

DIGI-FC-CECC: Turning Climate Science into an Interactive Learning Adventure

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DOI: <https://doi.org/10.47772/IJRISS.2025.925ILEIID000015>

Received: 23 September 2025; Accepted: 30 September 2025; Published: 04 November 2025

ABSTRACT

One of the greatest global challenges of the 21st century is climate change. The key contributors to carbon emission are transport and energy sectors (IEA, 2023). However, climate literacy among students remains insufficient, as learners often struggle to understand technical terminology and its relevance to daily life. DIGI-FC-CECC (Digital Flashcards for Carbon Emission and Climate Change) has been developed to address this issue as an interactive educational innovation. DIGI-FC-CECC introduces terms and definition for carbon emissions and climate change on the Quizlet platform. Students' are provided with study features (flashcards, learn, test) and gamified activities (Blast, Match, Blocks, Quizlet Live). Supporting divers learning needs, the platform equipped with audio function and the material can also be printed. By combining scientific knowledge with engaging learning strategies, DIGI-FC-CECC aims to improve climate literacy, encourage sustainable behaviour, and support education for sustainable development.

Keywords: (carbon emission, climate change, digital flashcard)

INTRODUCTION

One-quarter of global CO₂ emission originate from transport sector, making it a critical area in addressing climate change (IPCC, 2022). For effective mitigation, it is essential that students develop a strong foundation in climate-related concepts particularly as future decision-makers and professionals. Effective interventions can be achieved by emphasizing personally relevant and meaningful information while incorporating active and engaging teaching methods (Monroe et al., 2019). At the same time, digital learning tools and gamification have demonstrated significant potential to improve motivation and retention (Deterding et al., 2011). Addressing this educational challenges, DIGI-FC-CECC was innovated to transforming climate science into an accessible and enjoyable learning adventure.

Problem Statement

Students frequently face barriers in learning about carbon emissions and climate change due to complex terminology that is difficult to memorize and apply in real contexts. Traditional teaching methods that rely on textbooks and lectures which limit opportunities to address diverse learning styles and often leads to low engagement, especially digital natives which inherently an active user of technology and technology-savvy (Sadiku, 2017). Many existing educational tools remain fragmented educational and lack integration of interactivity and scientific accuracy. Without focused interventions, these hinder the development of climate literacy and reduce student capacity to contribute to sustainability goals.

Objectives

The objectives of DIGI-FC-CECC are to:

1. Provide the introduction of 28 key terms related to carbon emission and climate change based on international standard.
2. Integrate gamification elements into learning process and encourage spaced learning technique.
3. Platform that cater diversity in learning styles including with features that support text, visual, auditory.
4. Align with Sustainable Development Goal 13 (Climate Action) by fostering awareness and action-oriented learning.
5. Provide educators with a ready-to-use, flexible digital resource that complements existing curricula.

PRODUCT DESCRIPTION & METHODOLOGY

The carbon emission and climate change terminologies in DIGI-FC-CECC was developed using the Quizlet platform. The content was curated from authoritative sources such as the IPCC (2022) and UNFCCC (2021), ensuring scientific accuracy while simplifying terms for student comprehension. The platform also provides with study mode and gamification elements. Three main components in DIGI-FC-CECC :

1. Study tools (Figure 1) – Flashcards facilitate easy learning, Learn mode is provides brief ungraded quizzes to reinforce understanding. The Test mode support active recall and spaced repetition.
2. Gamification Tolls (Figure 2) – Blast, Match, Blocks, Quizlet Live to encourage collaboration and engagement (Deterding et al., 2011).
3. Accessibility Tools: Audio options for auditory learners and mobile compatibility for flexible learning. Multiple printable options are available to produce hardcopy versions for revision.

This methodology ensures that students not only memorize terms but also contextualize them within interactive experiences, reinforcing both cognitive and affective learning dimensions.

Figure 1 Study tools equipped with Flashcard, Learn and Test Mode

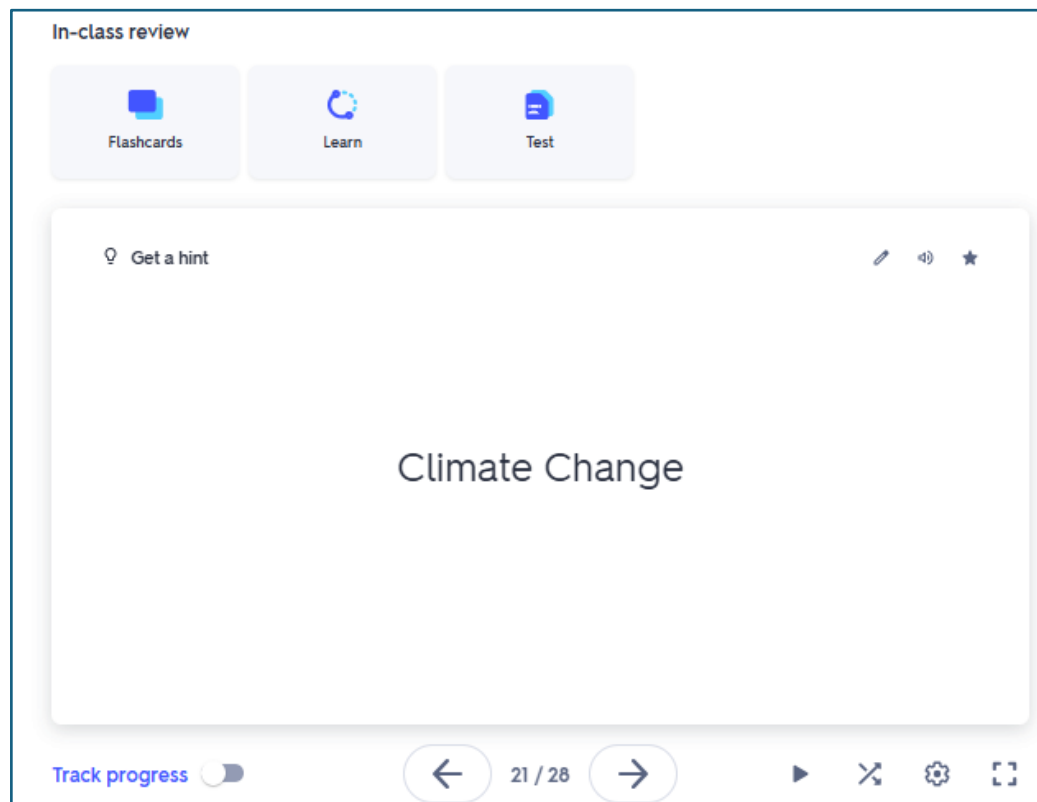


Figure 2 Gamification tools Quizlet Live, Blast, Match and Blocks

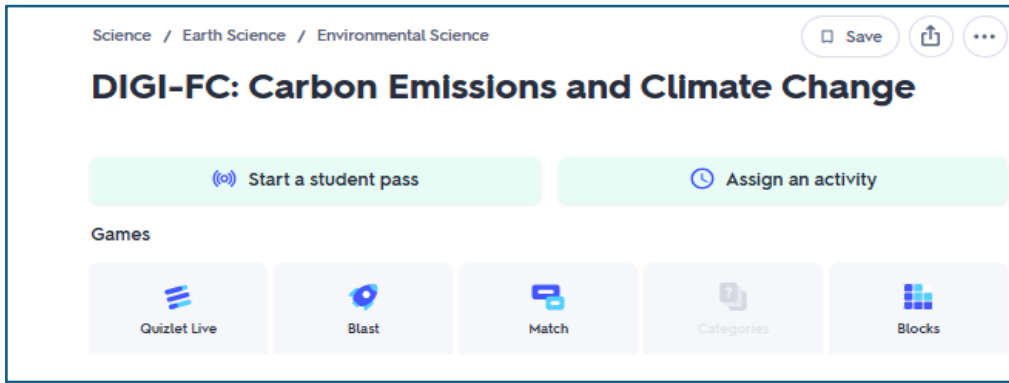
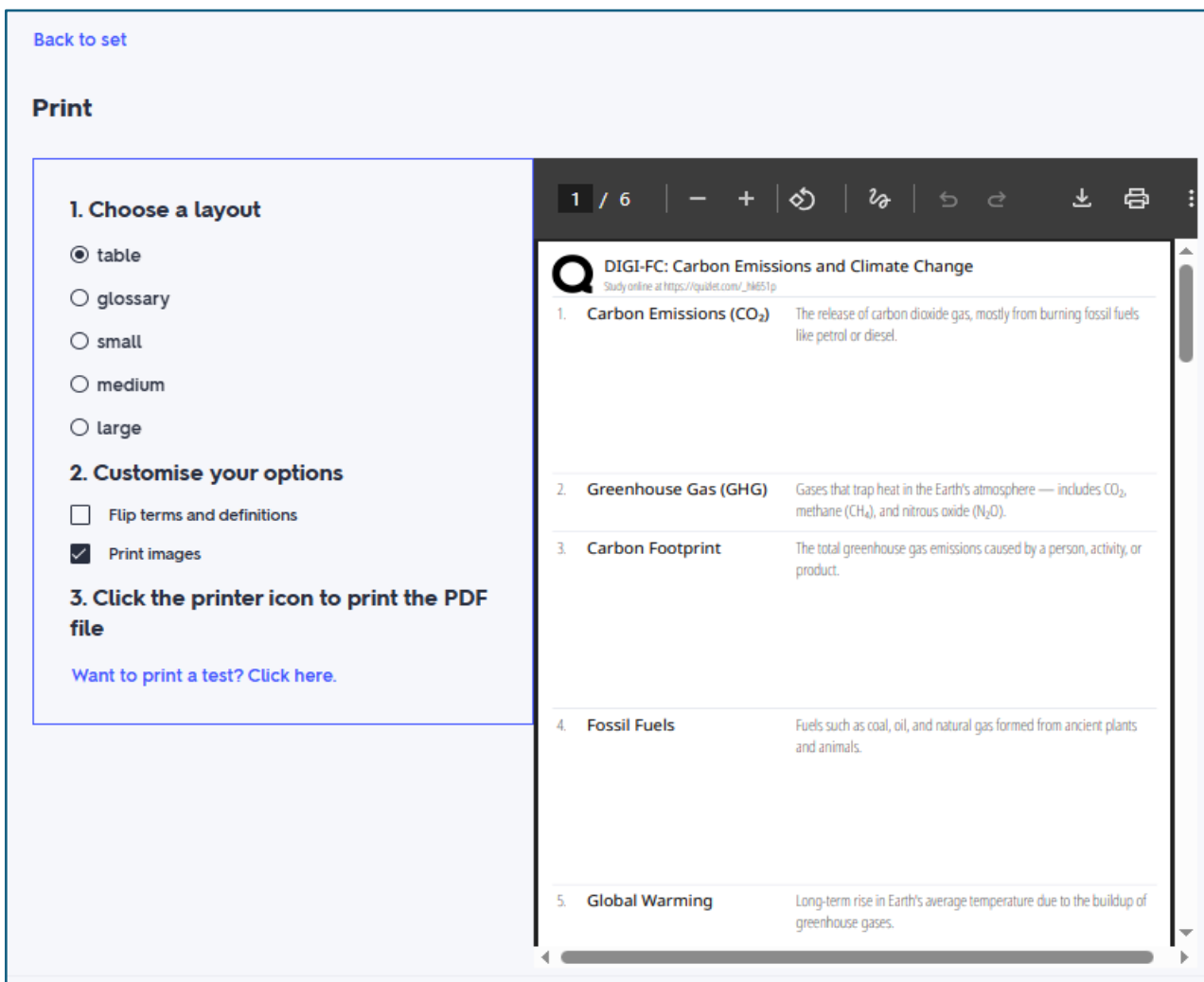


Figure 3 Multiple printable options



Potential Findings and Commercialisation

DIGI-FC-CECC is expected to enhance student motivation, engagement, and retention of climate-related terminology. Anticipated outcomes include improved recall rates, increased classroom participation, and greater student confidence in discussing sustainability issues. From a commercialization perspective, the innovation can be scaled through:

1. Licensing for educational institutions as a supplementary learning package.
2. Corporate training adaptations for industries with sustainability compliance requirements.
3. Government and NGO partnerships to integrate climate literacy into national programs.

These pathways highlight the dual potential of DIGI-FC-CECC as both an educational innovation and a viable commercial product.

NOVELTY AND RECOMMENDATIONS

The novelty of DIGI-FC-CECC lies in its unique integration of climate-specific content with gamification on a widely accessible platform. Unlike traditional teaching methods, it transforms static climate concepts into dynamic, student-driven learning experiences. It is recommended that DIGI-FC-CECC be further expanded into a stand-alone application, allowing for broader reach and integration into formal curricula. Educators are also encouraged to adopt DIGI-FC-CECC as a supplementary tool to cultivate climate literacy and encourage sustainable behaviour.

ACKNOWLEDGEMENTS

The development of DIGI-FC-CECC was made possible through the collaborative input of educators and students, as well as the availability of open-access climate and sustainability resources. Special appreciation is extended to the project grant *under* A Comprehensive Study of Economic Growth, Energy Consumption, and CO₂ Emissions in Malaysia's Transport Sector: Methodological and Policy Implications, which provided the foundation for initiating this digital flashcard innovation in climate science and educational technology platforms that have enabled innovative approaches to teaching and learning.

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