

Proceeding of International University Carnival on E-Learning



INTERNATIONAL UNIVERSITY CARNIVAL ON E-LEARNING

*“ Embracing AI for
Innovative Learning and
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INSECT RACE 2.0: ENRICHING LEARNING EXPERIENCE USING A GAME-BASED LEARNING APPROACH INTEGRATED WITH ARTIFICIAL INTELLIGENCE TOOLS

Siti Nurlydia Sazali^{1*}, Tan Wei Lim¹, Nurfarida Anum Zainaddin¹ & Ratnawati Hazali¹

¹Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia

*Corresponding author's email: ssnurlydia@unimas.my

Abstract

Science, Technology, Engineering and Mathematics (STEM) education is a significant platform to produce highly skilled workers and professionals to meet demands in the industrial and technological sectors in Malaysia. Despite the increasing efforts implemented by the government and the non-government organisations (NGOs) related to education system, the number of students enrolled in the STEM education from secondary schools to the higher-level institutions (college, matriculation, university) is quite worrying as many showed no interest to pursue further in this challenging field. However, not to feel discouraged by this situation, many educators are keen to initiate various efforts to provide enriched and inclusive methods in their teaching and learning to boost and uplift students' motivation. As part of enriching students' learning experience, we developed and implemented a game-based learning approach in one of our academic programme's courses offered to the Zoological Technology's undergraduates, namely, Entomology. In this course, students were exposed to the fundamental study about insects, covering topics related to their biology, physiology and ecology of these diverse animals. Hence, the *Insect Race 2.0*, a board game integrated with artificial intelligence (AI) tools is designed to cultivate students' interest and enthusiasm in learning science, as well as to transform traditional pedagogical strategies of learning science into an enjoyable, engaging and interactive learning experience among learners. Based on a survey conducted among the players, majority of the respondents provided positive feedbacks and commendations, indicating the efficacy of the *Insect Race 2.0* game. Overall, this board game serves as a valuable tool to diversify teaching and learning approaches in science subjects and useful to fill the knowledge gap in insect-themed educational games. In conclusion, teaching delivery of STEM education using AI integrated game-based learning approach could boost students' interest and create a fun, interactive and cooperative learning more effectively.

Keywords: game-based learning, insects, integrative learning, STEM, artificial intelligence tool

BACKGROUND OF THE RESEARCH / INNOVATION / INVENTION / DESIGN

One of the challenges in teaching Science, Technology, Engineering and Mathematics (STEM) education is fostering and boosting students' interest for these challenging subjects. Students often perceive science as difficult and too theoretical that apparently reduce their interest and

motivation to pursue advance studies in STEM related fields. STEM education is a significant platform to produce highly skilled workers and professionals to fulfill the national demands especially in the industrial and technological sectors in Malaysia (Chuan et al., 2025; Huzir et al, 2025). Despite the increasing efforts implemented by the government and the non-government organisations (NGOs) related to education system (Qureshi & Qureshi, 2021), the significant increase of STEM enrollments from 45.7% in year 2023 to 50.8% in year 2024 is still considered low compared to the national target of 60%, far behind other developing countries such as Singapore, Korea and Japan (Astro Awani, 2024; Sabah Media, 2024).

Inspired by this challenge, this study seeks to explore innovations in teaching and learning to enhance students' learning outcomes and to motivate students in STEM education. Hence, the Insect Race board game is developed and implemented in an elective core course, namely, Entomology, offered to the Zoological Technology's undergraduates in the Faculty of Resource Science and Technology (FRST), Universiti Malaysia Sarawak (UNIMAS). In this course, students were exposed to fundamental study of insects, covering various topics related to their biology, physiology and ecology. These small creatures are widely distributed around the world and notably known as pests in agricultures, plantations, and households. In spite of their notorious behaviour, many insects also play crucial roles in the environment as bio-indicators, pollinators, and decomposers in the nutrient cycles. By enabling students to study and relate scientific concepts of insects with real life applications, the enjoyable and interactive game sessions could foster learner's interest, build enthusiasm and facilitate cognitive understanding more effectively while enhancing their comprehension of the course content.

Reaching beyond the UNIMAS campus in Kota Samarahan, the Insect Race board game also extended its outreach and exhibited in community engagement events involving school students and the public in Bau, Lundu and Padawan areas. In general, this educational board game aims to educate people about the biology and ecology of insect groups, as well as to acknowledge their significant contributions in the ecosystem and their importance towards healthy environment.

DESCRIPTION OF THE RESEARCH / INNOVATION / INVENTION / DESIGN

The core design of the Insect Race board game is circular as it symbolises complete life stages of insects (Figure 1). To play the game, 2 to 6 players will be given 100 life tickets and an insect token, respectively. The insect tokens are mantid, grasshopper, cockroach, beetle, cicada and bee. The game consists of three total rounds, where the players will level up from egg, larvae to adult stage after each completed round. Furthermore, the spaces on the board represent ecological niches of insects which include different types of habitats and their ecological roles (predators or prey), questions and fortunes. Here, players will either gain or lose life tickets (if they fail to answer questions correctly), following the instructions written on the cards. During the game session, students will be exposed to questions related to scientific concepts and theoretical facts of which the upgraded version of the board game, namely, Insect Race 2.0 is integrated with artificial intelligence (AI) tools to optimize pedagogical strategies, provide real-time feedback and enrich learning experience among players. In the end, the winner is the one who holds the highest number of life tickets and has completed the game.

SIGNIFICANCE OF THE RESEARCH / INNOVATION / INVENTION / DESIGN

Insect Race 2.0 is designed to cultivate students' interest and enthusiasm in learning STEM education, specifically on entomology. The game-based learning approach integrated with AI tools could transform the traditional pedagogical strategy of learning science into a more enjoyable, engaging and effective interactive learning experience. Additionally, diversifying teaching and learning approaches significantly contributes to the Sustainable Development Goals, particularly SDG 4 for Quality Education, and SDG 15 for Life on Land.

IMPACT OF THE INNOVATION/INVENTION/DESIGN TOWARDS EDUCATION OR COMMUNITY

The implementation of Insect Race in STEM education is useful to improve understanding in cognitive-based subject through interactive learning experience and collaborative engagement among the students (Figure 2). Furthermore, Insect Race has been exhibited outside of the campus where it promotes citizen science and bridges the academia with community through engaging knowledge sharing, and be able to cultivate inclusivity by empowering the public with STEM education for lifelong learning and community well-being.

Its first outreach programme was held in SMK Tun Abdul Razak, Kuching on 5 July 2023, where students and teachers were introduced to the board game during “Perasman Program Mini Teater STEM Sarawak” organised by National STEM Association. Moreover, the board game was exhibited to the public at Petrosains Playsmart Kuching on 18 November 2023 and 17 February 2024, in conjunction with STEM education events organised by Petrosains Sdn. Bhd (Figure 3). Subsequently, Insect Race was also exhibited at the Postgraduate Open Day FRST, UNIMAS on 29 October 2024 and at the Sarawak Career and Training (SCaT) Fair 2025 on 5 July 2025.

COMMERCIALIZATION POTENTIAL

1. Developed as an interactive learning tool for STEM education.

CONCLUSION

In conclusion, this Insect Race 2.0 board game serves as a valuable tool to diversify teaching and learning approaches in STEM education, particularly fruitful in delivering lessons of entomology course in the Zoological Technology programme. Additionally, an AI integrated game-based learning could enhance students’ interest and foster a more enjoyable, interactive and cooperative learning experience to learners more effectively.

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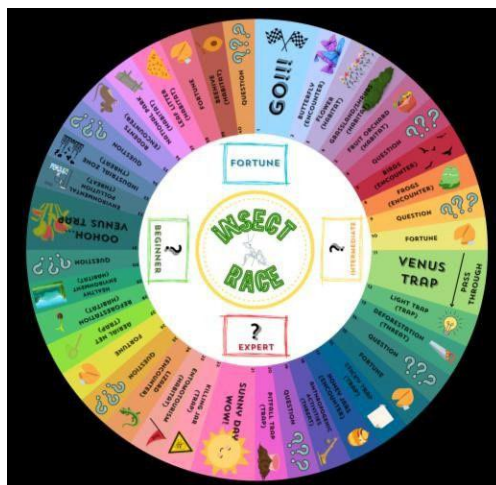


Figure 1: Insect Race board.

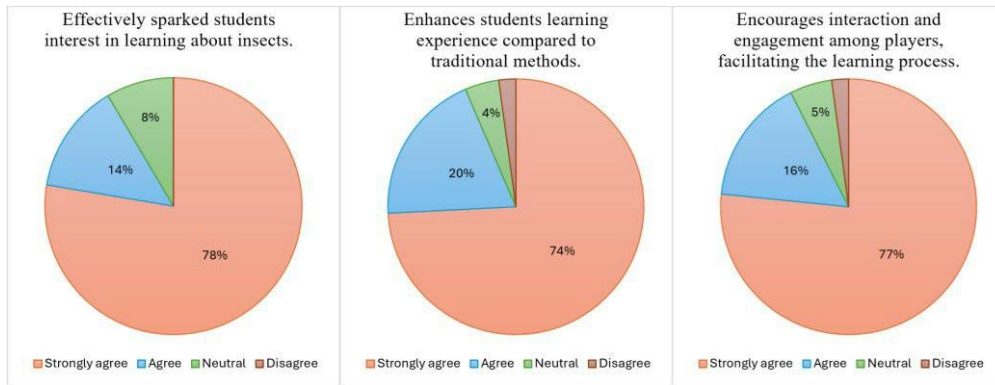


Figure 2: Students' feedback on Insect Race.



Figure 3: Exhibition of Insect Race at Petrosains Playsmart Kuching.

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