

Design and use of Mind Maps in Teaching Geography in High Schools

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ABSTRACT: In the current context of general education innovation, the application of active teaching methods to promote students' capacity has become an essential requirement. Mind maps, when properly designed and applied, are powerful visual tools that help systematize knowledge, develop thinking, and improve learning effectiveness. This paper focuses on analyzing the ability to apply mind maps in teaching Grade 12 Geography in some high schools in Vietnam. The research process was carried out through surveys and pedagogical experiments with the participation of 15 teachers and 160 students. The results show that the use of mind maps contributes positively to the innovation of teaching methods, helping students achieve higher results in learning. The article also proposes a number of orientations to improve the effectiveness of the implementation of mind maps in teaching practice, thereby contributing to promoting the process of educational innovation at the high school level.

KEYWORDS: Mind Map, Geography, Grade 12, high school, teaching methods, EdrawMind.

I. INTRODUCTION

In recent years, educational innovation, especially the innovation of teaching methods, has become an urgent requirement in the context of implementing a new general education program in Vietnam with the aim of comprehensively developing learners' capacities and qualities. This requires the teaching process to shift from traditional methods to active, learner-centered teaching methods, in order to promote students' initiative and ability to think independently. The Ministry of Education and Training has also concretized this requirement in the General Education Program in 2018 [1], emphasizing the organization of learning activities in the direction of developing the quality and capacity of learners, requiring teachers to innovate teaching methods suitable for each subject, school level. In response to that requirement, mind maps emerged as an effective support tool for both teachers and students [2]. This is an information visualization method that helps systematize knowledge in a logical and vivid way, and at the same time stimulates students' ability to remember, think critically, and present [3].

The effectiveness of mind maps in the field of education has been confirmed through a series of global studies. Mind maps convert information from text into vivid images, diagrams, and colors, helping to stimulate the brain to process data comprehensively, while increasing memory. The presentation of information in the form of diagrams also creates conditions for concepts to link with each other, supporting learners to understand more deeply and easily connect the ideas received. In addition, the mind map also reflects creativity, helping users to be flexible in thinking and discover new connections between problems [4]. The arrangement of ideas in the form of diagrams helps to identify the relationships between the elements, thereby paving the way for the planning and decision-making process. In group learning, mind maps help to divide work, plan, and track progress in a visual and easy-to-understand way. Mind maps are great tools for sharing ideas, encouraging creative exchange, and guiding common goals [5],[6]. Using a mind map helps develop the ability to observe, analyze, and synthesize diverse information from multiple sources, thereby creating a foundation for comprehensive thinking and quick reflection on emerging problems [7],[8]. In Vietnam, mind maps have been widely applied from primary to tertiary education, helping students develop logical and creative thinking abilities. Mind maps have been applied in subjects such as Vietnamese, Foreign Languages, Biology [9-11].

Currently, studies mainly focus on the overall effectiveness of mind maps, however very few studies mention the use of mind maps in Grade 12 Geography. Several studies have shown that mind maps have a lot of potential in teaching, but more in-depth studies are needed to evaluate the role of mind maps in improving students' learning effectiveness. The research objectives and orientations of the paper include: 1/ Research on the role of mind maps in teaching; 2/ The current situation of using mind maps in teaching Geography in high schools in Vietnam; 3/ Steps to design a mind map in teaching; 4/ Organizing teaching activities using mind maps in Grade 12 Geography in high schools.

II. RESEARCH RESULTS

2.1. The role of using mind maps in teaching

2.1.1. For students

Mind maps play an important role in supporting students to learn Geography effectively. Here are the benefits and specific examples that illustrate:

Systematize knowledge: Mind maps help students organize information in a coherent and intuitive way. For example, when learning about the different types of terrain on Earth, students can draw mind maps with major branches such as mountain ranges, mountain peaks, plateaus, plains, valleys, and deserts. Each sub-tributary provides detailed information about the characteristics, distribution locations, and significance of each terrain form.

Develop creative and critical thinking skills: Through organizing and analyzing geographic data, students are encouraged to discover new connections. For example, when researching global climate change, students can create a mind map to link causes (industrial emissions, deforestation) to consequences (rising temperatures, sea level rise, natural disasters) and remedial measures (planting trees, reduce emissions, use clean energy).

Improve memorization: Mind maps with attractive images, colors, and symbols make it easier for students to remember. In the lesson about continents or continents, students can use mind maps with symbols, images, and colors for each continent to memorize information about the natural geography and socio-economy of each continent.

Increase engagement and interaction: When organizing group teaching, mind maps are a tool to help students exchange ideas and work in groups together. For example, when researching Vietnam's natural resources, groups of students can build a mind map about each type of resource such as topography, geology, minerals, climate, and biology and discuss how to exploit it sustainably, thereby creating cohesion and interest in learning among members.

2.1.2. For teachers

Mind maps are an effective tool for teachers in teaching Geography, bringing many outstanding benefits with specific examples:

Mind maps serve as a useful teaching tool: Teachers can apply mind maps to organize lesson content in a clear and vivid way. For example, when teaching about the "River System in Vietnam," teachers can build a diagram with the main branches including distinctive features, typical rivers (Red River, Mekong River), and the importance of rivers to economic and social life.

Mind maps improve creativity in teaching methods: This tool helps teachers flexibly change the way they communicate knowledge, creating conditions for students to learn more creatively. For example, in the lesson "Global Climate Zones," teachers can design a mind map with visual images (such as the sun symbol representing the tropical climate, the snowflake representing the cold climate), to encourage students to interact and ask questions.

Mind maps support assessment and tracking of learning progress: Teachers can use mind maps to determine students' level of knowledge acquisition. For example, after the lesson on "Types of Terrain," teachers may ask students to draw their own mind maps, thereby assessing their ability to organize information and connections between terrain forms such as hills, plateaus, or plains.

Mind maps make it convenient when planning lessons: This tool makes it easy for teachers to synthesize and present lesson content in a systematic way. For example, in the lesson "Natural resources in Vietnam," teachers can build a diagram with the main branches such as forest resources, mineral resources, and water resources, thereby forming a detailed teaching plan, supporting sharing with colleagues.

2.1.3. For training quality

Mind maps play an important role in improving the quality of education. First of all, this tool improves teaching efficiency by promoting positive interaction between teachers and students. By arranging and presenting knowledge creatively, students not only easily grasp the content of the lesson but also increase their motivation to learn as well as self-research skills, thereby improving their learning outcomes. In addition, the mind map supports the innovation of teaching methods, bringing diversity in the approach to lessons compared to traditional methods. This helps educational institutions quickly transform to a modern teaching model, meeting the requirements of strong development of society. In addition, the application of mind maps also helps students develop comprehensive thinking. This tool not only imparts knowledge effectively, but also helps train important thinking skills such as analysis, synthesis, connection, and creativity. These skills play a fundamental role in building confidence and the ability to apply knowledge in practice. Finally, mind maps optimize educational outcomes by encouraging active learning methods, helping students acquire deep knowledge and develop critical thinking. As a result, the education system not only trains independent and creative individuals but also meets the increasing requirements of modern society.

2.2. The current situation of using mind maps in teaching Geography in high schools in Vietnam

Based on the survey results from 15 teachers and 160 grade 12 students at the high school level, the use of mind maps in teaching brings many advantages and limitations as follows:

Advantage: Mind maps assist teachers in presenting complex knowledge in a clear and systematic way, and flexibly integrate visual, chart, and written elements. This method not only improves students' analytical and information synthesis skills, but also encourages lively participation in class. Moreover, mind maps can be flexibly applied in many teaching activities such as introducing

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new lessons, reviewing learned knowledge, reinforcing content, or assisting with revision. In addition, students are encouraged to create their own mind maps according to their personal ideas, helping to improve their ability to think creatively, think independently and save time thanks to effective information arrangement.

Drawbacks: Designing a mind map requires a lot of time and effort from teachers, while not all teachers are familiar with using software or design tools. In addition, the evaluation of the mind map is still subjective because there is no clear and uniform set of criteria. Students also need to be able to think logically to systematize and organize information effectively, which not all students are proficient in. Some students also have difficulty adapting to new learning methods, especially when they are used to the traditional way of learning.

2.3. Steps to design a mind map in teaching

Table 1. Steps to design a mind map in teaching

Step	Details
1. Define the main objectives and contents	- Optimize the ability to absorb and process information and develop logical, analytical, synthetic, and creative thinking - Select the key content of the lesson (topic, chapter).
2. Choose the form of a mind map	- Branching Diagrams: Shows hierarchical relationships - Network Diagram: Representation of multidimensional relationships - Pie Diagram: Describe the cycle
3. Identify key keywords	- Choice: Short, easy-to-understand words, representing the main idea. - Arrangement: According to logical order (common →, cause and effect, time).
4. Draw a diagram	1: Write the topic keyword in the center. 2: Draw the main branch connected to the center. 3: Develop sub-branches. 4: Use images, colors. 5: Connect the branches with lines, arrows.
5. Inspection and Finishing	- Full, coherent, easy-to-understand, accurate assessment. - Bug fixes, additional information, layout and color adjustments.

2.4. Organizing teaching activities in Grade 12 Geography with mind maps

2.4.1. Mind Map Design with EdrawMind Software

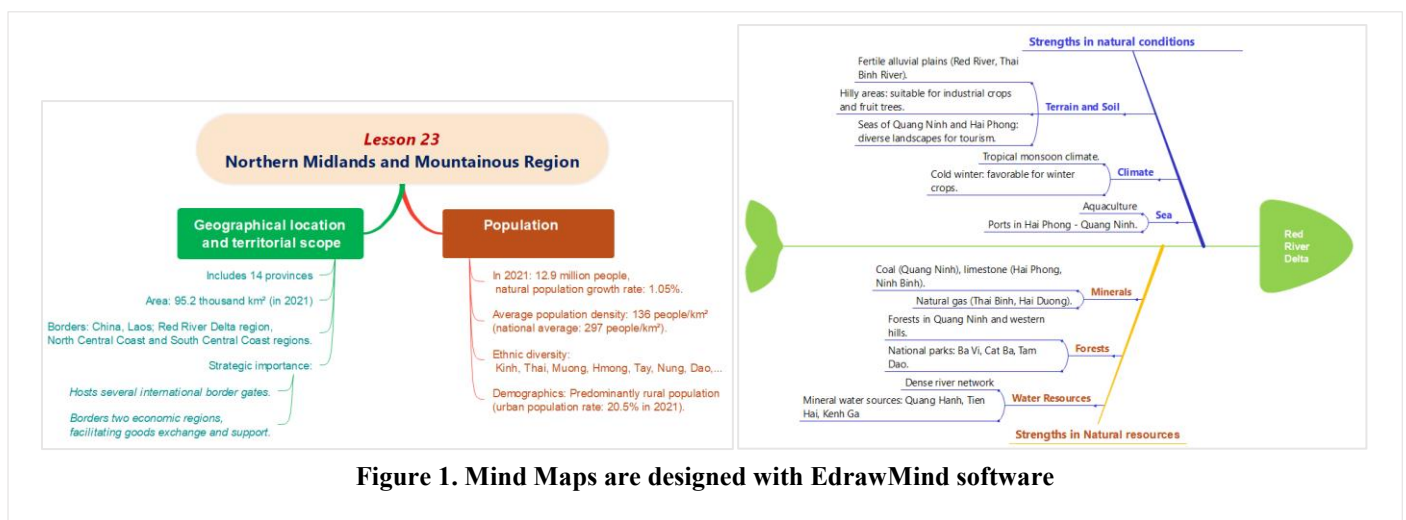


Figure 1. Mind Maps are designed with EdrawMind software

Currently, the development of technology has brought a series of software to support mind mapping, effectively serving teaching. These software are not only feature-diverse but also suitable for a wide range of teachers and students, from free apps like Canva, MindMap, to in-depth tools like EdrawMind or MindManager. In this article, we use EdrawMind software to design mind maps for teaching and learning [12].

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2.4.2. Using mind maps in teaching Grade 12 Geography

Below is a detailed guide to help teachers use the mind map designed by EdrawMind (with 2 main branches: Geographical Location and Territorial Range and Population) to organize teaching activities for students when teaching **Lesson 23: Northern Midlands and Mountains**, Grade 12 Geography:

a) Teaching objectives

- Help students master the knowledge of the geographical location characteristics, territorial scope and population of the region.
- Practice systems thinking and information analysis skills.
- Increase interaction and interest during class.

b) Preparation

- Mind Map: The map has been created on EdrawMind, including 2 main branches:
 - + Branch 1: Geographical location and territorial scope.
 - + Branch 2: Population.
- Supporting media: Projectors, interactive boards, or printed diagrams on large paper for easy observation by the whole class.
- Additional materials: Geographical map of Vietnam, illustrations of the northern midlands and mountains (terraced fields, ethnic minorities, etc.).

c) Teaching process

* Step 1: Introduce the mind map and lesson orientation

- The teacher introduces the lesson with pictures and asks thought-provoking questions such as:
 - + "What are the outstanding geographical features of the northern midlands and mountains?"
 - + "What role does the population of this region play in socio-economic development?"
- Next, the teacher introduces the mind map used to systematize the lesson knowledge.

* Step 2: Organize group activities

- Student grouping:
 - + Group 1: Learn and complete the content of the branch "Geographical location and territorial scope".
 - + Group 2: Learn and supplement the content of the "Population" branch.
- Team tasks:
 - + Read and analyze the materials provided by the teacher.
 - + List the outstanding features according to each branch of the diagram.
 - + Use keywords and illustrations to add to the diagram.

* Step 3: Present and discuss

- Representatives of each group presented the completed content from the mind map.
- Teachers comment, supplement opinions and answer students' questions.
- Complete the general thinking map of the whole class.

* Step 4: Connect to the lesson content

- Teachers use the completed diagram as a foundation to teach more deeply about the characteristics of the northern midlands and mountains.
- Emphasizing the connection between geographical location, population and socio-economic development of the region.

2.4.3. Pedagogical experiments

a) Experimental objectives

- Evaluate the effectiveness of teaching using mind maps compared to traditional teaching methods.
- Determine the impact of mind maps on students' ability to acquire knowledge, systems thinking, and interest in learning.

b) Selection of experimental subjects

- High school: Choose a school with relatively uniform learning conditions and student quality.
- Number of participating classes: 4 classes (160 students), divided into:
 - + 2 experimental classes of teaching according to lectures using mind maps.
 - + 2 control classes teaching according to traditional methods.

c) Preparation for experiments

- Teaching content: Select specific lessons.
 - + For example, **Lesson 23: Northern Midlands and Mountains** or **Lesson 24: Red River Delta**, Grade 12 Geography.
- Design lectures with mind maps for experimental classes.
- Traditional lectures (without using mind maps) for the control class.
- Supporting tools: Experimental class using projectors, mind maps pre-designed using EdrawMind software. The control class uses traditional lesson plans, textbooks and supplementary materials.
- Pre-Experimental Assessment: Organize an entrance test to assess students' background knowledge and initial skills in all 4 classes. Ensure the input points of the layers are similar, limiting the deviation of the results.

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d) Conduct experiments

Step 1: Teaching in 2 methods

- Experimental class: Use mind maps as the main teaching tool to guide and systematize knowledge. Students interact directly with the diagram, fill in information, and complete the branches.
- Control class: Teaching according to traditional methods. Teachers and students take notes and discuss without using mind maps.

Step 2: Organize the after-school assessment

- Theoretical test questions and analytical exercises (based on the lesson content).
- Measure the following criteria: memorization, comprehension, presentation skills and system thinking.

III. CONCLUSIONS

The use of mind maps in teaching has proven to be outstandingly effective in improving the quality of learning. Notably, in the classes where this method is implemented, the number of students with good scores has increased significantly, proving that the Mind Map is able to support students to systematize knowledge in a coherent, accessible and long-term memory. Moreover, the percentage of students achieving weak and average grades decreases significantly, showing that the mindset map is not only for excellent students but also provides clear benefits for those who need to develop their academic abilities. This affirms the advantages of mind maps in promoting positive thinking, inspiring learning and comprehensively improving learning outcomes for learners.

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