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Investigating the Impact of Cooperative Group Learning on Blended Teaching and Learning Outcomes: A Case Study of Sixth-Grade Students in an Elementary School

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Abstract: Taiwan's education landscape has undergone profound changes in the aftermath of the COVID-19 pandemic. Educators, students, and campus environments have all adapted to digital learning, facilitating a smoother transition to blended learning in the post-pandemic era. This study utilizes spatial production theory, blended teaching methodologies, and cooperative learning approaches to investigate the impact of collaborative learning on the efficacy of blended teaching. Findings indicate that elementary school students encounter challenges transforming digital materials into topic discussions, hindering peer discussion and interaction in cooperative learning settings. Consequently, the learning outcomes slightly lag those of the control group engaged in individual learning. However, the overall performance tends to concentration and improvement, as evidenced by the standard deviation.

Keywords: cooperative learning, production of space, post-pandemic era, blended learning, digital teaching material space

1. Introduction

In the wake of the COVID-19 pandemic, the landscape of physical education has been reshaped, necessitating a swift transition to remote teaching to mitigate the crisis. By April 2020, 185 out of 206 political entities worldwide had shuttered physical school education, impacting over 1.5 billion students compelled to adopt remote learning modalities (United Nations Educational, Scientific and Cultural Organization, 2020). This seismic shift in education delivery catalyzes comprehensive educational reform in the post-pandemic era (Olasile, 2020). Moreover, this paradigm shift has catalyzed a marked improvement in digital learning and teaching proficiencies among stakeholders in the education sector,

accompanied by a significant upgrade of campus information technology infrastructure, pivotal for facilitating blended learning practices.

Previously, integrating cooperative teaching into blended learning encountered formidable hurdles due to limitations in video teaching platforms. However, with the gradual return of teachers and students to physical classrooms, the amalgamation of cooperative learning into blended learning frameworks has become comparatively more feasible. Against this backdrop, this study draws upon Lefebvre's theory of the production of space (1991), the foundational elements of blended learning delineated by Osguthorpe and Graham (2003), and the IBIS (Issue-Based Information System) model refined by Liu and Tsai (2008), which is tailored to analyze group interaction behavioral processes. Subjects will be randomly selected and assigned to individual or group settings, with the latter comprising three to four individuals per group, considered optimal for cooperative learning. All other variables and environmental factors will remain constant across both settings, except for differences in group size.

This study, therefore, seeks to examine the impact of group cooperative learning on learning outcomes in blended learning environments. Grounded in Lefebvre’s (1991) theory of the production of space, the three elements of blended learning proposed by Osguthorpe and Graham (2003), and the Issue-Based Information System (IBIS) model as adapted by Liu and Tsai (2008) for analyzing group interaction processes, the study employs experimental observation and behavioral recording methods. Participants, selected through random sampling, are divided into individual and group conditions, with the group learning environment consisting of three to four members as per resource considerations. All other environmental and instructional conditions remain identical between the two groups. The study aims to explore how cooperative learning in group settings affects learning outcomes within the blended learning framework.

1.1 The production of space theory

In "The Production of Space" (1991), Lefebvre describes a spatial perspective that conceptualizes social space into three dimensions: perception, conception, and lived experience. He defines these three dimensions and their corresponding spatial elements in teaching activities as follows:

(1) Spatial Practice: This encompasses production and reproduction, ensuring continuity within the spatial constructs of every social formation. This cohesion involves specific abilities and actions within the relationship between each member and the space. In teaching activities, this corresponds to the spatial arrangement of instructional materials constructed by teachers, activated, and interacted with by students during teaching activities.

(2) Representations of space: This is closely tied to production relations and the "order" imposed by these relations, thus intertwined with knowledge, symbols, and codes. Distinguishing between life and perception through conception is the dominant space in any social or production mode. This idea corresponds to the space controlled and planned by the instructor in teaching activities.

(3) Representational spaces: This is the space directly lived through images and symbols; thus, it is the "user's" space, dominated and passive. In teaching activities, this corresponds to the space of the students, initially often passively imbued with learning experiences, and then through the rules of teaching activities, they gain autonomy in planning learning behaviors, where actual learning outcomes occur.

1.2 Blended Learning

Chang (2012) indicated that blended learning, as demonstrated, is a blended form of instruction that combines physical teaching with digital tools such as the Internet, technology, communication media, and online digital platforms. It encompasses both synchronous and asynchronous teaching modes. Osguthorpe and Graham (2003) further delineated blended learning into three types, composed of three elements (learning activities, students, and instructors):

(1) Type 1: instructors and students are in the same physical space, conducting face-to-face teaching and utilizing online interaction tools.

(2) Type 2: instructors are in the same physical space with some students, conducting face-to-face teaching while other students participate in learning activities through online tools.

(3) Type 3: some instructors and students are in the same physical space, conducting face-to-face teaching, while other instructors participate in teaching activities through online tools.

1.3 IBIS Discussion Model

Liu and Tsai (2008) indicated that peer discussion and dialogue interaction in cooperative learning is crucial for learning outcomes and group division of labor. Therefore, this study follows their interpretation of the IBIS discussion model, categorizing interaction behaviors into seven main types (questioning, answering, responding to answers, questioning responses, seeking support, off-topic, and prompting). Through this categorization, the study aims to understand how research subjects discuss and apply learning materials obtained from digital spaces.

2. Research Theory and Framework

The framework of this study, as illustrated in Figure 1., is formulated based on a synthesis of existing research and theoretical insights, focusing on the instructional interactions and group cooperative discussion modes within blended learning settings.

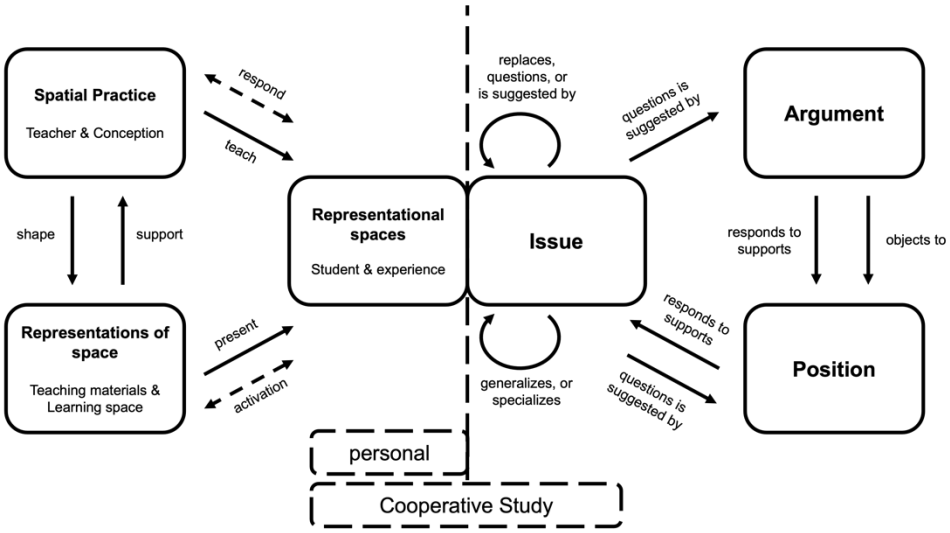

Figure 1. Research Framework

3. Research Design

This study employs a triangulation of data sources and nature, including pre-test and post-test questionnaires, teacher observations of student behavior, and semi-structured interviews with students. This approach aims to provide a comprehensive understanding of the impact of cooperative learning in the experimental group compared to individual learning in the control group on blended learning outcomes. The research process is illustrated in Figure 2.

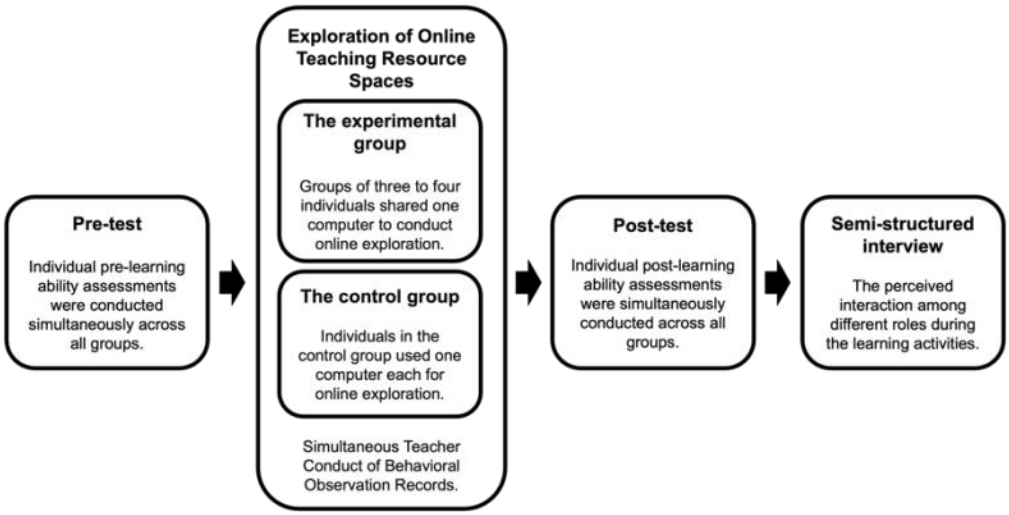

Figure 2. Research Process Diagram

4. Research Participants

The participants of this study are sixth-grade students from a public elementary school in Taichung City, Taiwan. One class of students will be randomly selected and divided into two groups (experimental and control groups) through random sampling. Following the explanation, both groups will engage in classroom learning simultaneously, with the only distinction being during online material exploration. These students have a certain level of familiarity with the platform used for the research tools, enabling smooth operation and minimizing the influence of novelty on other factors.

5. Research Tools

Drawing upon Lefebvre's (1991) theory of the production of space, this study establishes an online learning environment to observe interactions among various elements during instructional activities. After evaluating several commonly used online teaching platforms among Taiwanese students, Gather Town emerged as the most suitable platform for hosting the digital instructional space. In addition to enabling the creation of spatially hierarchical portals and password-protected doors, Gather Town offers features for integrating teaching material links and interactive mechanisms. Moreover, it incorporates thematic content centered around puzzle-solving and spatial design, fostering a detective-like scenario for student exploration and interaction. This design aims to augment student engagement in discussions, analysis, and collaborative reasoning with fellow group members.

Furthermore, within the digital instructional space, interactive quizzes are provided to aid students in assessing their learning outcomes. Reason clues are offered as additional incentives for problem-solving, thereby promoting active learning and application of pertinent course content.

Concurrently, the experimental and control groups are physically segregated in the physical classroom setting using a seating arrangement method. Throughout the instructional process, teachers assume the roles of facilitators, posing questions and offering guidance while ensuring equitable dissemination of information by displaying responses to student inquiries at the front of the classroom. Visual representations of the tools' interfaces are presented in Figures 3-8.

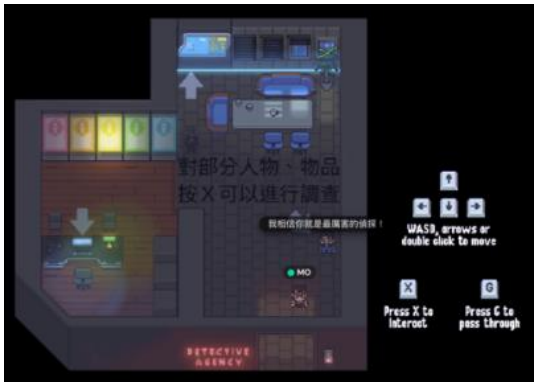

Figure 3. Cyberpunk Detective Theme

Figure 4. Interactive Character Avatars

Figure 5. Embedded Google Forms for Interactive Quizzing

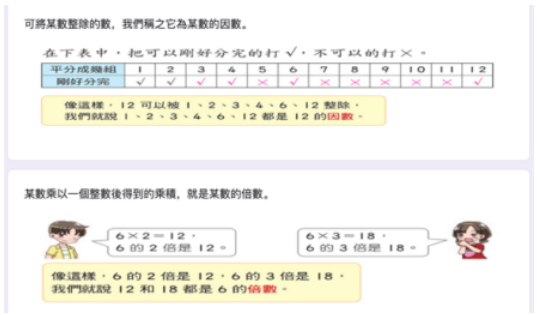

Figure 6. Embedded Excerpts of Instructional Content

Figure 7. Experimental group operating scenario

Figure 8. Control group operating scenario

The experimental group and control group followed identical procedural steps during the activities. The only distinction was in the approach to exploring the online space. In the experimental group, participants engaged in collaborative group discussions to determine exploration directions and puzzle-solving strategies. Conversely, in the control group, individuals fully controlled a virtual character on their own, independently deciding the exploration path and solving tasks.

6. Research Results

The analysis of learning outcomes data collected through pre-test and post-test assessments is presented in Table 1.

Table 1: Comparison of Pre-test and Post-test

Group	M Pre-test	M Post-test	SD Pre-test	SD Post-test	t	p
Experimental Group	75.0	77.1	13.4	12.0	-1.883	.082
Control Group	65.3	75.3	12.6	15.0	-3.606	.004*

* Indicates $p < .05$

According to the table above, both the experimental and control groups exhibited improvements in average scores. However, only the control group demonstrated a significant difference between pre-test and post-test scores. The experimental group displayed a further reduction in standard deviation, indicating that although the progress of the control group was more pronounced, significant improvements between the pre-test and post-test were observed in only a subset of participants. Conversely, the experimental group's results suggest that while the extent of improvement may not have been as substantial, overall, the participants' performance was more concentrated and demonstrated slight progress. This result implies that cooperative learning contributes to the advancement and development of each participant rather than exclusively benefiting students with specific learning preferences.

Regarding teacher observations, it was noted that during learning activities, the control group exhibited a higher frequency of interaction with digital materials, as they had complete control over avatars to explore the digital space. In contrast, in the experimental group, due to the limitation of one computer per group, operational decisions required consensus among group members, often guided by a more dominant member. This result occasionally impeded the initiation of discussions on topics, necessitating teacher intervention to impart relevant skills for cooperative learning.

In semi-structured interviews, participants expressed that engaging in puzzle-solving and reasoning activities within the digital space heightened their motivation for learning. However, they found the puzzles challenging, necessitating exploration and collection of clues within the digital space to complete the activities. Participants from the control group valued the autonomy of controlling their avatars but encountered difficulty overcoming challenging tasks independently. Conversely, participants from the experimental group perceived the opportunity for exploration as equitable (each group had one computer) but noted that discussions about exploration goals sometimes constrained exploration time. Additionally, there were instances where the member controlling the computer struggled to accurately describe issues, resulting in the need to pass materials around for separate readings, leading to extended discussion times.

7. Conclusion and Recommendations

In the post-pandemic educational landscape, participants in educational endeavors generally possess digital literacy skills and academic institutions are equipped with essential digital learning resources. However, mere access to digital tools does not guarantee enhanced learning outcomes. Instead, educators must adapt their instructional approaches to accommodate evolving learning environments. This study, which delves into cooperative group learning within blended teaching contexts, resonates with prior research (Liu & Tsai, 2008).

Findings from this study revealed challenges in smoothly implementing the IRIS discussion model. Issues such as limitations in equipment environments and the articulation of questions impeded discussions and dialogues when translating digital instructional materials into topic discussions. Consequently, the experimental group exhibited less significant improvement in learning outcomes than the control group. Nonetheless, it was noted that cooperative group learning exerted a positive, consolidating influence on overall performance among group members, fostering progress and concentration among students of varying proficiency levels.

Based on these observations, it is recommended that future research endeavors focus on developing scaffolding mechanisms for facilitating the translation of digital data into topic discussions. Additionally, conducting behavioral pattern analyses to discern the impact of different behavioral elements in blended cooperative group learning on learning outcomes would be beneficial. Furthermore, exploring the influence of equipment environments on learning agencies could yield valuable insights.

By pursuing these research directions, scholars can comprehensively understand the myriad influencing factors, teaching strategies, and instructional designs pertinent to blended cooperative group learning, thereby enhancing educational practices in the post-pandemic era.

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