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Simulating Strategic Decision-Making: A Digital System for Issue-Based Educational Games

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Abstract

This study aims to develop game system for an issue-based game, <Utopia>, which integrates both online and physical interactions to enhance students' understanding of social issues, critical thinking, and collaborative skills. <Utopia> employs data visualization to help players intuitively grasp the impact of various societal events. The gameplay involves multi-phase interactions and decision-making processes triggered by emergent events, including stages such as national conferences, joint discussions, and policy declarations. The system is supported by five key modules—parameter visualization, country profiles, chatroom, bulletin board, and trade management—which collectively facilitate students' discussion and strategic planning. It is anticipated that the <Utopia> issue-based game system will effectively foster students' problem-solving abilities and strengthen their capacity for critical analysis and collaboration in complex scenarios. Through a combination of questionnaire surveys and behavioral data collection, this study will analyze students' learning behaviors, team collaboration patterns, and reflections on social issues throughout the gameplay.

Keywords: Issue-Based Games, Strategic Behaviors, Game-Based Learning, System Design

1 Introduction

Issue-based games have emerged as innovative tools for promoting learning and public discourse. By incorporating decision-making, role-playing, and collaboration, these games allow players to explore complex societal, political, and environmental issues while developing critical thinking and teamwork skills (Gee, 2007). Traditional formats emphasized face-to-face interaction, fostering direct communication and cooperation. With technological advancement, online versions have expanded access, removing geographic barriers and allowing broader participation.

To harness the strengths of both formats, hybrid issue-based games—combining physical and online interaction—have gained traction. This model merges the authenticity of in-person engagement with the flexibility of digital tools, enhancing collaborative learning and real-world discussion (Vorderer, Klimmt, & Ritterfeld, 2004).

This study proposes the development of a hybrid system that supports student engagement with social issues through intuitive interaction and scenario-based exploration. By integrating digital and physical modes, the system aims to improve learning motivation, collaboration, and critical thinking, while offering guidance for future educational game design.

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2 Related Works

Issue-based games have evolved as powerful educational tools, transitioning from traditional face-to-face formats to online and hybrid models. Early formats like Model United Nations (MUN) emphasized in-person interaction, promoting collaboration, critical thinking, and global awareness (Drexler & Schmidt, 2015). With the rise of internet technologies, online platforms such as Online MUN and Second Life have enabled students worldwide to engage in virtual policy debates and role-playing on social issues (Koh & Lee, 2015; Bailenson & Blascovich, 2004).

Hybrid models, combining physical and online interactions, have since gained popularity. Blended approaches like flipped classrooms and simulation-based learning integrate online content delivery with in-person role-play and strategy discussions, enhancing critical thinking and collaboration (Bergmann & Sams, 2012; Garris et al., 2002). Recent research further supports the benefits of issue-based games: (Zhou et al., 2022) found such games improve motivation and strategic thinking, while (López-Belmonte et al., 2021) confirmed gains in collaboration and critical analysis.

Each mode—face-to-face, online, and hybrid—offers distinct advantages. In-person formats foster immediacy and authentic engagement (Zhao et al., 2005), while online environments leverage visualization to simplify complex systems and support autonomy (Chen et al., 2020). Hybrid models combine these benefits, creating flexible and collaborative learning spaces.

Effective design of issue-based learning systems requires clear objectives, reliable platforms, and mechanisms to ensure active engagement. (López-Pernas et al., 2021) emphasized the importance of integrating defined evaluation criteria and assessment tools to promote learner self-efficacy and track learning outcomes.

3 Game Design

3.1 Game Process

This study presents the development of <Utopia>, an issue-based game system that combines online and physical interactions. Featuring a user-friendly interface and dynamic data visualization, the system enables players to intuitively understand how changing variables impact scenarios. In-person, students assume roles to engage in issue-driven discussions. By merging the accessibility of digital platforms with the depth of face-to-face interaction, <Utopia> provides a flexible environment for exploring complex social topics.

Gameplay follows a structured, multi-phase cycle:1. A sudden event occurs in each country, initiating the round.2. Countries deliver news announcements to inform others and set the stage for discussion.3. Players hold domestic meetings to analyze the situation and develop response strategies.4. In joint discussions, representatives negotiate and present their positions, influencing policy outcomes.5. Each country publicly declares its strategic direction.6. In the management phase, players use action cards to implement strategies or address issues, which may trigger international responses.7. The round ends with a reflection phase, prompting players to evaluate their actions and improve strategies. This cycle repeats, promoting critical thinking and deeper understanding of complex, interrelated issues. (See Figure 1)

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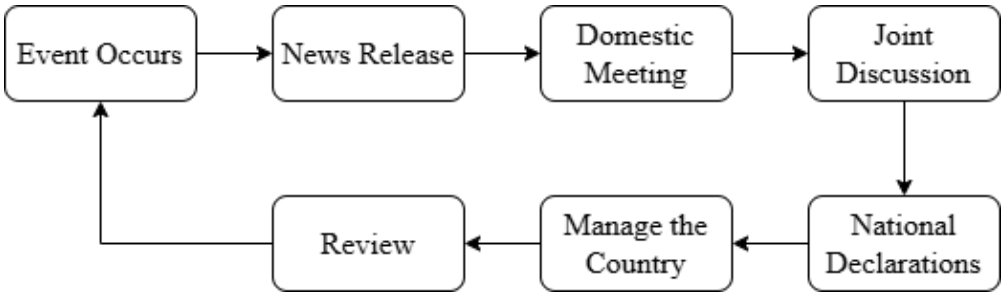

Figure 1: Game Flowchart

System Design and Development

The system was developed using XAMPP as the local server environment and Visual Studio Code (VS Code) as the main IDE. The front-end was built with HTML and JavaScript to support user interaction, while the back-end used PHP for server-side logic. A MySQL database manages player information, game progress, and event data, ensuring smooth system operations.

Players begin by logging in to access their assigned country profiles. Each round starts with a random event assignment, prompting domestic discussions via chatroom, followed by joint discussions with other countries to explore solutions. Players then use the bulletin board to declare national policies and strategies. A trade management module allows resource exchanges and strategic actions using "action cards." The complete system workflow is illustrated in the system flowchart. Figure 2.

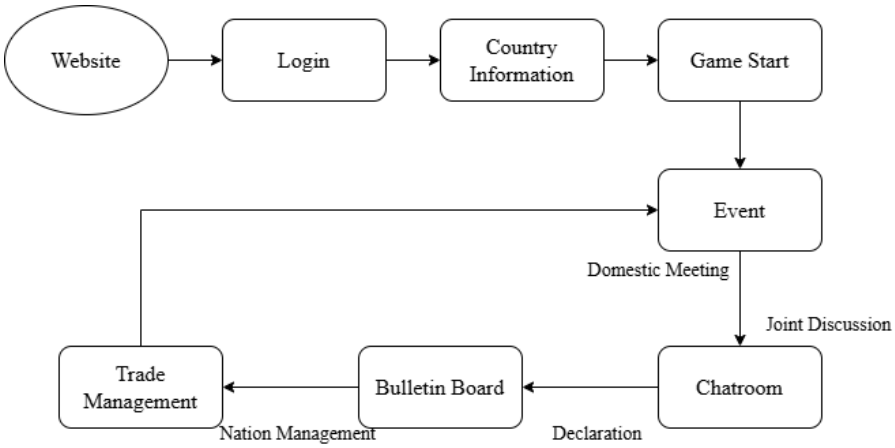

Figure 2: System Flowchart

3.2 System Modules

The system is composed of five core modules: parameter visualization, country information, chatroom, bulletin board, and trade management. The interface is designed to be intuitive and user-friendly, with clearly presented information that helps players quickly become familiar with the game environment and operational flow. The overall interface adopts a modular design approach, providing students with clear guidance and focused objectives. This structure enables learners to intuitively understand the impact of events and the broader social issues they represent. The system's interface architecture is illustrated in Figure 3.

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Figure 3: System Menu

(1) National Information

By clicking on either the global or national information panels, players can access background descriptions that provide context for each country's developmental status and current challenges (see Figure 4).

Figure 4: Country Information

(2) Parameter Visualization

The parameter visualization interface integrates two key dimensions: global parameters and national parameters. Through real-time visualization of parameter fluctuations, players can monitor both international trends and domestic conditions simultaneously. Global parameters encompass a range of indicators that help players assess worldwide dynamics, while national parameters reflect the current status of each country's resources. These parameters are dynamically presented, enabling players to intuitively understand how specific indicators are affected and why, thereby allowing them to make more strategic and informed decisions in response to unfolding events. (see Figure 5).

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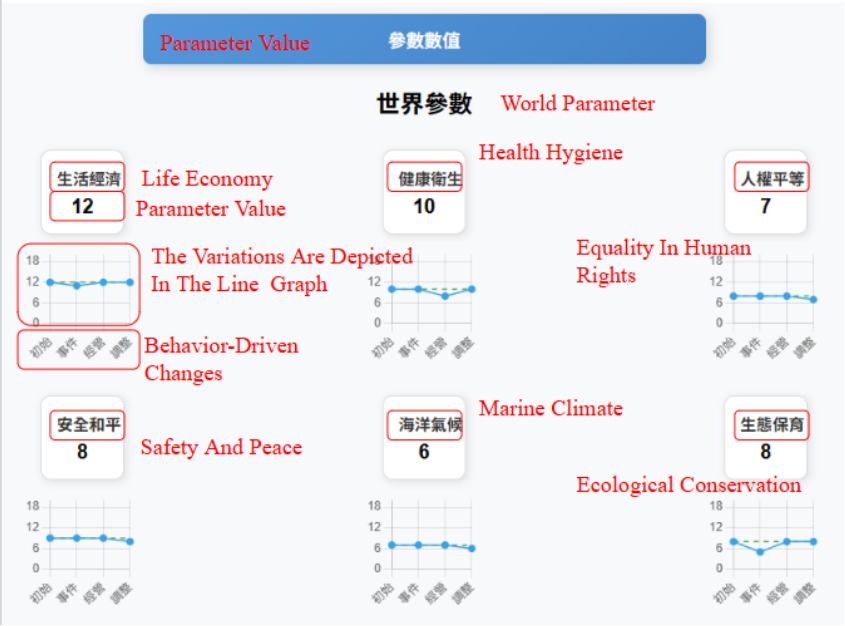

Figure 5: Parameter Value

(3) Bulletin Board

The Bulletin Board serves as the core platform for player communication and information exchange, integrating two primary functions: declarations and news. Through this interface, countries can issue official declarations to express their national positions, policies, or current situations. This function simulates public statements in international contexts, fostering cross-national interaction and discussion.

The system also includes a News interface that, at the beginning of each round, presents recent events in each country in the form of news reports. Each article includes the event type, headline, detailed description, and clearly indicates its impact on national parameters. These features compel players to respond to emerging crises, adding layers of complexity to their decision-making processes.

By engaging with the bulletin board's bidirectional communication and real-time updates, players can stay informed about global developments and adapt their own policies and diplomatic strategies accordingly. This enhances the game's realism, strategic depth, and educational value by cultivating students' skills in information analysis, crisis management, and negotiation. (See Figure 6)

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Figure 6: Bulletin Board

(3) Trading Management

The Trade Management interface allows players to engage in the buying and selling of various resources, simulating international economic interactions and development planning. The interface presents information in a clear tabular format, displaying item names, descriptions, categories, prices, quantities, and selection options. Players can adjust the purchase quantity using increment/decrement buttons and make selections via radio buttons, finalizing transactions by clicking the "Purchase" button.

This module replicates the policy choices and resource allocation processes necessary for national development in real-world scenarios. By participating in trade operations, players gain valuable insights into economic systems and international cooperation. (See Figure 7)

Figure 7: Trading Operations

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4 Research Method

This study will recruit 30 upper-grade elementary students in Taiwan, randomly assigning them into six groups to participate in online learning activities using an issue-based game. An introductory session will precede the gameplay to explain the rules, interface, and learning objectives. During the game, the system will automatically log student behaviors such as decision-making, path selection, interaction frequency, and collaboration patterns.

These behavioral logs will be analyzed alongside Likert-scale questionnaire responses focused on learning outcomes, game experience, teamwork, and usability. A mixed-methods approach will be employed to evaluate students' engagement, performance, and issue exploration. The study also examines how interface design, task scenarios, and team dynamics affect learning motivation and cognitive responses.

5 Expect Results

This study aims to develop an issue-based game system that helps students explore complex social issues through interactive gameplay. Learner feedback and system-generated data will be used to analyze learning experiences, behavioral patterns, and issue engagement. Student acceptance and user experience will be evaluated through questionnaires covering learning outcomes, gameplay, teamwork, and usability. It is expected that the game will increase student motivation, critical reflection, and collaboration through meaningful and challenging content.

System log data will also be analyzed to understand how students adapt strategies based on real-time feedback and tasks. These insights will reveal decision-making processes and their relationship to in-game outcomes. By integrating qualitative and behavioral data, the study aims to provide a comprehensive view of how issue-based games can enhance motivation, collaboration, problem-solving, and engagement with societal issues.

6 Conclusion

This study presents the development of an issue-based game system, <Utopia>, designed to enhance students' engagement with social issues and foster critical thinking. Integrating parameter visualization and role-playing, the system encourages in-depth exploration, multi-perspective analysis, collaborative problem-solving, and strategic thinking.

<Utopia> utilizes five core modules and a visually driven interface to support real-time tracking of global and national parameters, policy formulation, and cross-national communication. This blend of authentic interaction and digital support enhances decision-making and collaboration in complex scenarios, while improving usability and aligning with instructional goals.

By bridging physical and online environments through modular, scenario-based design, <Utopia> offers a flexible and stimulating platform for meaningful issue exploration. This approach promotes learning motivation and enriches student discussion, showing strong potential to inform future educational practices.

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