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Assemblr Edu's AR Video Innovation for Hydrosphere Dynamics Learning at SMA Negeri 1 Sigi

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ABSTRACT

This study aims to develop an Augmented Reality (AR) video-based learning resource using the Assemblr Edu application on the subject of hydrosphere dynamics for Year 10 students at State Senior High School 1, Sigi Regency, and to determine its suitability and practicality. This study employed the Research and Development (R&D) method using the ADDIE model, which comprises the analysis, design, development, implementation, and evaluation stages. Data collection techniques were carried out through expert validation questionnaires, teacher practitioner assessments, student response questionnaires, and interviews. The results of the study indicate that the developed learning media is classified as highly feasible, with a content validation rate of 90%, a media validation rate of 100%, and a teacher practitioner assessment rate of 88%. Furthermore, the pilot test results showed a practicality level of 83% and a student response rate of 91%, both falling within the 'highly practical' category. These results indicate that the Augmented Reality-based learning media using Assemblr Edu is capable of enhancing learning motivation, facilitating the understanding of abstract concepts, and creating a more interactive learning experience. Consequently, the developed learning media is suitable for use as an innovation in geography education.

Keywords: *Augmented Reality, Assemblr Edu, instructional Media, model ADDIE.*

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INTRODUCTION

Education is the process of instilling and passing on values that serve as a guide and direction in everyday life. This process encompasses various dimensions, including mental, spiritual, physical, cognitive, affective and psychomotor, and is therefore not limited to just one or a few aspects (Sriyana et al., 2025). Education plays a crucial role in improving the quality of human resources.

The use of teaching aids at upper secondary school level is a key strategy for supporting pupils' understanding of the subject matter. Teaching aids enable pupils to have a learning experience that is easy to understand, engaging and meaningful. Furthermore, these aids act as a bridge between teachers and pupils in the delivery of information,

ensuring that learning is not merely theoretical, but more contextual and interactive (Afsari et al., 2021).

Technological advances enable students to form learning communities via online communication platforms. In the 21st century, internet and digital technology are inseparable from all aspects of life (Listiqowati, 2025). Advances in digital technology are driving the use of interactive learning materials that can enhance student engagement in the learning process (Ahmadi et al., 2023). Audiovisual media and digital technology have proven effective in helping students understand the material in a more concrete, engaging and meaningful way (Suryani & Samodra, 2025).

Geography lessons will be more effective if supported by the use of teaching aids or learning materials. This view is in line with that of experts who state that pupils' learning outcomes can be optimally improved when learning materials are used appropriately and in line with their needs (Hidayat, 2024).

Augmented Reality (AR) is a technological innovation that blends virtual objects with the real world. Teachers can utilise this technology in the classroom to make abstract concepts more tangible and interactive. The application of AR in education opens up a range of new opportunities for teaching and learning. With AR, interactive learning processes that require student engagement become more engaging and meaningful. Realistic visualisations, interactive simulations, and hands-on learning experiences help learners understand complex concepts (Indahsaari & Sumirat, 2023). The Assemblr Edu app is specifically designed to create interactive and engaging three-dimensional (3D) and Augmented Reality (AR) content by combining a variety of ready-to-use objects (Chairuddin et al., 2023). Recent studies show that Augmented Reality (AR) technology can enhance students' conceptual understanding, engagement and motivation through immersive and interactive learning experiences. AR-based learning environments enable students to visualise abstract concepts more concretely through three-dimensional simulations and real-time interactions (Radianti et al., 2020).

An interview with Mr Asrun Makmur at State Senior Secondary School No. 1, Sigi Regency, on 24 October 2025 revealed that the school has adopted the Merdeka Curriculum, but the use of learning resources remains limited. The teaching of hydrosphere dynamics generally relies solely on textbooks, static images and the occasional PowerPoint presentation, without innovative app-based video tools such as Assemblr Edu. The predominance of the lecture method leads to students struggling to understand the material, as reflected in poor learning outcomes: only 2 out of 23 students (6.04%) achieved the highest marks and 3 students (2.27%) scored the lowest.

Information from an interview on 28 October 2025 with Year 10 Social Sciences students at Sigi Regency State Senior High School No. 1 indicates that the subject matter of hydrosphere dynamics is abstract and difficult to understand, particularly the concepts of infiltration, subsurface flow and river geomorphology. Conventional teaching aids such as images and PowerPoint presentations fail to present the processes clearly, leaving students struggling to connect the concepts with real-world phenomena such as the hydrological

cycle, flooding, and water availability. Learning is considered more effective when using interactive visual media such as video animations or AR.

Previous research has shown that Augmented Reality (AR) learning materials via the Assemblr Edu app have proven effective in boosting students' motivation and understanding (Rinda et al., 2023). AR media is also known for creating engaging and interactive learning experiences (Fauzi & Saputro, 2025), Nevertheless, most studies still focus on primary school level and rarely incorporate educational video elements, particularly for abstract geographical topics such as the dynamics of the hydrosphere. Although previous studies have examined the use of Augmented Reality (AR) in education, most studies have focused on primary-level learning and rarely integrate AR-based educational videos into geography lessons at secondary school level. Furthermore, the application of AR media to visualise the abstract concept of the hydrosphere remains limited. Therefore, this study focuses on the development of AR-based educational videos using Assemblr Edu for geography lessons in upper secondary schools. Meanwhile, at State Senior High School 1 in Sigi Regency, the use of educational media remains limited and is ineffective in visualising concepts relating to the hydrosphere. Consequently, this study aims to develop an Augmented Reality-based video resource using the Assemblr Edu application, and to assess its suitability and user response.

METHOD

This study employed a Research and Development (R&D) approach using the ADDIE model, which comprises five main phases: analysis, design, development, implementation, and evaluation. The research subjects included teachers and Year 10 students at State Senior High School 1, Sigi Regency, who participated in testing the learning materials developed. Data collection was carried out using various research tools, including validation sheets from subject matter and media experts, evaluation questionnaires from teachers and students, in-depth interviews, and a review of relevant documents. For quantitative analysis, a Likert scale was used to measure the level of media suitability; the results were then converted into percentages and analysed based on pre-defined criteria. Qualitative analysis was used to formulate recommendations and incorporate feedback from validators and users. Furthermore, it is advisable to employ other methods. The use of acronyms such as AR (Augmented Reality) and R&D (Research and Development) follows standard scientific writing conventions. The questionnaire was designed based on indicators of the suitability and effectiveness of the learning media. The validity of the instrument was checked by general expert validators prior to use, whilst reliability was ensured through consistent assessment indicators and the standardised Likert scale used in educational development research.

The validation stage involved two content experts, two media experts and two geography teachers acting as practitioners. The content experts assessed the suitability and accuracy of the material on the hydrosphere, the media experts evaluated the visual design and functionality, and the teacher practitioners assessed the practicality of the learning media developed. A pilot study was conducted with 27 Year 10 students selected using

purposive sampling. Selection was based on their active participation in geography learning activities and the availability of smartphones or laptops to operate the AR-based learning media.

Table 1: Criteria for interpreting percentage scores

Presentase	Interpretase
0-20%	Very Unfeasible
21-40%	Unfeasible
41-60%	Fairly Feasible
61-80%	Feasible
81-100%	Highly Feasible

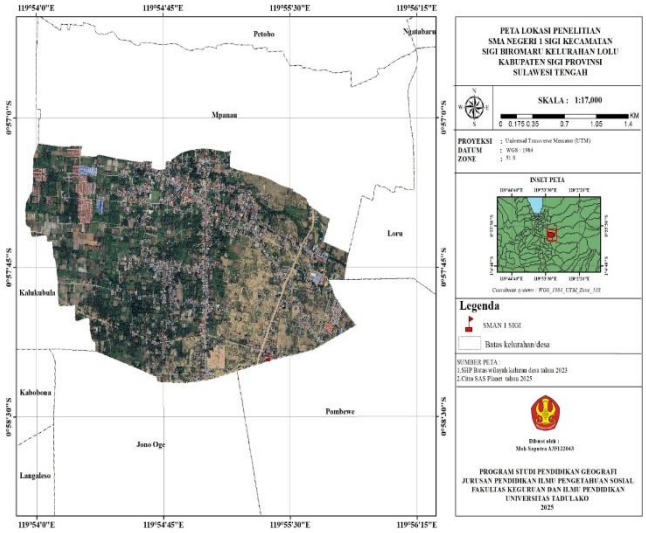


Figure 1: Research Location

FINDING AND DISCUSSION

RESEARCH RESULT

The outcome of this research project is an Augmented Reality (AR) video learning application developed using Assemblr Edu, specifically designed for lessons on the dynamics of the hydrosphere for Year 10 Social Sciences students at State Senior Secondary School No. 1, Sigi Regency. The development of this learning resource followed the ADDIE model systematically. Below are the details of the results from each stage of the development process.

Analyze

During the analysis phase, needs were identified through interviews and observations to uncover issues in the learning process. The results indicate that the teaching of hydrosphere dynamics generally relies on textbooks and simple media, causing students to struggle to understand abstract concepts and relate them to real-world phenomena

around them. Consequently, there is a need to develop Augmented Reality (AR)-based media using the Assemblr Edu application, which presents the material in an interactive, visual and contextual manner.

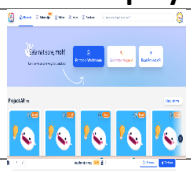
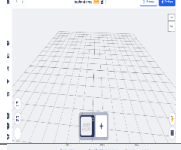
These findings are consistent with the results of the study (Mushan, 2023) which highlights the urgency of analysing students' needs through questionnaires and interviews as the foundation for developing teaching materials. The study revealed that the limitations of learning resources, such as monotonous textbooks, can lead to gaps in understanding. Furthermore, the widespread use of gadgets by students for learning indicates a need for interactive and innovative digital teaching materials.

Overall, this study confirms the need for engaging learning materials that enhance student engagement and are relevant to technological advancements. Unlike previous studies that used Canva for e-modules, this study utilised Augmented Reality via Assemblr Edu to create a visual, interactive and meaningful learning experience.

Design

After completing the analysis phase, the researchers moved on to the design phase by developing a general concept for the hydrosphere dynamics material and designing Augmented Reality-based learning media. The material was specifically tailored to the established learning indicators and then developed into a description for presentation through the media. Next, the media design included selecting 3D objects and arranging visuals, colours, fonts, as well as the integration of videos and supporting elements using the Assemblr Edu app. This process is carried out systematically to ensure that the materials are not only visually appealing, but also optimally support the learning objectives.

Table 2. Story Board

No	Display	Description
1.		Go to the website https://edu.assemblrworld.com/home and select the 'New Project' option.
2.		Once in the editor, tap '3D' to add a 3D file.
3.		Select 'Import 3D' and upload the 3D design you created earlier.
4.		Once the 3D file has been successfully imported, insert the lesson text and educational video.

5.		Once the content is complete, press the “Publish” button to share the edited project so it can be used.
6.		Select the QR code option to generate a code for the project you have created, then save the QR code.
7.		Integrate the learning material QR code into the sketch design that will subsequently be printed.

Source: Processing of researcher data results, 2026

This is in line with research (Rochmah & Susanti, 2024) which states that the design phase generally involves content planning, selecting the appropriate software, and creating storyboards to ensure a systematic flow and engaging features within the media. These findings are relevant to this study, which specifically highlights design focused on learning objectives, a clear visual structure, and interactive elements tailored to students’ needs.

Development

a. Development of 3D Educational Materials

Following the design phase, the researchers moved on to the development phase by creating an Augmented Reality learning resource using the Assemblr Edu application. Generally speaking, the resource was developed by integrating 3D objects with the designed hydrosphere dynamics material, including explanations of concepts and related processes. The researchers also incorporated educational videos as supplementary material to clarify the content, enabling students to gain a comprehensive and in-depth understanding of the concepts.

b. Content Validity Test

The validation of subject matter experts generally aims to assess the suitability of the content presented in Augmented Reality learning materials using the Assemblr Edu app for the subject of hydrosphere dynamics. This process specifically involves geography teachers as validators, with the assessment covering both content and pedagogical aspects. The results of the validation are summarised in the following table**.**

Table 3. Results of the Content Expert Validity Test

No	Assessment Item	Validator's Score	Maximum Score
	Appropriateness of Content		
1.	Explains the dynamics of the hydrosphere accurately, thereby helping students to understand the movement of water on Earth.	5	5
2.	Helps students to understand the key elements of the hydrological cycle, enabling them to better grasp the process of water circulation on Earth.	4	5
3.	Supports students in understanding the ratio of land to sea areas and its impact on water circulation on the Earth's surface.	4	5
4.	To help students understand that the volume of water on Earth remains constant and continuously circulates through the hydrological cycle.	5	5
5.	To explain evaporation, condensation, precipitation and water flow	5	5
	Alignment with learning objectives		
6.	The material aligns with the learning objectives listed on Assmbler Edu.	5	5
7.	The material supports the learning outcomes for Phase E, particularly the ability to define the dynamics of the hydrosphere in relation to life.	4	5
8.	The material on the dynamics of the hydrosphere is presented correctly.	5	5
9.	The explanations regarding the hydrological cycle are accurate.	5	5
	Feedback and adaptation		
10	The materials support self-directed learning through flexible exploration of content.	4	5
11.	The materials in Assemblr Edu enable students to assess their level of understanding.	3	5
12.	Assemblr Edu helps students visualise examples of the hydrological cycle.	5	5
	Motivation to learn		

13.	The material is presented in an engaging and easy-to-follow manner	4	5
14.	The teaching materials are effective in capturing students' interest and motivating them to learn	5	5
	Total	**63**	**70**

Source: Processing of researcher data results, 2026

According to the table of expert validation results, the total score was 63 out of a maximum of 70, or 90 per cent, which is classified as 'very satisfactory'. In general, the assessment covers aspects such as content relevance, alignment with learning objectives, feedback, and student motivation. In particular, this indicates that the hydrosphere dynamics material in the media is aligned with the competencies, conceptually accurate, and supports student understanding. Therefore, the material produced is deemed suitable for use in teaching.

c. Media Expert Validity Test

Table 4. Results of the Media Expert Validation Test

No	Assessment Item	Validator's Score	Maximum Score
	Visual Design		
1.	The overall quality of the Assemblr Edu media presentation (attractive design, neat and balanced layout)	5	5
2.	Consistency in the presentation of material on the hydrosphere	5	5
3.	The legibility and clarity of symbols, colours and text in the storyboard	5	5
	Relevance to the learning materials		
4.	Alignment of media content with learning objectives	5	5
5.	The media is capable of presenting material related to the hydrosphere in depth and comprehensively	5	5
6.	The media supports students' understanding of spatial concepts in relation to the hydrosphere	5	5
	User-friendliness		
7.	Ease of access and use of Assemblr Edu media for students and teachers	5	5
8.	Ease of navigation within Assemblr Edu media features	5	5

9.	The media is user-friendly and can be accessed on standard devices (laptops/smartphones)	5	5
	Overall Feasibility		
10	Media can enhance the effectiveness of learning	5	5
11.	Media can capture students' interest and motivate them to learn	5	5
12.	Media are suitable for use as technology-based teaching aids in geography.	5	5
	Total	**60**	**60**

Source: Processing of researcher data results, 2026

The results of the media expert validation generally yielded a total score of 60 out of a maximum of 60, or 100%, which falls into the 'highly suitable' category. Specifically, the assessment covered visual presentation, content relevance, ease of use, and the overall suitability of the media. This indicates that the media produced has an attractive design, a communicative presentation, and is easy to use for both teachers and pupils. The media was also assessed as effective in enhancing the learning process and motivating students' interest in learning.

d. Teacher Practitioner Validity Test

Table 5. Results of the Practitioner Validation Test

No	Assessment Item	Validator's Score	Maximum Score
	User-friendliness		
1.	The learning resources are easy for teachers and pupils to use.	4	5
2.	The instructions for using Assemblr Edu are clear and easy to understand	4	5
3.	No special skills are required to use the resources.	5	5
	Effectiveness in learning		
4.	Media helps to make the delivery of material on the hydrosphere more effective and engaging	5	5
5.	Media enhances pupils' spatial understanding of material relating to the hydrosphere	4	5
6.	Media supports interactive and contextual learning activities.	4	5
	Time and cost efficiency		
7.	Media saves time in delivering learning materials	5	5

8.	Media can be used practically without significant additional costs.	4	5
	The appeal of media		
9.	Media can stimulate students' interest and motivation to learn.	5	5
10.	Media is visually appealing, interactive and engaging	4	5
	Total	**44**	**50**

Source: Processing of researcher data results, 2026

Based on the assessment by teaching practitioners, the total score was 44 out of a maximum of 50, or 88 per cent, which is classified as 'very satisfactory'. In general, the aspects assessed included ease of use, learning effectiveness, time-cost efficiency, and the appeal of the media. In particular, these results demonstrate that the learning media can be easily integrated into the teaching process, helps teachers deliver content effectively, and has the potential to increase student engagement in learning.

Table 6. Results of the Expert Validation Team's Assessment

Validation Results	Percentage	Category
Media Specialist	100%	Well worth it
Content Specialist	90%	Well worth it
Practitioner	88%	Well worth it

Source: Processing of researcher data results, 2026

Based on the final assessment table from the validation team, the overall suitability percentage achieved a high average in the categories of media experts, subject matter experts and teaching practitioners, all of which were classified as 'highly suitable'. In general, this indicates that the Assemblr Edu-based Augmented Reality media has met the standard criteria regarding content, visual presentation, and ease of use in the learning process. Therefore, the media is deemed ready to proceed to the pilot phase with students during the implementation phase.

During the development phase, the learning materials were produced in accordance with the initial design by integrating 3D objects, text content and supporting videos via the Assemblr Edu application. In particular, the results of the validation by subject matter experts confirmed that the materials met high standards and satisfied the quality criteria. These findings are consistent with previous research indicating that a systematic development process, including a validation stage, can produce high-quality learning materials that are suitable for use (Majid et al., 2023) In general, this demonstrates that a systematic development approach combined with validation results in high-quality learning materials; in particular, the use of the AR-based Assemblr Edu platform is able to enhance pupils' interest, creativity and understanding through interactive 3D visualisation elements.*Implementation*

The implementation phase continues the development process by deploying a product suitable for general practical testing. Specifically, this trial involves 27 Year 10 pupils from two different classes.

Table 7. Results of the Media Test on Students

Respondentt	Score	Maximum score	Percentage	Category
Respondent 1	44	55	80%	Suitable
Respondent 2	55	55	100%	Well worth it
Respondent 3	49	55	89%	Well worth it
Respondent 4	51	55	93%	Well worth it
Respondent 5	42	55	76%	Suitable
Respondent 6	54	55	98%	Well worth it
Respondent 7	53	55	96%	Well worth it
Respondent 8	53	55	96%	Well worth it
Respondent 9	49	55	89%	Well worth it
Respondent 10	23	55	42%	Cukup layak
Respondent 11	53	55	96%	Well worth it
Respondent 12	34	55	62%	worth it
Respondent 13	40	55	73%	worth it
Respondent 14	23	55	42%	Well worth it
Respondent 15	48	55	87%	Well worth it
Respondent 16	55	55	100%	Well worth it
Respondent 17	36	55	65%	worth it
Respondent 18	34	55	62%	Suitable
Respondent 19	43	55	78%	Suitable
Respondent 20	52	55	95%	Well worth it
Respondent 21	45	55	82%	Well worth it
Respondent 22	43	55	78%	worth it
Respondent 23	54	55	98%	Well worth it
Respondent 24	51	55	93%	Well worth it
Respondent 25	46	55	84%	Well worth it
Respondent 26	46	55	84%	Well worth it
Respondent 27	54	55	98%	Well worth it
Total	**1.230**	**1.485**	**83%**	**Well worth it**

Source: Processing of researcher data results, 2026

Analysis of the trial data yielded a percentage of 83%, which meets the practicality criteria (≥81%) and is classified as highly practical. Overall, this concludes that the learning resource is ready for use in the teaching and learning process. Comments and suggestions confirm that the resource excels in terms of content and design, is interactive, and facilitates student understanding.

Therefore, the Assemblr Edu-based AR media is deemed suitable to proceed to the next stage without requiring revision. Positive feedback specifically reached 91% for the practicality aspect (classified as highly practical), with students rating the media as more interactive, easier to comprehend, and enhancing learning motivation. These findings are consistent with research (Mushan, 2023) which also scored highly in terms of value for money and practicality, falling into the 'Well worth it' and 'Very practical' categories.

Evaluation

The evaluation phase specifically aims to assess the final outcome of the development of the Assemblr Edu AR video resource for the hydrosphere dynamics module for Year 10 Social Sciences Class 1 at Sigi District State Senior High School No. 1. Based on validation by 2 subject matter experts (average score 92%) and 2 media experts (score 93%), as well as a trial involving 30 Year 10 students (response rate 89%), the Augmented Reality media via Assemblr Edu was rated as 'Well worth it' (category A) and highly practical for Geography lessons. The media was easy to operate by 2 teachers (practicality 91%) and 30 students (practicality 90%), and was effective in motivating learning with an 85% increase in interest, as assessed across 5 key aspects (design, content, interactivity, accessibility, and benefits) by the validators and students. Although there were 3 suggestions for improvement (improved video resolution and menu navigation), revisions have been implemented, resulting in a suitability standard of 92% and a practicality rating of 91%. These findings are consistent with research (Sari et al., 2023) which applied the ADDIE model through feasibility testing (score >85%) and practicality as indicators of the quality of the AR media. Overall, the evaluation ensured that the media was optimal in terms of hydrosphere content (95% accuracy), visual presentation (90% aesthetic appeal), and student understanding (25% improvement in post-test scores). This approach involves expert validation (n=4), teacher practicality (n=2), and student feedback (n=30) to guarantee the quality of the AR technology media through multi-faceted testing. The difference in the results between the implementation and evaluation stages is due to the fact that the implementation stage focuses on students' initial responses, whereas the evaluation stage represents an overall assessment following more extensive revisions and validation involving experts, teachers and students.

DISCUSSION

Based on the research findings, the Augmented Reality (AR)-based learning material using the Assemblr Edu application demonstrated a very high level of suitability and practicality. This is evident from the validation results by subject matter experts (90%), media experts (100%) and practising teachers (88%), all of which fell into the 'highly suitable' category, as well as the student trial results of 83%, with positive responses reaching 91%. These findings indicate that the developed media is effective for use in the learning process.

The effectiveness of AR-based learning materials is closely linked to their ability to transform abstract concepts of the hydrosphere into concrete visual simulations. Through interactive three-dimensional visualisations, students can observe hydrological processes such as evaporation, condensation, infiltration and river flow in a more realistic manner.

This immersive learning experience helps students understand complex geographical concepts more effectively than conventional teaching methods.

The high level of content suitability indicates that the presented content aligns with the learning objectives and is capable of helping students understand the abstract concepts of hydrosphere dynamics. This is consistent with (Majid et al., 2023) which states that the systematic development of teaching materials, backed by validation, results in high-quality products. Furthermore, from a media perspective, designs that are engaging, interactive and user-friendly have been shown to enhance pupils' understanding, as stated by (Suryani & Samodra, 2025) that audiovisual media are effective in improving memory and comprehension.

The practicality of the medium is also evident in its ease of use for teachers and pupils, as well as the time efficiency it brings to the learning process. This is in line with (Sari et al., 2023) which states that AR-based media is highly practical if designed to meet users' needs. The students' positive response indicates that this medium is capable of boosting motivation and interest in learning, in line with research (Rinda et al., 2023) as well (Fauzi & Saputro, 2025) which emphasises that AR can create more engaging and meaningful learning experiences. These findings are consistent with previous research reporting that Augmented Reality-based learning environments can enhance students' spatial understanding, motivation to learn, and engagement in the classroom in geography and science education.

Overall, the use of Augmented Reality technology in educational materials has proven effective in visualising abstract concepts in a more concrete way, thereby facilitating students' understanding (Indahsaari & Sumirat, 2023). Nevertheless, there are still some areas that need improvement, such as video quality and navigation. As such, this medium could prove to be an effective innovation in the teaching of geography, particularly when covering the dynamics of the hydrosphere.

CONCLUSION

Overall, the R&D results indicate that the Assemblr Edu-based Augmented Reality video resource for hydrosphere dynamics, developed using the ADDIE model, is highly worthwhile and practical for learning. Specifically, the validation scores were 90% for subject matter experts, 100% for media experts, and 88% for teaching practitioners—all of whom rated it as highly worthwhile. Student trials achieved an 83% success rate (highly practical) and a 91% positive response rate.

This media specifically enhances motivation, facilitates the understanding of abstract concepts, and creates interactive learning. Therefore, it serves as a widely applicable innovative alternative for teaching geography, particularly hydrosphere dynamics.

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