

Designing Effective Project-Based E-Learning Platforms for Software Engineers

Significance, Contribution to the Discipline, and Research Problem

The rapid evolution of technology in the software industry creates continuous demand for upskilling. Since the COVID-19 pandemic, external e-learning platforms such as Coursera, Udemy, LinkedIn Learning, and YouTube have become primary avenues for professional development. These platforms allow software engineers to access training flexibly alongside their work commitments, supporting both individual career growth and organisational competitiveness (Deshmukh and Mehta, 2024). Project-Based Learning (PBL) is widely recognised as an effective approach for building advanced, practical skills by immersing learners in authentic, real-world tasks (Spirina *et al.*, 2025). However, recent evidence suggests that many PBL implementations remain geared towards students or entry-level learners rather than experienced professionals (Tenhunen *et al.*, 2023). This limits the value of such courses for software engineers who require learning experiences closely aligned with workplace complexity and tools.

This proposal builds directly on the earlier literature review but narrows the focus to external PBL platforms serving software engineers, addressing three specific and recurring challenges. Firstly, many courses are too basic, lacking the complexity required to reflect real workplace problems. Secondly, there is often no structured

learning pathway, leaving learners to navigate disconnected modules with no clear sense of progression. Finally, full-time engineers face severe time constraints due to their employment commitments, meaning that course design must account for limited, fragmented study periods.

These challenges not only hinder individual learning outcomes but also contribute to broader skill shortages and inefficiencies within the technology sector. As economic uncertainty places greater emphasis on career resilience, the importance of accessible, career-aligned learning has increased; LinkedIn (2024) reports that organisations now prioritise career-aligned and personalised learning. By identifying and consolidating design principles, this research will produce actionable recommendations to support platform designers and course creators in delivering advanced, efficient, and relevant learning experiences.

Research Question

What design principles can improve the effectiveness of project-based e-learning platforms for software engineers?

Aims and Objectives

This research aims to identify evidence-based design principles that enhance the effectiveness and usability of project-based e-learning platforms for software engineers.

The study has the following objectives:

- To review recent academic and grey literature (post-2020) on project-based e-learning and professional upskilling.
- To synthesise factors influencing platform effectiveness, including project complexity, structured pathways, and time flexibility.
- To develop a concise set of practical, actionable design guidelines for platform designers and course creators.
- To highlight research gaps and propose directions for future empirical investigations.

Key Literature Related to the Project

Recent meta-analyses confirm that project-based learning delivers superior outcomes compared to traditional teaching methods, particularly in technical disciplines such as computing and engineering (Spirina *et al.*, 2025). However, a systematic review of capstone courses in software engineering highlights that most projects are proof-of-concept exercises rather than realistic, production-level challenges. This mismatch limits skill transfer to workplace contexts and leaves experienced professionals underserved (Tenhunen *et al.*, 2023).

Industry sources show both the scale and nature of engineers' learning behaviour: Stack Overflow (2024) reports that the majority of developers use online resources to learn, while LinkedIn (2024) highlights the organisational priority on career-aligned, personalised learning. Together, these sources imply a strong demand for applicable, well-structured learning pathways, although neither provides a direct measure of user frustration about course sequencing or depth on commercial platforms.

Promising experiments, such as Romao *et al.* (2024), demonstrate that industry-academic collaboration can create authentic, complex learning experiences, but these models require resources and mentoring beyond what global commercial platforms typically offer. Together, these studies point to a research gap: while PBL is effective in principle, commercial platforms are not currently optimised for advanced, time-constrained learners such as full-time software engineers. This project seeks to address this gap by consolidating existing knowledge and producing evidence-based design principles.

Methodology / Development Strategy / Research Design

The study will adopt a qualitative, exploratory approach, using a narrative literature review with thematic synthesis. This method is well-suited to integrating diverse sources and generating practical insights within the module's timeframe.

The key stages of the methodology will include:

- **Search strategy:** Define inclusion criteria focusing on literature published between 2020 and 2025 to ensure post-COVID relevance.
- **Literature search:** Conduct searches across databases such as ScienceDirect, ACM Digital Library, arXiv, and the University of Essex Online Library, along with grey literature, including LinkedIn and Stack Overflow reports.
- **Screening and extraction:** Identify and extract relevant data on learner demographics, course structures, project design, and outcomes.

- **Thematic synthesis:** Analyse extracted data to identify recurring themes such as complexity, learning pathways, and time-flexible design.
- **Guideline development:** Translate these themes into a set of evidence-based design principles and a practitioner checklist.

Transparency will be maintained by documenting search decisions and recognising potential biases, especially within corporate reports.

Ethical Considerations and Risk Assessment

As this study relies entirely on secondary, publicly available data, ethical risks are minimal. Proper Harvard-style referencing will be used to ensure academic integrity, and copyright restrictions will be respected when using industry reports. Any potential biases within grey literature sources will be acknowledged and critically discussed. Since no personal data will be collected, compliance with GDPR is straightforward.

Description of Artefact(s)

The project will produce the following outputs:

1. A concise set of design principles for improving project-based platforms.
2. A practitioner-focused checklist for platform designers and course creators.

Timeline of Proposed Activities

Phase	Activities	Months
1	Refine research question and develop search protocol	1–2
2	Conduct literature search and initial screening	3–4
3	Full-text review and data extraction	5–6
4	Thematic synthesis and development of design principles	7–8
5	Writing of final report and practitioner checklist	9–10
6	Revision and final submission	11–12

This timeline has been developed on the assumption that the research will be conducted on a part-time basis alongside full-time employment commitments.

References

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