Developing a World Geography Gamification Lesson Plan with Digital Tools

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Abstract

Purpose: The purpose of this study is to develop a geography class teaching and learning guide that enables learners to realistically explore the characteristics of the world's climate and geographical environment using digital tools. **Research design, data and methodology:** We review previous research on classes using goal-based scenario learning models, gamification, and digital tools, and explore tools that can be applied to world geography classes. Based on the exploration results, a goal-based scenario learning module is designed and a strategy for promoting educational gamification is established based on the ADDIE instructional design model. **Results:** The study comprises four sessions. Sessions 1-3 involve performance evaluations using a goal-based scenario learning module. Learners create game characters reflecting geographical characteristics, present results, and proceed with 3D modeling. In Session 4, a gamification class using Google Sites on the CoSpaces metaverse platform will be conducted. **Conclusions:** The study introduces a goal-based scenario learning model and a gamification class using digital tools to empower learners in exploring geographical diversity and its impact on lifestyles. Utilizing an accessible online platform, the study provides practical measures for integrating digital tools into geography education, addressing the current importance of digital technology in teaching.

Keywords: Gamification, Geography education, Metaverse, Goal-based scenarios, Convergence education

JEL Classification Code: I20, I21, I29

1. Introduction ⱼ

Gamification refers to applying game principles and techniques to non-game fields to stimulate the experiencer's interest and improve immersion. Recently, as the positive influence of games has been highly regarded, they are being actively used in the field of education as a tool to increase learning effectiveness.

The ideal talent pursued by the current 2022 revised curriculum is 'a creative, convergent talent with sound character.' In other words, the school's educational goal is to cultivate talent who can create new things using conceptual knowledge. Education so far has focused on nurturing talent suitable for the catch-up imitation economy through knowledge memorization classes.

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However, future education should move in the direction of organizing learning content around core concepts and improving interest in learning through student participation classes (Seoul Metropolitan Office of Education). Additionally, it is often said that we have entered the era of the Fourth Industrial Revolution, a new type of learner called the digital native has emerged. They want to learn in an active and convergent way rather than the existing standardized learning method. In addition, starting with COVID-19, digitalization of education has become a necessity rather than an option. In line with this, instructors are also thinking about teaching methods suitable for new learners and the digital age and are focusing on gamification as a solution (Kim, 2020).

Global citizenship and geography courses in social studies study how spatial differences in different parts of the world affect human life. The goal of the curriculum is to enable learners to understand the diversity of human life depending on the region through an understanding of the natural and human environment of the surface space. Furthermore, it aims to cultivate global citizens who pursue a world of mutual coexistence with the value of cultural diversity in mind (Ministry of Education of Korea, 2022).

However, in world geography classes, there is a lot of content to memorize and it is difficult for learners to find connections with real life on their own, so it is often difficult to continue learning with extrinsic motivation alone. In this situation, gamification classes using digital tools that can implement virtual reality allow learners to understand geographical concepts and phenomena more deeply by indirectly experiencing and interacting with environments that they have only encountered through text in textbooks. In addition, the goal-based scenario learning model is used to assign specific roles to learners and present tasks so that learners can actively learn the knowledge and skills necessary in the process of performing tasks. In this study, learners were given the role of 'Geographic Pokémon game character creator' and presented with tasks to create characters reflecting geographical elements to be used in gamification classes and to devise a story. Learners will be able to develop geographical thinking skills and imagination in the process of performing tasks, and as instructors use learners' results in gamification classes, learners will be able to participate more actively in classes.

This study developed a performance assessment and gamification lesson based on the content of the 2022 Curriculum Standards for Global Citizenship and Geography, Unit 2, "Mosaic World, Diverse Natural Environments and Cultures of the World". The content of Unit 2 is especially difficult for students to experience directly, and there are many basic concepts to learn.

Therefore, we aim to improve the application ability of conceptual knowledge and prevent the formation of misconceptions through performance evaluation and gamification classes after systematically organizing explanatory lectures by the instructor. The learning elements of Unit 2 are 'Diverse climates and human life', 'Climate change issues and efforts to address them', 'Sustainable use of landforms', 'Landscapes and symbols of the world's major religions', and 'Geographical meanings of different foods and festivals'. This study designed lessons based on two of these learning elements, "Diverse climates and human life" and "Sustainable use of land".

2. Literature Review

To improve the negative perception in schools that social studies classes are boring subjects with a lot of content to memorize, attempts have been actively made to apply gamification in social studies classes and prove its effectiveness. For example, Kang (2008) used multimedia cross-puzzle games and golden bell games in geography classes, suggesting that gamified classes increase students' creativity and concentration and self-directed learning, thereby increasing their interest in learning and academic achievement. found to have improved.

Kim (2020) analyzed the educational effects of history gamification classes using games created by in-service teachers. As a result, it was found that students who took gamification classes significantly increased their academic achievement and learning motivation compared to the comparison group. In addition, in a descriptive evaluation such as writing a virtual diary based on a specific era conducted after class, it was verified that the learners in the experimental group had higher historical facts, reasoning, interpretation, and imagination than the comparison group. This shows that the game promoted emotional learning about the topic, increased empathy for others, and improved understanding of other people's values (Kang, 2008; Baek, 1995).

Kim (2022) developed a learning module using a goal-based scenario learning model to effectively apply technologies such as AI to the educational field. The modules presented in this study are topics that are meaningful in geography education and where digital tools can enhance learning effectiveness, an online platform that is easily accessible to learners and instructors, and an opportunity for students to think and explore using digital tools on their own initiative. It was developed considering possible pedagogical design. Among them, the module 'Creating a Geographicon that symbolizes a city image' utilizes AutoDraw, an artificial intelligence-based tool that automatically converts sketches into simple images, allowing learners to learn about the city more actively during the task performance process.

Nam and Kim (2018) emphasized the importance of research on how instructors and learners directly create and utilize virtual reality content in future education. This study designed a class to teach CoSpaces, a virtual reality production platform, to prospective teachers and analyzed its impact on learners' learning motivation. As a result, it was found that new skills and a sense of achievement influenced improving learning motivation. However, because this is not a study targeting a specific subject, it is unknown what effect virtual reality has on social studies classes.

The use of virtual reality in social studies classes helps learners increase learning motivation by immersing themselves in and experiencing the subject content and promote social citizenship, which is the ultimate goal of social studies education. In addition, instructors can meet learners' learning diversity needs by applying materials that reflect learners' learning preferences to virtual reality (Jeon, 2018).

3. Strategies for Developing Lesson Plans

This lesson plan is based on the two learning elements 'Diverse climates and human life' and 'Sustainable use of landforms' and the achievement criteria in Table 1. A performance evaluation module is developed using a goal-based scenario learning model so that learners can actively explore learning content, and an educational gamification promotion strategy that can improve immersion and learning interest based on the ADDIE model, a systematic instructional design model.

3.1. Goal-Based Scenario Learning Model-Based Learning Module

In this learning module, learners take on the role of game company employees and perform the task of creating characters to be used in world geography educational games.

The task consists of two phases: "Designing a Geo-Pokémon" and "Creating a Geo-Pokémon in 3D". In the "Plan a Geo-Pokémon" stage, learners can practice applying their knowledge by understanding and analyzing spatial information about the geographical environment, and then expressing it in writing and drawing to create a character that lives in different climatic or topographical environments around the world. In the "Creating Geo-Pokémon in 3D form" step, learners will model based on their sketches from the previous step. Through 3D modeling, learners develop the spatial perception skills necessary for geographic thinking. The learning modules are listed in Table 1.

Table 1: Learning Modules

element	Content
Learning objectives	Based on their learning, students can design a GeoPokémon that reflects the characteristics of a specific climate and geographic environment and explain the connection to geography in writing.
Achievement criteria	- Identify the relationship between the climate environment and human life based on an understanding of the world's different climates. - Identify the relationship between the world's major landforms and human life, and discuss sustainable use through examples of conflicts between development and conservation over land use.
Cover story	You've just joined a game company after spending the last two years traveling the world. Your first project is to create Pokémon for a world geography educational game adapted from the story of the Japanese animated Pokémon TV series. Your boss has asked you to creatively reflect key features of the world's climate and geography in the Pokémon's names, appearance, and habitats. As the only person in the company with world travel experience, you are exactly what the project needs. Drawing on your experiences from two years of world travel, you'll create a GeoPokémon that will help teach teenagers about world geography.
Mission	Become a game character creator and create a GeoPokémon and write an introduction that relates to your curriculum.
Scenario activities	Mission 1: Plan a GeoPokémon - Research the housing and lifestyle of people living in a specific climate or terrain. - Analyze how the appearance and skills of existing Pokémon in the anime relate to their habitats. Mission 2: Build a GeoPokémon in 3D form. - After learning the basics of Tinkercad, model your planned GeoPokémon. - Submit your modeled GeoPokémon as an assignment in Google Classroom using the export feature
Evaluation	Mission accomplished: Complete the Canva activity sheet and share your GeoPokémon modeling file in Google Classroom.

Reference: Kim (2022)

3.2. Strategies for Promoting Educational Gamification for World Geography Education

The strategy for promoting educational gamification for world geography education consists of analysis, design, development, implementation, and evaluation, as follows. First, in the analysis phase, we established the target audience, scope of education, and educational goals. The target audience is high school students who have learned the conceptual knowledge of Unit 2 through explanatory lessons.

Assume that they have learned the conceptual knowledge, but when solving application problems, they confuse concepts or fail to make comparative analysis. To improve this, the instructor wants to improve the application of conceptual knowledge through gamification lessons and evaluate its effectiveness by conducting a performance evaluation based on a goal- based scenario learning model.

In the design phase, you design the learning motivation, game story, mechanics, and medium to be used to Stimulate extrinsic motivation by designing prizes for high scorers to encourage all learners to actively participate in the game. The game story is adapted from the Japanese animated Pokémon TV series. The story follows a high school student as he goes on an adventure to find Climate Pokémon and Terrain Pokémon, learning about the characteristics of each climate and terrain. There are 10 GeoPokémon in the game, all designed and created by the learners themselves.

Learners must complete in-game quests to get the clues they need to find the GeoPokémon. Each quest is related to the unit content. The game is designed to maximize the fun of exploration, challenge, competition, discovery, and fantasy among the 20 fun experiences of Korhonen's PLEX model for educational gamification, and to immerse learners in the game by using quests, leaderboards, progress markers, and victory conditions among the mechanics (Kim; Werbach & Hunter, 2012).

The main mediums to use for gamification are Google Sites, Google Sheets, Google Forms, and CoSpaces. Google Sites is the program that the game is based on, and everything happens within a Google Sites page. Google Sites provides features like embedding html code, so you can embed CoSpaces scenes, leaderboards using Google Sheets, and more on your page.

The development phase is divided into two parts: creating the Google Sites page and creating the CoSpaces scene. First, we use the backgrounds and panoramic images provided by CoSpaces to create six different climates and four different terrains for each scene. After implementing the scenery, we use the block coding program provided within CoSpaces to implement the interaction between the user and GeoPokémon so that the user can perform quests. If the user successfully completes the quest, they will receive a GeoPokémon and a password to advance to the next stage.

The acquired GeoPokémon will always follow the user. Additionally, CoSpaces provides physics features such as friction, gravity, elasticity, and collision, which can be leveraged to give players a more realistic experience of the environment and terrain.

The Google Sites page consists of two gameplay pages and two progress and ranking pages, totaling 16 pages. The gameplay page consists of images, text, html code for the CoSpaces scene, and a password field to tell the story. After viewing the images and text, learners play CoSpaces and complete the quests. If they succeed, they get one GeoPokémon from that scene and a password to advance to the next page. Learners enter the correct password in the password field at the bottom of the page and click the button to advance to the next page.

The Progress and Ranking page embed a Google Form and a Google Spreadsheet that acts as a leaderboard. The Google Form is used to collect and rank the response times of learners who have completed each round of the quest, and when learners submit their questionnaires, the results are immediately reflected in a chart in Google Sheets where they can see their ranking. Learners can see their ranking every two rounds. Here's how Google Sites is structured and what each page contains. (see Table 2).

Table 2: Google Sites page-specific content

Page	Content	Page	Content
1	Introducing and starting the game	9	Searching for Alpine Climate Pokémon
2	Searching for Rainforest Pokémon	10	Check your game progress and ranking 3
3	Searching for Tropical Savannah Pokémon	11	Searching for Glacier Terrain Pokémon
4	Check your game progress and ranking 1	12	Searching for Volcanic Terrain Pokémon
5	Searching for West Coast Oceanic Pokémon	13	Check your game progress and ranking 4
6	Searching for Mediterranean Climate Pokémon	14	Searching for Coral Reef Coastal terrain Pokémon
7	Check your game progress and ranking 2	15	Searching for Karst Terrain Pokémon
8	Searching for Arid Climate Pokémon	16	End the game and check your final ranking

In the implementation phase, you will play a 50-minute game for high school students in a world geography course. Before starting the game, explain how CoSpaces works. Instruct students to start the game via the URL of the Google site that you have posted in advance on Google classroom. Once the game begins, display a leaderboard on the board using Google Sheets to show real-time rankings.

In the post-game evaluation phase, you'll examine learners' interest, learning benefits, and satisfaction with the world geography gamification lesson. You'll also gather their feedback on the game's operation to make adjustments and improvements.

4. Results

The following lessons were designed based on the

performance assessment module using the goal-based scenario learning model and the strategy to promote educational gamification.

4.1. Chronological Lesson Design

The class is designed in four sessions, and the first through third sessions are used to evaluate the performance of GeoPokémon production, and the last session is used to create a game using the GeoPokémon produced by the learners. The topics, learning objectives, and media used for each lesson are shown in Table 3.

Table 3: Chronological lesson design

Session 1	
classification	Performance Evaluation
Lesson topics	Become a game character creator and create a GeoPokémon and write an introduction that relates to your curriculum.
Learning objectives	① With a basic understanding of climate factors and climate elements, you can analyze and compare the key characteristics and factors of each climate. ② You can use what you learn to design GeoPokémon that reflect the characteristics of a specific climate and terrain environment. Write an introduction to a planned GeoPokémon game that applies content knowledge.
Media	Sheets, Canva, Textbook
Session 2	
classification	Performance Evaluation
Lesson topics	Presenting and peer reviewing performance appraisal results
Learning objectives	Explain how your planned Pokémon relates to the climate and terrain environment
Media	Canva
Session 3	
classification	Performance Evaluation
Lesson topics	Modeling your planned GeoPokémon with Tinkercad
Learning objectives	Understand Tinkercad's capabilities and model your own GeoPokémon.
Media	Tinkercad, Google Classroom
Session 4	
classification	Gamification Class
Lesson topics	Review the content of Lesson 2 by using CoSpaces to play the game Geographic Journey with Pokémon to build on the content knowledge you learned in Lesson 2.
Learning objectives	Understand how CoSpaces works and be able to use your knowledge to solve problems in the game.

Media	Google Classroom, Google Sites, CoSpaces

4.2 Chronological Lesson Plans

The performance assessment will take place over three periods. The lesson plan is shown in Table 4.

Table 4: Lesson Plans for Sessions 1, 2, and 3

Topics	Become a game character creator and create a GeoPokémon and write an introduction that relates to your curriculum.	
Learning objectives	① With a basic understanding of climate factors and climate elements, you can analyze and compare the key characteristics and factors of each climate. ② Based on what you learn, you can create GeoPokémon that reflect the characteristics of a specific climate and terrain environment. ③ Write an introduction to a planned GeoPokémon game that applies content knowledge.	
Course Materials	Performance Assessment Activity Sheet, Textbook, Laptop, Canva, Google Classroom, Tinkercad	
Stages of learning	Teaching and learning activities	Learning Modalities
Organize your moderation and select activity topics (1st time)	① After the representative is selected, the representative recruits his or her own members. ② Each group chooses an activity topic (specific climate, terrain) by lottery.	Full learning Moderated activities
Collecting data (1st time)	Read the missions and scenarios in the learning module and discuss the direction of Pokémon creation based on the textbook content and the data you have collected.	Moderated activities
Planning and writing introductions (1st time)	① Create a GeoPokémon based on the results of the group discussion. ② Take a picture of the GeoPokémon you created and upload it to your digital journal in Canva. ③ Write an introduction to your created GeoPokémon's appearance, traits, and skills in a digital journal on Canva that relates to the activity topic.	Moderated activities
Presentations and peer review (2nd time)	① Present on the GeoPokémon project the group organized using Canva	Full learning Moderated activities

	②	Make an announcement that communicates your intentions.	
	③	Use Canva's Emoji app for peer review by placing a heart emoji on the moderated page that best reflects the geography.	
Modeling (3rd time)	①	Learn the basic features of Tinkercad	Full learning Moderated activities
	②	Model the GeoPokémon you created into 3D form.	
	③	The focus is on modeling the characteristics of the planned GeoPokémon to stand out, rather than modeling them in an elaborate way.	
	④	Submit your modeled GeoPokémon as an assignment in Google Classroom.	

In the first round, organize a group for performance evaluation and select a topic. After selecting the topic, gather the materials needed to create the GeoPokémon and discuss the direction of the project with your group. Based on the results of the group discussion, draw a GeoPokémon on the performance assessment activity sheet, take a picture of it, and upload it to the Canva digital activity sheet. The Canva digital activity sheet is organized as shown in Figure 1, with a basic information section, an introduction section, and a peer evaluation section, and can be edited simultaneously with the group.
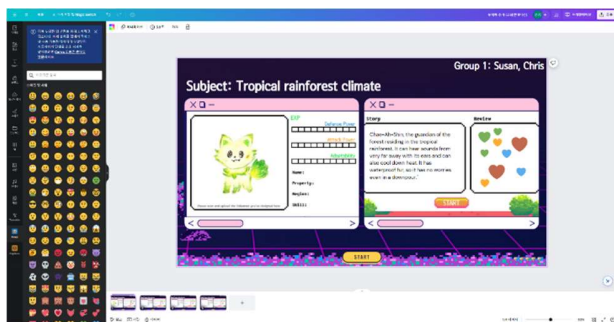

Figure 1: Canva Digital Activity Sheet

In the second session, each group will present their GeoPokémon and peer-review their work using the Canva digital workbook. In the third session, students will learn the basic features of Tinkercad and model their GeoPokémon. After completion, students are encouraged to share their work on Google Classroom so that the entire group can be compiled. The process of creating a GeoPokémon with

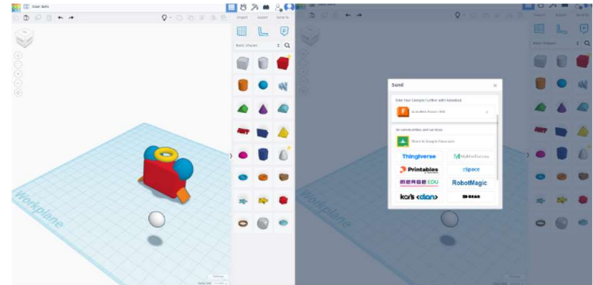Tinkercad and sharing it on Google Classroom is shown in Figure 2.

Figure 2: Tinkercad operation screen and export to Google Classroom screen

In the final lesson, you will teach a gamification lesson based on the content of Lesson 2. Before the fourth lesson, the instructor will create a game and a Google Sites page for the class. The platform you will use to create the game is CoSpaces. You will use the built-in elements in CoSpaces to create a geographical landscape and use Coblocks to allow the characters in the game to interact with the player. The process for creating a CoSpaces game is shown in Figure 3.
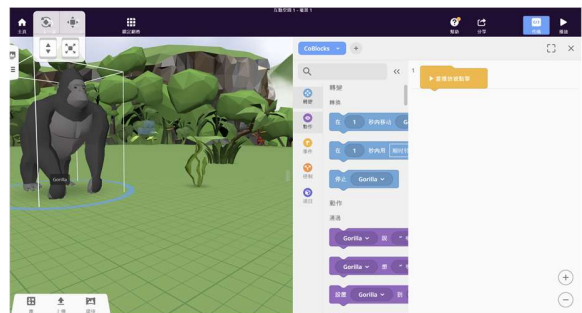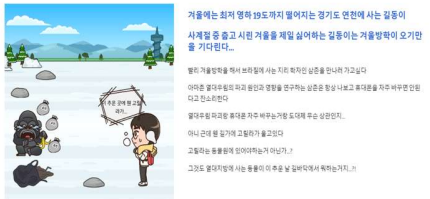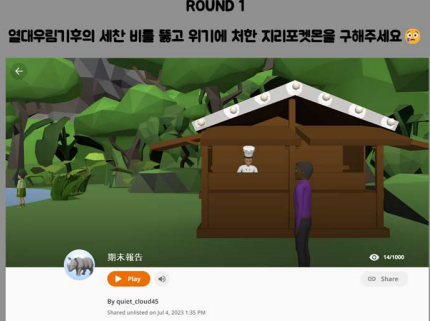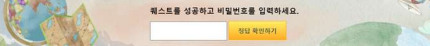

Figure 3: CoSpaces game creation scene

The Google Sites page is divided into two parts: the play page and the progress and ranking page. The play page is divided into a banner, text and images to tell the game's story, HTML code for the CoSpaces scene, and a password field, as shown in Table 5.

Table 5: Gameplay page organization

Element	Form
지리포켓몬과 떠나는 기후&지형 대장정	Banner

	Game scenario description images and text
	CoSpaces Scene
	Password field

The Progress and Ranking page consist of a banner, an explanation of how scoring works, the Google Forms needed to calculate progress and rank, and a Google Spreadsheets integration chart that acts as a leaderboard. (see Table 6).
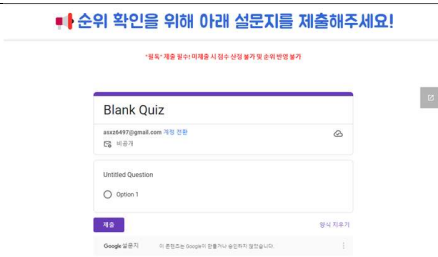
After creating the game and the Google Sites page, teach the gamification lesson using the lesson plan in Table 7.

Table 6: Configuring the View Progress and Rankings page

Element	Form
	Banner
	Scoring methodology description text
	Google Forms

Table 7: Lesson Plan for Session 4

Topics	Review the content of Lesson 2 by using CoSpaces to play the game Geographic Journey with Pokémon to build on the content knowledge you learned in Lesson 2.	
Learning objectives	Understand how CoSpaces works and use the knowledge you learned in Lesson 2 to solve problems in the game.	
Course materials	Textbooks, Laptops, Google Classroom, Google Sites, CoSpaces	
Stages of learning	**Teaching and learning activities**	**Learning Modalities**
Explain the rules of the game	① Describes the basic operations of CoSpaces. ② Describe the structure of Google Sites and the rules of the game. ③ Explain that the game is an individual activity, not a group activity.	Full learning
Play the game	① Instruct students to log into Google Classroom and access the Google sites URL that you have uploaded to start the game. ② Encourage students not to share answers with each other during play.	Full learning
Awards and recognition	① Refer to the leaderboard and award prizes to the three learners who complete the quest the fastest. ② Investigate learners' interest in, helpfulness to, and satisfaction with this gamification lesson, as well as their feedback on the game's operation for modifications and enhancements.	Full learning

5. Discussion

The goal-based scenario learning model and gamification lessons using digital tools proposed in this study have an advantage of being designed based on an online platform, which is easy to access for both instructors and learners and can be used practically in the classroom. However, the effectiveness of the lessons may be limited by differences in learners' digital capabilities, and the nature of online platform-based lessons may limit participation due to internet connectivity or technical issues. Another disadvantage is that instructors need to be proficient in using digital tools to design lessons and may need to be proficient in areas that are outside the scope of typical geography teaching knowledge, such as 3D modeling and coding. This can also be a limitation in terms of increased lesson preparation burden for instructors. Therefore, the teaching strategy proposed in this study may minimize the burden on geography instructors by collaborating with art and information education instructors to create a fusion class.

The following are the differences between this study and previous studies on goal-based scenario teaching and gamification lesson plans using digital tools.

First, Kang (2008) focused on making learners learn factual knowledge of geography in an enjoyable way by using Golden Bell game, world map puzzle, etc. However, the gamification lesson plan in this study goes beyond learning factual knowledge and uses a 3D-based online platform to help learners experience spatial differences in different regions of the world in three dimensions and understand different lifestyles and ways of thinking due to spatial differences.

Second, Kim (2022) used AutoDraw, an artificial intelligence-based tool that automatically converts sketches into simple images, in the module 'Creating a geocon to symbolize city images'. Auto Draw has the advantage of lowering the learning barrier for non-artistic learners, but it also has the limitation that the AI-recommended drawings do not reflect the creativity of the learners. However, Tinkercad, which was used in this study, can fully reflect the imagination and creativity of learners, and at the same time, it can also develop spatial perception through modeling tasks.

At a time when digitization of education is becoming a necessity rather than an option across disciplines, geography educators need to understand the possibilities of digital technologies and continue to research strategies that can be effectively implemented in geography education. In this context, this study is significant in that it explores how existing digital tools can be incorporated into geography education and develops a teaching module.

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