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MOOC RC DESIGN

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ABSTRACT

Reinforced Concrete (RC) Design is an educational innovation designed to enhance civil engineering subject by offering a flexible, globally accessible and industry-relevant course through an e-learning platform Massive Open Online Course (MOOC). This course focuses on the design of key RC building elements, i.e. slabs, beams, columns, shear walls and foundations, and delivered through structured modules aligned with Malaysia UBBL and Eurocodes. RC Design supports lifelong learning and improves students' competency by integrating interactive and outcome-based learning methods. This course features comprehensive assessments comprising of design assignment, project and online tests to strengthen critical thinking and practical application. Special features include virtual site visits to connect theory with real-world practice, gamified quizzes to enhance engagement and the application of design software to expose learners to digital tools utilised in the industry. Original teaching videos, real-world design cases and forums for instructor-student interaction enhance the overall learning experience. RC Design was developed using a systematic instructional design approach, implemented with clear learning outcomes and interactive content and monitored via learner engagement data and surveys. Feedback shows strong satisfaction: 70% of learners find this course beneficial and about 90% of respondents cite its effectiveness. This innovation supports the Malaysia Education Blueprint 2015–2025 and Sustainable Development Goal 4 (Quality Education) by ensuring equitable access to technical education and promoting lifelong learning through digital transformation in engineering education. RC Design not only bridges the education gap but also re-defines how future engineers are prepared for complex problem-solving in the digital era.

Keywords: *e-learning, MOOC, Outcome-based Education, Reinforced Concrete Design, SDG*

INTRODUCTION

Malaysia's higher education system is undergoing a strategic shift toward digital transformation, with a strong emphasis on flexible and accessible learning models, such as Massive Open Online Courses (MOOCs) to support quality education while aligning with the Malaysia Education Blueprint (2015–2025). MOOCs have proven effective in broadening access to quality engineering education, especially in resource-constrained environments (Illi & Elhassouny, 2025). Interactive content and gamified assessments in MOOCs integrated with flipped classroom strategies improve learner performance and learner autonomy as well as reduce dropout rates (Zakaria et al., 2024; Zhou, 2023). MOOCs also link theory to practice using tools like video demonstrations and virtual visits (Huang et al., 2024) and support deep learning through real-time feedback mechanisms and visualisation tools (Topali et al., 2023). However, challenges remain. Many Malaysian institutions, especially regional campuses, face limitations in delivering high-quality engineering design education due to insufficient lab resources, untrained instructors, a lack of access to digital tools, and a failure to engage students or reflect real-world design challenges (Hamed et al., 2025; Sulistiana & Imron, 2024). This gap creates a pressing need for flexible, interactive and industry-aligned e-learning platforms. Motivated by these challenges, the MOOC Reinforced Concrete (RC) Design was developed to serve as a scalable and engaging solution for this gap, specifically for civil engineering and architectural education in Malaysia. This extended abstract aims to present the distinctive features, implementation strategy and effectiveness of this e-learning course based on feedback and survey results from its initial cohorts, which was published in 2022 and has been continually maintained by the developers. It can be assessed at https://ufuture.uitm.edu.my/mooc/course_detail.php?course=ECS559.

RC Design was developed and hosted on Universiti Teknologi MARA's (UiTM) Learning Management Platform *uFuture*. This course is built with several innovative features to empower learners to study at their own pace, tailored for civil engineering undergraduates and professionals who seek to build or reinforce their competencies in the design of RC structures. Structured around two key learning outcomes, content is delivered through professionally produced video lectures, downloadable notes, and various engaging learning activities. Six major topics enable learners to equip themselves with fundamental engineering and design knowledge on RC building design including slabs, beams, columns, shear walls and foundations based on Malaysia UBBL and Eurocode 2. Learners are encouraged to actively engage with the content through quizzes and online tests. The incorporation of gamified assessments, via platform like Quizizz, adds an element of competition and instant feedback, and helps in sustaining engagement while reinforcing key concepts. This course also incorporates a virtual site visit, where students observe real-world construction scenarios that enable a deeper contextual understanding. Since its launch in 2017, MOOC RC Design has attracted over 250 active users, with high levels of participation in assessments and discussion forums. The use of design software ESTEEM bridges the gap between theoretical knowledge and real-world design application, equipping learners with tools commonly utilised in industry practice. Assignment and project are crafted to simulate professional scenarios, encouraging critical thinking and problem-solving. Most importantly, this course fosters interactive learning through embedded comment sections, peer forums, and instructors feedback. This promotes a learning community that supports collaboration, reflection, and continuous improvement. The platform also ensures continual quality improvement (CQI) through

structured surveys and analytics, enabling instructors to refine content based on learner needs and performance trends. The innovation also includes an automated tracking feature that monitors course progress and triggers certificate generation upon completion, issued by UiTM. **Figure 1** shows the key features of MOOC RC Design.

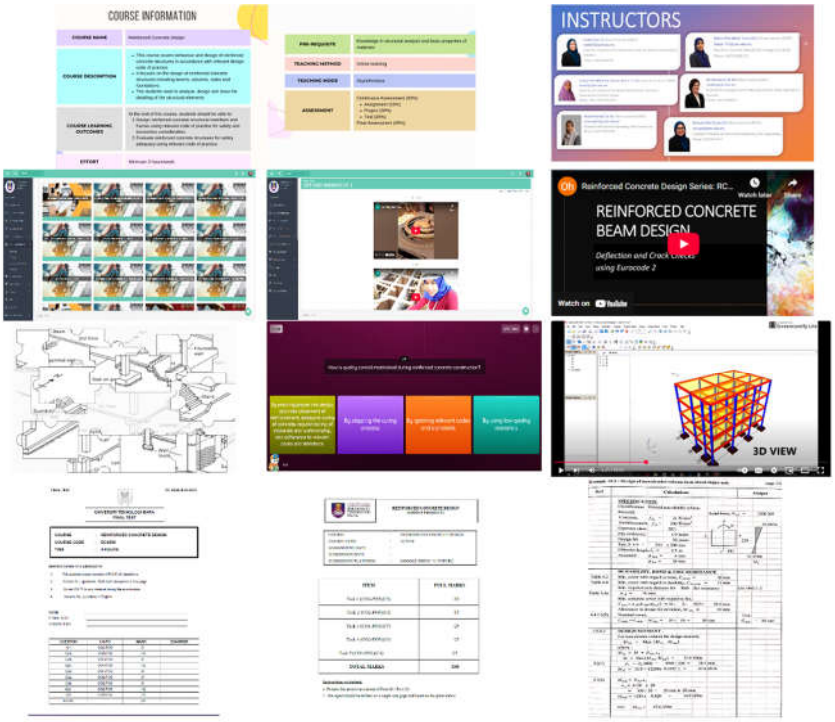

Figure 1. MOOC RC Design key features

METHOD

A quantitative survey-based study was conducted among undergraduate civil engineering students to evaluate the effectiveness of MOOC RC Design. The survey aims to assess learners' perceptions and experiences with various components of the innovation, including course structure, content, learning activities, assessments, accessibility and perceived benefits. A structured questionnaire was developed comprising of six main parts: 1) prior understanding of RC Design, 2) course structure and delivery, 3) content and learning activities, 4) assessments, 5) accessibility and learning environment, and 6) benefits of taking RC Design. An additional open-ended section was included for qualitative feedback and suggestions for improvement. The questionnaire items were adapted and validated from previous MOOC effectiveness studies, ensuring content relevance and clarity.

The survey used a five-point Likert scale to measure levels of agreement or satisfaction, ranging from "Strongly Disagree" (1) to "Strongly Agree" (5), and "Very Unsatisfactory" (1) to "Very Satisfactory" (5), depending on the nature of the question. A total of 74 respondents from the Civil Engineering

undergraduate programme voluntarily participated in the survey after completing this course. Participation was anonymous and informed consent was obtained from all participants. Data collection was conducted online using a secure Google Form from May to June 2025. Responses were automatically tabulated for analysis. The data were downloaded in spreadsheet format and cleaned to ensure completeness and consistency. Descriptive and inferential statistical analyses were then performed to interpret the results. Open-ended responses were analysed using thematic analysis to extract key qualitative insights. Recurring themes were identified in the learners' comments, which provided additional context to the quantitative findings, particularly in areas related to motivation, user interface design, and instruction clarity.

RESULTS AND DISCUSSIONS

The results, as illustrated in **Figure 2**, provide insight into learners' understanding and satisfaction with MOOC RC Design. In **Figure 2a**, a significant majority of respondents (>80% recorded for "Very Much" and "Much" responses) indicate they understood the purpose and benefits of this course, suggesting that learners possess a strong grasp of what MOOC RC Design offers in terms of educational value. A small portion (12.2%) remained "Unsure," while minimal responses were recorded for "Little" (5.4%) and "Very Little" (1.4%), indicating a low level of misunderstanding or unfamiliarity among learners. In **Figure 2b**, learners' satisfaction regarding the effectiveness of MOOC RC Design is similarly positive. The majority of respondents (63.5%) agreed, and a further 28.4% strongly agreed that RC Design course offered through MOOC is effective, showing a cumulative 91.9% positive satisfaction level. Only a minor percentage remained undecided (8.1%), and notably, no respondents disagreed or strongly disagreed.

These results highlight the positive perception and effectiveness of MOOC RC Design in delivering meaningful learning experiences. The high levels of understanding and satisfaction among respondents support the continual integration of RC Design into formal and informal education frameworks. The findings also suggest that the instructional design and content delivery of MOOC RC Design effectively meets learner expectations.

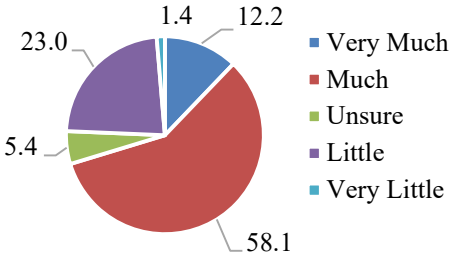

Figure 2a.: Level of understanding of the purpose and benefits of e-learning through MOOC RC Design

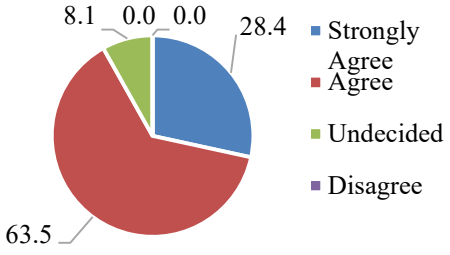

Figure 2b.: Overall satisfaction level on effectiveness of e-learning through MOOC RC Design

For the instructional design and content delivery of MOOC RC Design, the survey results demonstrate a high level of student satisfaction with this course, as shown in **Table 1**. A majority of respondents, 53% strongly agree and 39% agree, that the downloadable PDF lecture notes are useful indicating that learners value having accessible reference materials to support self-paced learning. Similarly, the short video lecture format (2–10 minutes) is well received, with 46% strongly agree and 41% agree responses, signifying that the video duration is appropriate. This suggests that microlearning strategies used in the MOOC aligned well with learner preferences and attention spans, contributing to higher engagement and retention.

The structure of learning activities over 10 sessions was also positively evaluated, with 55% respondents strongly agree and 34% respondents agree that the distribution was appropriate. This reflects effective modularization of the content, which is particularly important in sustaining motivation and enabling gradual progression in technical courses. The clarity of instruction was another strength, with 30% and 40% participants strongly agree and agree, respectively, that the content delivery was clear and easy to follow. This shows the effectiveness of the pedagogical approach, particularly the use of clear explanations, structured sequencing, and visual demonstrations in video lectures.

With regards to the use of educational technology, 32% respondents strongly agree and 33% respondents agree that the tools used are interesting and easy to navigate. While the majority response remains positive, the slightly lower percentage on disagreement spectrum suggests room for enhancement in terms of inter-activity or user interface design. For the assessment format, which comprising tasks with durations of 2–5 minutes, is seen as adequate by most learners (28% strongly agree and 36% agree). This indicates that concise assessments are effective in reinforcing key concepts without causing fatigue or cognitive overload. The relatively low percentages of disagreement (below 5%) and neutral responses (3%–11%) suggest that the majority of learners found this course to be a well-designed and engaging learning experience. Nevertheless, these minor neutral and negative responses highlight the potential areas for further improvement, particularly in enhancing technological engagement and refining content interactivity to better support diverse learning preferences.

Table 1.: Learners' Responses on MOOC Features

	Percentage Response (%)					
Responses	Lecture notes given in PDF file and can be downloaded	Video lectures given with duration range of 2-10 mins is appropriate	The learning activities were delivered throughout 10 sessions is acceptable	Instructional given in every lesson is clear and easy to follow	Educational technology used is interesting and easy to use	The assessment given with duration range of 2-5 mins is appropriate and adequate

Strongly Agree	53	46	35	41	43	38
Agree	39	41	55	46	45	49
Not Sure	3	11	4	11	9	11
Disagree	0	1	0	0	3	1
Strongly Disagree	5	1	5	3	0	1

CONCLUSION

The educational innovation of MOOC RC Design represents a significant step toward transforming civil engineering education in Malaysia by offering a flexible, accessible and interactive learning environment. Through a structured design and delivery model, this course successfully integrated essential topics in reinforced concrete design with modern digital tools such as video lectures, gamified assessments, virtual site visits and design software. An extensive survey involving 74 civil engineering undergraduates provided valuable insights into learner satisfaction and the overall effectiveness of the innovation. Feedback from respondents indicate a high level of satisfaction across all evaluated aspects, including course structure, instructional clarity, content relevance and platform usability. The participants appreciated the flexibility of MOOC RC Design and its ability to support deeper understanding through guided assessments and interactive activities. Statistical analysis further confirmed strong internal reliability and a consistent positive response across diverse learner backgrounds. This study highlights the potential of MOOCs to deliver technical engineering subjects effectively and equitably, especially in contexts with limited access to traditional classroom resources. These findings are significant for institutions and policymakers aiming to scale up digital education for engineering programs. Moreover, the RC Design innovation could be adapted for other disciplines, promoting innovation in teaching while supporting national goals for digital learning, educational transformation and SDG4.

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REFERENCES

Hamed, A. S. A., Wong, S. L., Rani, M. Z. A., Khambari, M. N. M., Abd Rahim, N. A., & Moses, P. (2025). Integrating Computational Thinking into Malaysian STEM Education: Challenges, Opportunities, and Strategic Solutions. *Bulletin of the Technical Committee on Learning Technology (ISSN: 2306-0212)*, *25*(1), 13-20.

Huang, A., de la Mora Velasco, E., & Haney, A. (2024). Examining instructional technologies in hospitality and tourism education: A systematic review of literature. Journal of Hospitality & Tourism Education, 36(2), 113-131. https://doi.org/10.1080/10963758.2022.2109480.

Illi, C., & Elhassouny, A. (2025). Edu-Metaverse: A Comprehensive Review of Virtual Learning Environments. IEEE Access. https://doi.org/10.1109/ACCESS.2025.3540944.

Topali, P., Chounta, I. A., Martínez-Monés, A., & Dimitriadis, Y. (2023). Delving into instructor-led feedback interventions informed by learning analytics in massive open online courses. *Journal of Computer Assisted Learning*, *39*(4), 1039-1060. https://doi.org/10.1111/jcal.12799.

Sulistiana, T., & Imron, A. (2024). Challenges and Opportunities Towards Quality Education in Indonesia and Malaysia. *Proceedings Series of Educational Studies*, (4), 478-488.

Zakaria, A. L. J., Anas, B., & Malki, M. O. C. (2024). A Systematic Review of Gamification in MOOCs: Effects on Student Motivation, Engagement, and Dropout Rates. *Journal of Educators Online*, *21*(2), n2.

Zhou, X. (2023). A conceptual review of the effectiveness of flipped learning in vocational learners' cognitive skills and emotional states. *Frontiers in Psychology*, *13*, 1039025. https://doi.org/10.3389/fpsyg.2022.1039025.