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Future City: A Simulation for Making SDGs Action Decisions

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Abstract: The Sustainable Development Goals (SDGs) deliver a concept aimed at addressing social, economic, and environmental challenges that require collaborative efforts from everyone. The actions often involve conflicts of interest between businesses, governments, social organizations, and citizens. This study develops an inquiry-based learning system <Future City> aiming to illustrate SDGs issues. Students play different roles and simulate future social scenarios based on their positions and action decisions. This assists students in understanding the concepts of sustainability.

Keywords: SDGs, Simulation, Action Decisions

1. Introduction

To enhance students' awareness of sustainable development, the Taiwanese government has integrated the United Nations' proposed SDGs into education which involves not only videos and reading materials but also activities that encourage student participation and reflection. The effectiveness of these efforts goes beyond mere promotion; they are primarily focused on education. As a result, this system builds upon the <City Auncel> developed by Lu, Shih, & Hong (2022), and further develops an issue simulation decision system designed to engage students in various societal roles. Students work within the interests of their respective roles while also considering the common welfare. This entails finding a balance between ecological environments and socio-economic development, achieved by resolving conflicts of interest through effective negotiations. Consequently, this study delves into the impact of SDGs simulations on learners' understanding of the SDGs and their behavioral decisions.

2. Literature Review

2.1 SDGs-related simulation

The United Nations the SDGs to mitigate climate change and promote sustainable development on a global scale (Rosati & Faria, 2019). However, establishing partnerships among businesses, governments, and civil society can be challenging if they have competing goals (Brinkerhoff & Brinkerhoff, 2011).

Computer simulation is a tool used to approximate real-world results and aid in future planning. For example, Collste (2017) utilized the iSDG dynamic model to simulate the annual effects of solar energy investment and policy interventions on the SDGs of Good Health and Well-Being, Quality Education, and Affordable and Clean Energy. The study investigated the causal relationship between electricity acquisition, education, and life expectancy, and the results showed that improved electricity supply was associated with increased educational attainment and life expectancy. Another simulation system, iplan (Ruis et al., 2023), is based on urban development actions and uses a complex computational model to simulate land use scenarios, helping players explore and solve land use problems and cultivate students to make meaningful actions to address social and environmental issues.

This study focuses the development of a simulation system based on the survival crisis of the Formosan Leopard Cat, which is related to sustainable cities and communities, climate action, and life on land. In the simulation, students assume different roles, including

government officials, conservationists, developers, hunters, and farmers, to explore issues related to urban development and ecological conservation.

2.2 Action Decision

In the simulation, students had to make developmental decisions. During the process, the current social environmental situation is taken into consideration. Students collect information, evaluate the uncertainty of action consequences, and analyze the pros and cons of various actions before making the best next possible decision. Different decision models emerge depending on the tasks at hand, and the decision maker possesses analytical characteristics considering the variables that appear in the field. Students evaluate the probability of future states and target schemes with the focus on the decision event (Klein & Calderwood,1991). In this study, each player's decision-making process will be analyzed in regard of the inquiry-learning and issue-discussion.

3. System Architecture

The simulation system supports the inquiry process in three stages: Inquiry, Action, and Negotiation, that are cycled for three rounds (Figure 1).

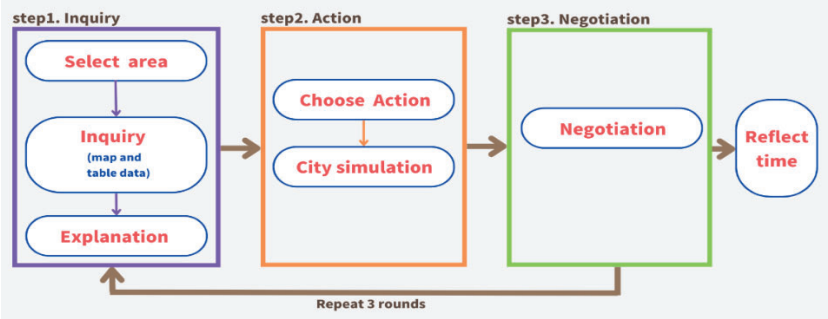

Figure 1. Simulation process flow chart

The first stage, Inquiry, requires students to select a region for exploration, identify problems relating to SDGs issues, and provide explanations. The second stage, Action, students choose a development action, and the system simulates the environmental changes caused by the action. The third stage, Negotiation, requires students to resolve conflicts of interests arise from the developmental actions done by various roles in future cities. All behaviors in the simulation are synchronized, presented, and recorded in the database.

4. Simulation Design

Roles in the simulation has respective independent values and missions that the collective action would affect the common geographical values (Table 1).

Table 1. *Independent and* common *missions*

	Missions	
	Independent	common
Government	Public opinion>60, Environment > 60, Public opinion > 60, Public category >=1.	Development>60 Environment >60.
Conservationists	Environmental protection>=2, Environment > 60	
Developers	Buildings >=2, Money > 1000.	
Hunters	Production>50, Money > 300.	
Farmers	Production>50, Money > 300.	

There are 20 actions players can choose from, including public, conservation, construction, hunting, and agriculture (Figure 2). All actions cause corresponding numerical value changes. For instance, building an industrial area upstream of a river or in a general

plain area make different impacts on water pollution. Thus, it is important that the player investigates the relevant data of an area before taking action. Action labels are added to the map with the identification of respective roles (Figure 3). Players can inspect the impact of their actions on the environment and adjust their future action decisions.

Figure 2. Action option diagram.

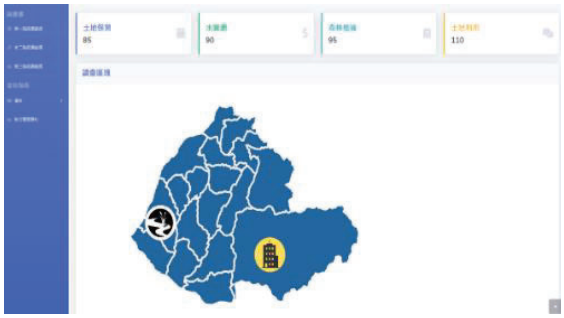

Figure 3. Future City Simulation.

5. Methods

This study plans to use pre-test and post-test as well as questionnaires to understand students' attitudes, awareness, and knowledge of SDGs. The collected system data will be statistically analyzed to understand whether their understanding of the concept and perceptions of sustainable development goals has improved.

6. Expected Results

Utilizing an inquiry-based learning approach, this research empowers students to delve into real-world data, ensuring that they possess a substantial background knowledge before making behavioral decisions. The study aims to incorporate SDGs issues through role-play simulations, investigating students' understanding and attitudes towards addressing SDGs problems. It also examines their ability to access relevant information and their decision-making process in response to simulated future social and environmental changes. The negotiation processes they engage in while resolving conflicts of interest among different groups will be analyzed. By scrutinizing the disparities between actual data and simulated data resulting from behavioral decisions, users can reflect on the environmental impact they have generated, which aids in their comprehension of SDGs issues. The simulation system is anticipated to promote the understanding of SDGs issues through an entertaining approach and encourage players to allocate more attention to the topic of sustainable development.

References

Brinkerhoff, D. W., & Brinkerhoff, J. M. (2011). Public–private partnerships: Perspectives on purposes, publicness, and good governance. *Public administration and development, 31*(1), 2-14.

Collste, D., Pedercini, M., & Cornell, S. E. (2017). Policy coherence to achieve the SDGs: using integrated simulation models to assess effective policies. *Sustainability science, 12,* 921-931.

Klein, G. A., & Calderwood, R. (1991). Decision models: Some lessons from the field. I*EEE Transactions on systems, man, and cybernetics, 21*(5), 1018-1026.

Lu, Y.H., Shih, J.L., & Hong, G.D. (2022). Issue-based Guided Inquiry Model with Real Socioscientific Open Data <City Auncel>. *The Main Proceedings of the 30th International Conference on Computers in Education (536-541)*, Malaysia: Asia-Pacific Society on Computers in Education.

Rosati, F., & Faria, L. G. (2019). Addressing the SDGs in sustainability reports: The relationship with institutional factors. *Journal of Cleaner Production, 215*, 1312-1326.

Ruis, A. R., Barford, C., Brohinsky, J., Tan, Y., Bougie, M., Cai, Z., Lark T. J., & Shaffer, D.W.(2023) Iplan: A Platform for Constructing Localized. Reduced-Form Models of Land-Use Impacts. Retrieved from https://ssrn.com/abstract=4358320