

A Deep Learning-Based Teaching Design for High School Geography Units: Taking the Example of Landforms of the Humanistic Education Edition

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Abstract: The traditional teaching methods of one-way cultivation of students can no longer meet the requirements of talent cultivation at this stage. The issue of how to promote students from passive acceptance to the independent cognitive understanding stage (i.e. deep learning) has become the focus of geography teaching. Therefore, under the guidance of deep learning theory, this paper takes the “landforms” knowledge unit of the Humanistic Education Edition as an example, improves the classroom teaching means through the unit teaching mode, reconstructs the “landforms” teaching unit, and explores the specific teaching of high school geography unit based on deep learning. This study provides a good example and guidelines for high school geography teaching and learning.

Keywords: Deep learning; Unit teaching; Geography education; Case design; High school education

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1. Introduction

In the “21st century” or “future-oriented” education literature, there are repeated calls for deep learning, which emphasizes the development of meaningful learning and the enhancement of students’ problem-solving, critical thinking, and knowledge transfer skills ^[1]. The Compulsory Education Curriculum Program (2022 Edition) proposes that curriculum implementation should deepen pedagogical reform and explore unit teaching ^[2]. This points out the importance of large-unit teaching. The design of unit teaching can fully reveal the vertical and horizontal relationship between the subject knowledge and repeatedly integrate and process the specific facts and abstract concepts of the subject, which can better improve students’ problem-solving and knowledge transfer skills ^[3]. This study integrates the theory of deep learning with the theory of unit teaching, and takes the teaching unit of “landforms” as a case study, and explores the unit teaching path that can achieve the goal of deep learning through designing specific teaching activity programs and teaching evaluation. It intends to provide some guidelines for the reform of geography teaching mode.

2. Reconstructing the “landforms” teaching unit

The unit teaching design under the guidance of deep learning theory divides the design process into three stages: determining the teaching unit, carrying out teaching activities, and designing teaching evaluation, providing design cases for teachers' reference.

2.1. Determination of teaching units

Determining the content and theme of the unit of study is the beginning and most critical step in teaching the unit. The following points need to be borne in mind when determining the unit of study.

- (1) Teaching unit is oriented by the curriculum standards and mindful of the logic and body of knowledge of the subject. Teaching topics should be in line with the standards of the geography curriculum and cover the core literacy and key concepts of the discipline. At the same time, it should follow the logic and system of knowledge of the geography discipline to ensure the coherence and systematicity of the content.
- (2) The integration of unit content needs to be relevant. If the reorganization of unit content has no practical significance, then such reorganization is unnecessary. The reorganization of learning units does not have to be confined to the traditional teaching units of the textbooks, but the teaching units need to be defined in a way that embodies the core qualities of the geography subject, solves practical problems, or enhances the practical skills of students.
- (3) The teaching unit needs to be student-centered and have authentic contexts. Teachers should be students' learning motivators, skill cultivators, and thought guides^[4]. Teaching topics should take into account the cognitive level, interests, and needs of students, starting from the shallow to the deep, in order to promote active and deep learning. Teaching should create situations based on the teaching objects, teaching content, and principles of life that students are familiar with, the creation of authentic contexts can increase students' interest^[5]. Teaching themes should be based on real geographical things, phenomena, or problematic situations to increase the interest in knowledge.

The selection and definition of the study unit “landforms” is based on the above principles. It is analyzed as follows:

- (1) In the curriculum standards, the content requirements for landforms are “1.4 Identify three to four landforms and describe the major features of their landscapes through field observations or using video and images” and “1.3 Explain, with examples, the effects of internal and external forces on changes in landforms, and describe the relationship between human activities and landforms.” These two parts are from Compulsory I and Optional I, respectively^[6]. Although they appear to be independent, they are in fact interrelated.
- (2) The content of the unit on “landforms” is extensive and fragmented. The knowledge points are separated from each other. Integrating these related contents to form a new learning unit will help students master a systematic knowledge system. In the study unit “landform,” the content of Compulsory I focuses mainly on the description and characterization of geomorphological phenomena, while the content of Optional I explores the reasons behind the phenomena in greater depth. In order to enable students to better understand geomorphological phenomena and the reasons for their formation, the learning unit takes the following steps: firstly, creating a situation from actual geomorphological phenomena; secondly, digging into the internal and external force factors for the formation of geomorphological phenomena; thirdly, carrying out a practical field course; and lastly, analyzing the impact of different types of geomorphological phenomena on human production activities. Such a learning unit helps students to establish a systematic knowledge system, master

knowledge from shallow to deep, combine theory with reality, improve the ability to solve practical problems, and cultivate the concept of harmonious coexistence between human beings and nature [7].

- (3) The determination of the teaching unit “geomorphology” takes full account of the students’ subjective position, and is introduced in the context of the animated story *Calabash Brothers*, with which they are familiar. This unit uses “from a geographical point of view to analyze the birthplace of Calabash Brothers” as the main line of tasks to carry out teaching activities, so that geography learning is more interesting, so as to better stimulate students’ interest in learning.

2.2. Design ideas

The specific design ideas of this study are shown in Figure 1.

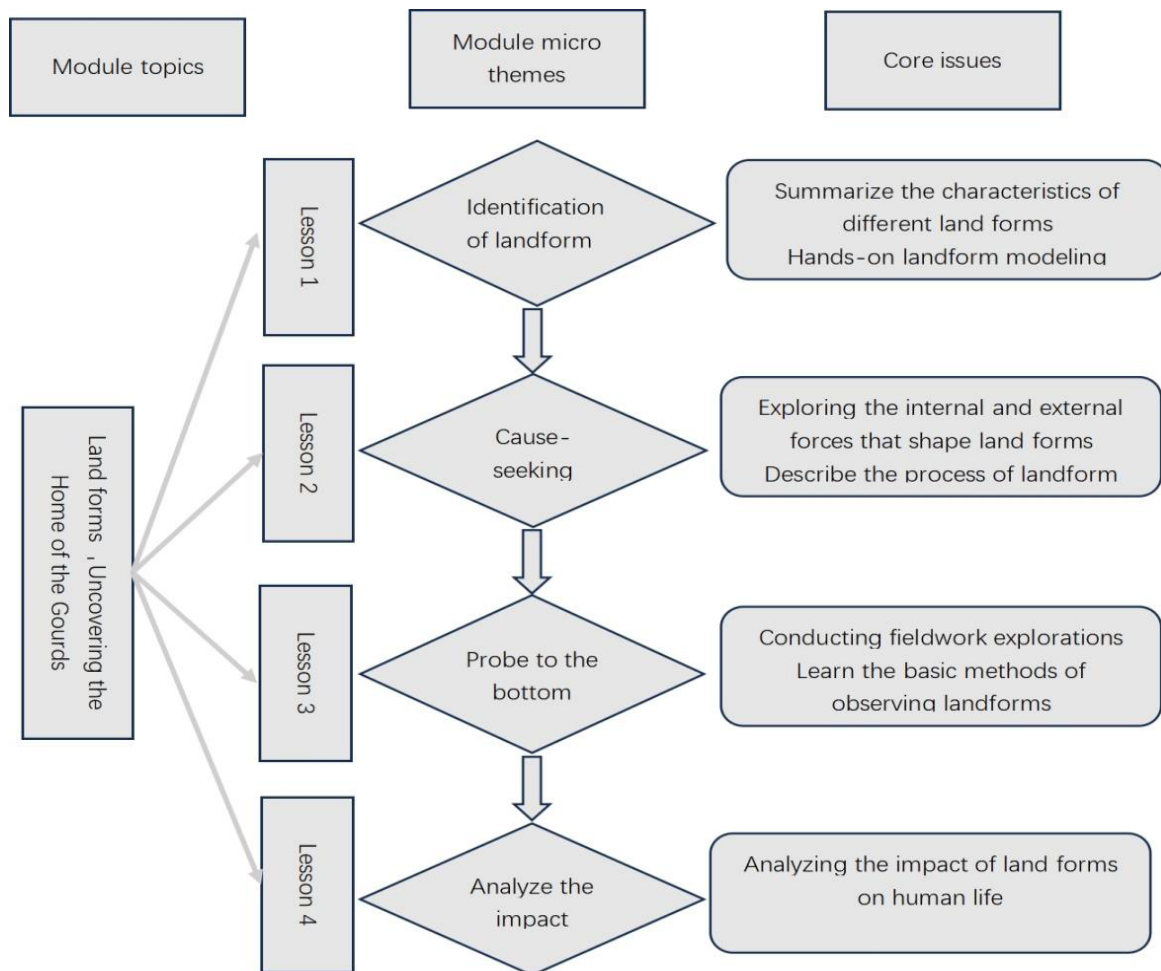


Figure 1. Design ideas

2.3. Educational activity

Teaching activities are the way to realize the teaching objectives. This unit divides teaching activities into four lessons, with “analyzing the birthplace of Calabash Brothers from a geographical point of view” as the contextual entry point. These teaching activities include hands-on operation, knowledge learning, practical investigation, and generalization and analysis, etc., and each link is closely interlinked and progressive. This will help improve students’ higher-order thinking skills, thus realizing the goal of deep learning. Due to space constraints, we will take “Karst Landscapes” as an example to illustrate the design of specific teaching activities in detail. The specific design of teaching activities is shown as follows.

Lesson 1: Identification of landforms

[Scene creation]: “Into the Calabash Brothers’ Home”The clip about the geographical environment (karst landform landscape) in the cartoon *Calabash Brothers* has been introduced into a new lesson.

[Learning task]:

- (1) To get a preliminary understanding of the karst landscape and its distribution area by watching cartoons about the karst landscape.
- (2) To further understand the different karst landscapes through the observation of karst landscape pictures.
- (3) According to the geomorphic model, in the group as a unit, the use of plasticine to make a karst geomorphic model deepens the understanding of geomorphic characteristics.

[Design intent]: Well-known cartoons are played to arouse students’ childhood memories and arouse their interest in learning. Hands-on modeling can further enhance students’ understanding of geomorphic features. At the same time, it can improve students’ hands-on skills.

[Core element]: Regional awareness, practical geography skills.

[Scene creation]: “Uncovering the Calabash Brothers’ Home”The details of the film (from the house, clothing, and organisms to infer the climate, biology, and other conditions of the place) reveal the geographical characteristics of the place, and explore the formation of the geomorphic reasons and evolution history.

[Learning task]:

- (1) To independently explore the influence of magmatic activity on surface morphology.
- (2) To explore the influence of plate movement on surface morphology in groups.
- (3) To independently explore the karst landscape at different stages, and master the characteristics and formation reasons of the above-ground landscape such as peak cluster, peak forest, solitary peak, remnant mound, and stone forest.
- (4) To explore the underground landscape of karst landform and master the characteristics and formation reasons of karst caves in groups.

[Design intent]: Through the display of dynamic pictures and videos, the formation process of landforms can be more intuitively understood, which is convenient for students to understand and master. The teaching methods of independent inquiry and cooperative inquiry are mainly adopted to improve students’ mastery of knowledge and exercise students’ ability to analyze and solve problems.

[Core element]: Comprehensive thinking skills.

Lesson 3: Probe to the bottom[Scene creation]: “Field Exploration of the Calabash Brothers’ Home”This paper explores the birthplace of Calabash Brothers, takes southern Yunnan Province as the object of investigation and practice, and makes field observations of landforms.

[Learning task]:

- (1) To understand the methods of collecting terrain data, and learn the selection of observation points during field landform observation.
- (2) To take a place in southern Yunnan as an example to understand the sequence and content of landform observation.
- (3) To make field observations in the area near their hometown in small groups, and make timely records and reports.

[Design intent]: By introducing the situation and learning the general method of geomorphic observation and then conducting field investigation and research, it not only improves the efficiency of practical investigation, but also exercises students’ practical skills, deepens their understanding of the geomorphic

landscape of their hometown, and establishes the concept of human-land coordination.

[Core element]: Regional awareness, practical geography skills.

Lesson 4: Analyze the impact [Scene creation]: “Help Calabash Brothers’ Grandfather” Under the background of analyzing this kind of landform, what impact does it have on Grandpa Calabash Brothers’ life? How to help Grandpa Gourd better carry out agricultural production activities here?

[Learning task]:

- (1) To understand the impact of landforms on human activities on the basis of the group as a unit and the practical investigation site. (To analyze the influence of landform on settlement distribution and highway location from slope and slope direction)
- (2) To analyze the impact of karst landforms on local life, both in terms of favorable (tourism) and unfavorable (agricultural impact).
- (3) To explore and analyze in groups the landforms reasons why Fuyang became an important national commodity grain base, a comprehensive transportation hub, and a large population.

[Design intent]: After the first three hours of learning, students have a basic understanding of landforms, to analyze the impact of landforms on human activities based on the results of practical exploration. Secondly, by providing materials and information, students can transfer and apply what they have learned, which is conducive to the cultivation of students’ problem-solving and higher-order thinking skills.

[Core element]: Regional awareness, comprehensive thinking skills.

3. Evaluation of teaching and learning for sustainability

Traditional teaching evaluation often focuses on knowledge and skills as well as the final examination but ignores the examination of emotional attitude and values, and the usual assessment^[8]. The goal of deep learning determines that unit teaching must emphasize sustainable evaluation in the learning process. Carrying out sustainable evaluation in geography teaching refers to the systematic and continuous monitoring and evaluation of students’ learning outcomes in the process of geography teaching to ensure that students can achieve the expected teaching goals at different levels of core literacy^[9]. Accordingly, a tiered evaluation scale was designed (**Table 1**).

Table 1. Graded evaluation scale

Evaluation content	Grading evaluation standard
Mastery of karst landscape features	Level 1: Be able to accurately identify whether a landscape is a karst landscape based on a picture. Level 2: Be able to accurately identify landforms from photographs and characterize some of the typical karst landform types. Level 3: Be able to identify landforms from pictures and be able to give a complete statement of typical karst landscape features. (Including characteristics of above and below-ground karst landscapes)
Recognition of evolutionary processes in karst landscapes	Level 1: Be able to recognize that the process of karst landscape evolution is the result of a combination of internal and external forces. Level 2: Be able to recognize that the process of landscape evolution in karst landscapes is the result of a combination of internal and external forces and be able to describe the two steps in the evolutionary process. Level 3: Be able to recognize the results of internal and external forces in the evolution of karst landscapes and be able to accurately describe all steps of the evolutionary process.
Mastery of external factors in the formation of karst landscapes	Level 1: Be able to name one or two external causes of the formation of karst landforms. Level 2: Be able to give a complete statement of the external causes of the formation of karst landforms. Level 3: Be able to accurately state the external factors of karst landscape formation and be able to analyze the reasons for the formation of karst landscape in a certain place based on the materials.

Table 1 (Continue)

Evaluation content	Grading evaluation standard
Geomorphological observation capacity	Level 1: Be able to understand the general methods of topographic data collection and be able to select the correct location for field observations. Level 2: Be able to knowledge of the sequence and methods of landform observation and be able to produce a record sheet of landform observations. Level 3: Be able to produce a complete record sheet of geomorphologic observations. (Contents include place of observation, elevation, relative height, ground relief, surface morphology, comprehensive judgment of large geomorphic units, area, distribution, and land use.)
Analysis of the impact of landforms on human activities	Level 1: Be able to know that landforms have both favorable and unfavorable impacts on human production activities and be able to name some of the impacts of landforms on human activities. Level 2: Be able to give a complete statement of the effects of landforms on human activities (both favorable and unfavorable) and be able to state what the different types of landforms reveal about human productive activities. Level 3: Be able to mention, on the basis of the material, the development strategy of the place in the context of a certain landscape and how the harmonious coexistence of human beings and nature should be realized.

4. Retrospect and prospect

The unit teaching oriented to deep learning plays an important role in improving students' ability and comprehensive quality in all aspects. The teaching content design of "landforms" unit pays attention to the combination of theory and practice, which is comprehensive and practical, and is conducive to the cultivation of students' core quality. However, the teaching design provided in this paper only serves as a simple guideline for teachers, and the specific implementation steps and contents need to be modified according to the actual situation. In addition, whether the teaching effect of each class is consistent with the preset effect remains to be further studied. For this study, due to the limitation of research time and personal competency, although the teaching design of terrain unit is based on the teaching materials of humanistic education edition, the teaching content of deep learning-based unit is not limited to the teaching materials, so the follow-up research should expand the research scope of unit teaching and innovate a new model of deep learning-based high school geography teaching with students as the main focus.

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Disclosure statement

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