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Using multi-criteria decision making to design an educational game for building retrofits

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ABSTRACT

CONTEXT

The United Nations Agenda 2030 indicated that higher education institutions are responsible for achieving sustainable development goals through expanding human capital. However, the existing learning and teaching approach remains outdated and does not promote enough student engagement. Serious games have been increasingly used in a higher education setting to increase student interaction, collaboration, and engagement. It has an enormous potential to support effective sustainability education through experiential learning that facilitates better knowledge retention and actual experience in dealing with decision-making activities.

PURPOSE OR GOAL

The overarching goals of this study are to (i) identify building retrofitting practices from the literature, (ii) identify building sustainability criteria to measure the success of retrofitting projects and (iii) evaluate and rank the impacts of building retrofitting practices on sustainability criteria. The purpose of this evaluation is to build key parameters and factors for the serious game that will be developed in the subsequent stage.

APPROACH OR METHODOLOGY/METHODS

An analytical hierarchy process (AHP) approach was employed in this study. First, evaluation criteria were reviewed from literature related to building retrofitting. The literature review was also conducted to retrieve the list of retrofitting practices for existing buildings globally. Secondly, questionnaire surveys were distributed to building retrofitting experts (academics and industries) across Australia to measure the evaluation criteria' impacts on different retrofitting practices. The questionnaire used the pairwise comparison matrix with a 9-point scale. Finally, the evaluation of the retrofitting practice was calculated based on the priority weighting of the factors and ranked accordingly.

ACTUAL OR ANTICIPATED OUTCOMES

The anticipated outcomes of this study are: (i) a ranked list of building retrofitting practices along with the impacts across different evaluation criteria, (ii) finding the best retrofitting practices for improving building sustainability performance, (iii) key parameters and extent of influence of factors that will be used to build students' understanding on building retrofits in the game. Based on these results, a design framework for the serious game can be established.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

The AHP method has been prominently used to identify and rank best practices in various sustainability topics. This paper used the AHP method for a similar purpose, but to aid the development of a design framework for the serious game of building retrofits as the analysis contains the impacts evaluation of different retrofitting practices.

KEYWORDS

Multi-criteria decision-making; building retrofitting, serious game.

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