

# Construction and application of a comprehensive evaluation system for study travel destination-illustrated by the example of the Shuping Danxia scenic spot in Lanzhou

Zhongping Zhang<sup>1,\*</sup>, Huan Zou<sup>1</sup>, Yue Zeng<sup>2</sup>, Jialin Hu<sup>1</sup>, and Xiaohui Rao<sup>1</sup>

<sup>1</sup>College of Geography and Environmental Science, Northwest Normal University, Lanzhou, China

<sup>2</sup>College of Foreign Languages and Literature, Northwest Normal University, Lanzhou, China

**Abstract.** Study travel is an educational activity integrating experiential education and study travel. The choice of destination affects the courses design and development of the activities. This paper conducts a systematic research on the evaluation of study travel destinations with the help of Delphi method and hierarchical analysis, selecting four factors such as facility services, education and teaching, geographic environment and resource characteristics to establish a comprehensive evaluation system of study travel destination. The paper takes the Shuping Danxia scenic spot in Lanzhou as an example. The evaluation results show that the development time of Shuping Danxia Scenic Spot is relatively short, and the study travel and course design have not yet been systemized. It is still necessary to further optimize the overall resource quality with local characteristic culture. The evaluation system established in this paper not only helps study travel educators to choose suitable destinations, but also helps to provide references for potential scenic spots to be built as study travel destinations.

## 1 Introduction

Study travel is an educational tourism activity, which takes primary and secondary school students as the main object. It can take collective travel life as the carrier, improves students' quality as the teaching purpose, and relies on social resources such as tourist attractions to carry out experiential education and study travel. It is an effective way to implement the fundamental task of cultivating virtuous people and promoting practical education. According to the types of study travel products, it can be divided into two types: touring study type and camping study type. Before 2017, study travel carried out mostly intellectual and popular science activities. In 2017, the Ministry of Education announced the first batch of "National scientific research and practice education base or camp for primary and secondary school students ". Then all localities strengthened the construction of study travel bases, most of the courses are camping study style in fixed places, with the

---

\* Corresponding author: [cheung.cav@gmail.com](mailto:cheung.cav@gmail.com)

themes of natural viewing, science popularization, investigation, inspirational expansion and cultural recreation to cultivate students' comprehensive quality.

The core of study travel, which is different from leisure tourism, lies in teaching, making study travel an experiential education<sup>[1]</sup>. Jhon Dewey's view on experiential education is that "students seem to learn better when they are doing something"<sup>[2]</sup>. The research of destination should not only focus on the construction, but also its' resources evaluation, to combine the resources with designed courses. The selection of destinations is a very important part of what students can learn during the travel. Based on the review of previous literature, Wu Jing<sup>[3]</sup>, Zhong Zhiping<sup>[4]</sup>, Zhao Zhifeng<sup>[5]</sup> and other researchers expounded the construction and operation of study travel bases from multiple perspectives and with various methods; Liu Chang<sup>[6]</sup>, Mei Yuqing<sup>[7]</sup>, Luo Yanpin<sup>[8]</sup>, Chen Dongjun<sup>[9]</sup> and other researchers set up evaluation systems from different aspects of study travel destination and provide theoretical references for this paper. However, few researchers have established a comprehensive evaluation index system of study travel destinations. In reality, educators need to choose a systematic evaluation system to measure whether the destination is consistent with education purpose. Therefore, it is urgent to establish a comprehensive evaluation index system for the study travel destination, which helps them analyze the adaptability of the target scenic spots and education purpose, and provide a theoretical basis for the study travel destination selection.

Based on this, this paper constructs a comprehensive evaluation system of study travel destination on the basis of existing research. On the one hand, it provides an evaluation basis for educators, and digs up education resources; on the other hand, with the epidemic situation affecting tourism, many scenic spots are expected to be built into study travel bases. For scenic spots still not being study travel bases, few people pay attention to them because of the lack of competitive advantages. By constructing the comprehensive evaluation index of study travel destination, the author provides new ideas and references for the construction of study travel scenic spots, so as to improve the service level and regional popularity. This paper attempts to establish a new methodology to determine the indicators that are of great significance to the study travel destination. Determining the evaluation indicators with multiple perspectives is beneficial to the construction of study travel destination and the formulation of local policies. Specifically, this is the superposition of deficient elements of existing research, which is not limited to the perspective of pedagogy and geography.

## **2 Construction of a comprehensive evaluation system for study travel destination**

### **2.1 Index construction system**

According to the definition of study travel, the evaluation of study travel destination needs to be considered with the subject, carrier, course design and teaching objective, tourism attraction, location condition, tourism service, etc. Among them, due to the great differences in the definition of "tourism attraction" in academia, this paper adopts MacCannell's definition, from the identification of tourist, scenic spot and sign<sup>[10]</sup> three perspectives, integrate the educational, experiential, thematic, practical principles and factors of study travel product to build a comprehensive evaluation model of study travel destination (Figure 1).

Based on the above indicators and academic research, a comprehensive evaluation system for study travel destination (Table 1) has been preliminarily constructed, which includes four criterion layers (B1-B4) of study travel facilities and services, educational and

teaching, geographical environment, resource characteristics, and 20 index factors (C1-C20) such as regional difference, traffic accessibility and educational attributes.



**Fig. 1.** Comprehensive evaluation model of study travel destination.

## 2.2 Index implication

The facilities and services (B1) of study travel destination are an important part of study travel activities<sup>[5]</sup>. The perfection of destination facilities and service level greatly affect the selection of the destination. In the process of study travel, in the face of students with different knowledge basis and age, the study travel instructor's explanation of scenic spots cannot be equivalent to traditional tourism reception. It requires the destination to have a certain study travel construction and the ability to train professionals. In terms of student safety, the perfection of facilities, traffic accessibility, and the allocation of emergency personnel are the bottom line for the selection of destination. To sum up, index C1-C5 are used to evaluate the facilities and services of study travel destination.

**Table 1.** Comprehensive evaluation system of study travel destination.

Criterion layer	Index layer	Index explanation
Facilities and services B1	Professional science popularization ability C1	Educational background, working hours and training hours
	Business qualification and base level C2	Operating duration, the number of students receiving study travel, the number of corresponding qualification certificates and the issuing units
	Perfection of science educational facilities C3	The number of signs, hardware development of local resources such as landform and cultural characteristics
	Safety guarantee conditions C4	The number of medical institutions, the number of security personnel, danger signs
	Traffic accessibility C5	Accessibility index, dispersion index, road network density
Education and teaching B2	Subjects (students) C6	Student grade, the number of middle school students at the destination, and the number of middle school students in the surrounding area
	Organizers (teachers and experts) C7	Knowledge base, presentation skill, work attitude
	Learning experience C8	Dining conditions, accommodation, entertainment venues
	Course design C9	Adaptability of matching with teaching objectives, educational purpose, content, and implementation plan
	Educational value attributes C10	Science popularization value, emotional attitude, ability, professional knowledge
Geographical environment B3	Financial expenditure on educational C11	The investment expenditure of regional educational, the ratio of local educational budget to actual local GDP per year
	Educational level C12	Gross enrollment rate in high school, consolidation rate of compulsory educational, ratio of students in regular high school and secondary vocational educational
	Cultural heritage C13	The number and distribution density of cultural heritages, dominance of non-heritage resources
	Regional variation C14	Intra-annual variation in climatic characteristics (temperature extremes, humidity extremes), vegetation cover, land use
	Environmental capacity C15	Tourism psychological capacity, tourism resource capacity, tourism ecological capacity, tourism economic development capacity, tourism regional capacity
Resource characteristic B4	Resource diversity C16	The total supply of regional tourism resources, resource scale, resource level and national cultural abundance
	Resource typicality C17	Rare and unique degree, research degree, science popularization degree
	Resource combination C18	The index of sustainable and effective supply of regional tourism resources, the index of scale development realization, the number of resource types and the concentration of resource unit
	Resource reputation C19	Total number of visitors, social platform satisfaction evaluation, popularity
	Resource-friendly period C20	Moisture-temperature index, the comfort period intersection of wind efficiency index

Educational and teaching (B2), as the core of study travel, is also a complex activity involving multiple elements such as pedagogy, subject knowledge, student knowledge, management, and evaluation<sup>[11]</sup>. The number of students and teachers that can be received and the ability to reflect the educational level of the destination, the experience gained by the students in the study travel destination, the course design they feel, and the educational value attributes contained in them are difficult to quantify, but they are also the important index of study travel educational. The degree of adaptability of course design, teaching objectives and themes is affected by the resource attributes of the study travel destination,

and science popularization helps to improve students' knowledge structure. To sum up, index C6-C10 are used to evaluate the educational and teaching ability of study travel destination.

Study travel destination need to be based on the geographical environment (B3). Among many natural and humanity elements, environmental capacity affects the intensity of local development and utilization, and differences in geographical environment provide the basis for the diversification of study travel destination<sup>[12]</sup>. The educational level, financial level and cultural heritage have a great influence on the development of study travel destination. In order to reduce the influence of regional differences, the average is not used for evaluation when the specific implication of index is selected. In summary, the geographical environment of study travel destination is evaluated by index C11-C15.

The resource characteristics (B4) index selection of study travel destination is relatively mature, and the implication of this part is improved by referring to previous research, and evaluation indexes such as eWOM and travel-friendly period are introduced. Empirical evidence shows that online users' praise significantly affects the image of a destination, and the destination in the travel-friendly period will gain more passengers during this period. To sum up, index C16-C20 are used to evaluate the resource characteristics of study travel destination. Since there are evaluation indexes of multiple quantitative methods in the comprehensive evaluation system of study travel destination, the implication of each evaluation index is explained by the measurement.

### 2.3 Data source and weight determination

The research data mainly comes from on-the-spot investigations, questionnaires, statistical annuals and government work reports. According to the scope of the corresponding client, SPSS software was used to perform path analysis, to preprocess the data, then to examine the direct and indirect effects of research variables that have certain effects on other dependent variables. Based on the above preprocessed data, the Delphi method and the Analytic Hierarchy Process (AHP) method are used to assign the index weights<sup>[13-14]</sup>. After the comprehensive evaluation system of study travel destination was constructed, the Delphi method was used to consult 9 experts from geography, tourism management, pedagogy, and middle school geography teachers to evaluate each index, then adjust the index with lower comprehensive scores. The weight of each index was then determined using AHP, which helped to integrate the collective ideas of each questionnaire to compare each factor and geometric mean. The specific operation steps are as follows:

According to the principle of analytic hierarchy process, 13 middle school geography teachers and practitioners in related fields are invited to construct judgment matrix  $A = (a_{ij})_{n \times n}$ , using the 1-9 ratio scale according to the index importance calibration value, and then carry out the relative comparison calculation between the two indexes ( Table 2);

**Table 2.** Meaning of 1-9 scales.

Proportional scale	Implication
1	Two elements have the same importance
3	The former is slightly more important than the latter
5	The former is significantly more important than the latter
7	The former is strongly more important than the latter
9	The former is critically more important than the latter
2,4,6,8	The intermediate value of the above adjacent judgments

(2) Take the value obtained from the above calculation, and use the geometric mean method to calculate the weight vector. The calculation formula is as follows:

$$w_i = \frac{(\prod_{j=1}^n a_{ij})^{\frac{1}{n}}}{\sum_{i=1}^n (\prod_{j=1}^n a_{ij})^{\frac{1}{n}}}, \quad i = 1, 2, \dots, n \tag{1}$$

The elements in matrix A are multiplied row by row to obtain a new set of vectors, the components of the new vector are subjected to the n-th power operation, and then the obtained vector is normalized to obtain a single-level sorting calculation result;

$$CI = \frac{\lambda_{max} - n}{n - 1} \quad CR = \frac{CI}{RI} \tag{2}$$

(3) Due to the difference and complexity of the research area, as well as the diversity of individual knowledge and possible one-sidedness and other factors, the consistency test of each index factor needs to be carried out after the single-level ranking calculation. The formula for calculating the performance index CI and the consistency ratio CR is as follows:

After inspection, it can be seen that the calculation consistency ratio of each judgment matrix CR is less than 0.10, which meets the consistency requirements;

(4) Carry out the total ranking calculation of the hierarchy, and finally obtain the weight value of each evaluation index of the study travel travel destination (Table 3).

**Table 3.** Total weights and ranking results.

Target Layer A	Criterion layer B		Index layer C		Total Weight	Total Ranking
	Index	Index relative to A weight	Sub-index	Index relative to B weight		
Comprehensive evaluation of study travel destination	Facilities and Services B1	0.1188	Professional science popularization ability C1	0.2723	0.0324	8
			Business qualification and base level C2	0.0541	0.0064	16
			Perfection of science educational facilities C3	0.1221	0.0145	13
			Safety guarantee conditions C4	0.4974	0.0591	6
			Traffic accessibility C5	0.0541	0.0064	16
	Education and teaching B2	0.5967	Subjects (students) C6	0.0509	0.0304	11
			Organizers (teachers and experts) C7	0.2485	0.1483	2
			Learning experience C8	0.1135	0.0677	5
			Course design C9	0.5352	0.3193	1
			Educational value attribute C10	0.0519	0.0310	9
	Geographic environment B3	0.0554	Financial expenditure on education C11	0.0790	0.0044	18
			Educational level C12	0.2393	0.0132	14
			Cultural heritage C13	0.5574	0.0309	10
			Regional difference degree C14	0.0644	0.0036	19
			Environmental capacity C15	0.0599	0.0033	20
	Resource characteristics B4	0.2292	Resource variation C16	0.4251	0.0974	3
			Resource typicality C17	0.2993	0.0686	4
			Resource combination C18	0.1613	0.0370	7
			Resource reputation C19	0.0750	0.0172	12
			Resource travel-friendly period C20	0.0392	0.0090	15

## 2.4 Destination evaluation model

According to the application scenarios of the evaluation system and the obtained index weights, the weighted summation multi-index comprehensive evaluation model is selected and substituted into the comprehensive evaluation model of available study travel destinations. The calculation formula is as follows:

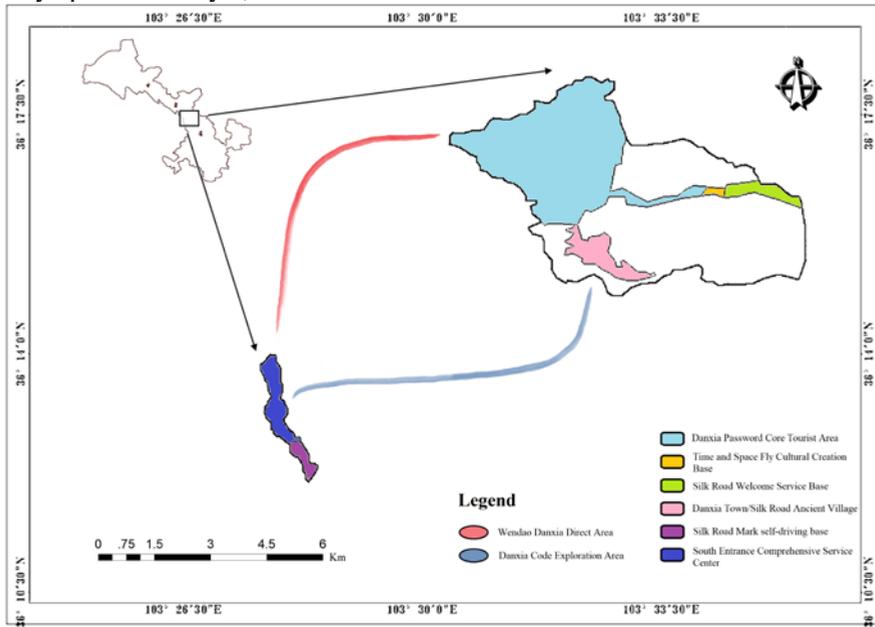
$$E = \sum_{i=1}^n P_i W_i \quad (i = 1, 2, \dots, n) \quad (3)$$

In the formula, E is the comprehensive evaluation value of the study travel destination, n is the number of evaluation index, Pi is the weight value of the i-th evaluation index, and Wi is the score of the i-th evaluation index.

## 3 Case study

### 3.1 Overview of research area

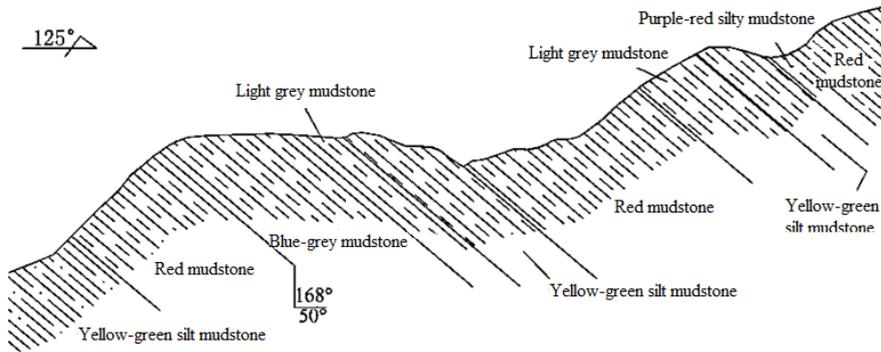
This study takes the Shuping Danxia Scenic Spot in Lanzhou City as an example for case study. Yongdeng Danxia landform area is located 40 kilometers northwest of the main urban area of Lanzhou City, Gansu Province, in the Xianshui River Basin and its adjacent areas of Yongdeng county. The Shuping Danxia Scenic Spot is located on the northeast side of the Yongdeng Danxia landform area and is connected to the 201 provincial road. The planned area of Shuping Danxia Geopark is 407 square kilometers, the core area is 86 square kilometers, and the core tour area of the first phase is 27.2 square kilometers. The first phase of the scenic spot project (Figure 2) was approved by the municipal government for the overall planning in 2017. The construction started in April 2019, and the park officially opened on May 1, 2021.



**Fig. 2.** The location of the first phase of the Lanzhou Shuping Danxia Geopark.



**Fig. 3.** Shuping Danxia Colorful Mound.



**Fig. 4.** Measured profile of Xinghua Village (according to Gui Xiangang, 2019).

There are many tourism attractions near Lanzhou, such as Xinglong Mountain National Nature Reserve, Qinwangchuan National Wetland Park, Shifogou National Forest Park, etc. Among them, Shuping Danxia is located in the tributary of the Yellow River and belongs to Sandstone Danxia is mainly composed of piedmont and fluvial facies clastic deposits<sup>[15]</sup>. The local red clastic rock layers are widely distributed and the lithology is loose, but due to the thick layer of loess covering and the protection of the gravel layer, the vertical joints of the red layer are obviously developed. As the environment changes, the gravel layer is gradually destroyed, the collapse is significant, the erosion is intensified, and it becomes a general red hill with gentle slope (Figure 3,4)<sup>[16-17]</sup>. The main planning of the scenic spot is based on the spatial structure of "three cores, two belts, six districts and three halls", the author visited the scenic spot in October 2020 and May 2022. The local geological and geomorphological resources are extremely rich, and the teaching content of the geomorphic unit of the geography course in ordinary high school and compulsory educational has a strong correlation and is highly matched. In addition, the development of the scenic spot is relatively complete. The core tourist area is connected with viewing platforms, the research center and Danxia Geological Museum can be completed in 2022.

### 3.2 Data compilation

The research data were collected through on-the-spot investigations and questionnaires, Lanzhou City and Yongdeng county statistical annuals, and government work reports. Data processing includes grading the subjective evaluation index, involving expert evaluation, scenic spot staff oral and on-the-spot investigations, using the semantic difference method to summarize and analyze. The objective evaluation index is obtained from the analysis and processing of relevant statistical data. According to the specific factors of each evaluation index, use Excel to preprocess the relevant data, and use ArcGIS and other software to

comprehensively analyze the regional DEM and remote sensing data to obtain specific values, and divide it into five grades: excellent, good, average, failed, worse (Table 4). The evaluation results are completed by the aforementioned 9 experts, scholars and middle school teachers who have determined the evaluation index, and the average value is finally taken as the score of each index.

### **3.3 Application of evaluation system**

According to the index scores of the evaluation system and the calculation formula of the above destination evaluation model, the comprehensive score of Shuping Danxia scenic spot as a study travel destination is 3.9856, which has great development potential. In terms of study travel facilities and services, Shuping Danxia scenic spot has been officially opened for more than one year. At present, it has been rated as a 3A scenic spot and a national research base. There are 45 study travel tutors with bachelor degree or above. At present, there are more than 40 danger signs in phase I of the scenic spot, and the study travel signs are being listed one after another. There is a medical room in the scenic spot, and the number of security personnel is about 43. The construction of safety guarantee facilities and medical services needs to be further improved. The construction of the scenic spot integrates the local characteristic manhole culture and consists of nine characteristic units. There is a Shuimo Danxia geological exhibition hall. The study travel exhibition hall is expected to be completed in July 2022. On May 8, 2022, the scenic spot was visited by the study travel team for the first time, with more than 100 students and teachers. Although the Danxia landform area where Shuping Danxia scenic spot is located was discovered earlier and not far from the urban area, there are few studies on the scenic spot due to poor road repair, narrow lanes and low degree of public transport construction.

In terms of study travel, the scenic spot decomposes the course content into understanding the Danxia landform geological tectonic changes, and analyzes the vegetation difference between the shady and sunny slopes of the Shuping Danxia. The study travel courses are designed to focus on science popularization, so as to cultivate students' ability of pragmatism. However, the number of permanent residents in the surrounding area of the scenic spot is small, the number of primary and secondary school students and the local financial level are difficult to support the development of study travel resources in the scenic spot. In addition, due to local factors such as climate, the diversity of vegetation types in the scenic spot is not high, and the land utilization rate is low. The maximum instantaneous capacity of the scenic spot is 12,000 person-times. Although the gross enrollment rate of local high schools in Yongdeng county can reach 98.57%, the proportion of local education investment and actual expenditure to GDP needs to be increased urgently. How to give full play to the attraction of this scenic spot to primary and secondary school students in surrounding cities requires a deeper discussion. The rich local cultural heritage and 48 municipal-level intangible cultural heritage resources are expected to become an important cornerstone for the development of study travel education.

The Shuping Danxia Scenic Spot will receive an average of 1,000 people a day during Labor Day in 2022, and tourists on travel and social platforms have achieved excellent levels of satisfaction with the scenic spot. In addition, the region is less affected by the monsoon climate, and the comfort period of the temperature and humidity index and wind efficiency index intersects from May to September each year. This period covers Labor Day, Dragon Boat Festival and summer vacations for primary and secondary school students, so that the travel suitable time limit is short. Compared with other regions in China, the local latitude and altitude zonality have strong comparative advantages in terms of resource richness and combination. With the expansion of the scale of publicity for this

place, the popularity of the scenic spot and the increase in the number of tourists are just around the corner.

**Table 4.** Data sources and processing.

Criterion layer	Index layer	Data sources	Grade score
Facilities and services B1	Professional science popularization ability C1	On-the-spot investigation, scenic spot staff oral narration	Good
	Business qualification and base level C2	scenic spot staff oral narration	Average
	Perfection of science educational facilities C3	On-the-spot investigation, scenic spot staff oral narration	Average
	Safety guarantee conditions C4	On-the-spot investigation, scenic spot staff oral narration	Good
	Traffic accessibility C5	On-the-spot investigation, related data, data analysis	Failed
Education and teaching B2	Subjects (students) C6	Experts and middle school teachers' evaluation	Good
	Organizers(teachers and experts) C7	Experts and middle school teachers' evaluation	Good
	Study travel experience C8	Students' evaluation after study travel	Excellent
	Course design C9	Experts and middle school teachers' evaluation	Good
	Educational value attributes C10	Student evaluation, experts and middle school teachers' evaluation	Excellent
Geographic environment B3	Financial expenditure on education C11	Lanzhou city and Yongdeng county statistical annuls	Failed
	Educational Level C12	On-the-spot investigation, Yongdeng county statistical communique	Average
	Cultural heritage C13	On-the-spot investigation, Yongdeng county financial media report	Good
	Regional variation C14	Relevant data data analysis, Yongdeng county Shuping town and key area control detailed planning	Average
	Environmental capacity C15	Related data data analysis, scenic spot staff oral narration	Good
Resource characteristics B4	Resource diversity C16	On-the-spot investigation, related data, data analysis, experts' evaluation	Good
	Resource typicality C17	Related data, data analysis, experts' evaluation	Good
	Resource combination C18	Related data, data analysis, experts' evaluation	Average
	Resource reputation C19	Questionnaire survey, tourist online evaluation	Average
	Resource travel-friendly period C20	Experts' evaluation, relevant data, data analysis	Good

## 4 Conclusion and prospect

Reviewing the development trend of study travel in recent years, the social attention of study travel continues to increase. Up to now, primary and secondary schools and the administrative departments in charge of education lack scientific planning of study travel routes, lack of understanding of study travel destinations, and do not determine the theme in the activities according to regional characteristics and school segment characteristics. In addition, due to the impact of the current epidemic and the international situation, which urges the increase of short-distance study travel to a certain extent. This paper makes a comprehensive evaluation of study travel destinations from the perspective of the main participants of study travel, so as to provide reference and basis for the construction and selection of study travel destinations to a certain extent. From the perspective of subject and

different levels of course construction, this paper emphasizes multi-dimensional comprehensive analysis, which has strong practical value.

At present, Gansu Province actively advocates the development of study travel. It is foreseeable that with the cooperation of various parties such as policy guarantees and corporate norms, study travel will be further enhanced and developed. For Shuping Danxia Scenic Spot, based on natural resource and historical culture relics, making full use of study and travel products created by research bases makes it a new highlight of Yongdeng county tourism. However, the scenic base conditions and social support are not as high as they should be, and there is a lack of overall design from the mode to the implementation and to comprehensive evaluation. Based on the above case study, Shuping Danxia Scenic Area still needs to: I. Improve relevant systems and mechanisms, and strengthen the supervision and protection of research travel; II. Accelerate the development of high-quality study travel products in line with market demand; III. attach importance to the cultivation of professional talents and promote the high-quality development of study travel; IV. increase market promotion and promotion to enhance the reputation of local research and study travel; V. pay attention to the creation of a model leading image, and form a representative and exemplary study travel destination.

## References

1. W.F. Jin, CCNU (2019)
2. J. Dewey, *Experience and education*, **3**, 64-67(1986)
3. J. Wu, MB **27**, 182-183 (2016)
4. Z.P. Zhong, T.Q. Liu, SSiH **06**, 147-153 (2018)
5. Z.F. Zhao, R.Q. Guo, BER **15**, 17-19 (2019)
6. C. Liu, YUFE (2018)
7. Y.Q. Mei, XTU (2018)
8. Y.P. Luo, W.Q. Liao, TG **02**, 89-94 (2020)
9. D.J. Chen, L. S. Zhong, L.L. Xiao, AES **20**, 7222-7230 (2020)
10. D. MacCannell, *The tourist: A new theory of the leisure class* (2013)
11. Y. Zhang, SoE **15**, 27-29 (2020)
12. Z.F. Zhao, R.Q. Guo, CETE **03**,65-66 (2019)
13. W.J. Zheng, J.H. Tu, TRoMSG **04**, 68-71 (2022)
14. M. Jin, SXU (2020)
15. Z.J. Chen, K.G. Huang, W.Z. Dai, EG **14**, 159-166 (1994)
16. K.G. Huang, B. Zhang, JoNWNUN(NS) **04**, 57-61 (1994)
17. X.G. Gui, LZU (2019)