complex problems, collaborating with peers, and taking ownership of their learning(Singha and Singha, 2024). This student-centred model emphasises critical thinking, creativity, and the ability to synthesise and apply information to novel situations. In the context of IT education, where the rapid pace of technological advancement demands continual adaptation, IBL can help students develop the skills necessary to navigate uncertainty and solve real-world challenges.

This position paper outlines the potential of implementing IBL in IT education, with a focus on first-year units. It discusses the challenges of traditional teaching methods, explores the benefits of IBL, and proposes a pilot program of IBL in an introductory database unit. The paper also examines the key factors that would contribute to the successful implementation of IBL, including teacher education, curriculum redesign, and authentic assessments(Justice et al., 2009). By aligning teaching practices with the needs of a modern IT curriculum, this paper aims to provide a framework for enhancing student engagement, improving learning outcomes, and preparing students for the challenges they will face in the tech industry.

2 IT EDUCATIONAL LANDSCAPE

A clear understanding of the educational outcomes and requirements of the discipline is necessary before considering the pedagogical methodology. This sec-

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tion outlines the context of the Bachelor of Information Technology (BIT) course and its database unit, providing the foundation for the evaluation of the proposed intervention.

IT education at the tertiary level is centred around equipping students with a broad set of technical, practical, and interpersonal skills that are critical to their success in the rapidly advancing digital landscape (Deba et al., 2014). The curriculum is structured to not only build technical expertise but also foster critical thinking and problem-solving skills, ensuring that students are capable of addressing complex IT challenges. The course outcomes are specifically designed to help students understand core concepts, develop analytical skills, and prepare them to meet the demands of the IT industry.

2.1 Macquarie University: BIT Course Outcomes

The Bachelor of Information Technology at Macquarie University is the third most popular program, with more than 10,000 enrolled students. It provides seven specialisations, including data science and cyber security. The program's objective is to develop students' skills and knowledge, preparing them for successful careers in the dynamic IT sector.

The degree evaluates student learning through a comprehensive set of course outcomes that encompass the entire curriculum, as outlined below:

- **Outcome1.** Demonstrate comprehensive knowledge in essential areas of Information Technology, including data management and modelling, networking, cybersecurity, and programming.
- **Outcome2.** Analyse complex problem requirements to design and assess technological solutions for practical issues.
- **Outcome3.** Apply advanced knowledge and skills from a specific area of Information Technology to address real-world challenges in domains such as software design, applied data modelling and analysis, and cybersecurity detection and mitigation.
- **Outcome 4.** Collaborate effectively as a valuable team member on an industry-relevant project.
- **Outcome 5.** Exhibit clear and critical thinking, well-informed judgment, and professional standards when relating knowledge and skills in Information Technology to broader societal contexts, particularly in ethical and security decision making.

The course outcomes are a higher-level abstraction of the unit outcomes. Individual units break down complex skills into manageable competencies, allowing students to engage with the content and be assessed on their progress toward achieving the course outcomes(Gottipati and Shankararaman, 2018).

2.2 Traditional Teaching Pedagogy

The traditional teaching pedagogy is predominantly teacher-centred, emphasising lectures and reliance on textbooks. It is characterised by a rigid curriculum centred on standardised assessments and a focus on memorisation. This methodology prioritises rote learning and memory recall, often at the expense of fostering deeper comprehension and practical application (Silwal and Kafle, 2024). Current instructional delivery includes lectures and practical sessions, while assessments are conducted through take-home assignments and in-class evaluations. In traditional pedagogy, assessments are predominantly summative, including exams, quizzes, and assignments. These evaluative methods emphasise the recall and reproduction of established knowledge rather than encouraging critical thinking, creativity, or problem-solving skills.

Traditional teaching pedagogy contributes to **challenges** in IT education, hindering students' career readiness and industry preparedness(Van Wyk, 2022), these include:

Traditional teaching pedagogy limits students' outcomes by prioritising lectures and textbook-based learning over experiential learning and critical thinking. This approach presents several challenges in IT education, negatively affecting students' readiness for careers and industry demands (Van Wyk, 2022). The primary issues include:

- **Limited Student Engagement.** Traditional teaching often involves passive learning, resulting in diminished student involvement in the educational process, which limits opportunities for collaboration, inquiry, and exploration.
- **Lack of Personalisation.** Traditional pedagogy frequently adopts a uniform approach, not accounting for the diverse learning styles and paces of individual students, potentially limiting the overall effectiveness of instruction for all learners.
- **Minimal Feedback Opportunities.** In traditional models, feedback is often limited to assessments such as exams, with fewer opportunities for timely or formative feedback, which can hinder student growth and improvement.

- **Emphasis on Content Delivery.** Traditional teaching places a high emphasis on content delivery rather than fostering higher-order skills such as critical thinking, problem-solving, and real-world application.
- **Inflexible Learning Environments.** The structure of traditional teaching methods often restricts the ability to adapt lessons to real-time student needs or integrate modern technologies and tools that could enhance learning experiences.
- **Assessment of Narrow Skills.** Traditional assessments predominantly measure content recall, which may not fully reflect a student's ability to apply knowledge in real-world contexts or demonstrate a broad range of competencies.
- **Limited Collaboration.** Traditional teaching methods often lack opportunities for collaborative learning, which is essential for developing interpersonal skills and the ability to work effectively in teams, both critical competencies in professional settings.

An analysis of learning outcomes across different instructional methods reveals the primary challenges faced when shifting from traditional teaching to inquiry-based learning (IBL) (Bartolomé, 2025).

This context prompts an exploration of how particular units, like Database Design and Management, can leverage pedagogical strategies that align with these outcomes to improve student achievement.

2.3 Unit Specific Challenges: Introductory Database Design and Management

The Introductory Database Design and Management unit, which is conducted annually for at least 1100 students, has faced increased failure rates in recent years. A new pedagogical strategy is being explored to improve student outcomes, engagement, and overall learning experiences, with the goal of enhancing academic performance.

The conventional teaching methodology, characterised by a reliance on lectures and practical exercises based on textbook content, has posed significant challenges. While this approach ensured thorough coverage of material, it did not foster active engagement or the practical application of knowledge to real-world scenarios.

Students encountered difficulties with conceptual topics in database design, such as normalisation, which proved challenging to contextualise in practical applications. This issue was further compounded when attention turned to database management subjects, such as data quality, and more advanced concepts like data marts and data warehouses, which were also viewed as overly theoretical. Students showed greater engagement with more pragmatic topics, such as database implementation and Structured Query Language (MySQL). Conversely, students engaged positively with more applied topics such as database implementation and Structured Query Language (MySQL). Despite the introductory nature of the course, students struggled to synthesise their knowledge into database design and implementation scenarios that were not explicitly covered in the curriculum. While they could execute discrete tasks, they found it challenging to apply their understanding in more holistic and interconnected contexts.

3 THE PROPOSED INTERVENTION

Research in IT education shows that IBL enhances technical skills and problem-solving, for example (Lazonder and Harmsen, 2016) found that IBL in software development courses improved students' problem-solving and collaboration abilities. (Öztürk et al., 2022) reported that IBL in database design increased student engagement and understanding of complex topics like SQL. Barron et al. (2015) also highlighted that IBL in information systems courses helped students apply theoretical knowledge to real-world problems. These studies demonstrate that IBL effectively bridges theory and practice in IT education.

IBL necessitates careful attention to several key elements, including teacher training, content development, and authentic assessment methods(Badeleh and Gashmardi, 2024). This evidence-driven approach, grounded in diverse research findings, facilitates the establishment of an effective and impactful educational solution. At the same time, the intervention's systematic design promotes successful implementation. The intervention is designed to be implemented in four phases as shown in the Figure 1

3.1 Phase 1: Align IBL with Course Outcomes

The initial step of the IBL intervention involves evaluating the alignment of inquiry-based learning (IBL) pedagogy with the intended learning outcomes at the course level. At Macquarie University, IBL aligns well with the course objectives of BIT education by

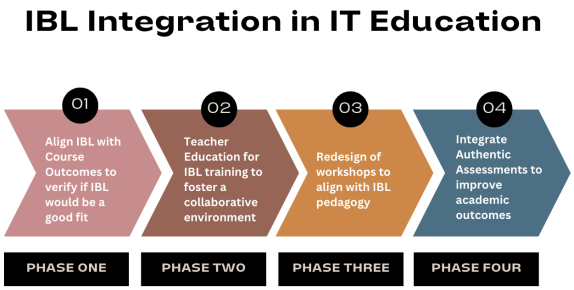

Figure 1: Phases of IBL Implementation.

fostering essential competencies required in the IT sector. The learner-centric aspect of IBL encourages active participation in the curriculum, enabling students to cultivate the problem-solving and teamwork skills vital for success in both academic and professional environments.

Course Outcome 2, which emphasises the analysis of complex problems to devise and evaluate IT solutions, is supported by IBL's focus on real-world problem-solving and critical analysis. Through IBL, students engage in open-ended projects that necessitate the identification and resolution of real-world challenges, emulating the demands of the IT industry. Course Outcome 3, which emphasises the application of knowledge to solve practical problems in areas such as software design and data modelling, is reinforced through IBL's experiential learning approach. In this framework, students develop tangible solutions in collaborative settings, reflecting the interdisciplinary and pragmatic nature of the IT field. Course Outcome 4, which prioritises effective teamwork, is enhanced by IBL's emphasis on collaborative learning and peer interaction. By working together on inquiry-based projects, students refine their communication, collaboration, and problem-solving skills, which are crucial in IT professional settings.

IBL offers a dynamic approach that directly supports the achievement of course outcomes, ensuring students grasp theoretical concepts and apply them in real-world scenarios.

3.2 Phase 2: Teacher Education

The education and support of teachers are essential initial steps for the successful implementation of inquiry-based learning (IBL). This process equips teachers with the fundamental knowledge and skills required for the effective execution of the intervention (Fry et al., 2025). An introductory program will be established to familiarise teachers with IBL methodologies and instructional design, ensuring sustained support and effective application.

Teachers will guide teachers in facilitating IBL classrooms, emphasising collaborative learning techniques. They will gather and integrate information on IBL, subsequently sharing their insights to align understanding and standardise IBL practices within the unit, promoting a unified pedagogical approach (Evans, 2025). This experiential learning will enable teachers to comprehend the practical applications of IBL, ensuring consistency in its implementation across the unit.

For successful IBL implementation, effective resource allocation is crucial. Teachers need dedicated time for preparation, and students require adequate time for engagement. Ongoing support for instructors is essential to maintain effective delivery. Technology should be readily available for research, collaboration, and accessing resources, ensuring no disruptions in learning. Additionally, administrative support is critical to coordinate scheduling, facilitate group work, and ensure the availability of necessary materials. With the teacher education framework in place, the unit must be redesigned to align IBL with learning outcomes and instructional delivery. This alignment will enhance the relevance and effectiveness of the approach, ensuring it fosters capable graduates.

3.3 Phase 3: Workshop Redesign

The unit will be restructured to promote an Inquiry-Based Learning (IBL) approach while preserving the established learning outcomes. This restructuring will involve rethinking learning activities and instructional methods to create an IBL environment that emphasises student engagement and a deeper connection to the course content(Beltran and Kaplanis, 2024).

The initial stage of this transformation will concentrate on revising workshop materials to support IBL. Questions and case studies will be designed to foster collaborative activities, enabling students to tackle challenges in database design, identify relevant information, and propose solutions. The workshop framework will be built around five principal components(Lin, 2013) to facilitate IBL:

1. **Collaborative Problem-Solving.** Group work will stimulate diverse solutions and mimic real-world professional scenarios.
2. **Open-Ended Tasks.** These tasks will allow students to engage with concepts and link them to practical issues. By identifying entities, attributes, and their interrelations, students will develop their designs and assumptions based on case studies. In SQL assignments, students will generate their own questions, enhancing class discussions by reflecting on examples covered in lectures.

3. **Class Discussions.** Following their collaborative efforts, groups will participate in class discussions to share insights, evaluate various strategies, and analyse the advantages and limitations of their designs.
4. **Reflection.** Students will be encouraged to reflect on their choices and the reasoning behind their design decisions for open-ended tasks, considering how these choices impact the overall system architecture.
5. **Instructor Support.** Instructors will facilitate students in reaching suitable solutions by guiding them in two main areas: identifying relevant information and effectively synthesising it to meet the class objectives. Weekly resources will be provided to instructors to enhance questioning techniques and promote engaging discussions.

3.4 Phase 4: Integrate Authentic Assessments

Authentic assessments are designed to simulate real-world challenges, evaluating students' abilities to apply knowledge and skills in practical situations.

In IBL, authentic assessments play a crucial role by focusing on students' capacity to engage with complex problems and make meaningful contributions to solutions (Barron, 2015). Evaluations are frequently employed in this context, where students undertake tasks that reflect real-life scenarios and require the application of learned concepts to produce tangible outcomes. Peer reviews also play a significant role, allowing students to critique each other's work, provide constructive feedback, and gain insights from diverse viewpoints (Kokotsaki, 2016).

To foster collaboration, a redesign of authentic assessments to incorporate group-based projects is proposed. One potential assessment plan involves the design and implementation of a database governed by specific business rules, where students take on distinct roles as to those within an IT team. This structure mirrors real-world teamwork, thereby promoting accountability and interdependence among peers. Given students' existing participation in inquiry-based learning (IBL) during workshops, they are well-prepared to address these group tasks beyond the classroom setting. This approach not only enhances critical thinking and problem-solving skills but also ensures that assessments effectively measure students' abilities to navigate complex challenges in professional environments. Ultimately, this strategy seeks to bridge academic learning with practical applications, equipping students for future contributions in their respective fields (Devaki, 2024).

3.5 Distinctions Between IBL and PBL

Inquiry-Based Learning and Project-Based Learning(PBL) share similarities in promoting student-centred, collaborative, and real-world problem-solving approaches. Differences between the pedagogies are important to note; IBL focuses on the process of inquiry, critical thinking, and open-ended exploration, while PBL centres on structured projects with defined outcomes. Given the large sample of 1,200 students, IBL is a better fit for IT education due to its method, flexibility and scalability. IBL can adapt across various disciplines without requiring extensive resources for individualised projects, making it suitable for large groups. Additionally its focus on inquiry and teacher-guided exploration allows for efficient feedback and support across a large cohort.

3.6 Evaluating the Intervention

A robust framework for assessing the effectiveness of IBL interventions integrates both quantitative measures (e.g., academic performance, engagement, and retention) and qualitative assessments (e.g., student motivation, instructor feedback, and inquiry depth) to provide a holistic evaluation of student learning outcomes. Studies highlight the importance of pre/post-test comparisons, participation tracking, student self-assessments, and structured rubrics to measure knowledge application and cognitive development effectively (Fan, 2015), (Lazonder and Harmsen, 2016), (Öztürk et al., 2022), (Chu et al., 2021).
Quantitative measures will include:

- **Grades.** Reflecting academic achievement through authentic assessments and course assignments.
- **Engagement.** Measured by attendance, participation in group activities, and time spent on tasks.
- **Knowledge Retention.** Tracked through course completion rates and follow-up surveys assessing students' ability to apply learned knowledge in future contexts.

Qualitative measures will include:

- **Student Surveys.** Assessing motivation, perceived engagement, and overall involvement in the learning process.
- **Instructor Feedback.** Providing insights into the quality of student participation, problem-solving, and collaboration in the classroom.

4 COUNTER ARGUMENTS

The literature identifies several challenges associated with the implementation of IBL in IT education. A primary concern involves the transition from traditional teacher-centred methodologies to student-focused learning frameworks. This shift can be particularly challenging in IT due to the inherently technical nature of the material, which often necessitates structured learning pathways. Consequently, students may struggle to engage with open-ended assignments that require autonomy and independent critical thinking (Lötter, 2023).

Additionally, the necessity for students to adopt IBL methodologies may clash with the practical aspects of IT courses, where the acquisition of specific technical skills is critical. Learners often find themselves grappling with the inherent ambiguity of IBL tasks that do not have clear solutions, which can generate feelings of uncertainty and impede their navigation through the learning process. Educators may face challenges in assessing student progress and delivering appropriate support within IBL frameworks, as the absence of standardised evaluations complicates the assessment landscape (Kamath and White, 2023).

IBL presents several challenges that need careful consideration. Firstly, effective time management is crucial as students may struggle to balance collaborative tasks, research, and discussions with other course demands, resulting in uneven progress. Secondly, group dynamics can create issues where unequal participation may lead to some members dominating discussions. However, others remain passive, affecting the quality of group work. Additionally, logistical and technical difficulties can hinder engagement, as students may face challenges with platforms, database access, and document management, creating stress and disrupting the learning process. Finally, student preparedness is a concern, as the transition to a more self-directed learning approach may be daunting for those accustomed to structured, teacher-led environments. Despite these obstacles, the benefits of implementing IBL in IT education must be carefully weighed against these potential challenges.

5 POSITION STATEMENT

This position paper underscores the significance of IBL as a vital strategy for achieving the educational goals of IT courses. It highlights the advantages of IBL in fostering an engaging, learner-centric environment that encourages in-depth involvement and skill enhancement. Increased student participation, enhanced critical thinking, and the ability to apply theoretical knowledge to practical scenarios exemplify the effectiveness of this pedagogical approach. Despite existing challenges in adapting IBL for diverse learner needs, the demonstrated long-term benefits, including improved collaboration, motivation, and learning outcomes, support its continued application.

A review of the literature related to IBL in IT education reveals several critical insights. Although there are not many extensive studies specifically focused on integrating IBL tertiary-level level IT edu, evidence from related disciplines suggests its potential efficacy in enhancing student outcomes. Research in areas such as programming, database design, and software development has demonstrated that IBL techniques, such as collaborative problem-solving and real-world case studies, can significantly improve critical thinking, problem-solving abilities, and engagement, making it a promising approach for IT education.

The successes observed in other academic disciplines demonstrate the necessity of robust faculty support, particularly when educators function as facilitators who guide students through inquiry-based activities rather than solely delivering traditional lectures. Studies suggest that when learners are engaged in IBL and receive prompt feedback, their capacity to apply knowledge in practical contexts is enhanced. Prioritising student engagement, providing tailored support, and encouraging collaboration are crucial for effectively implementing IBL in IT education. These components not only lead to improved academic outcomes but also contribute to higher retention rates as students feel more connected and invested in their educational journey.

5.1 Future Directions

A pilot implementation of this plan is scheduled for the upcoming semester, targeting a cohort of over 1,200 first-year students enrolled in the introductory database course. This trial will involve the collection of both qualitative and quantitative data via student surveys administered at the beginning and end of the semester, along with an analysis of academic performance. The primary objectives are to understand students' perspectives on and outcomes from Inquiry-Based Learning (IBL) and to obtain faculty feedback regarding their experiences in applying IBL methodologies. Data for analysis will encompass factors such as student type (domestic/international), gender, and repeat status (first-time/repeating). If the trial is deemed successful, there are plans to expand the initiative to additional first-year courses in subsequent semesters. Currently, assessments for the program-

ming unit have been redesigned to align with IBL principles, and a dedicated team has been established to focus on the implementation of these pedagogical practices. Future research will also aim to assess student progress in subsequent courses, enabling an evaluation of the effectiveness of the IBL approach on defined course outcomes.

6 CONCLUSION

IBL represents a significant shift in the pedagogical landscape of IT education, aligning instructional strategies with the dynamic needs of both students and the technology industry. By emphasising active engagement over passive learning, IBL fosters crucial skills such as critical thinking, problem-solving, and collaboration. The proposed implementation of IBL in introductory units, like the database course, offers a valuable opportunity to assess its impact on student outcomes and faculty experiences.

While the transition to IBL presents various challenges, including time management, group dynamics, and technical hurdles, the potential advantages are substantial. Enhanced student engagement, deeper learning experiences, and increased retention rates provide a strong justification for this transformative approach. The framework proposed herein underscores the importance of comprehensive teacher training, thoughtful redesign of course structures, and the incorporation of authentic assessments to facilitate the effective implementation of IBL.

Furthermore, ongoing research is essential to evaluate the long-term effects of IBL on student success across various first-year units. By embracing IBL, IT education can better equip students with the skills and knowledge needed to excel in a rapidly changing professional landscape.

REFERENCES

Badeleh, A. and Gashmardi, N. (2024). Design, development and validation of inquiry-based science education with a technology approach in education. *Journal of Research in Chemistry Education*.

Barron, L. (2015). Preparing pre-service teachers for performance assessments. *Journal of Interdisciplinary Studies in Education*.

Bartolomé, E. (2025). Didactic models for active and inquiry-based learning of machines and mechanisms. *International Journal of Mechanical Engineering Education*.

Beltran, R. and Kaplanis, N. (2024). Time to close the knowledge–practice gap in field teaching. *Frontiers in Ecology*.

Chu, S. K. W., Reynolds, R. B., Tavares, N. J., and Notari, M. (2021). *21st Century Skills Development Through Inquiry-Based Learning: From Theory to Practice*. Springer. PDF.

Deba, A. A., Jabor, M. K., Buntat, Y., and Musta'mal, A. H. (2014). Potential of service-learning on students' interpersonal skills development in technical and vocational education. *Asian Social Science*, 10(21):1.

Devaki, V. (2024). Exploring the impact of innovative assessment methods on learning outcomes: A review of project-based assessments, portfolios, peer assessment, and self-assessment. *Policy Development, Curriculum Design, and Administration of Language Education*, pages 343–374.

Evans, D. (2025). The effect of inquiry-based learning on content mastery and understanding of nos concepts in a secondary chemistry classroom. *Exploring Social and Cultural Contexts of the Nature of Science Education*.

Fan, X. (2015). Effectiveness of an inquiry-based learning using interactive simulations for enhancing students' conceptual understanding in physics. PDF Link.

Fry, K., Nakar, S., and Zorn, K. (2025). Professional learning interventions for inquiry-based pedagogies in primary classrooms: A scoping review (2012–2022). *Mathematics Education Research Journal*.

Gottipati, S. and Shankararaman, V. (2018). Competency analytics tool: Analyzing curriculum using course competencies. *Education and Information Technologies*, 23:41–60.

Justice, C., Rice, J., Roy, D., Hudspith, B., and Jenkins, H. (2009). Inquiry-based learning in higher education: Administrators' perspectives on integrating inquiry pedagogy into the curriculum. *Higher Education*, 58(6):841–855.

Kamath, A. and White, P. J. (2023). Tensions in teaching senior biology using inquiry based learning. *Teaching Science*, 69(1):29–40.

Kokotsaki, D., M. V. . W. A. (2016). Project-based learning: A review of the literature. *Improving Schools*, 19(3):267–277.

Lazonder, A. W. and Harmsen, R. (2016). Meta-analysis of inquiry-based learning: Effects of guidance. *Review of Educational Research*. SAGE Link.

Lin, H., H. Z. R. Y. K. . L. S. T. (2013). The impact of collaborative reflections on teachers' inquiry teaching. *International Journal of Science Education*.

Lötter, L. (2023). *The use of a flipped classroom model for inquiry-based learning in Senior Phase Natural Sciences*. PhD thesis, University of Johannesburg.

Schuh, K. L. (2004). Learner-centered principles in teacher-centered practices? *Teaching and Teacher education*, 20(8):833–846.

Silwal, U. and Kafle, R. (2024). Evidence-based teaching practices in physics: An overview on authentic teaching and learning. *Journal of Nepal Physical Society*.

Singha, R. and Singha, S. (2024). Application of experiential, inquiry-based, problem-based, and project-based

learning in sustainable education. In *Teaching and Learning for a Sustainable Future: Innovative Strategies and Best Practices*, pages 109–128. IGI Global.

Van Wyk, M. (2022). *Pre-service teachers' preparedness for Fourth Industrial Revolution teaching and learning*. PhD thesis, Cape Peninsula University of Technology.

Öztürk, B., Kaya, M., and Demir, M. (2022). Does inquiry-based learning model improve learning outcomes? a second-order meta-analysis. *Journal of Pedagogical Research*. PDF Link.