Evaluation of urban and rural planning teaching outcomes based on structural equation modeling

Fei Su[1], Yitian zhao[1],*

[1]College of Tourism and Urban-Rural Planning, Zhejiang Gongshang University, Hangzhou, 310018, Zhejiang

*Corresponding author:Zyt673696790@163.com

Abstract. This study constructs a satisfaction evaluation system for urban and rural planning teaching based on Bloom's classification of educational objectives, and concludes the following: (1) there is no significant effect of learning outcomes in the cognitive domain on student satisfaction, and there is a significant effect of learning outcomes in the affective and spiritual domains on student satisfaction; (2) urban and rural planning teaching should pay more attention to the cultivation of students' practical abilities, offer courses for students with different needs, and improve students' independent thinking ability and innovation consciousness.

Keywords : OBE education concept; Bloom's classification of educational objectives; structural equation model

1   Introduction

The report of the 20th Party Congress pointed out that building a regional economic layout and territorial spatial system with complementary advantages and high-quality development. Since China has entered the era of territorial spatial planning, the demand for traditional planning preparation has decreased, and the in-depth participation of multiple disciplines in territorial spatial planning has become the trend today[1]. Urban and rural planning as an important segment of territorial spatial planning, there is a close logical connection between them. The reconstruction of the territorial spatial planning system is a major driving force for the transformation of the urban and rural planning discipline and an effective means to promote the improvement of the urban and rural planning teaching system[2].

Outcome-based Education (OBE) was proposed by Sparty in 1981, and its main concept is to focus explicitly on all elements of the educational system that can ensure the completion of students' studies[3]. This educational philosophy focuses on the "student outcomes" orientation, shifting the center of teaching from "teaching" to "learning" and from single teacher instruction to student competency development[4]. This study investigates the evaluation system of student satisfaction in urban and rural planning teaching under the OBE model through structural equation modeling with

student satisfaction as the final goal to improve the lack of objective evaluation system of OBE teaching in colleges and universities, and to provide reference for urban and rural planning discipline teaching.

2   Research Methodology

2.1   Model Construction

Construction of student satisfaction evaluation index system

In the 1950s era American educational psychologists such as Bloom divided the cognitive domain into six levels of knowledge, comprehension, application, analysis, synthesis, and evaluation, and in 2001 Anderson et al. changed it to six levels of memory, comprehension, application, analysis, evaluation, and creation, dividing knowledge into factual, conceptual, procedural, and metacognitive knowledge[5]. The affective domain is concerned with the range of students' mental activities such as interests, attitudes, values and emotional intentions during the teaching and learning process and is divided into five levels: acceptance, response, value assessment, organization and personalization. The motor skills domain is divided into six categories: perception, readiness, guided response, mechanical practice, complex response, and creativity[6]. In recent years, some scholars have proposed a new domain of educational goals: the spiritual domain. Malser expanded the spiritual domain of student learning goals to focus on students' inner well-being, proposing five dimensions of respect, valuing, connection, empowerment, and self-actualization[7].

In this study, three major domains of Bloom's educational goals, cognitive, affective, and spiritual, were selected as the dimensions of students' expected learning outcomes attainment; six sub-dimensions of memory, comprehension, application, analysis and evaluation, and creativity were retained in the cognitive domain; acceptance, response, assessment, and organization were selected and combined into two sub-dimensions of acceptance and response and assessment and organization in the affective domain; and two sub-dimensions of esteem and valuing were selected in the spiritual domain.

This paper constructs a model of students' expected learning outcomes achievement through Bloom's educational objectives and constructs a student satisfaction evaluation index system with student satisfaction as the landing point of the study, which is used to guide the design of teaching objectives, teaching strategies and assessment, as seen in the Table 1.

Table 1. Student satisfaction evaluation index system (Self-drawn by author)

	Evaluation Dimension	Specific indicators		Indicator Description
		Name	Code	
Student satisfaction evalua-	Cognitive field	Memory	R1	Extraction of relevant knowledge from long term memory
		Understanding	R2	Extract knowledge from verbal, written and other instructional information

tion index system		Applications	R3	Exercise a procedure in a given situation
		Analysis	R4	Decompose the material into its components, determine the interrelationship between the components and with the whole
		Evaluation	R5	Judgment based on principles and criteria
		Creation	R6	Reorganize elements to form a new structure
	Emotional field	Acceptance and Response	Q1	Learners are receptive to learning and actively engaged in it
		Evaluation and Organization	Q2	The learner can relate the value of knowledge and compare, describe, and elaborate on what has been learned
	Spiritual field	Respect	J1	Beyond narrow self-interest
		recognition	J2	Respect for the importance, value, and usefulness of qualities related to human spiritual well-being
	Student Satisfaction		M	Students' satisfaction with expected learning outcomes

Structural equation modeling

Structural equation modeling is a multivariate statistical method based on covariance matrix, which includes multivariate analytical equations with statistical methods such as factor analysis and path analysis[8]. Based on structural equation modeling, a predetermined model of the factors influencing student satisfaction is constructed, containing a total of four variables and four latent variables, and the latent variables include "cognitive domain", "affective domain", "spiritual domain The latent variables include "cognitive domain", "affective domain", "spiritual domain", and "student satisfaction". Each latent variable corresponds to its observed variable, i.e., the factors affecting each latent variable, and the arrows in the path diagram indicate the interrelationships among the latent variables as shown in Figure 1.
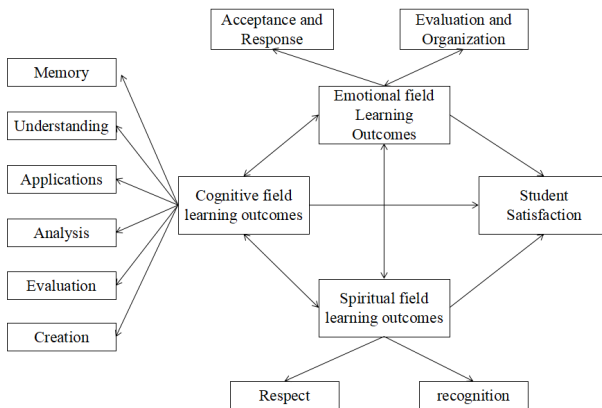

Fig. 1. Outcome-oriented factor model of student satisfaction (Self-drawn by author)

2.2   Model testing and results

Path analysis

Path analysis was conducted on the data that passed the reliability and validity analysis, and by testing the model path coefficients, we were able to test whether the path coefficients were significant and determine the effect of the exogenous potential variables (independent variables) on the endogenous potential variables (dependent variables) directly. According to the significance test results of the model path coefficients and the standardized path coefficient values shown in Table 2, it can be learned that: the spiritual domain and the emotional domain have a significant positive influence on satisfaction, and the cognitive domain does not have an influence on satisfaction; there is a significant positive covariance correlation between the cognitive domain, the emotional domain and the spiritual domain. In the subsequent revision of the model, the non-significant paths were considered to be removed.

Table 2. Summary table of model regression coefficients (Self-drawn by author)

X		Y	Non-normalized path coefficient	SE	z(CR value)	p	Standardized path coefficient
Spiritual field	$\longrightarrow$	Satisfaction	0.63	0.131	4.807	0	0.563
Emotional field	$\longrightarrow$	Satisfaction	0.374	0.168	2.232	0.026	0.334
Cognitive field	$\longrightarrow$	Satisfaction	-0.201	0.166	-1.211	0.226	-0.144
Emotional field	$\longleftrightarrow$	Spiritual field	0.421	0.079	5.352	0	0.77
Cognitive field	$\longleftrightarrow$	Spiritual field	0.26	0.058	4.472	0	0.592
Cognitive field	$\longleftrightarrow$	Emotional field	0.34	0.063	5.379	0	0.776

Note: $\rightarrow$ indicates the path influence relationship

Modification of structural equation model

Model correction is mainly done by adding or deleting parameter variables by referring to the model correction index values and t-values, or by increasing the correlation between variables to improve the model fit[8]. Considering that the predefined model variables studied in the theoretical sense do not need to be added or deleted, therefore, to improve the model fit, the correlation was established by increasing the path with the largest MI value with reference to the correction index MI value, and if the chi-square value ($\chi 2$) decreased significantly after adding the corresponding path and the theoretical explanation was reasonable, it indicated that the correction was meaningful, the results of the modified model adaptation are shown in Table 3. The new structural equation model was obtained by eliminating the insignificant paths, and the path diagram of the standardized parameter estimation of the modified model

reflects the causal relationship between the latent and observed variables as shown in Figure 2.

Table 3. Modified model fitness analysis (Self-drawn by author)

Commonly used indicators	χ2	df	p	Cardinality freedom ratioχ2/df	GFI	RMSEA	RMR	CFI	NFI	NNFI
Judgment Criteria	-	-	>0.05	<3	>0.9	<0.10	<0.05	>0.9	>0.9	>0.9
Value	112.852	36	0	3.135	0.81	0.168	0.168	0.909	0.874	0.861
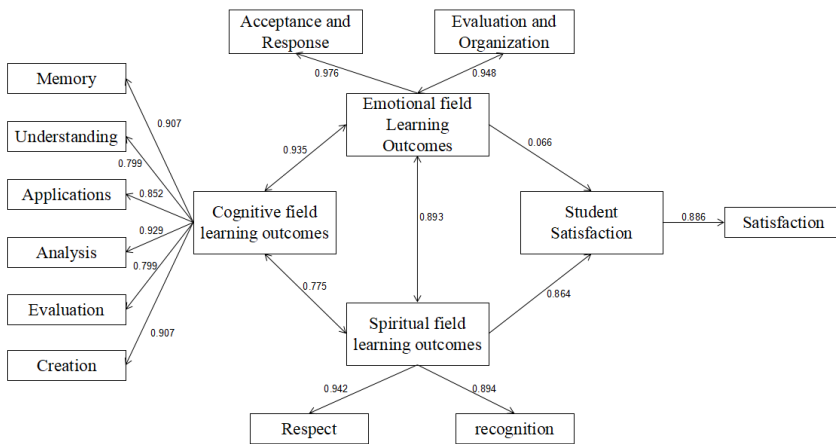
Fig. 2. Modified structural equation model diagram (Self-drawn by author)

3   Study results and discussion

3.1   Study results

This study constructs an OBE education evaluation model based on Bloom's Classification of Educational Objectives to accept the results of urban and rural planning teaching under the OBE education concept while providing a new perspective for future related research. In this study, the following conclusions were drawn in terms of scale construction, curriculum and teaching characteristics, student learning characteristics, and factors influencing student satisfaction:

(1) According to the path analysis, we can learn that the learning outcomes in the cognitive domain do not have a significant impact on student satisfaction, which indicates that students pay more attention to the overall atmosphere in the learning process, and a good learning atmosphere can lead to more efficient learning, and it is necessary for teachers, as students' guides, to guide students into a good learning state, to develop corresponding teaching programs with students' final learning out-

comes, and to avoid the traditional teaching model that cannot (2) The teaching of urban and rural planning in our school should be based on the following principles

(2) The teaching of urban and rural planning in our school focuses on the combination of theory and practice, through which students can effectively master the basic theory of urban and rural planning and be able to skillfully apply relevant tools, specifically in the use of CAD, ArcGis and other software. In terms of teaching evaluation, the course focuses on examining students' mastery of urban and rural planning theories, specifically in terms of, examining students' drafting, cooperating to complete planning schemes, and having the ability to think independently about planning schemes to propose planning concepts. However, due to the limitation of training direction, the school curriculum still lacks the cultivation of students' ability of quick problem, and most of the students demanded the school to provide more quick problem courses, and some of them requested to add courses related to the history of urban and rural planning. Most of the students have the habit of independent study after class, mainly because of the needs of the examination, and fewer students study independently because of their interests. Therefore, teachers should pay attention to the cultivation of students' interests, guide students to apply course-related knowledge in their daily learning life, and improve their commitment to learning.

3.2   Discussion

As a highly practical and comprehensive social discipline, urban and rural planning, by embedding various forms of research activities to enhance students' interest in learning, is conducive to improving students' comprehensive quality and ability and cultivating comprehensive territorial and spatial planning talents[9]. Targeted training by grade level focuses on the transmission of theoretical knowledge and practical skills for lower grade students, cultivates the ability to cooperate in completing planning solutions, and trains independent thinking about planning concepts and extrapolating solutions. For the senior students, they are trained to write essays and hand-drawing ability, to meet the needs of the examination population, to exercise the ability to combine theory and practice, and to encourage them to join project research. As the final destination of the planning population, we should vigorously develop the advantages of our own geography background, integrate the knowledge of land planning on the basis of adhering to the inner development laws of urban and rural planning, explore the design of multi-level planning courses with disciplinary characteristics, and establish a more inclusive disciplinary evaluation and certification system.

This study is based on structural equation modeling to evaluate urban and rural planning teaching based on OBE concept, but the data collected are mainly from students' self-assessment, lacking teachers' rating of students' learning outcomes, and the subsequent study will consider the integrated teacher and student evaluation results for analysis.

Funding

References

1. Chen H S, Chen H, Xiao Y, et al. Reflections on the construction of urban and rural planning disciplines in the era of territorial spatial planning [J]. Planner. 2020, 36(07): 22-26.
2. Zhou Q. H., Yang X. D.. Reflections on urban and rural planning education for territorial spatial planning[J]. Planner. 2020, 36(07): 27-32.
3. Chunliu, Guo Yueqin, Wang Yan. Reform and practice of OBE-based postgraduate academic English teaching mode in the context of "double first-class": the case of China University of Petroleum (East China)[J]. Degree and Postgraduate Education. 2021(05): 42-47.
4. Wang L, Zhou DY. Research on teaching Civics based on the OBE concept in the curriculum - taking accounting as an example [J]. Finance and Accounting Newsletter. 2022(14): 24-27.
5. Guo Fangtao. Flaws and considerations of the practical maintenance of Bloom's educational goal classification model[J]. Education Review. 2022(09): 13-19.
6. Guo Teng. Inheritance and development - the similarities and differences between the three-dimensional objectives of the new curriculum and Bloom's educational objectives [J]. China Modern Education Equipment. 2007(04): 135-136.
7. Lafever M. Switching from Bloom to the Medicine Wheel: creating learning outcomes that support Indigenous ways of knowing in post-secondary education[J]. Intercultural education (London, England), 27(2016), 5,p.409-424.
8. Luo LJ, Ding C.Y., Wang J.Y., et al. Evaluation of old-age suitability of urban park green spaces based on structural equation modeling [J]. Science, Technology and Engineering. 2022, 22(23): 10230-10237.
9. Zhong Sheng. Urban and rural planning education:theory and practice of research-based teaching[J]. Journal of Urban Planning,2018(01):107-113.
   DOI:10.16361/j.upf.201801013.