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Application Of Artificial Intelligence In Teaching Geography In High Schools According To The New 2018 General Education Program In Vietnam

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ABSTRACT:- The application of artificial intelligence (AI) in education is becoming an important trend, providing powerful tools for data analysis, trend forecasting and effective strategies. This study aims to analyze the benefits and challenges for education, as well as popular applications of AI in education. Especially the application of AI in teaching Geography in high schools according to the new General Education Program 2018 in Vietnam. AI helps bring many benefits in innovating teaching and learning methods, but also comes with many challenges and requires reasonable investment to optimize efficiency in education. In the context of current digital transformation, AI not only helps teachers save time but also improves the quality of lectures for students. In the future, this trend is expected to grow and bring more benefits to both teachers and learners.

Keywords:- AI, AI applications in education, AI in teaching Geography, new General Education Program 2018.

I. INTRODUCTION

One of the technologies that has been mentioned a lot in recent years, contributing to creating strong breakthroughs and bringing about "miraculous" results is AI. AI is an interdisciplinary field of Philosophy, Psychology, Neuroscience, Mathematics, Cybernetics, Computer Science, Linguistics, Economics [14]. AI will be one of the "levers" that help information technology become increasingly familiar in life and bring about breakthroughs in the following years. Currently, AI is being applied in many fields of science and life, including education. Some training institutions have gradually introduced AI into teaching and management, contributing to creating clear changes in management and teaching.

J. McCarthy was the first to introduce the term "AI" into a scientific concept. AI research aims to accurately describe aspects of intellectual processing and learning (to gain knowledge) and to create systems and machines that simulate learning and intellectual processing [9] the development of AI shows that the achievements of each subsequent stage are the result of inheriting and promoting suitable parts and reducing and correcting inappropriate parts from previous stages. AI is a promising branch of computer science. Over the years, AI has done a lot and also failed to do a lot of what was predicted. But it is undeniable that, since the introduction of AI into education, teaching has become more effective thanks to the support from these devices. AI is defined as a computer system that is capable of engaging in human-like processes, including learning, adapting, synthesizing, self-correcting, and using data for complex processing tasks [13].

Artificial Intelligence in Education (AIEd) emerged around the 1970s [10] and focuses on research, development and evaluation of computer software to improve teaching and learning. The long-term goal is to collect learner feedback, assess learner performance and weaknesses, personalize for an individual or group of learners, and ultimately use AI techniques to explore and develop teaching and learning theories [2]. AIEd plays an important role by combining science-oriented research (AI) and psychology/pedagogy (education).

The current application of AI in education shows that AI is becoming an important part in improving and innovating teaching, learning and educational management methods. These applications not only help improve the quality of education but also promote creativity and optimize learning processes. The future of AI in education promises to develop even more strongly, helping to create more flexible, effective and optimal learning models. AI can bring about a revolution in education, helping students and teachers work smarter, not just work harder.

II. RESEARCH METHODS

To conduct this study, the author mainly uses the method of literature review, collection and analysis. Literature review helps to synthesize, analyze and evaluate existing research on AI in education to understand the current context and trends in educational AI research. Collect and analyze articles, books and studies related to AI in education. Summarize research results, find gaps in knowledge and propose future research directions.
In addition, the study also used in-depth expert interviews to collect information. Using interview questions focused on major issues such as AI implementation in education, current applications, and difficulties in integrating AI into the education system. By using experts, this study not only helps to understand the current applications of AI in education but also identifies challenges, opportunities, and future development directions.

III. RESEARCH CONTENT AND RESULTS

3.1. Benefits and challenges in applying AI in education

3.1.1. Benefits of AI for the education sector

In modern education, AI brings many benefits, new ideas and methods for improving and enhancing the quality of education [3].

- In addition to supporting students and teachers, AI also helps education administrators improve the efficiency of their management and optimize their resources. AI systems can analyze data on learning needs, facility usage, and resource allocation to make optimal decisions on class schedules, curriculum, and classroom usage, helping schools use resources efficiently and improve productivity.
- One of the biggest benefits of AI in education is the ability to personalize the learning experience. AI has the ability to collect and analyze learning data of each student, such as learning speed, learning style, and specific strengths and weaknesses of each individual. Then, based on the collected data, the system can recommend the most suitable programs, learning materials, and teaching methods for each student. This helps each student develop their individual potential without being pressured to keep up with the overall pace of the class.
- AI allows the integration of virtual reality (VR) and simulation technology into teaching, helping students practice and experience reality in a vivid and realistic way. For fields of study that require practice and real-life experience such as medicine, engineering and science, the use of VR and simulation tools not only helps students master knowledge but also practice practical skills in a safe, risk-free environment.
- AI not only helps improve students' learning efficiency but also effectively supports teachers in the teaching process. By automating administrative tasks such as grading, tracking learning progress and analyzing each student's learning outcomes, AI helps teachers save time and effort. This allows teachers to spend more time focusing on more important tasks, such as preparing quality lesson content, interacting, supporting struggling students, etc. In addition, AI systems can automatically send detailed reports on students' learning progress and areas for improvement to teachers, helping teachers make timely interventions to improve learning outcomes for each student.
- With the support of AI, teachers can access detailed data on students' learning outcomes, thereby adjusting teaching methods to best suit each class or individual. Data on academic performance, psychological factors, and learning barriers allow teachers to better understand students' strengths and weaknesses, thereby helping them improve their delivery and lesson content. Education administrators can also use analytics from AI to adjust and improve the quality of training programs, ensuring that the curriculum is always relevant to the needs of learners and the development of society.

3.1.2. Common applications of AI in education

The application of AI in education is opening up many outstanding opportunities, supporting teachers to reduce time-consuming tasks such as grading and reporting, while helping students improve their personalized learning experience and enhance their ability to absorb in virtual classrooms. Below are the outstanding applications of AI in education today [8].

- AI helps create automatic lesson plans:

+ Creating automatic lesson plans is one of the most popular ways of applying AI that many teachers have been implementing for a long time. On the Internet today, there are countless AI-integrated teaching tools for all ages and levels of learners. These platforms will significantly support teachers in creating high-quality personalized courses and lectures, thereby meeting the needs, interests and levels of each student.
+ Some outstanding lesson plan creation support tools that teachers can refer to include:

(1) Top Hat's Content Marketplace application: Provides a library of customizable course content. Teachers can use this content to create engaging lessons.
(2) Education Copilot application: Designs lesson plans with a reasonable, logical structure. Supports the creation of quality lesson materials.
(3) ChatGPT application: Used as an information search engine. Teachers can ask the chatbot to gather specific information for lesson planning, instead of having to search through a list of Google results. Teachers can also ask ChatGPT to create lesson plans, present information, or perform many other specific tasks.

- AI helps personalize learning programs for each student:
+ Personalized learning to meet the unique needs of each student has always been a priority in the education sector. Recently, thanks to the support of AI, personalizing learning programs has become easier than ever.
+ An AI grading tool that teachers can refer to for application is Gradescope. This tool allows teachers to upload assignments and tests, then automatically grade them using programmed algorithms.
- AI helps identify knowledge gaps:
+ AI can analyze student data through assignments and tests to identify "gaps" in their skills and knowledge. With this information, the tool will provide students with appropriate learning materials, helping them improve their learning outcomes quickly.
+ One of the standout AI tools for finding "gaps" is Edmentum's Exact Path. Exact Path uses adaptive testing to identify areas where students are struggling, then provides personalized learning paths to help them improve. Teachers can use this tool to track student progress and adjust instruction as needed.
- Create practice exercises:
+ In the past, to help students prepare well for exams, teachers often had to spend a lot of time preparing practice exercises. However, now, AI lesson preparation tools are gradually changing the way teachers prepare exercises before exams. By using natural language processing technology, these tools can analyze student data and provide targeted practice exercises, thereby helping students improve their test-taking skills effectively.
+ To save time in preparing practice exercises, teachers can refer to the following AI applications:
(1) ExamSoft application: Supports data analysis, helps teachers create targeted practice exercises, focusing on areas where students need the most support.
(2) R. Test application: Collects real-time data, predicts scores and automatically notes students' areas for improvement after only 30 questions. Often used to prepare review lessons for standardized tests such as TOEIC, SAT, ACT.
(3) ClassPoint's PowerPoint application: Collects data from teachers' documents to create review questions in multiple-choice format.
(4) Quizgecko application: Supports creating multiple-choice question sets from any textbook provided by teachers.
- Automate administration and tasks:
+ AI tools are gradually reforming the system management process of many educational institutions in Vietnam:
For administrators: AI-integrated tools can automate tasks such as: Registering student information, creating transcripts, arranging timetables. This can help reduce errors and increase efficiency, allowing schools to better manage small tasks. Moreover, school administrators can also focus more on improving the educational experience for students.
For teachers: AI also helps teachers automate daily tasks such as: Taking attendance, sending reminders to students and arranging daily work schedules. This not only saves time but also ensures that teachers' work is done accurately and effectively.
+ Some tools to automate administration and tasks:
(1) Zapier application: Has the ability to connect with different platforms. Zapier allows teachers to automate daily tasks such as grading assignments or sending email reminders to students.
(2) Untis application: Untis simplifies administration by helping teachers create timetables, create electronic gradebooks, etc.
(3) AscTimetables application: Application to manage student schedules. Teachers only need to enter information about lessons, classes, class numbers and some related rules into the program. Multiple classes can be combined, or multiple teachers can manage a class on the application.
- Personalized online learning:
+ Personalized online learning with the support of AI is dramatically changing the way students absorb learning content. Online learning platforms integrated with AI allow students to learn flexibly according to their personal schedule, habits, abilities and learning speed, with support from virtual tutors when needed.
+ Squirrel AI application: Squirrel AI is designed based on the foundation of adaptive learning methods to provide personalized support for students. The tool is capable of analyzing individual learning abilities and behaviors and identifying areas where students need improvement. Based on this information, the platform will provide appropriate exercises to help students improve their learning outcomes.
- AI gives instant feedback to students:
+ One of the important tasks that teachers need to perform every day is to provide feedback on students' work and products. Feedback is not just about scores but also includes analysis and evaluation of the work results as well as detailed explanations for the correct answers. However, this requires a lot of time, effort and is easily subjective depending on the psychological and physical characteristics of the person giving feedback. To overcome this, AI was born to provide a more effective and objective approach to providing feedback to students. AI feedback systems use algorithms to analyze students' processes and results. Based on a set of fixed

criteria that have been agreed upon, the feedback provided will be more objective and accurate. In addition, feedback by AI also helps reduce students' feelings of confusion and fear, thereby increasing their confidence.

+ Turnitin Feedback Studio: Turnitin Feedback Studio is used to analyze any writing or essay. When you upload a document, the tool will automatically provide feedback on grammar, spelling, and punctuation. In addition, Turnitin Feedback Studio also allows teachers to customize feedback and send it to students, helping them understand more details about the good points and areas for improvement in their writing.

- AI creates interactive learning environments for students:

+ AI is gradually changing the way students learn in the digital age. AI learning tools that integrate many game elements can significantly improve the learning experience for students, thanks to their high interactivity and personalization. It can be said that with a digital learning environment, the time spent teaching academic knowledge can be significantly saved while students still achieve unexpected results.

+ Typical AI tools that help create a highly interactive learning environment:

(1) MATH application (by Carnegie Learning): Uses intelligent algorithms to provide personalized instructions, helping students learn at their own pace and receive support when needed.

(2) Duolingo application: Provides exercises designed to suit each person's learning progress, along with interesting reward features.

(3) FLYER Virtual Exam Room Application: English exam preparation application for children is integrated with AI technology along with beautiful, vivid graphics. Students can both learn English and get acquainted with the digital learning environment in an interesting and effective way.

- AI 1-on-1 support:

+ Chatbots and virtual assistants can provide 1-on-1 support to students by answering questions, providing additional explanations, and guiding them step-by-step through the learning process. One of the key advantages of this feature is that it allows students to receive instant and personalized support based on their specific needs.

+ 1-on-1 support applications:

(1) IBM Watson Assistant application: AI platform developed by IBM to create intelligent chatbots.

(2) Google Dialogflow application: AI-based chatbot development platform developed by Google.

(3) ChatGPT application from OpenAI: AI model developed by OpenAI.

- Concept modeling: Some AI tools are capable of creating visual models based on real-world scenarios. Students can interact with these models and gain a deeper understanding of complex concepts.

3.1.3. Challenges and limitations of applying AI in education

The development of AI may threaten the existence and mastery of the world of humans [1], and humans become the second most intelligent species on Earth. In the field of education, besides the positive impacts as mentioned above, AI also has potential challenges and difficulties when applied in practice. This part of the article will focus on presenting the challenges that will be encountered when applying AI in education to improve fairness and quality of learning. Although AI brings many potential improvements to education, the process of applying this technology still faces many major challenges. Below are the prominent barriers and limitations that educational institutions, teachers, and students may encounter:

- The application of AI in education requires modern software and hardware systems along with a team of highly qualified experts. The initial investment cost for AI infrastructure, from technology equipment, network systems to management and development teams, is often quite high. This can be a major barrier for schools, especially in areas with limited financial conditions. Maintaining and upgrading AI systems also requires funding, leading to long-term financial problems. Hilbert mentioned in [7] that the lack of basic infrastructure conditions also creates a new digital divide in the use of data-based knowledge to make smart decisions. To remove these obstacles, many policies must be put in place. It is necessary to create many international alliances to build infrastructure in the poorest areas of the developing world and create conditions for everyone to have access to the internet [4].

- Protecting personal data when using AI is a top concern, especially when it comes to student data. AI systems can collect a large amount of sensitive information from students, and if not properly secured, this data can be accessed without permission or misused. Schools and educational institutions need to comply with strict data protection regulations, ensuring the safety and privacy of both students and teachers. With privacy and data security being a concern, the main challenge lies in being able to use personal data while ensuring that individuals' personally identifiable information and privacy preferences are protected. It is also important to put in place the necessary safeguards to prevent data theft. In education, this becomes even more difficult given that young learners are legally unable to give explicit consent to the collection and use of their personal data. The collection and use of personal data, even when used to improve learning, must always be based on explicit and informed consent, transparency, fairness and equity [5].

- The implementation of AI in education raises many ethical questions, including the rights and interests of students and teachers. Issues such as whether AI will partially replace teachers' work or reduce direct human interaction in education also need to be carefully considered. For AI to best support education without diminishing human values, there needs to be a reasonable balance between technology and the role of teachers,

ensuring that AI truly benefits students' learning and development. In policies to develop AI in general and AI in education in particular, it is necessary to pay close attention to the ethical issues associated with the collection, production, analysis and dissemination of large-scale data about people [6].

- Despite the positive aspects of AI, it can also contribute to inequality among disadvantaged and vulnerable populations who are more likely to be excluded from AI-enabled education. The result is a new type of digital divide: the divide in the use of data-driven knowledge for intelligent decision-making [7]. When designing policies for AI in higher education, ensuring equity and inclusion is key. A study has identified the main obstacles to the introduction of AI into education in developing countries as: 1- Availability of ICT hardware; 2- Availability of electricity; 3- Internet reliability; 4- Data costs; 5- Basic IT skills of students; 6- Language and 7- Lack of culturally appropriate content [12].

Some schools or regions may not have access to AI technology due to high costs or infrastructure limitations. This leads to inequities in the application of AI in education, and makes it difficult for disadvantaged students to access advanced technologies.

- To effectively deploy and manage AI systems, schools need a team of human resources with in-depth knowledge of technology and system management capabilities. However, the human resources with high expertise in AI in education are still limited, leading to difficulties in ensuring the quality and effectiveness of the system. Training new staff and developing AI skills for teachers is also time-consuming and costly.

3.2. Application of AI in teaching geography in high schools according to the new general education program 2018.

3.2.1. Brief introduction of the geography program in the new general education program 2018 [11]

- Characteristics of Geography subject:

+ Geography education is implemented at all levels of general education. In primary and secondary schools, geography education content is included in History and Geography subjects; in high school, Geography is a subject in the group of social sciences selected according to students' aspirations and career orientation.

+ Geography belongs to both the field of social sciences (Economic - Social Geography) and the field of natural sciences (Natural Geography), helping students gain basic understanding of geography science, occupations related to geography, the ability to apply geographical knowledge in life; at the same time, consolidating and expanding the foundation of knowledge and core general skills that have been formed in the basic education stage, creating a solid foundation for students to continue studying related occupations.

- Viewpoints on program development:

+ The program ensures the development of students' qualities and abilities: The Geography program clearly identifies the qualities and abilities that can be formed and developed through the subject. On the one hand, the program is based on the requirements for the main qualities and core abilities as the basis and starting point for selecting educational content; on the other hand, the program forms and develops the main qualities and core abilities for students through guiding students to absorb and apply the educational content of the subject into practice.

+ The program ensures the connection between classes, levels of education and meets the requirements of career orientation: The program content is designed in three streams: general geography, world geography, Vietnamese geography, including core knowledge and learning topics; developing, expanding and enhancing the geography education content learned at the secondary school level; ensure concise, basic, updated scientific and modern knowledge of geography, development issues of the world, region, Vietnam and locality. The educational content and requirements of the program take into account the suitability with the reality of teaching in general schools in the development orientation.

For students with career orientation related to geographical knowledge, in addition to core knowledge, the program has learning topics in each class, to implement the requirement of deep differentiation, meeting the requirements of career orientation.

+ The program ensures inheritance and modernity: The inherited Geography program promotes the advantages of existing programs, absorbs the experience of developing subject programs of countries with advanced education, approaches the achievements of modern science and technology; suitable for social and educational practices, conditions and learning abilities of students in different regions.

+ The program focuses on integration, practice and application: The Geography program focuses on integration, practice, linking the educational content of the subject with reality to train students in the skills of applying geographical knowledge to research and solve some practical problems to a certain extent, meeting the demands of life.

Integration is shown at many different levels and forms: integration between knowledge of natural geography, population geography, society and economic geography in the subject; integrating related content (environmental education, seas and islands, natural disaster prevention, climate change; population education, gender, heritage, traffic safety, ...) into geography content; applying knowledge of other subjects (Physics, Chemistry, Biology, History, ...) in clarifying geographical knowledge; combining knowledge of many different fields to build into highly integrated topics.

The program identifies practice, training, and application as important content, and at the same time, as a practical and effective tool to develop students' capacity. This content focuses on applying geographical knowledge into practice to contribute to the development of specific capacities of the subject.

+ The program is built in an open direction: On the basis of ensuring orientation, requirements to be achieved and core educational content unified nationwide, the program allocates a certain amount of time for schools to guide students to practice learning about local geography in accordance with their conditions; at the same time, deploy educational plans suitable to the educational objects and conditions of educational institutions and localities.

The program is built in a general direction, not too detailed, creating conditions for textbook authors and school teachers to proactively and creatively implement the program in the conditions of science, technology and society constantly developing, often posing new requirements for education.

- Program objectives: Based on the basic knowledge and educational methods that promote students' proactive, positive, and creative activities, the Geography Program helps students form and develop geographical capacity - a manifestation of scientific capacity; at the same time, it contributes with other subjects and educational activities to develop in students the main qualities and general capacities that have been formed in the basic education stage, especially love for the homeland and country; correct attitudes towards the natural and social environment; career orientation ability; to form a citizen's personality, ready to contribute to the cause of building and defending the Fatherland.

- Requirements to be achieved:

+ Requirements to be achieved on main qualities and general competencies: Geography contributes to the formation and development of students' main qualities and general competencies at levels appropriate to the subject and grade level as prescribed in the General Program.

Geography contributes, together with other subjects and educational activities, to develop in students the main qualities and general competencies that have been formed in the basic education stage, especially love for the homeland and country; correct attitudes towards the natural and social environment; career orientation ability; to form a citizen's personality, ready to contribute to the cause of building and defending the Fatherland. The new Geography program represents a shift from a content approach to a competency approach; clearly identifying the qualities and competencies that need to be achieved; considering those necessary competencies as the starting point and basis for selecting the knowledge that needs to be taught in the program.

+ Requirements for specific competencies: Geography forms and develops in students geographical competencies (specific manifestations of scientific competencies) including the following components: geographical scientific awareness (perceiving the world from a spatial perspective, explaining geographical phenomena and processes); studying geography (using geographical tools, organizing field studies, exploiting the internet to serve the subject); applying learned knowledge and skills (updating information and making connections to reality, implementing the topic of discovery learning from practice, applying geographical knowledge to solve some practical problems).

- Teaching methods:

+ General orientation: The teaching methods of Geography are implemented according to the following general orientations:

(1) Actively promote students' activities; in which teachers are the organizers, guides, encouragers, and create a friendly learning environment for students; students learn proactively, positively, creatively, and focus on practicing self-study skills.

(2) Enhance experiential activities for students, link geography lessons with local, national, and world realities; apply knowledge to solve environmental, economic, and social problems in the locality, thereby developing awareness, skills, forming qualities, specific abilities, and general abilities.

(3) Diversify teaching methods, flexibly combine advanced teaching methods, specific teaching methods of the subject such as: using maps, diagrams, statistics, charts, pictures, models, observations, fieldwork, etc.; Improve and use in the direction of promoting the positive aspects of traditional teaching methods such as: presentations, questions and answers, etc.

(4) Implement diverse and flexible forms of teaching organization, combining individual teaching, group teaching, class teaching; teaching in class, outdoor teaching, teaching in practice, fieldwork; visiting, surveying localities, collecting, systematizing information, displaying, introducing, exhibiting, learning games, etc.

(5) Organize, guide, create conditions for students to explore, discover, exploit and acquire knowledge from geographical teaching aids such as: maps, atlases, pictures, models, observation tools, measuring tools, documents, materials, etc. Encourage, create conditions, build a favorable learning environment for students to exploit information from the Internet to serve their studies; train students in skills to process and present geographical information using information technology and communications, etc.; Increase self-made teaching equipment with the application of information and communication technology (create learning websites, build a system of lessons, exercises, practices, and tests using popular and suitable software, build video clips introducing geographical objects and phenomena, etc.).

+ Orientation of methods for forming and developing key qualities and general capacities:
(1) Methods for forming and developing key qualities: Through organizing learning activities, Geography teaches students a scientific worldview, patriotism, love for nature, love for workers, respect for different human values; awareness, belief, responsibility and specific actions in the rational use of natural resources and environmental protection; training students in diligence and honesty in studying and scientific research.
(2) Methods for forming and developing general capacities:
Autonomy and self-study capacity: formed and developed through learning activities such as collecting information and presenting geographical reports; survey, investigate local realities, apply knowledge to solve practical problems...
Communication and cooperation skills: are formed and developed through group activities and discussion teaching methods, project teaching, seminars...
Problem-solving and creative skills: are formed and developed through activities such as problem discovery, hypothesis or assumption, finding logic in problem solving, proposing solutions to solve problems, evaluating solutions to solve problems, scientific imagination, solving new problems, self-study of geographical theories and tools.
+ Orientation of methods for forming and developing geographical skills
(1) To develop the component of geographical science cognitive skills, teachers create opportunities for students to mobilize existing knowledge and experience to participate in forming new knowledge. Pay attention to organizing activities to approach geographical objects and phenomena occurring in life according to the space-time relationship, answering basic questions: what, where, how...; training students in the skills of analyzing the relationships (mutual support, cause and effect) between natural geographical phenomena and processes, between economic and social geographical phenomena and processes as well as between natural systems and economic and social systems.
(2) To develop the component of geographical learning capacity, teachers create conditions for students to use geographical tools such as: geographical atlases, maps, diagrams, charts, diagrams, cross-sections, models, blocks, data tables, pictures... to explore and discover geographical knowledge; increase the use of the Internet in learning, organize students to study in the field, in the local natural, economic and social environment.
(3) To develop the ability to apply knowledge and skills learned in geography, students need to be given opportunities to update information and make practical connections, approach practical situations, carry out learning topics to explore from practice; apply geographical knowledge and skills to solve some appropriate practical problems. Teachers need to pay attention to training students in the skills of problem detection, research planning, problem solving, evaluating problem solving results, proposing solutions to overcome or improve, and increasing the use of exercises that require the application of practical knowledge and critical and creative thinking.
- Assessment of educational outcomes:
+ General orientation:
(1) Assessment of educational outcomes in Geography aims to provide accurate, timely and valuable information on the level of meeting the requirements of the program and the progress of students to guide learning activities.
(2) The basis for assessing students' educational outcomes is the requirements for qualities and abilities specified in the overall program and the Geography program.
(3) Regarding assessment content, in addition to assessing knowledge, it is necessary to strengthen the assessment of students' skills such as: working with maps, atlases, charts, diagrams, data tables, pictures, observing, collecting, processing and systematizing information, using outdoor learning tools, using technology and information communication in learning... Focus on assessing the ability to apply knowledge to specific situations.
(4) Diversify assessment forms, increase regular assessment for all students in different forms. Combine teacher assessment with self-assessment and mutual assessment of students.
(5) Educational outcomes are assessed in qualitative and quantitative forms through regular and periodic assessments, on that basis, synthesize the general assessment results on students' qualities, abilities and progress.
+ Some forms of testing and assessment: Geography uses the following main forms of assessment:
(1) Assessment through writing: essays, objective tests, essays, field trip reports, collection results reports, research results reports, investigations...
(2) Assessment through questions and presentations: answering questions and presentations, interviews, presenting research issues...
(3) Assessment through observation: observing students' use of learning tools, performing practical exercises, group discussions, field studies, field trips, local surveys, participating in research projects... by using observation boards, learning records...

3.2.2. Application of AI in teaching Geography in high schools according to the new 2018 General Education Program.

The content of Geography education in high school (grades 10, 11, 12) according to the new General Education Program 2018 [11] includes general geography, world economic and social geography, and Vietnamese geography (natural geography and economic and social geography). In addition to core knowledge, the content of Geography education also includes learning topics, distributed in accordance with the main content of each grade.

3.2.2.1. Content of Grade 10 Geography Program: General Geography

Table 1. Applying AI in teaching content in the 10th grade Geography program

No.	Knowledge	Program content	Applying AI in teaching content in the 10th grade Geography program
1	Core knowledge	1. Physical geography	- AI helps assess geological hazards such as earthquakes or landslides and supports disaster preparedness and response by analyzing geospatial data on fault lines, rock types, and terrain. - AI supports exploration of geological resources such as minerals or oil and gas by analyzing geospatial data from geological structures, remote sensing data, and geophysical surveys. - AI can improve weather forecasting by analyzing real-time data from satellites, monitoring stations, and meteorological models. Machine learning algorithms can recognize weather patterns from historical data, leading to more accurate forecasts of extreme weather events such as hurricanes, heavy rains, extreme temperatures, and droughts. - AI can be used to analyze terrain, ocean wave patterns, and geological activities such as earthquakes and volcanoes. Machine learning algorithms can analyze data from seismic sensors and satellites to detect and predict geological activity. AI can also help create detailed topographic maps and analyze geological changes over time.
		2. Economic and social geography	- AI supports public health planning by analyzing geospatial data such as population density, health facilities, and disease prevalence, supporting resource allocation and health service delivery. - AI helps assess the impact of noise on human health and supports urban planning and noise mitigation strategies by analyzing noise data, population density, and health indicators. - AI can analyze historical trends, labor market data, and economic factors to forecast future labor demand. For example, machine learning algorithms can predict which occupations will have high growth demand, helping policymakers and educators prepare the workforce. - AI can process and analyze large amounts of data from surveys, employment reports, and other sources to provide insights into the labor situation, including unemployment rates, labor force participation levels, and analysis of factors affecting the labor market.
2	Study topics	1. Climate change	- AI assists in simulating and forecasting the impacts of climate change at global and regional scales. Deep learning models can help analyze atmospheric data, temperature, sea level, and other environmental factors to predict the impacts of climate change on ecosystems, agricultural production, and human communities. - AI can analyze satellite imagery and coastal terrain to monitor and predict erosion patterns to support coastal protection and management efforts. - By analyzing historical rainfall data, river levels, and terrain features, AI can predict areas at high risk of flooding, supporting timely evacuation and disaster response. - AI enables monitoring of coastal changes, such as beach erosion or shoreline changes, through the analysis of satellite imagery and LiDAR data, supporting coastal management and adaptation strategy development. - AI helps assess damage caused by natural disasters such as hurricanes or earthquakes, and supports disaster response and recovery efforts by analyzing satellite imagery and satellite photos. - AI helps manage coastal risks by analyzing geospatial data on sea level rise, storm surges, and vulnerability, supporting adaptation planning and

			coastal protection measures. - AI can analyze geospatial data on climate forecasts, socioeconomic factors, and ecosystem vulnerabilities to assess climate change impacts and develop adaptation strategies. - AI supports climate change mitigation efforts by analyzing data from satellite sensors, atmospheric models, and emissions inventories to monitor and map greenhouse gas emissions. - AI helps communicate disaster risks and supports public awareness and preparedness by analyzing geospatial data and creating visualization, mapping, and risk communication tools.
		2. Urbanization	- AI supports smart city management by integrating geospatial data with data from various sensors and IoT devices, supporting efficient resource management and improving city services. - AI helps plan urban resilience strategies and supports adaptive and resilient urban development by analyzing geospatial data on natural disasters, infrastructure vulnerabilities, and social vulnerabilities. - AI can analyze noise data, land use patterns, and urban development plans to optimize noise planning in urban areas and ensure that noise-sensitive activities are located in appropriate locations. - AI can assess urban green infrastructure such as parks and green roofs by analyzing geospatial data such as vegetation cover, ecosystem services, and accessibility. - AI helps design noise-reducing urban environments by analyzing noise data, urban layout, and architectural features to support noise reduction and urban livability strategies. - AI can analyze satellite imagery and temperature data to identify and assess the urban heat island effect, supporting urban planning and heat mitigation strategies. - AI monitors and manages urban air quality to support pollution reduction strategies by analyzing data from air quality sensors, traffic patterns, and emission sources. - AI enables analysis of urban growth patterns to support urban planning and infrastructure development by integrating satellite imagery, population data, and land use information. - AI can use machine learning algorithms and big data to analyze the growth of urban areas and forecast future development trends. These models can predict residential expansion, infrastructure needs, transportation, public services, and other factors, helping planners make strategic decisions about sustainable urban development. - AI can analyze real-time traffic data to optimize mobility in cities. AI systems can predict traffic congestion, adjust traffic signals, and make alternative route suggestions. This helps reduce traffic congestion, save travel time, and reduce air pollution. - AI can assist in the study and analysis of urban social issues such as poverty, crime, racism, and social inequality. Machine learning models can analyze data from social databases, community surveys, and crime reports to identify problems and propose appropriate solutions. - AI can analyze large amounts of spatial data (GIS), population data, and environmental factors to support urban planning decisions. AI models can simulate city development scenarios and assess the economic, social, and environmental impacts of each planning decision. This helps planners make more sustainable decisions that are appropriate to the needs of the community.

3.2.2.2. Content of Grade 11 Geography Program: World Economic and Social Geography

Table 2. Applying AI in teaching content in the 11th grade Geography program

No.	Knowledge	Program content	Applying AI in teaching content in the 11th grade Geography program
	Core knowledge	Regional and national geography	- AI can analyze spatial data such as maps, satellite images, and GIS (Geographic Information System) data to find trends, patterns, and changes in the space of regions around the world. AI can help identify changes in areas such as urbanization, deforestation, or changes in land cover from satellite images or GIS data. AI can analyze land use to better understand agricultural development, urbanization, and nature conservation. - AI can help analyze and predict changes in climate and environmental factors, which is important for global geographic research. Machine learning algorithms can analyze data from climate models, satellite data, and natural variability to forecast: AI helps simulate and predict the impacts of climate change on different regions, such as rising sea levels, extreme climate change, and dangerous weather events globally. AI can analyze and predict air, water, and soil pollution levels in different regions around the world, helping to come up with effective mitigation measures. - AI helps to study urban and economic development trends, providing insights into factors affecting regional and national development. Applications include: AI can predict urbanization trends, thereby helping urban planners make rational decisions on infrastructure, transportation, and residential development. AI algorithms can analyze economic factors such as GDP, investment levels, income, unemployment, and assess the economic development of each country or region. - AI helps to analyze migration and migration patterns between regions and countries, thereby better understanding the impact of factors such as wars, natural disasters, and migration policies. AI can help monitor and analyze migration trends, especially in emergency situations such as conflicts or natural disasters. Machine learning models can predict future migration trends and help countries and regions plan to receive and support migrants. - AI can be used to predict natural disaster risks and support relief efforts, protect the environment and people globally: AI helps forecast and detect natural disasters such as earthquakes, storms, floods, droughts and wildfires early. Machine learning algorithms can analyze data from various sources to predict these events and minimize their impact. After a natural disaster occurs, AI can help analyze the damage and support quick and effective relief efforts. - AI can analyze and predict changes in population and social factors, thereby supporting policy making: AI can analyze population growth trends, thereby supporting countries in planning for public services, infrastructure, and sustainable development. AI can help analyze factors such as poverty levels, unemployment rates, and other social issues to make development policies. - AI plays an important role in protecting ecosystems and supporting sustainable development strategies globally: AI can help monitor wildlife, especially endangered species, by analyzing satellite images or biological data. AI can support decisions on how to use natural resources sustainably, from forest management to optimizing agricultural production.
2	Study topics	1. Some issues about Southeast Asia region	- AI can help collect and analyze data from satellites, sensors, and surveillance vehicles to monitor the state of the marine environment and resources in Southeast Asia. Machine learning algorithms can predict the impact of exploitation activities (such as fishing, oil and gas exploration, or cargo transportation) on the marine environment and biodiversity. This supports sustainable exploitation decisions and avoids actions that are harmful to the environment and ecosystems. - AI can be used to analyze data on the history of disputes, sovereignty claims, and international agreements related to the sea. AI tools such as semantic analysis, machine learning models can help better understand the causes of disputes, thereby proposing more peaceful and equitable solutions. AI can also help create simulations of situations to support negotiating parties in making appropriate decisions during peaceful dialogues. - AI can help monitor marine resource exploitation, especially fishing and oil and gas exploitation. AI systems using data from surveillance cameras, drones, and

			satellites can detect illegal or environmentally harmful exploitation activities. This close monitoring and supervision helps countries in the region maintain fairness in resource exploitation and prevent infringement of the rights of other countries. - AI can assist in simulating scenarios of marine resource sharing among countries in the region. Machine learning algorithms can help optimize the allocation of marine resources in a fair and sustainable manner, reduce unnecessary competition, and create reasonable sharing mechanisms. This will help countries cooperate in resource exploitation without increasing tensions. - AI can promote cooperation among countries in the maritime region through joint research platforms where countries can share data on marine resources, scientific research, and environmental issues. AI systems can help analyze this data to produce joint reports and make recommendations for peaceful cooperative policies. - AI can support the analysis of legal frameworks and international agreements related to the sea, such as the United Nations Convention on the Law of the Sea (UNCLOS). AI tools can help compare the sovereignty claims and legal claims of countries, find commonalities and differences, thereby supporting the development of legal mechanisms to resolve disputes and promote peace. - AI can also be used to build education and public awareness programs on the importance of protecting marine resources and cooperating in resource exploitation. AI applications can provide learning materials, simulations, and educational videos on marine environmental protection, helping to raise awareness among countries and communities in the region about the need for peaceful cooperation.
		2. Some issues about world tourism	- AI supports tourism planning by analyzing geospatial data on visitor patterns, infrastructure, and environmental sensitivity, supporting sustainable tourism development and management. - AI can analyze spatial images and geophysical data to identify and map archaeological sites, cultural historical relics, and tourist attractions, contributing to the preservation and research of cultural heritage and tourism development. - AI can help analyze and monitor major tourism events around the world, such as festivals, conferences, or sporting events. Based on data from social networks and websites, AI can predict the success of these events, helping organizers and researchers better prepare. - AI can process and analyze big data on customer travel behavior, helping countries around the world better understand the motivations, preferences, and consumption habits of tourists. This information is crucial in developing sustainable tourism strategies and managing tourism destinations around the world. - AI can analyze data from different sources (such as social media, online searches, and customer data) to predict future global tourism trends. These AI systems help researchers and tourism businesses better understand popular destinations, traveler habits, and factors that influence changes in the tourism industry (such as natural disasters, epidemics, or policy changes).

3.2.2.3. Grade 12 Geography Program Content: Vietnam Geography

Table 3. Applying AI in teaching content in the 12th grade Geography program

No.	Knowledge	Program content	Applying AI in teaching content in the 12th grade Geography program
1	Core knowledge	1. Physical geography	- AI automates surveying and mapping processes by using machine learning algorithms to extract features and create accurate maps from geolocated aerial or satellite imagery. - AI enables feature in location-based services such as mapping, navigation, and geocoding, providing precise location and routing information for a variety of applications in Physical Geography. - AI helps monitor and map marine biodiversity to support marine protection and management by analyzing satellite imagery, bathymetric data, and species distribution patterns. - AI monitors soil moisture to support precision farming practices and water

			resource management by analyzing satellite imagery and weather data. - AI supports water conservation and management initiatives by analyzing geospatial data on water demand, availability, and efficiency to support water conservation planning. - AI can help monitor and analyze changes in hydrological systems, such as river and lake levels, flooding, and meteorological phenomena that affect water. AI algorithms can predict areas at risk of flooding or drought, helping governments and communities be more proactive in protecting water resources. - AI helps plan pest control strategies and support integrated pest management practices by analyzing geospatial data on pest populations, habitat suitability, and crop vulnerability. - AI can analyze noise data, migration patterns, and ecological parameters to assess the impact of noise on wildlife migration routes, supporting conservation planning and habitat connectivity. - AI can help monitor and manage natural resources such as water, forests, minerals, and land. AI systems can analyze data from sensors, satellites, and drones to monitor the change and degradation of these resources. For example, AI can help detect forest fires, illegal mining, or land degradation early.
		2. Population geography	- AI can analyze geospatial data on population density, employment centers, and transportation networks to assess public transportation needs and optimize service delivery. - AI can use big data to analyze population distribution, including factors such as age, gender, occupation, income, etc. AI models such as machine learning and neural networks can help predict future population changes, thereby supporting decisions on urban planning, infrastructure development, and public service provision. - AI can analyze population migration and mobility data through the use of data sources such as location services (GPS), social networks, and mobile applications. These analyses help study migration trends (temporary or permanent), areas with increasing or decreasing population density, and reasons why people move (e.g., looking for work, changes in quality of life, natural disasters, or political factors). - Combining AI with Geographic Information Systems (GIS) helps create maps and spatial analyses to study factors such as population distribution over space and time. AI can help analyze areas with rapid population growth, areas lacking infrastructure, or areas in need of improved public services. - AI can analyze social and economic factors of the population such as income, education level, occupation, health, etc. This analysis helps to better understand vulnerable populations or social problems (such as poverty, unemployment, social inequality). - AI can help monitor factors that affect the quality of life of residents, such as health status, education, environment, and public services (clean water, electricity, transportation, etc.). Data collected from sensors and IoT (Internet of Things) devices can be analyzed by AI systems to assess the quality of life and propose improvement measures. - AI can help analyze the behaviors and habits of residents to support the development of effective social policies. Machine learning algorithms can analyze behavioral patterns (e.g. shopping trends, travel habits, use of public services) to better understand the needs and desires of residents, thereby proposing appropriate policies.
		3. Geography of economic sectors	- AI can analyze weather and climate data and forecast extreme weather events such as storms, floods, and droughts to help farmers proactively protect their crops. AI systems can combine satellite data, sensors, and climate models to forecast and provide accurate information on weather conditions for each agricultural area. - AI uses images from cameras and sensors to detect early diseases on crops. AI systems can recognize signs of disease through images of leaves or soil samples, thereby providing timely intervention solutions, helping to minimize damage to farmers. - AI can analyze soil moisture, water content, and nutrient needs of crops,

			helping to optimize water and fertilizer use. Automatic irrigation systems, integrated with AI, can adjust the amount of water needed for crops, thereby saving water and minimizing environmental pollution. - AI supports precision agriculture by collecting and analyzing data from sensors, drones, satellites, and other devices to monitor soil, crop, and environmental conditions. This allows farmers to make smart decisions about resource use and crop management, thereby increasing productivity and reducing costs. - AI can help optimize the agricultural supply chain from production to consumption. AI systems can analyze data on market demand, harvest time, and transportation capacity to forecast supply and optimize the distribution of agricultural products. This not only helps reduce surplus or shortage of agricultural products, but also helps farmers get more value from their products. - AI can support research and analysis of soil properties, including pH, moisture, nutrients, and drainage. Through soil sensors and data analysis, AI helps farmers choose the right crop varieties and optimize farming processes. - AI can support research and development of new crop and livestock varieties that are resistant to diseases, climate change, and other environmental factors. AI helps analyze genetic data to detect beneficial genetic traits, thereby creating new crop or livestock varieties with higher productivity and better quality. - AI can provide solutions and advice to farmers based on data analysis from various sources, helping them make the right decisions in production management. AI applications such as virtual assistants can provide information on market prices, crop seasons, or appropriate farming techniques. - AI can be applied in automated machines and robots to reduce labor and improve production efficiency. These robots can perform tasks such as harvesting, tilling, or sorting agricultural products after harvest. - AI helps control robots to automate industrial production processes, reduce human errors and increase productivity. AI can analyze data from machines and equipment to predict when they need maintenance, reducing downtime and repair costs. - AI is used to analyze medical images (such as X-rays, MRIs) to assist doctors in detecting diseases, such as cancer or cardiovascular diseases. AI can analyze genetic data to support personalized treatment, helping to determine the most effective treatment for patients. - AI helps analyze financial data to forecast markets, detect fraud and optimize investment decisions. Many banks and financial companies use AI to develop chatbots, which help answer customer questions and perform automated transactions. - AI is a key technology in the development of self-driving cars, helping to reduce traffic accidents and improve traffic efficiency. AI can analyze and optimize traffic flow, reduce congestion, and improve transportation efficiency. - AI can analyze consumer behavior across social media platforms and websites, helping companies identify trends and optimize advertising strategies. AI can automate marketing campaigns, adjusting the content and timing of emails or ads based on customer feedback.

		4. Geography of economic regions	- AI can be combined with GIS to analyze and process spatial data, thereby providing insights into the natural, social and economic characteristics of regions. - AI helps predict the impact of environmental factors such as climate change, floods, droughts, or other natural disasters on economic regions, helping government agencies and businesses plan for adaptation and prevention. - AI can assist in building models for economic regional development planning, especially the allocation of resources and infrastructure development. Through predictive models, AI helps optimize resource allocation, from infrastructure construction to identifying areas that can develop specific industries such as industry, agriculture or tourism. AI can analyze factors such as labor resources, transportation infrastructure, market potential, and natural resources to identify regions with strong development potential and economic investment opportunities in each region. - AI can analyze and forecast factors such as GDP, per capita income, human development index (HDI), or other economic indicators in each economic region of Vietnam. This analysis helps identify regions that are developing strongly or at risk of falling behind. AI can analyze consumption trends, competition levels, and factors affecting market demand in different economic regions, thereby providing industry development strategies suitable to the characteristics of each region. - AI can use satellite images, sensors, and weather data to monitor and manage natural resources such as land, water, forests, and minerals. Regions with rich resources can be analyzed to develop industries such as agriculture, fisheries, processing industry, ecotourism, etc. AI can analyze population movements and urbanization trends in regions, helping to predict the demand for housing, public services, transportation, and social amenities. - AI can help policymakers build regional economic development strategies based on real-world data analysis, demand forecasting, and identifying risk factors. These policies can include investments in infrastructure, education, healthcare, and key industries.
2	Study topics	1. Natural disasters and prevention measures	- AI can analyze data from monitoring stations, satellites, and environmental sensors to predict extreme weather events such as storms, floods, droughts, or heavy rains. Machine learning models can be trained to recognize past climate patterns and predict future natural disaster trends, helping authorities issue timely warnings. AI can help analyze and predict the development of storms, their danger, and identify areas that may be severely affected, giving authorities and people time to prepare and evacuate if necessary. For example, AI can use satellite data and meteorological simulation models to assess the severity of storms and floods. - AI can analyze satellite imagery and sensor data to monitor natural disasters such as floods, wildfires, soil erosion, or landslides. These technologies help monitor natural disasters in hard-to-reach areas, especially in mountainous areas, islands, or areas isolated by natural disasters. AI can assist in analyzing the impact of natural disasters on infrastructure, agriculture, and social life. For example, AI can predict areas that will be severely affected by floods based on rainfall data, terrain elevation, and other factors, thereby providing warnings and effective response plans. - AI can help predict the level of damage that natural disasters may cause to different areas, thereby optimizing response strategies. This includes identifying areas that need urgent relief, routes for transporting relief supplies, and areas that may need to be evacuated. AI can help optimize the distribution and management of rescue resources, from providing food, water, medicine to deploying rescue forces. AI can analyze emergency situations and come up with the most effective distribution plans based on real-time data. - AI can build disaster simulation models to predict different scenarios, thereby providing appropriate prevention plans. For example, simulating the spread of floodwaters or the effects of storms in densely populated areas will help authorities have better response plans. AI can assess risk factors in disaster-prone areas such as coastlines, mountainous areas or areas with weak

			infrastructure, thereby proposing solutions to build disaster prevention infrastructure such as dikes, dams, wave-breaking structures or measures to protect residential areas. - AI can analyze data on the extent of damage and social conditions to predict post-disaster relief needs, from food, water, and other necessities. Accurate forecasting helps relief organizations such as government agencies and NGOs allocate resources quickly and efficiently. AI can help develop post-disaster reconstruction plans, including analyzing areas that need infrastructure restoration first, choosing safe and cost-effective construction technologies, thereby making the reconstruction process faster and more efficient. - AI can be integrated into mobile applications that help people receive early warnings about natural disasters, situation updates, and evacuation instructions. These applications can use AI to make personalized recommendations based on location and current weather conditions. AI can help build smart community systems to manage disaster information, enabling people and organizations to share information and respond to emergencies together. - AI can help design simulation training programs for communities and rescue workers, helping them better prepare for disaster situations. These simulations help people learn how to act quickly and accurately in an emergency.
		2. Regional development	- AI helps identify suitable locations for parks, green spaces and urban forests by analysing geospatial data on population density, land availability and ecosystem services. - AI helps plan water supply systems by analysing geospatial data on water resources, demand and infrastructure and optimise water management and distribution. - AI helps plan green infrastructure such as green roofs, rain gardens and urban forests by analysing geospatial data on land availability, stormwater flows and ecosystem services. - AI helps develop land use planning and support sustainable land management and development by analysing geospatial data on land suitability, environmental constraints and socio-economic factors. - AI performs marine spatial planning and supports sustainable marine resource management by analyzing geospatial data on marine ecosystems, human activities, and conservation goals. - AI supports water conservation and management initiatives by analyzing geospatial data on water demand, availability, and efficiency to support water conservation planning.
		3. Craft village development	- AI can help improve the production process of craft villages through technologies such as machine learning and autonomous robots. Algorithms can analyze and optimize stages, reduce production time and costs, and improve product quality. For example, in handicraft villages, AI can help automate some steps, such as cutting, processing, or quality inspection. - AI can collect and analyze data from the product consumption market of craft villages, helping artisans and businesses grasp consumption trends, customer preferences, and the needs of domestic and international markets. This helps them adjust their production, marketing, and product development strategies more appropriately. - By analyzing data from e-commerce websites, social networks, and online sales platforms, AI can help forecast consumption trends of typical products of craft villages. This will support craft villages in preparing production resources in a timely manner and minimizing waste. - AI can be applied in monitoring the quality of craft village products through automatic inspection systems, using machine learning to analyze images, detect product defects, thereby minimizing the rate of defective products. This technology can also be applied in monitoring factors affecting product quality, such as humidity and temperature during the production process. - Traditional techniques in craft villages can be preserved and enhanced by using AI to record, analyze and communicate manual processes. For example, AI can help create 3D models of products, manual manufacturing techniques, and store them in databases, thereby helping to preserve valuable knowledge

			and pass it on to future generations. - AI can support artisans in creating new products by analyzing market trends, customer needs, and coming up with suitable product development ideas. AI design tools can also help simulate new ideas quickly and easily, supporting the innovation process in craft production. - AI can support craft villages in promoting products through digital platforms through search engine optimization (SEO), online advertising, market analysis, and social media management. AI helps analyze marketing strategies effectively, thereby improving customer outreach and increasing revenue for handmade products. - AI can help analyze environmental and social factors to develop sustainable business models for craft villages. AI algorithms can optimize resource use, minimize waste and protect the environment during production, helping craft villages develop sustainably without affecting the surrounding ecosystem. - AI can support training programs for workers in craft villages through online learning platforms, training AI in specific skills such as design, production or management. This technology helps improve people's professional capacity, while enhancing creativity and applying technology to craft villages. - AI can optimize the supply chain of craft villages from input materials to product distribution to the market. Machine learning algorithms can help predict and manage inventory, optimize transportation and distribution stages, minimize costs and ensure timely supply.

IV. CONCLUSION

The application of AI in teaching Geography not only helps improve the quality of teaching but also creates a flexible, personalized learning environment, encouraging creativity and critical thinking. This is very consistent with the goals of the new General Education Program 2018, aiming to develop students' abilities and qualities, helping students to apply knowledge to real life. AI in education is a new step forward, opening up many opportunities to improve and optimize the teaching and learning process. However, to fully exploit the benefits that AI brings, schools and teachers need to have a methodical implementation plan, ensuring the rights and security of students. The application of AI in teaching Geography is not only an investment in technology but also an investment in the future of education, helping to create a more flexible, modern and sustainable learning environment.

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