EVALUATION OF ONSITE INTERACTIVE LEARNING ACTIVITIES FOR INITIATING COURSES IN A DISTANCE LEARNING ENGINEERING DEGREE

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Distance learning in engineering education is often challenged by lack of hands-on experiences critical for developing practical skills. This study examines implementing a scenario-based physical interactive activity within the Bachelor of Science Honours in Engineering program at The Open University of Sri Lanka. The activity centred on the conceptual design of an autonomous car, was conducted at regional centres across the country to enhance accessibility. It involved students watching an educational video, identifying and mapping design keywords, creating technical illustrations, and initiating programming. This approach aimed to mimic the real-world engineering processes and encourage students to explore and learn autonomously.

Approximately 84% overall attendance was recorded, including full attendance in the Jaffna and Batticaloa centres. Nearly 83% of participants expressed a strong preference for physical activities over online ones, especially among students from outstations such as Jaffna, Batticaloa, and Kandy. Conversely, a significant number of Colombo-based students favoured online learning. Most students preferred engaging in the activity directly, using own learning strategies rather than pre-reading materials. This method was appreciated for enhancing understanding and retention, bridging the gap between theory and practice. Qualitative feedback highlighted the high satisfaction levels of the students and the value of hands-on experiences in group work. The decentralised model proved to provide equitable access and foster collaboration.

This learning approach combines the flexibility of distance education with essential practical engagement, offering a balanced educational experience. The success of this model suggests potential for broader application in other disciplines and programmes, providing a blueprint for integrating physical activities in distance learning. Future research should explore the long-term impacts and scalability of such teaching and learning models.

Keywords: Distance Learning, Decentralised Teaching, Physical Interactive Activities, Engineering Education

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INTRODUCTION

Distance learning in engineering education has predominantly relied on online platforms, offering students flexibility and accessibility. However, a critical component often missing from fully online courses is the hands-on, physical interaction vital for engineering students to develop practical skills and competencies (Freeman et al., 2014). During the COVID-19 global pandemic, most of the activities were conducted online and after that many institutions were reluctant to return to physical mode. Some researchers such as (Tubbal et al., 2023) suggest mixed mode as a solution while some researchers explore the remote functionality of physical laboratories (Almarshoud, 2011). The objective of this study is to explore the feasibility and assess the impact of a start-off activity in the Bachelor of Science Honours in Engineering programme offered by The Open University of Sri Lanka (OUSL). The activity was strategically conducted at five Regional Centers of OUSL across the country to maximize student participation and engagement. The study was conducted based on the following research questions.

1. Which mode, physical or online, is perceived by students for the first activity of a course in an engineering degree offered in distance mode?
2. Is there a significant effect from the decentralisation of activities in distance education rather than going for online mode for interactive activities?
3. Which method do students prefer: reading books and learning before attempting the activity, or using own learning style to explore and learn while engaging?

METHODOLOGY

The activity was a scenario-based conceptual design project titled “Autonomous vehicle” which was not informed to the students before they came. The attendees are first-year undergraduates registered for the two compulsory courses of BSc Hons (Eng); EEX3410 – Introduction to Electrical Engineering and EEX3417 – Software Development for Engineers. It was conducted group-wise where each group consisted of 5 to 6 students and the maximum number of groups per session was 7. Each group was helped by a Demonstrator or a Lecturer while the main activity coordination was done by two Senior Lecturers. The duration of the activity was 5 hours including a lunch break.

The research team expected students to imagine a real-world situation in their future engineering careers, identifying themselves as professionals working in a company. This approach aligns with constructivist learning principles, encouraging students to construct knowledge through real-world problem-solving (Tran, 2020). Notably, the lecturers did not teach the formal engineering design process (like requirement gathering, concept maps, flow charts, etc.) before the activity; instead, they encouraged students to explore and formulate these processes using own learning strategies. The activity comprised the following key steps:

1. **Keyword identification**: Students watched a video on autonomous cars and identified the key concepts and design elements. This initial step helped in gathering

design requirements and familiarizing students with the project's scope (Feisel & Rosa, 2005).

2. **Design**: Students created a concept map to show the relationships and connections between the keywords and the main design. This step encouraged logical thinking and helped in organizing their thoughts systematically.

3. **Technical Illustration**: Students produced technical illustrations of specific parts of the car. This involved drawing detailed diagrams and creating flowcharts to outline the design and functionality. This step mimicked the process of programming.

Each step was followed by a group presentation where all other groups were asked to comment and ask questions about their work. Interactions were mainly done within the group and the staff encouraged them by engaging in their group work to help find and explain relevant information.

Some students even began preliminary programming using logical thinking and flow charts, which laid the groundwork for software development which is a good indication of enthusiasm for self-learning. They also considered hardware interfacing, integrating sensors and actuators into their designs to simulate real-world applications.

The activity was conducted at Colombo, Kandy, Jaffna, Batticaloa and Matara Regional Centers to ensure accessibility for students dispersed across the country. This decentralized approach, which is entrusted to OUSL Regional Educational Service (RES), allowed students to participate without the need for long-distance travel. Academic staff from the central campus and Kandy Regional Center visited other centres to conduct the activity. A paper-based questionnaire was given to the participants before and after the activity. Questions were set to identify the students' perceptions of the necessity of each course unit in the curriculum and the significance of the design process in engineering.

RESULTS AND DISCUSSION

Research Question 1: **Mode preference for the first activity of the programme.** Though the activity was not included in the continuous assessment but was only an experimental one, the overall student participation rate was approximately 85%, with 100% attendance recorded at the Jaffna and Batticaloa regional centres. The summary of attendance is presented in Table 1.

Table 1: Percentage of attendance to the activity in regional centers

Center	Colombo	Kandy	Batticaloa	Jaffna	Matara	Total
Registered	190	49	18	13	7	277
Participated	159	41	18	13	4	235
Percentage	83.7 %	83.7 %	100 %	100 %	57.1 %	84.8 %

Feedback showed that most of the students appreciated and enjoyed the scenario-based approach to learning as they were provided with self-confidence. They also thanked the facilitators for providing a new experience. Specifically, students from outstations such as Jaffna, Batticaloa, and Kandy preferred physical activities, while a significant number of students in Colombo expressed preference for online activities. Overall, 82.7 % preferred physical attendance. One student commented, "This was the first time I truly felt like an engineer". Another student noted, "The opportunity to work with my peers in person made a huge difference in my understanding". Students also appreciated the convenience of multiple locations, with one stating, "Having a session near my hometown is a good opportunity for my higher studies". Another student at the end of the session in Jaffna, spoke in his native language saying, "It is a motivation for them to see people from main campus visiting their hometown".

Research Question 2: Decentralisation of delivery. The decentralized execution of the activity was well-received, with students appreciating the convenience and accessibility provided by the multiple locations. As shown in Figure 1, the students joined from almost all 26 districts of the country and 53.8 % of them can reach the regional centre within 2 hours of travel time. Another 25 % need to spend 3 hours. This proves the success of RES of OUSL.

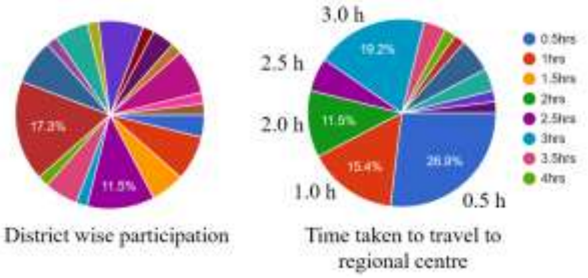

Figure 1: District-wise participation (left) and the time taken to travel regional centre (right)

Research Question 3: **Preferred learning method.** Regarding learning methods, most of the students preferred to explore and learn while engaging in the activity rather than reading books beforehand. They felt that this approach allowed them understand and retain the material better, as it encouraged active participation and critical thinking. This method aligns with active learning strategies, which have shown increasing student performance in STEM fields (Freeman et al., 2014). As shown in Figure 2, it is evident that 98.2 % of students have had a satisfactory understanding of the engineering design process after the activity. The activity successfully conveyed the significance of the two selected courses in the curriculum, as confirmed by the feedback, which shows 100% satisfaction from respondents.

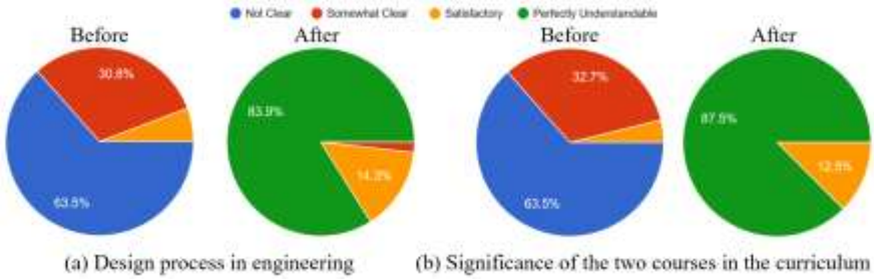

Figure 2: Students' feedback on their understanding of the engineering design process (a) and the significance of the two courses in the curriculum (b).

Figure 3 shows that before attending the activity 64 % of the students did not have a clear understanding of OUSL learning style. Also, it shows that 100 % of the students were able to understand it after the activity.

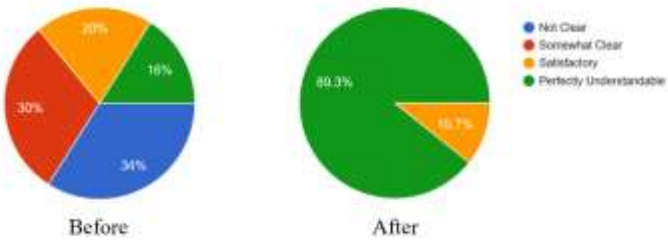

Figure 3: Students feedback on their understanding of OUSL teaching-learning style

The qualitative feedback highlighted that they greatly valued the hands-on experience, noting that it bridged the gap between theory and practice, which is often a limitation in fully online courses. One student mentioned, "Exploring and learning during the activity made the concepts much clearer and more memorable than just reading about them”.

CONCLUSIONS/RECOMMENDATIONS

The integration of physical activities in a distance learning environment offers a balanced approach to engineering education, combining the flexibility of online learning with the essential hands-on experience. The decentralised implementation model proved effective overcoming of the geographical barriers associated with distance learning. By bringing the physical activities to various locations, the programme ensured equitable access for all students. This approach also fostered a sense of collaboration among students, which is often lacking in online learning environments.

Incorporating physical activities into the said programme significantly enhanced the educational experience by supplying essential hands-on practice. This approach not only improves student satisfaction but also ensures that the quality of education is on par with, in-person programmes. The success of the decentralised execution model demonstrates the feasibility and benefits of such an approach.

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