Study on the Statistical Characteristics of Location Factors Questions in the National Unified Entrance Examination for Colleges and Universities of China during 2011-2021

Wei Yan[1, 2], Qi Yang[1], Minghua Liu[1, 2*], Yaogeng Tan[3], Jia Ning[4], Jiawen Wang[1],

and Yifan Wang[1]

[1] School of Geographic Sciences, Xinyang Normal University, Xinyang, Henan, 46400, China
[2] Xinyang Key Laboratory of Climate Change and Environmental Evolution, Xinyang Normal University, Xinyang, Henan, 46400, China
[3] Information Center (Hydrology Monitor and Forecast Center), Ministry of Water Resources, Beijing, 100053, China
[4] Key Laboratory of Land Surface Pattern and Simulation, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China
* Corresponding author's e-mail: lmhhqs@126.com

Abstract

It is of great reference value for teachers and students in teaching and learning to clarify the proposition characteristics of geography examination questions in the National Unified Entrance Examination for Colleges and Universities (NUEECU). This paper was designed to investigate the characteristics of quantity and score distribution, topics, form of material presentation, and questioning mode of geography questions of location factors by using the data of the comprehensive ability test of liberal arts in the NUEECU during 2011-2021. The results showed that the quantity and score of geography questions of location factors showed a fluctuating upward trend at rates of 1.65 questions per year (7.8 points per year) before 2019 and reversed after 2019 at rates of -4.50 questions per year (-20.0 points per year). In terms of topics, the proportion of geography questions in industry, agriculture, and service industry decreased successively, but the proportion of geography questions of service industrial location factors might increase in the future. Choice questions mainly presented materials in the form of text description, while comprehensive questions mainly presented them in the form of a combination of text description and pictures, among which a combination of text description and maps was the most common form. The primary questioning mode of geography questions were reasons, summary, and advantages and disadvantages, respectively, to test students' comprehensive ability.

Keywords: Location Factors, geography examination questions, statistical analysis, National Unified Entrance Examination for Colleges and Universities

1. Introduction

The National Unified Entrance Examination for Colleges and Universities (NUEECU), as an important link between basic education and higher education, is an effective way and a vital carrier to fulfil the fundamental task of cultivating the morality and talents of students [1]. With the continuous reform and deepening of the geography curriculum standards, questions of the NUEECU are closer to the development trend of The Times, in line with the educational requirements of

modern society, and highlighting the cultivation of the core literacy of geography [2].

Geography questions of the NUEECU are essential references in geography teaching in senior high schools, which play an important role in instructing teachers and students. Based on the starting point of the NUEECU, Zhang [3] pointed out that geography questions should not only fully reflect the concept and requirements of geography curriculum standards, but also respect and follow the rules and objectives of the examination itself. Jiang and Xiao [4] pointed out the importance of

geography questions of the NUEECU from the foothold, that was, as an effective means of teaching evaluation, the NUEECU could not only test students' learning achievements, but also play an important guiding role in classroom teaching. In the meanwhile, the value orientation of geography questions of the NUEECU was bound to profoundly affect the situation of geography curriculum reform in senior high schools [5]. Therefore, the geography examination of the NUEECU is an important means and way to promote the cultivation of students' human-environment coordination, regional cognition, comprehensive thinking, and geography practice literacy [6].

Location factors belongs to the content of the Third chapter in Compulsory Geography Book II (2019 Edition) published by People's Education Press. This section not only serves as a critical link between the preceding and the following in the textbook, but also achieves a good integration and mastery with other geography knowledge in practical application. As one of the main geography examination contents in the NUEECU, the teaching and learning of location factors focuses on giving play to students' subjectivity and fully embodies the curriculum concept of "learning the geography that is useful for life" [7]. Therefore, this paper profoundly explored the presentation and application of geography knowledge points related to location factors in the papers of the NUEECU by analysing the characteristics of quantity and score distribution, topics, form of material presentation, and questioning mode of geography questions, which can point the orientation for teachers to teach and students to learn relevant geography knowledge.

2. Data and Methods

The data used in this research are mainly from the geography part of 25 sets of examination papers for the comprehensive ability test of liberal arts in the NUEECU during 2011-2021. These examination papers consist of a set of national examination papers of curriculum standard (NEPCS) each year during 2011-2012, two sets of NEPCS (named Paper I and Paper II) each year during 2013-2015, three sets of NEPCS (named Paper I, Paper II, and Paper III) each year during 2016-2020, and two sets of NEPCS (named Paper A and Paper B) in 2021. The geography questions

in each set of NEPCS have a total score of 100 points each year. Questions 1-11 are choice questions, with 4 points for each question, Questions 36-37 are comprehensive questions containing multiple questions, with a total score of 46 points, and Questions 42-44, as one of three alternative questions, are worth 10 points. It should be noted that the total quantity and score of questions each year refer to the cumulative value of all NEPCS in that year.

Methods of charts and statistical analysis [8], such as trend analysis and proportion analysis, were used in this paper. Among them, the bar chart, the plot of line and symbol, and trend analysis were mainly applied to describe the temporal variation characteristics of question quantity and scores, while the doughnut plot and proportion analysis were mainly adopted to describe the statistical characteristics of the form of material presentation and questioning mode of geography questions.

3. Results and Discussion

3.1. Analysis of question quantity and scores

Figure 1 shows the characteristics of question quantity and scores in geography examination papers involving location factors during 2011-2021. According to figure 1a, there were 115 geography questions for all examination papers during 2011-2021, with a total score of 602 points. An average of 10.45 geography questions were tested each year, with an average score of about 54.73 points. Among them, the minimum total score of questions appeared in 2013, with 22 points and five questions. The maximum total score, appeared in 2019, was 100 points, and the number of questions peaked at 20. Changes of question quantity and scores could be roughly divided into two stages: (1) From 2011 to 2019, the total quantity and score of questions showed a fluctuating uptrend, with an increasing rate of 1.65 questions and 7.8 points per year, respectively. The total score increased from 22 points to 100 points, increasing about 355%. (2) From 2019 to 2021, the total quantity and score of questions showed a downward trend, with the total score dropping from 100 points to 60 points and the number of questions dropping from 20 to 11, but the total quantity and score of questions were still high.
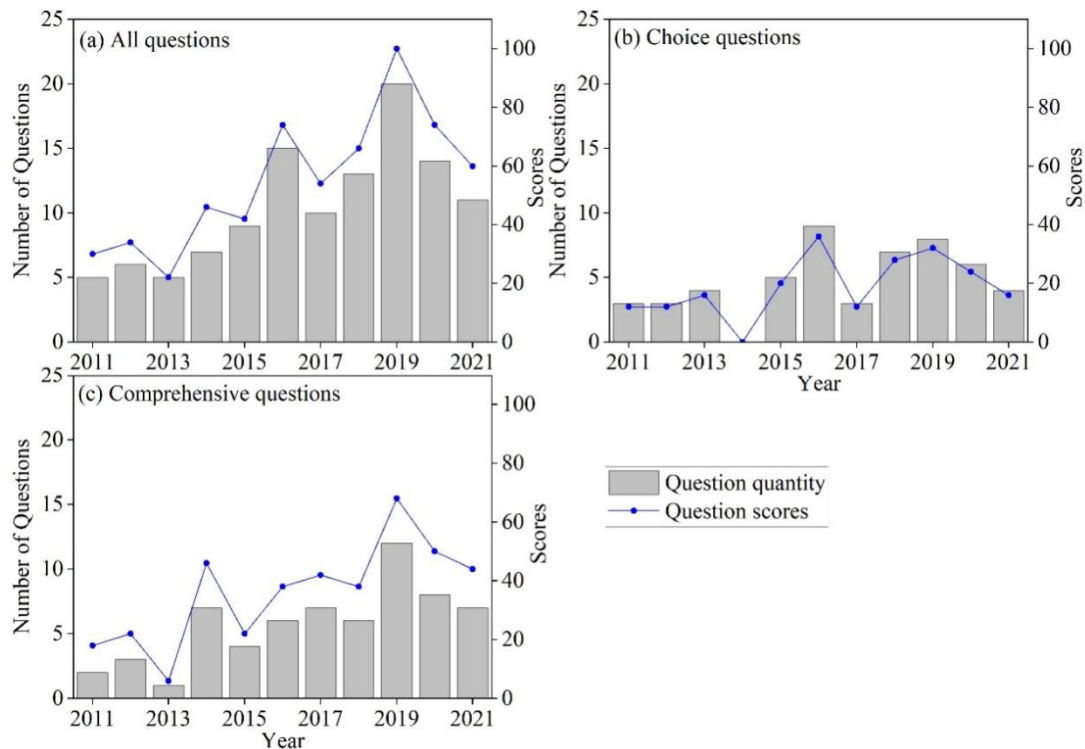
Figure 1. Question quantity and scores in NEPCS involving location factors during 2011-2021, (a) all questions, (b) choice questions, and (c) comprehensive questions.

In terms of choice questions, figure 1b showed that there were 52 choice questions of location factor during 2011-2021, with a total score of 208 points, and an average of 4.73 choice questions were tested each year, with an average score of about 18.91 points. The maximum total score of choice questions appeared in 2016, with a total quantity and score of 9 questions and 36 points, respectively, while there were no questions of location factors in the form of choice questions in 2014. Overall, the choice question quantity and score of the location factors showed trends of "slowly rising - rapidly rising - declining - rising – declining", with the turning points of 2013/2014, 2016, 2017, and 2019, respectively.

As shown in figure 1c, there were 63 comprehensive questions of location factor during 2011-2021, with a total score of 394 points. An average of 5.73 comprehensive questions were tested each year, with an average score of about 35.82 points. The minimum and maximum total scores of comprehensive questions appeared in 2013 and 2019, with a total score of 3 points and 68 points, respectively. Overall, the quantity and score of comprehensive questions increased at a rate of 0.72 questions and 3.92 points per year, respectively.

In general, the number of choice questions and comprehensive questions accounted for 45.2% and 54.8%, respectively, and their scores accounted for 34.6% and 65.4%, respectively, indicating that the NUEECU tended to examine the knowledge of location factors in the form of comprehensive questions.

3.2. Topics analysis

Location factors mainly involve agriculture, industry, and service industry. Figure 2 shows the changes in the question quantity and scores of the three topics in the geography examination papers of the NUEECU during 2011-2021. Figure 2d showed that question quantity of agricultural, industrial, and service industrial location factors accounted for 40.0%, 51.3%, and 8.7%, respectively. Their scores accounted for 38.9%, 52.1%, and 9.0%, respectively. It indicated that the NUEECU mainly examined industrial and agricultural location factors, which was consistent with the dominant position of industry and agriculture in China's national economy [9].
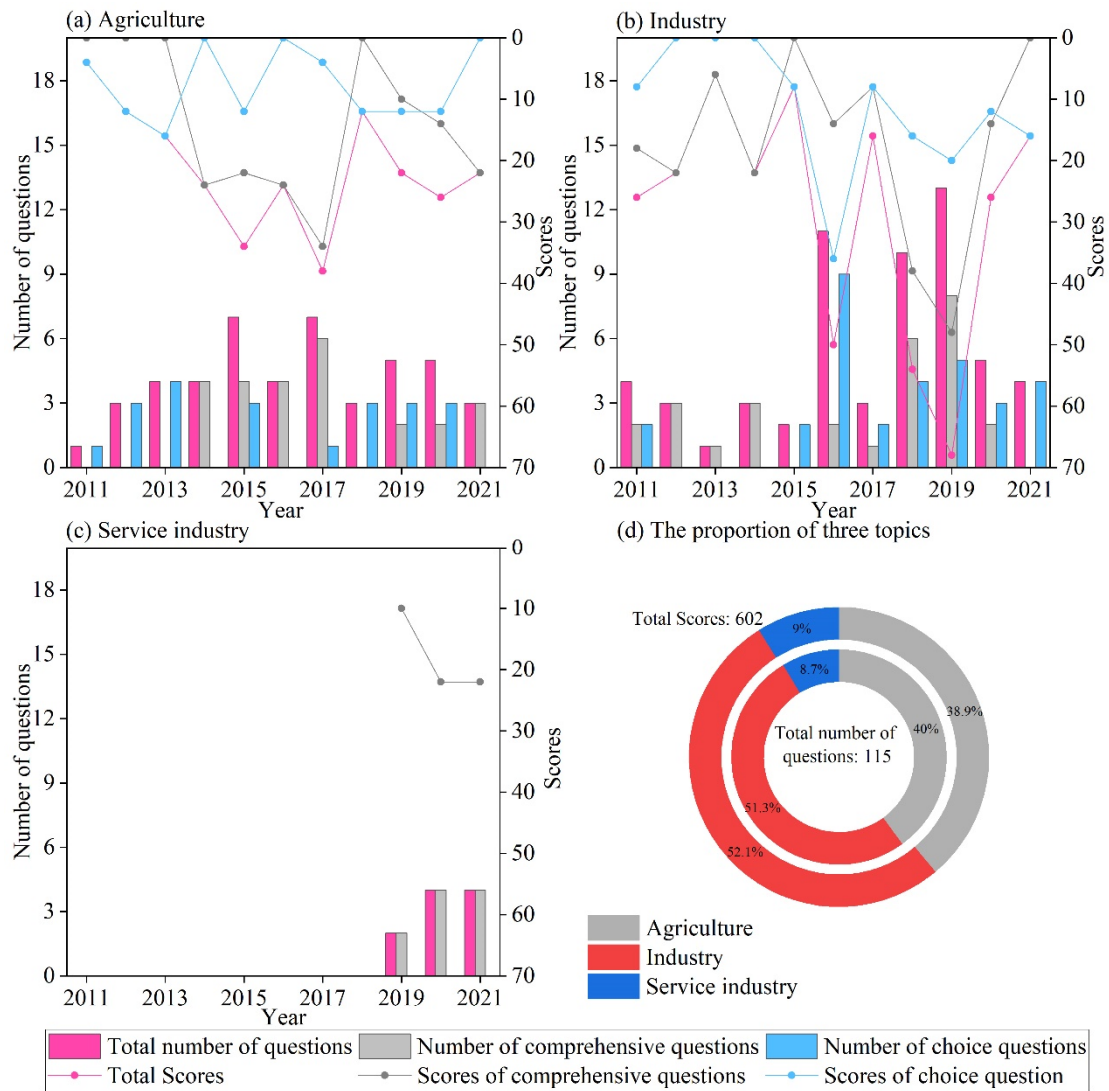
Figure 2. Question quantity and scores of each topic in NEPCS during 2011-2021, (a) agriculture, (b) industry, (c) services industry, and (d) doughnut plot of the proportion of three topics.

The quantity and scores of questions of agricultural location factors showed trends of first increasing and then decreasing, and the peak value mainly occurred in 2015 and 2017, respectively. It should be pointed out that they were only in the form of choice questions before 2013, then they were in the form of both choice questions and comprehensive questions, and the latter was the primary type (Figure 2a). There existed trends of decreasing-increasing-decreasing for the quantity and scores of questions of industrial location factors, and the peak value occurred in 2016, 2018, and 2019, respectively. In addition, the geography examination papers of industrial location factors were mainly presented in the form of comprehensive questions before 2014, and then the number of choice questions increased, while the scores were still dominated by comprehensive questions (Figure 2b). Generally, it was apparent that the changing trend of questions of industrial and agricultural location factors was

complementary. Questions of service industrial location factors occurred only after 2019 in the form of comprehensive questions (Figure 2c), which was related to economic development and industrial transformation and upgrading [9, 10], and reflected the principle that geography education kept pace with The Times and economic development.

3.3. Form of material presentation of geography questions

Geography has comprehensive and regional features [11]. And pictures can intuitively reflect the geography processes, principles, and characteristics of a particular area [12]. Therefore, geography examination papers of the NUEECU mainly exhibit their materials in the form of a combination of text description and pictures, which can build real situations to guide the solution of practical problems.
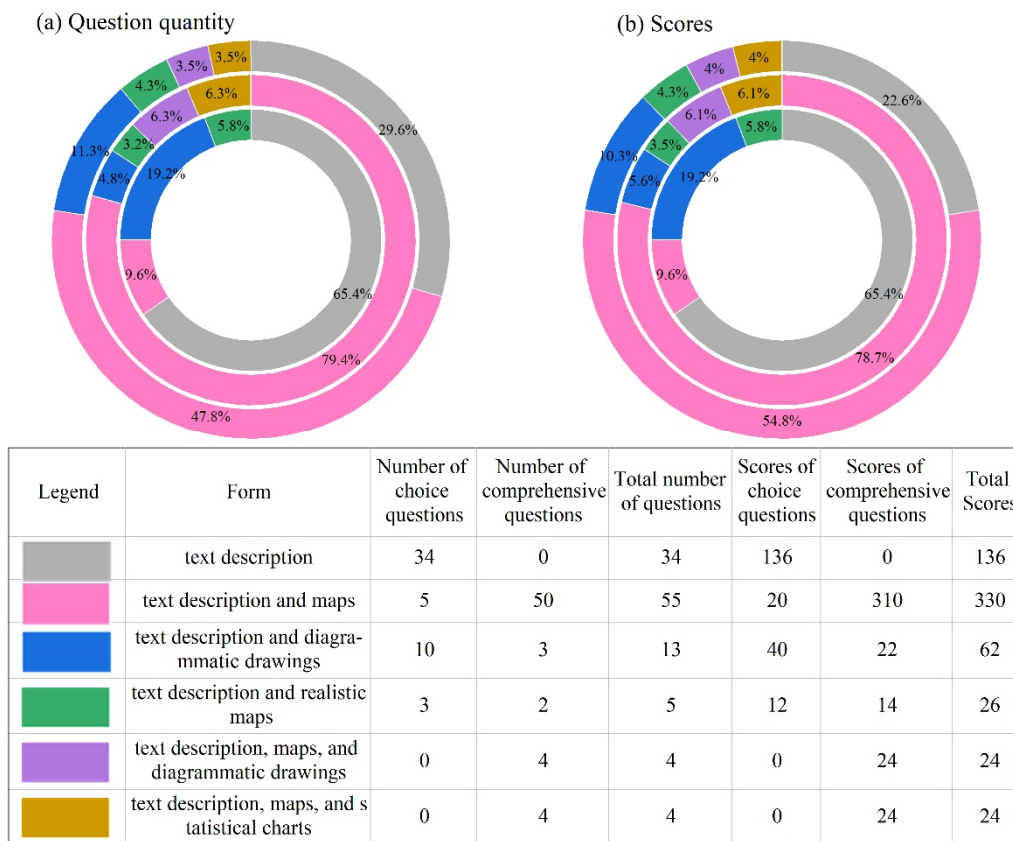
Figure 3. Form of material presentation of geography questions in examination papers during 2011-2021, (a) question quantity and (b) scores. Note: The doughnut plot respectively represents choice questions, comprehensive questions, and total questions from inside to outside, and the table shows the quantity and score of questions in different material presentation forms.

The form of the material presentation includes text description, maps, realistic maps, diagrammatic drawings, statistical charts, etc., as shown in figure 3. In general, all questions of location factors contained text materials, and all comprehensive questions were shown in the form of a combination of text description and pictures. The questions, only presented in the form of text description, appeared in choice questions, with 34 questions, accounting for 29.6%, and the proportion of their scores was 22.6%. Most questions were presented in the form of a combination of text description and maps, with 55 questions, accounting for 47.8%, and the proportion of their scores was 54.8%. There were 13 questions, whose materials were shown in the form of a combination of text description and diagrammatic drawings, accounting for 11.30%, while there were few questions whose materials were presented in the form of a combination of text description and realistic maps, a combination of text description, maps, and diagrammatic drawings, and a combination of text description, maps, and statistical charts, respectively, accounting for less than 5% of the questions quantity and scores.

3.4. Questioning mode of geography questions

Questioning is a pivotal link to realize the function

of examination. It is paid attention for geography questions to the exploration and innovative design of the thought and mode of questioning. Therefore, clarifying the characteristics of the questioning mode is conducive to efficiently and accurately answering geography questions. Figure 4 shows the proportion of different questioning modes of geography questions in examination papers from 2011 to 2021. The questioning modes were divided into eight types: reasons, characteristics, comparison, purpose, measures, summary, influence, and advantages and disadvantages, respectively. Among them, the mode of reasons appeared the highest frequency in questioning, with 38 questions, accounting for 33.0%. Questioning modes of summary and advantages and disadvantages accounted for 20.0% and 18.3%, respectively. The question quantity of comparison, influence, and purpose ranged from 8 to 11, accounting for 9.6%, 8.7%, and 7.0%, respectively. In addition, the questioning mode about characteristics and measures accounted for the smallest proportion of 1.7%, respectively. In brief, geography questions paid more attention to exploring the reasons of geography phenomena, the comparative characteristics of advantages and disadvantages of geography phenomena or processes, and to focusing on the examination of students' ability to summarize.
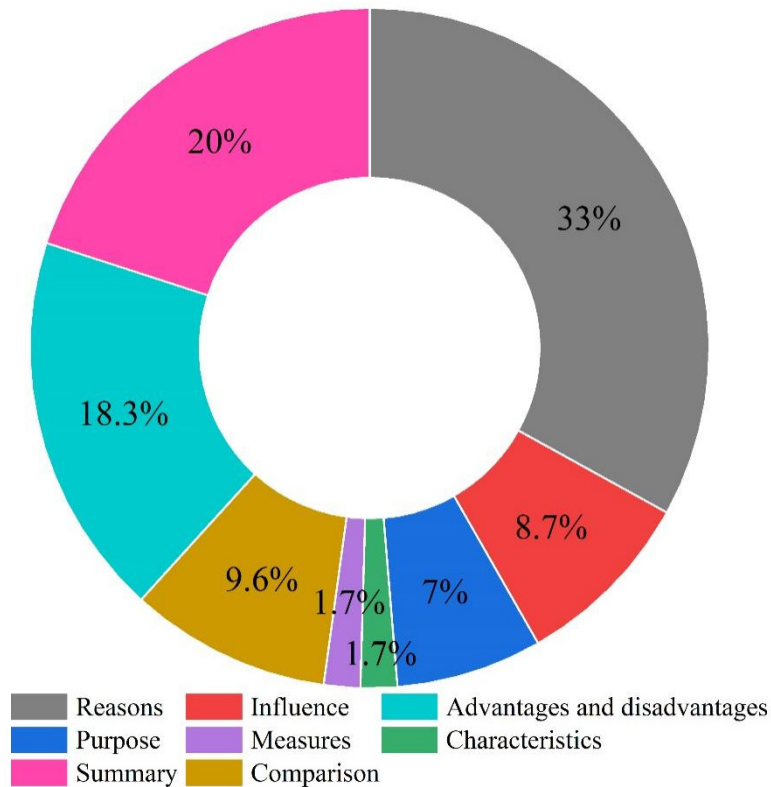
Figure 4. The proportion of different questioning modes of geography questions in examination papers.

4. Conclusions

Based on geography questions of the comprehensive ability test of liberal arts in the NUEECU, this paper analysed and discussed the characteristics of questions of location factors during 2011-2021, to clarify their importance and trend in geography examination. The conclusions are as follows:

(1) From 2011 to 2021, there were 115 questions of location factors in the examination papers, with a total score of 602 points. And it showed a trend of rising first and then declining, with 2019 as the turning point. Choice questions showed a trend of "slowly rising - fast rising - decreasing - rising – decreasing", while comprehensive questions mainly showed an upward trend. In addition, the quantity and score of comprehensive questions were higher than that of choice questions.

(2) The proportion of question quantity (scores) of agricultural, industrial, and service industrial location factors were 40.0% (38.9%), 51.3% (52.1%), and 8.7% (9.0%), respectively. The time distribution of questions of agricultural and industrial location factors was complementary. The proportion of questions related to service industrial location factors was small, but it might increase in the future with economic development and industrial transformation and upgrading.

(3) In aspect of form of material presentation, the geography examination papers of NUEECU mainly adopted the form of a combination of text description and pictures. Among them, a combination of text description and maps was the most presentation form, whose question quantity and score accounted for 47.8% and 54.8%, respectively. Pure text description appeared only in choice questions, while a combination of text description and pictures was the main display form of comprehensive questions' materials.

(4) The main questioning modes were reasons, summary, and advantages and disadvantages, accounting for 33%, 20.0%, and 18.3%, respectively. Therefore, in daily teaching and learning, teachers and students should pay more attention to the knowledge of reasons of geographical phenomena, and the advantages and disadvantages of geographical phenomena or processes. Students' ability to summarize should also be strengthened.

Overall, on the one hand, our research can provide references for teachers to carry out teaching activities effectively and improve the efficiency of geography classroom teaching. On the other hand, it can provide the scientific basis for helping students flexibly carry out autonomous learning activities and exploring convenient geography learning methods for the NUEECU.

Acknowledgments

References

[1] National Education Examinations Authority, (2020) Scientifically Develop the Items to Promote Quality Education: Analysis of the Geography Test of 2020 Gaokao. China Examinations, 340: 57-61. (in Chinese with English abstract)

[2] Li, J., Xue, E., (2021) Education Policy in Chinese High Schools. Exploring Education Policy in a Globalized World: Concepts, Contexts, and Practices. Springer, Singapore.

[3] Zhang, Y. (2012) Discussions on the Geography Test Design in the College Entrance Examination under the New Curriculum Standard. Curriculum, Teaching Material and Method, 32(11): 100-104. (in Chinese with English abstract)

[4] Jiang, Y., Xiao, Q., (2012) The Value Orientation of Geography Examination Questions in the College Entrance Examination under the Concept of New Curriculum Standard. Teaching Reference of Middle School Geography, 10: 14-15. (in Chinese)

[5] Guo, F., Duan, Y., He, S., Gong, Q., Yao, Z. (2022) Analysis of Sustainable Development Questions of College Entrance Examination Geography Papers in China: 2010-2020. Sustainability, 14(3): 1526.

[6] Ministry of Education of the People's Republic of China, (2020) Geography Curriculum Standard for Senior High School (2017 Edition Revised in 2020). Beijing: People's Education Press. (in Chinese)

[7] Zhu, S., (2013) Embodiments and implementation of strategic studies on the concept of "Learning the geography that is useful for life". Shijiazhuang: Hebei Normal University. (in Chinese with English abstract)

[8] Larson, R., Farber, B., (2020) Elementary Statistics: Picturing the World, 7th Edition. Person.

[9] Han, M., (2021) Research on the Transformation and Upgrading of China's Economic Industrial Structure under the Background of High-quality Development--Based on the Perspective of Marxist Political Economy. Changchun: Jilin University. (in Chinese with English abstract)

[10] Jing, S., Xia, Y., Cheng, H., (2015) Coupling Path of China's Modern Service Industry and Agriculture Based on Improved Entropy Method. Asian Agricultural Research, 7(12): 1-8.

[11] Sachs, J.D., (2019) The Ages of Globalization: Geography, Technology, and Institutions. New York: Columbia University Press.

[12] Demiralp, N., (2007) Geography Education Through Maps. Bulgarian Journal of Science and Education Policy, 1(1): 93-102.