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EXPLORING ENGINEERING STUDENT PERSPECTIVES: UTILIZING COMMERCIAL MOBILE APPS FOR ENVIRONMENTAL ERGONOMICS ASSESSMENT IN COMMUNITY-BASED PROJECTS

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Abstract

Through a community-based project, this study seeks to investigate students' perceptions of the use of commercial mobile applications in the assessment of environmental ergonomics. This study aims to combine mobile technology with community needs in a comprehensive endeavour to increase knowledge of how the physical environment affects human well-being. Community refers to the general public in homes, in car workshops, and in university laboratories. This study employs a mixed-method approach consisting of interviews and questionnaires to determine the perspectives of students regarding this endeavour. The results of the study indicate that through participation in community-based initiatives, their understanding of crucial aspects of environmental ergonomics increased significantly. Students are enthusiastic about using mobile applications to conduct ergonomics evaluations. This study will increase students' awareness of the significance of joint ergonomics and encourage the community to implement comparable initiatives to enhance the well-being of the whole. This study concludes that the use of commercial mobile applications in the evaluation of ergonomics can have a positive effect on student comprehension and community awareness of the significance of the human-physical environment relationship. Therefore,

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efforts to integrate mobile technology into the community-centered project methodology should continue to strengthen this relationship over time.

Keywords: Community; engineering; mobile application; project; SDG

Abstrak

Melalui projek berasaskan komuniti, kajian ini bertujuan untuk menyiasat persepsi pelajar terhadap penggunaan aplikasi mudah alih komersial dalam penilaian ergonomik alam sekitar. Kajian ini bertujuan untuk menggabungkan teknologi mudah alih dengan keperluan komuniti dalam usaha menyeluruh untuk meningkatkan pengetahuan tentang bagaimana persekitaran fizikal mempengaruhi kesejahteraan manusia. Komuniti merujuk kepada orang awam di rumah, di bengkel kereta, dan di makmal universiti. Kajian ini menggunakan pendekatan kaedah campuran yang terdiri daripada temu bual dan soal selidik untuk menentukan perspektif pelajar mengenai usaha ini. Hasil kajian menunjukkan bahawa melalui penyertaan dalam inisiatif berasaskan komuniti, pemahaman mereka tentang aspek penting ergonomik alam sekitar meningkat dengan ketara. Pelajar bersemangat menggunakan aplikasi mudah alih untuk menjalankan penilaian ergonomik. Kajian ini akan meningkatkan kesedaran pelajar tentang kepentingan ergonomik bersama dan menggalakkan masyarakat melaksanakan inisiatif setanding untuk meningkatkan kesejahteraan keseluruhannya. Kajian ini merumuskan bahawa penggunaan aplikasi mudah alih komersial dalam penilaian ergonomik boleh memberi kesan positif terhadap kefahaman pelajar dan kesedaran masyarakat terhadap kepentingan hubungan persekitaran manusia-fizikal. Oleh itu, usaha untuk mengintegrasikan teknologi mudah alih ke dalam metodologi projek berpusatkan komuniti harus terus mengukuhkan hubungan ini dari semasa ke semasa.

Kata kunci: Komuniti; kejuruteraan; aplikasi mobil; projek; SDG3

1.0 INTRODUCTION

In the modern era, ensuring the long-term sustainability of knowledge has become a crucial factor in ensuring the transmission of knowledge, discoveries, and comprehension between successive generations. In addition to focusing on programmes within the University, the University is becoming increasingly active in organising the agenda and scheduling programmes that involve parties outside the University including community. Community-based interactions in the domains of science, technology, engineering, and mathematics (STEM) are generally structured around projects. These projects involve several elements and factors that are not explicitly covered by the models commonly employed in community-

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engaged learning in a broader context (Leidig & Oakes, 2021). In the realm of advanced technology, the promotion of education is advocated to equip learners with the necessary skills and knowledge to adapt to the diverse range of sociotechnical elements. Numerous endeavours have been undertaken to enhance the pedagogical practises within STEM curriculum, with the aim of benefiting educators and students in community educational institutions. This involves a pedagogical framework centred around providing students with a curriculum that integrates academic principles with practical applications in specific domains (Phan & Ngo, 2020; Khamis et al. 2023).

Teaching and learning have undergone a swift evolution in the current educational environment. To increase the interest and comprehension of students in this new millennium, the teaching and learning world needs to look into the digital world or by using mobile learning. According to Khaddage and Lattenman (2013), mobile learning is described as "learning across multiple contexts, through social and content interactions, using personal electronic devices." This concept was taken from Crompton (2013). The utilisation of mobile learning (m-learning) is anticipated to experience significant growth due to the consistent increase in the proportion of individuals within emerging economies who possess and utilise smartphones (Shahrol et al. 2023; Etim & Olatokun 2024).

Engineering students mostly require hands-on experience dealing with a variety of materials and equipment. During the implementation of that process, occurrences may arise when the necessary equipment is found to be defective or insufficient for doing collaborative tasks involving a large number of users. Hence, digital applications, particularly those that are readily accessible via smartphones, are the preferred option in today's education world. Typically, these activities must be completed so that students can apply the theory they have learned in real-world application. Digital applications have become significantly influential in contemporary engineering projects. The use of smartphones has facilitated expedited and convenient access to a wide range of these apps. The utilisation of cost-free mobile applications not only streamlines the engineering procedure but also offers notable benefits (Punithavathi & Geetha, 2020). The primary role of smart phone in engineering projects is in their capacity to facilitate convenient accessibility to essential engineering software particularly related to environmental assessment (Jain, Chakraborty & Chakraverty, 2018). The aforementioned role has significant importance in the surveillance and rectification of engineering endeavours. The collection and transmission of various data, including temperature, pressure, humidity, and other relevant metrics, can be facilitated through the

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integration of sensors into smart phones, enabling seamless transfer to an analysis system.

This article explores the perception of students who engage in community-based projects aimed at transferring information from the classroom to real-world contexts. Furthermore, this study also examines the exploration of mobile applications as a potential substitute for equipment in the assessment of environmental ergonomics. It is imperative to implement the community empowerment approach through the execution of an awareness programme focused on healthy and safe lifestyle to effectively accomplish the Sustainable Development Goals (SDG) particularly on good health and well-being. The application and dissemination of theoretical concepts and acquired knowledge from the academic setting to real-world contexts are widely recognised as valuable means of enhancing the comprehension of university students, specifically those at the undergraduate level.

2.0 METHODOLOGY

This project involves the participation of final year students who are enrolled in an elective course in the domain of mechanical engineering. This community project serves as a group assignment that contributes to the evaluation criteria of this elective course.

2.1 Participant and Theme Selection

The study included a cohort of 31 students who were enrolled in the Manufacturing Ergonomics Course. The students were separated into multiple groups. The composition of each group is entirely up to the students' decision. The focus of this research pertains to the assessment of the ergonomic environment inside the community, specifically concerning the subject of lighting. There are three different types of locations where this illumination assessment must be completed: at home, in car workshops, and in university laboratory. The rationale behind the choice of these locations is based on the premise that each area within this setting is expected to possess a different illuminance measurement. Hence, it is possible for students to compare the illuminance values acquired in this project with the standards that have been used as a basis of reference.

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2.2 Implementation Procedure of Project Based Community

The flow chart depicting the project's engagement with the community is displayed in Figure 1. As depicted in Figure 1, this project comprises of two primary phases. The initial stage encompasses pre-project activities prior to students' involvement with the community. Subsequently, the second phase encompasses student engagement in community-based activities. Prior to commencing the assignment, the lecturer delivers the relevant concepts along with information pertaining to the subject of lighting to the students. This discussion encompasses several theories and facts pertaining to the clarification of important terminologies associated with the subject matter, as well as the effects caused by insufficient illumination. The main source of information on this topic is the guideline produced by Department of Occupational Safety and Health Malaysia. Furthermore, students are instructed on the procedure for evaluating lighting conditions by the utilisation of a predefined formula outlined in this particular guideline. The lux metre equipment, which is commonly used in this assessment, is also demonstrated to the students. Students are also exposed to the usage of mobile applications from smart phones for lighting evaluation as a substitute of the common equipment due to insufficient supplies of the lux metre. The sorting of themes is determined by grouping. Each group needs to conduct interviews and surveys with the target group. The primary objective of employing the interview and survey method is to ascertain the extent of knowledge, awareness, or engagement pertaining to diverse matters.

The second phase involves community and student-led activities. This activity is supervised by the lecturer of this course. During the interaction between the community and the students, the lecturer initially reviews the content of the interview and the survey form. The purpose of this action is to ensure that the inquiries addressed are relevant to the subject matter of this project. Furthermore, the goal of the review is to verify that the inquiries posed align with the established theory and encompass precise information pertaining to the topic given. Upon the completion of this project, each group is required to compile all the acquired information into a comprehensive report. Students were also instructed to write a leaflet or brochure outlining the significance of lighting as well as any other pertinent information for distribution to the community.

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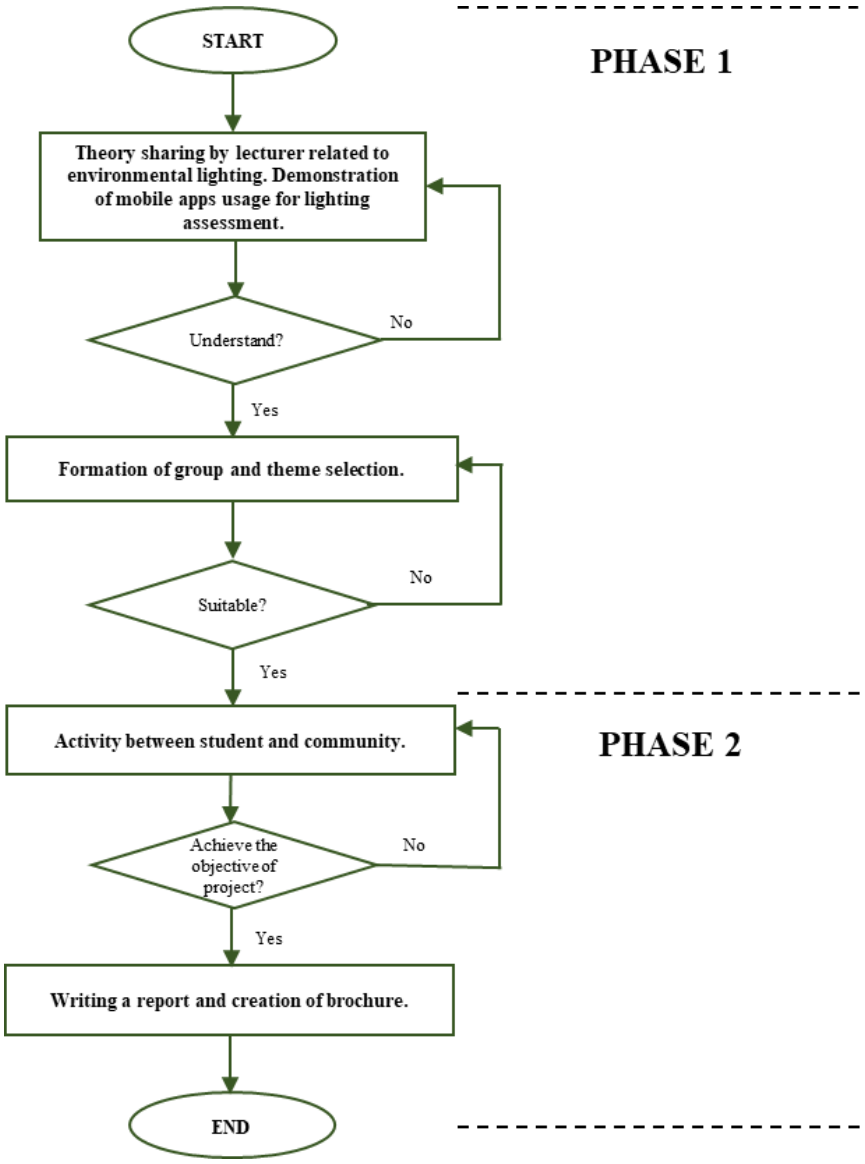

Figure 1. Flow chart of the community-based project

3.0 RESULTS AND DISCUSSION

Two approaches have been explored to measure feedback pertaining to a community-based project centred around lighting assessment. The first approach pertains to the students' perception of community-based projects in terms of their ability for strengthening their knowledge in the respective subject matter. The second approach concerns the students' perception of utilising digital applications in the evaluation of lighting conditions as a replacement for existing equipment.

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3.1 Student Perception Related to Community-based Project

The findings of this study indicate a noticeable enhancement in students' understanding of the subject matter after their involvement in this project. Figure 2 shows the result of students' knowledge related to lighting assessment in three periods: before class, after class and after project. This response pertains to the measurement of knowledge level, utilising a scale ranging from 1 denoting a very low level to 5 representing an extremely high level. The data gathered shows that the majority of students, which is more than 80%, have attained a deeper degree of understanding regarding many aspects of lighting and its effects on the environment and human well-being.

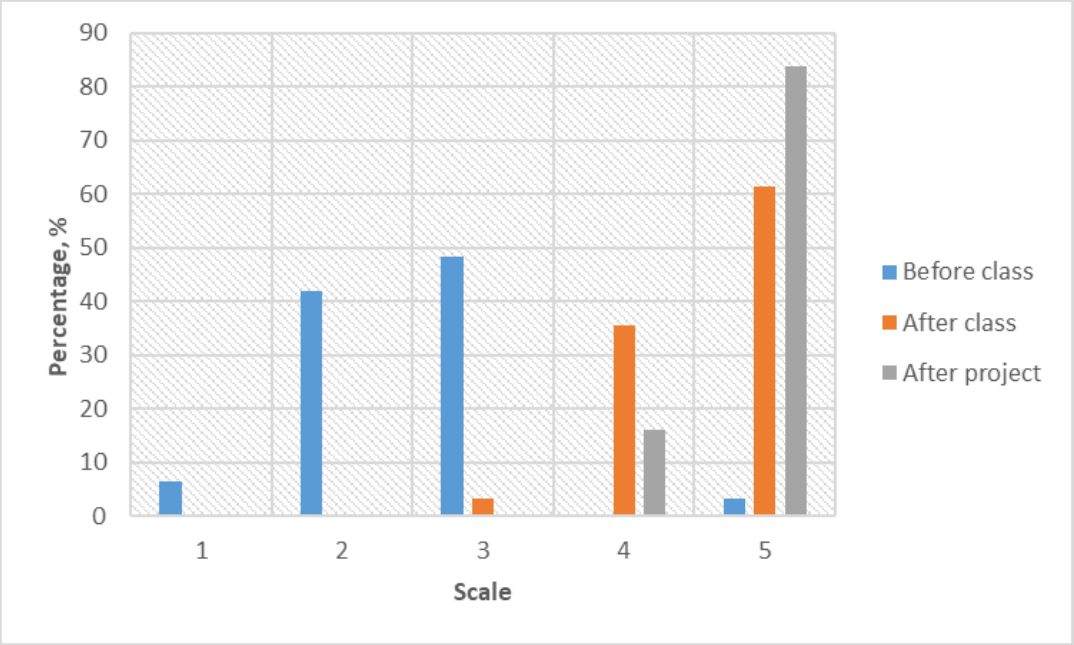

Figure 2. Improvement of student knowledge related to lighting assessment

In addition, the community-based project has fulfilled expectations through its provision of extensive learning opportunities and meaningful practical application. The students emphasised that this project provided them with the opportunity to comprehend theoretical topics inside a real engineering structure, while also enabling them to use this knowledge in practical and significant scenarios. The attainment of this goal is facilitated by various key aspects that significantly contribute to the achievement of this project. However, there are several challanges that have been encountered by the student during conducting this project. One of it is to attain participation from community particularly from workshop employees in completing the project. Communication with this community also sometime hard due to some

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of them are not aware with lighting terminologies and principles. Solution adopted was to reach out to multiple parties in attaining better collaboration and cooperation. Furthermore, time management is also one of the challenge face by the student. It is due to student need to work in team and carry out the project outside the campus particularly for those groups that involve with theme designated under house and car workshop.

3.2 Student Perception Related to Mobile Application

Figure 3 illustrates the possible impact of utilising a digital lux metre application on a smartphone to facilitate hands-on engagement and better comprehension of the lighting topic. Based on the data presented in Figure 2, it is evident that majority of the students provide great agreement on using the mobile application can help them to understand about the lighting assessment. It is because this mobile application is flexible and can use anytime and anywhere. Only a mere 3.2% of participants, specifically one individual, expressed disagreement with the notion that this particular strategy contributes to enhancing their comprehension of the lighting topic. The discrepancy of results obtained from different commercially available and free mobile applications for smartphones can be attributed to the inherent differences in their capabilities. Therefore, it is possible that it may yield inaccurate outcomes when compared to the prescribed guidelines.

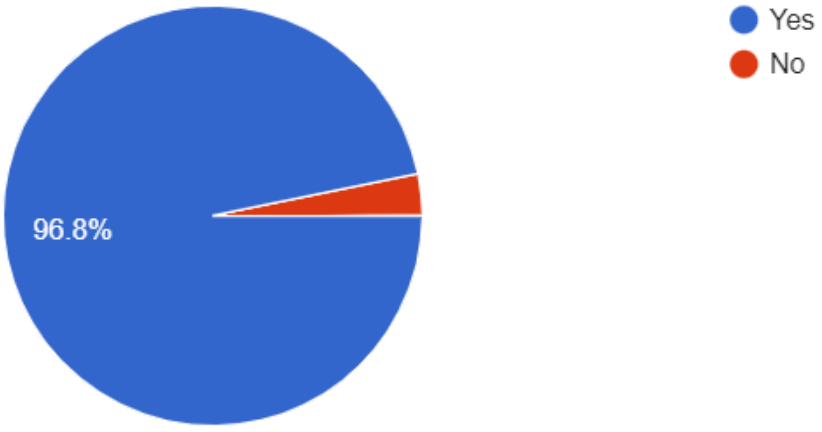

Figure 3. Feedback on hands-on experience by using lux metre through smart phone

In order to deal with this issue, it is necessary for students to conduct iterative measurements and evaluations in this workspace to get optimal results. Performing this measurement requires a significant amount of time and additional work. Furthermore, the complexity of collected data might be attributed to the presence of a diverse range of light

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sources. To solve this problem, multiple measurements with varying angles must be taken in order to calculate the mean value.

3.3 Overall Discussion

In general, the findings of this study indicate that the lighting assessment project conducted in collaboration with the community has yielded favourable outcomes in terms of students' comprehension.. This project provides evidence to support the notion that engaging in practical experiences within authentic contexts is a highly efficacious approach for enhancing learning outcomes and fostering a more profound influence on students. The finding from past literatures highlight that enggagement with community not only enhance the understanding but also provide a significant positive impact to the knowledge sharing and learning behaviour between different parties (Yilmaz, 2016; Eid & Al-Jabri, 2016; Khamis et al. 2023).

In terms of the utilisation of smartphones in relation to mobile applications, the findings of this study indicate that a majority of students agreed that this technology facilitated their hands-on and practical assessment experiences in the context of the lighting theme. The study conducted by Sayedalamin et al. (2016) revealed that a significant proportion of students held the perspective that mobile applications offer advantages in the realm of clinical decision-making. These applications have been discovered to aid in the process of differential diagnosis, facilitate faster access to Evidence-Based Medical practises, reduce time consumption, and bring additional benefits. To address the issue of outcome divergence in mobile applications, it is imperative to ensure the selection of appropriate mobile apps by conducting a comparative analysis of illuminance values obtained from standard equipment and the respective mobile apps.

However, the primary goal of this community-based project is to enhance students' comprehension by having them conduct their own illumination assessments by referring to the proper procedure as emphasised by the guidelines. The promotion and implementation of mobile applications for educational purposes in Malaysia should be emphasised and given attention. It is imperative for higher education institutions in Malaysia to refrain from solely relying on conventional approaches to teaching and learning. According to Marzuki et al. (2019), it is recommended that higher education institutions in Malaysia should proactively implement mobile applications as a teaching and learning tool. This approach is expected to support students in improving their academic performance, considering the potential advantages associated with the use of mobile apps.

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In general, the study emphasises the value of community-based projects in strengthening student comprehension of the course material. Through the integration of community-based projects into the curriculum, students are provided with a valuable opportunity to bridge the gap between theoretical concepts and real-world application. Students have the opportunity to observe the practical application of the principles presented in the classroom, thereby addressing authentic issues that may emerge. This experience enhances their comprehension, fostering a more integrated and profound understanding, hence facilitating improved knowledge assimilation. Furthermore, the integration of practical experience through the utilisation of mobile applications in engineering education curriculum is crucial for the development of graduates who possess a holistic comprehension and are equipped to make significant contributions towards the advancement of community and environmental sustainability.

4.0 CONCLUSION

The implementation of this community-based project by considering as an awareness programme creates opportunities for collaboration between university students and many stakeholders within the community. Through the application of academic knowledge to practical contexts, students are granted the opportunity to gain a more profound understanding of the issues and requirements of the community. This practise not only enhances their acquisition of knowledge but also yields more efficient outcomes in the long term. Within the realm of higher education, the prioritisation of practical implementation of theoretical principles and knowledge confers a distinct benefit to students, particularly those engaged in the pursuit of an undergraduate degree. The hands-on experience gained from executing this awareness programme provides individuals with a comprehensive and pragmatic understanding of how the theoretical concepts learnt in the classroom may be effectively utilised to address real-world challenges. Furthermore, this process also cultivates interpersonal and leadership abilities that hold significant value in the realm of professional growth. The extensive examination of the Sustainable Development Goals displays a dedication to sustainable and all-encompassing development. By fostering collaboration, empowering communities, and incorporating academic principles into practical applications, it is possible to establish a foundation of informed and adaptable communities. This approach can facilitate the attainment of both healthy and secure lifestyles, while concurrently advancing sustainable development objectives for a more promising future. Overall, students demonstrated their ability to apply theoretical ideas of environmental ergonomics in real-life situations. This hands-on experience helped to reinforce their comprehension and bridge the gap between

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classroom learning and practical application. Community-based projects required students to actively engage with lessons, ask questions, and solve difficulties. This active learning approach has been shown to improve comprehension and recollect of complex ideas as compared to passive learning techniques.

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