SOLUTION-BASED DESIGN PROCESS AS PEDAGOGY IN CONSTRUCTING INTEGRATED STEM TASKS: WITHIN THE AUSTRALIAN CURRICULUM

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THEME:

Innovative STEM pedagogy and curriculum

BACKGROUND AND AIMS

Integrated STEM education signifies teaching across two or more STEM-related subjects to address and solve authentic problems through design solutions (Zhou et al., 2020). Many researchers and teachers adopt design process models as scaffolding to construct integrated STEM tasks (Li et al., 2019); that is, educational projects that have a connecting idea, target curriculum content, and aim to improve student capabilities (Australian Curriculum Assessment and Reporting Authority [ACARA], 2016). 'Solution-based Design Process' (SBDP) holds the epistemology to integrate cross-disciplinary content, and enables students to identify, apply, and develop design concepts from the disciplines to find and solve problems (Zhou et al., 2022). To address the lack of research on using applicable design process models to construct integrated STEM tasks, we explore teachers' perceived benefits and challenges when adopting SBDP to develop relevant educational projects, and then propose practical guidelines within the Australian curriculum.

METHODOLOGY

This study employs a co-design methodology to implement PD (professional development) for four groups of in-service teachers (n=11) from Queensland middle schools. In each group, 2 to 3 members taught at least two Year 9 or 10 STEM-related subjects designated in the Australian curriculum. We established two sequential PD workshops that adopted SBDP and assisted the participating teachers to construct design-led integrated STEM tasks. A range of data is collected and thematically analysed, including focus group transcriptions and individual survey responses.

RESULTS AND CONCLUSIONS

First, we found that participants linked content knowledge with certain features and specific focuses of ACARA's STEM-related curriculum. A review of the combination of the included curriculum content also informed a sequence to formulate integrated STEM attributes. Second, about participating teachers' perceived benefits, we identified that they comprehended integrated STEM education by learning the task construction method. The noted benefits also reveal the value of task construction in terms of promoting diverse interactions, encouraging teacher willingness, and stimulating future students' learning. Third, we found that participants' difficulties centred on the cognitive thinking and practical actions

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related to task construction. Guidelines based on these results consist of four categories: (i) clarifying epistemology and sequence; (ii) preparing for the use of SBDP; (iii) incorporating suitable curriculum content; and (iv) planning integrative teaching and learning. In conclusion, this study has the potential to improve planning and teaching resources for STEM educators, to encourage an epistemological shift in the Australian STEM education community, and to enhance the prospects of future innovative thinkers.

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