Exploring Collaborative Argumentation Through a Local-Issue-Based Board Game: A Case Study with High School Student Groups

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Abstract

This qualitative case study explores how a locally contextualized board game can foster collaborative argumentation among high school students. We developed *Z-City Myth*, a role-playing argumentation game informed by dialogic argumentation and situated cognition theories, where players collaborate to interpret data, build hypotheses, and present conclusions on an investigation. Two 3-student groups (N = 6) participated in this research, including gameplay observation and post-game interviews. Thematic analysis characterized how students in both groups used data as evidence, coordinated perspectives, and applied reasoning strategies. Results suggest the game affords collaborative argumentation, demonstrating its potential in learning argumentation, such as providing authentic argumentation context and assessment. As two student groups also demonstrated issues and challenges in collaboration and argumentation, further scaffolding on both are required in the future.

Keywords: collaborative argumentation, game-based learning, local issues, problem solving, qualitative research

1 Introduction

In 21st-century education, collaborative problem-solving and argumentation are considered essential competencies. International assessments such as PISA highlight the need for students to engage not only in complex reasoning, but also in dialogic and cooperative inquiry. While Taiwan's recent curriculum reform - known as the 2019 "Curriculum Guidelines for 12-Year Basic Education" – rolled out inquiry-based learning as required courses, many secondary school teachers reported a lack of instructional materials or tools to support real-world problem solving and especially meaningful collaborative inquiry via argumentation.

To address the above challenge, we developed *Z-City Myth*, a role-playing board game that fosters evidence-based argumentation through in-game data collection, interpretation and collaboration on solving real-world problems. Grounded in collaborative argumentation, game-based learning and situated learning, *Z-City Myth* places students, role-playing as investigators, in a game challenge where they analyze data, form hypotheses, and reason together.

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This study investigates how *Z-City Myth* engages participant students in argumentation and what reasoning strategies emerge across different groups. By examining two high school student groups during gameplay, we aim to understand how the game may facilitate collaborative argumentation as well as how students perform collaborative argumentation. The results will inform its potential as an instructional tool for teaching and assessing collaborative argumentation.

2 Literature Review

2.1 Rethinking Argumentation Education

Argumentation is widely recognized as a key skill for communication and reasoning in a democratic society. Traditional models such as Toulmin's Argument Pattern (TAP) and the Claim-Evidence-Reasoning (CER) framework have long been used to teach and assess learners' understanding of argument structure [1][2][3]. While TAP and CER are useful for identifying learners' awareness of argument structure, they often fall short in capturing the dynamic, evolving nature of argumentation in real-world contexts where argumentation is not viewed as structure or grammar but a form of dialogues and discourses, particularly when multiple perspectives and cognitive conflicts are involved in solving problems. Kuhn [4] reframes **argumentation as a process of coordinating theory and evidence across multiple perspectives**. This view aligns with the situated cognition theory [5][6], which highlights the importance of contextualized argumentation in authentic activities rather than distilling argumentation structures when learners learn to argue. Rather than focusing solely on structural correctness, argumentation education should foster dialogic engagement - encouraging students to negotiate meaning, revise claims, and reason through collaborative efforts. In other words, argumentation education should move beyond structural drills and recognition toward using argumentative dialogue as a tool for solving complex, real-world problems [4].

2.2 Designing Argumentation Games for Learning

Learning with games provides immersive, role-driven environments where students may actively construct meaning through decisions and actions [7]. Jan addressed the situated nature of learning to integrate epistemological awareness, cognitive engagement, and social interaction highlighted by Kuhn, Gee and Brown to propose a situated argumentation game design framework [8]. To test the situated argumentation design framework, Jan developed *Mad City Mystery* (MCM) and *Green City Blues* (GCB), both multi-players role-playing games that successfully engage students in real-world issues through collaborative argumentation. We build on Jan's situated argumentation design framework to design the *Z-City Myth* role-playing argumentation board game, emphasizing structured reasoning, authentic contexts, and dialogic collaboration as the mechanism for fostering situated argumentation.

2.3 *Z-City Myth*

Z-City Myth is a role-playing board game based on real-world incidents in Z city, an industrial hub for computer hardware production in Taiwan. Players assume investigative roles to solve a fictionalized mystery that requires players to analyze diverse text-based sources - such as news reports and testimonies. Three players, taking on distinct investigative roles as government official, independent journalist, and environmental scientist, receive the following information:

A 55-year-old local resident named Hsu is found dead on a rural roadside. While the police initially consider ruling the case an accident due to a lack of new evidence, the suspicious circumstances prompt local authorities to dispatch a special investigation team to uncover the truth and ensure public safety. As members of this investigation team, you need to answer two key questions:

(1) What caused Hsu's death?
(2) What underlying risks may exist in the Z-City community?

You will uncover the above - supported by evidence and sound arguments- at a public hearing.

Inspired by Jan's situated argumentation game design framework [8], *Z-City Myth* engage players in structured, inquiry-driven argumentation discourse in a meaningful context. Players collected data and information from Non-Player Characters (NPCs) as the sources for their arguments about Hsu's death and the underlying myth in Z-City. As NPCs provide only role-specific information to each of the three players, players must exchange information and engage in collaborative discussions to figure out the mysteries. The left side of Figure 1 demonstrates NPCs cards all three players will receive through virtual interviews in the game. The right side of Figure 1 demonstrates information each player receives from an NPC interview. Players scrutinize these cards, examine information and distill evidence, build hypotheses and alternative views, modify hypotheses based on emerging interviews. In other words, they coordinate theories and evidences collaboratively.

Figure 1: Players investigate the case by receiving data from Non-Player Characters (NPCs).

3   Research Methodology

3.1   Participants and Context

To investigate how *Z-City Myth* engages participant student groups in collaborative argumentation and what reasoning strategies emerge across two different groups, this study adopted a qualitative case study approach [9][10]. Participants were selected through purposive sampling from a community-based senior high school in T-City, Taiwan. Two groups of students (Group A and Group B, N = 6), aged 16–17, were recommended by their subject teachers based on their average to above-average academic performance and communication skills. Researchers

provided a brief rule explanation but remained non-intrusive during gameplay. Each group played the game for up to 100 minutes in a quiet classroom, followed by a 20-minute interview.

Figure 2: Two different high school groups (Group A and Group B)

3.2 Data Collection and Analysis

As we view students' group performance as the unit of analysis, we collect the following group interaction data: (1) full video and audio recordings of the gameplay sessions, (2) students' written notes on large sheets of poster paper provided during the game—such as key evidence, inferences, and reasoning diagrams, and (3) approximately 20-minute post-game semi-structural interviews with each group. All recorded materials were fully transcribed and used as references during the analysis process.

We employed thematic analysis as proposed by Braun and Clarke [11] to analyze Group A's and Group B's behavior patterns around collaborative argumentation during the game, particularly note taking, reasoning, discussion, conclusion and goal perception. The thematic analysis method consists of six steps: familiarization with the data, initial coding, theme identification, theme review, theme naming, and final report generation. Coding categories were informed by Kuhn's definition of argumentation processes and included: data usage, perspective sharing, evidence coordination, hypothesis revision, and conclusion integration [4]. A cross-group analysis of argumentation dialogues was conducted to identify both shared patterns and contrasting approaches between the two groups. Triangulation, cross-coder validation, and member checking were employed to ensure the trustworthiness of findings.

4 Findings and Discussion

4.1 Comparative Summary: Defining how Group A and Group B

Table 1: Comparison Between Two Groups

Group A	Group B
Note Strategy: Individual, uncoordinated	**Note Strategy**: Joint, co-edited
Reasoning Base: Individual notes	**Reasoning Base:** Shared evidence
Discussion Form: Parallel assertions	**Discussion Form:** Claim–Evidence–Rebuttal–reconstruction interactions
Conclusion Style: Presents only final results, omits reasoning steps	**Conclusion Style:** Outlines hypotheses and evidence clearly and structurally

Perception of Goal: "Find the correct answer"	**Perception of Goal:** "Present the reasoning process"

Overall, Group A and Group B demonstrated contrasting reasoning strategies, role coordination, and collaboration models while they strive to make arguments about Hsu's death and Z-City mystery requested by the *Z-City Myth*. These differences suggest that argumentation quality depends not only on individual skills, but also on shared goals and strategic interaction. Without effective cooperation, even capable students struggled to integrate reasoning, whereas synchronized collaboration enabled stronger group-level argumentation.

4.2 Group A: A Note-Centered Collaboration Model - Superficial Cooperation, Individual Reasoning

Group A consisted of three 10th-grade students who, at the beginning of the game, adopted a "divide and conquer" strategy—each member freely read a portion of the cards and took individual notes. The group assumed that by working in parallel, they could function like "clones" of one another, using similar logic to classify and record the information. However, notable differences soon emerged: one student categorized by event, another by character, and the third focused on whether statements made by characters were "reasonable." These divergent approaches led to fragmented and unaligned notes, making later group discussions difficult to synthesize.

During the reasoning process, each student relied heavily on their own notes, advancing individual hypotheses and attempting to persuade others without referencing shared evidence or engaging in true collaborative integration. For example, when debating whether the elderly farmer's death was linked to gang activity, each student cited different cards to support conflicting interpretations. Due to the lack of a shared basis for comparison, the group failed to reach consensus and ultimately chose the "most interesting" hypothesis as their answer to Hsu's death.

In the simulated public hearing, Group A summarized their chosen hypothesis briefly, without explaining their reasoning process, contrasting evidence, or the rationale behind rejecting alternative hypotheses. This approach suggested that students perceived argumentation as a "task with a correct answer" rather than as a process of constructing and justifying claims through collaborative discourse.

4.3 Group B: A Dialogic Co-Construction Model - Collaborative Inquiry and Reflexive Reasoning

Group B was composed of three 11th-grade students who emphasized synchronous reading and collective reasoning. They adopted a systematic approach in which one student read a card aloud while the other two verified and discussed its contents, with clearly assigned roles for each group member. Together, they decided to examine the cards one by one, recording character information, event logic, and hypothesis progression. One student served as the primary notetaker, while the others helped verify facts and fill in missing details—creating a form of "collaborative editing" that ensured shared understanding across the team.

During the reasoning process, Group B regularly articulated both supporting and opposing views for each hypothesis, often using counterexample testing to assess the strength of their arguments. For instance, when exploring whether the elderly farmer was framed for insurance fraud, they proactively cited contradictory evidence such as "the wife was not present at the scene" and "the

insurance agent claimed no forms were received," and discussed how these contradictions should be addressed during the public hearing.

Notably, Group B maintained a clear distinction between verified information and their group's speculative reasoning. In their final presentation, they explicitly stated, "This inference isn't confirmed by the cards—we just find it plausible, so we've included it in the group's conclusion, but we'll still label it as a hypothesis rather than a confirmation." This practice of evidence qualification and layered reasoning demonstrated the high-level cognitive abilities required for effective collaborative argumentation.

5 Contributions

This study revealed how an argumentation board game can reveal students' collaborative reasoning patterns and the influence of group strategies on argumentation quality. The game offers a structured, interactive context beyond traditional assessments. When students lacked mechanisms for joint negotiation and reasoning construction, even strong note-taking and analysis skills failed to yield coherent group discussions. In contrast, synchronized interaction and co-construction of reasoning pathways supported more effective engagement in collaborative argumentation. Future work may develop observation rubrics based on gameplay or integrate such games into curriculum designs to support progressive argumentation instruction.

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