The Influence of Deep Approach to Learning on Undergraduate Students' Vocational Interest Type --Based on the survey from "211 Project" Universities

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Abstract. With the survey from 1310 undergraduates in seven "211 project" universities, this paper exams Chinese undergraduate students' vocational interest (VI) and their characteristics of deep approach to learning (DAL), and analyzes the relationship between VI type and characteristics of DAL. The research indicates that: (1) the main VI of undergraduates can be categorized into three types, they are artistic type, social type and research type; (2) the characteristics for different types vary from the perspective of sex, major, birthplace, and the level of income; (3) DAL has positive prediction on VI type of the undergraduate students. This paper also provides three suggestions for the development of undergraduates' cultivation, they are: (1) breaking through the limitation among different disciplines，and encouraging the diversification of VI for undergraduates; (2) optimizing the evaluation for undergraduates，and enhancing the level of undergraduates' DAL; (3) emphasizing the interaction between VI and DAL，and promoting the level of learning performance and employability.

Introduction

According to educational psychologist Biggs, learning methods, developed based on interaction between individual characteristics and external environment, occupies the central position in students' learning process and will further affect their learning quality and final results [1]. Specifically, students' learning methods can be divided into shallow learning and deep approach to learning (or deep learning，DAL) and the latter is an effective educational practice. Students using DAL will extract independent meaning from the learning materials, integrating or relating them with their previous experience [2]. Nelson Laird believes that DAL consists of reflective and integrative learning and higher-order learning. The former refers to the method in which students associate their own understanding and experience with the learning content at hand, or their study with the surroundings to re-examine their existing beliefs and views on certain issues through eyes of others; the latter emphasizes that students' learning is not simply about rote memorization of facts, but more involved in complex cognitive tasks such as application, analysis, judgment, and integration of knowledge [3].

A large number of empirical studies have validated that the DAL will exert positive effect on students' cognitive and emotional development, innovation ability as well as their academic achievement [4-6]. Over the past 10 years, researchers began shifting their attention to the relationship between students' VI and deep approach to learning. Holland's classical theory of VI is so applied into university students' study and their disciplinary background by many researchers holding that students' VI can be classified into six types, namely conventional type, pragmatic type, research type, entrepreneurial type, social type and artistic type [7]. Using simplified version of self-exploration scale and learning process questionnaires, Zhang conducted a survey among college students in a normal university in China's mainland. By this he leads to explore the relationship between six VI types and college students learning methods with the findings showing that VI and students' learning process is interactive [8].

"211 Project" universities are bases of talents education, knowledge production and way-out

resolutions to major issues concerning national and local economic construction and social development. Although many “211 Project” universities are either research oriented or teaching-research oriented, a few of them are under criticism for their inefficient training systems, scarcity of critical spirit or even deviation from educational purposes [9]. In particular to the training process, students’ complaints such as “neither to get a full understanding of what they learned nor flexibly applied what they learned to solve real problems” are prominent in certain disciplines [10]. Other studies also find that college students have low degree of identification with their majors and their vocational interests have a poor match with their majors [11]. VI and DAL are critical to students' growth and development. Since this has been repeatedly proved by academic researches and the practical situation, then how about college students in China's “211 Project” universities? What are the characteristics of their VI and DAL? This research intends to answer these questions based on an empirical study, and tries to encourage students to adopt DAL and thus provides support to guide their vocational planning.

Research Design

Sample selection. Samples are chosen from seven “211 Project” universities, namely Beihang University, Beijing Institute of Technology, East China Normal University, Shandong University, Central University of Finance and Economics, China Ocean University and China University of Geo-sciences (Wuhan). Only sophomores and juniors are selected because in comparison to freshman, they have been accustomed to life and learning in college. With the deepening of their academic learning, they become more rational in terms of VI and vocational development. Seniors are graduated students to be, so most of them are occupied with internship, job seeking or other activities. Courses become less and their VIs and learning methods will be impacted by more uncontrollable factors, therefore, they are excluded in this study. With the selection of random sampling, 1440 questionnaires are issued in the mentioned above seven universities, with 1368 questionnaires retrieved and retrieving rate of 95%. After strict selection, 1310 valid questionnaires are finally obtained, with the effective rate of 95.8 %. The demographic data is shown in Table 1.

Table 1: Demographic Statistics of Samples

variables	category	subjects	ratio（%）
gender	male	599	45.7
	female	711	54.3
major	arts	594	45.3
	science and engineering	716	54.7
Students’ source place	urban	521	39.8
	town	393	30.0
	rural	396	30.2
income	⩽1000RMB	129	9.8
	1001-4000RMB	403	30.8
	4001-7000RMB	364	27.9
	7001-10000RMB	222	16.9
	⩾10001RMB	192	14.6

Measuring Tools. The scale of VI type complied by Liu Yongxian is used in this study to evaluate students’ VI type. Based on Holland’s vocational personality types, the scale is composed by 6 sub-scales and they are conventional type, pragmatic type, research type, entrepreneurial type, social type and artistic type with each sub-scales of five items and 30 items in total[7]. Scoring method used by the present study is the original Likert scoring method at 5 levels with assignments from low to high. In this study, the internal consistency coefficient for the scale is 0.787, and it ranges from 0.660 to 0.830 for 6 sub-scales.

Deep approach to learning scale by Rocconi is used in this study to measure students’ deep

approach to learning. The scale has a total of 11 items in two sub-scales—reflective and integrative learning (7 items) as well as higher-order learning (4 items) respectively[2]. Two sub-scales are using the original Like a scoring method at 4 levels with assignments from low to high. In the study, the internal consistency coefficient for the whole scale is 0.764 and it ranges from 0.696 to 0.677 for 2 sub-scales .

The Results and Analysis

The Characteristics of College Students' VI Type and DAL. F-test is used to examine the scores obtained by the tested students in the six VI types. It shows that the difference among students' scores in these interest types is remarkable. Their average score in each type and the examination are shown in Table 2.

Table 2: Different Scoring in VI Types

VI type	*M*±*SD*	*F*
Pragmatic type	2.92±0.94	77.132***
Artistic type	3.30±0.74	
Conventional type	2.81±0.78	
Entrepreneurial type	3.00±0.77	
Research type	3.11±0.73	
Social type	3.25±0.73	

Note：$^{*}p<0.05$；$^{**}p<0.01$；$^{***}p<0.001$ Same below

Multiple comparison by LSD reveals that there is little gap in students' scores in artistic type and social type, and students' score in these two types are significantly higher than the other four; scores in research type are lower than that in the artistic type and social type but much higher than that in the other three types of VI; in conventional type, students' scores are lower than that in the other five, so they are the lowest. Through analysis, we find that artistic type, social type and research type are university students' main types of vocational interests.

Analysis on Correlation between VI and DAL. The analysis on correlation between students' vocational interest and deep learning demonstrates that artistic type, conventional type, entrepreneurial type, research type and social type have a significant positive correlation with reflective and integrative learning. Conventional type, entrepreneurial type, research type and social type positively correlate to higher-order learning. While the correlative relationship between pragmatic type and two types of deep learning is not significant. The concrete results are shown in table3.

Table 3: Analysis on the Relationship between Students' VI and DAL

Variables	Pragmatic type	Artistic type	Conventional type	Entrepreneurial type	Research type	Social type
Reflective and integrative learning	0.052	0.083**	0.094**	0.195***	0.254***	0.146***
higher-order learning	-0.020	0.060*	0.128***	0.113***	0.177***	0.110***

The Predictive Role of DAL in VI. Multiple regression analysis is also carried out to examine the predictive role of DAL for VI type. After controlling the effects of demographic variables, the results show that reflective and integrative learning have a significant positive effect on all types of VI, particularly in research and social types. Higher-order learning can effectively predict conventional type and research type. Specific regression coefficient values are shown in table4.

Table 4: Multiple Regression Analysis on Predictive Role of DAL on VI

	Variables and steps	Predict pragmatic type		Predict artistic type		Predict Conventional type		Predict entrepreneurial type		Predict Research type		Predict Social type	
		Beta	ΔR^2	*Beta*	ΔR^2	*Beta*	ΔR^2	*Beta*	ΔR^2	*Beta*	ΔR^2	*Beta*	ΔR^2
	gender	-0.283***		0.288***		0.161***		-0.005		-0.082		0.022	
	grade	-0.009		0.028		0.063**		0.009		-0.037		-0.022	
1	major	-0.190***	0.156	0.077**	0.110	0.120***	0.062	0.107***	0.014	-0.036	0.012	0.010	0.003
	hometown	0.031		-0.051		0.061*		0.021		0.002		0.044	
	income	0.025		0.015		-0.011		0.052		-0.001		0.012	
	Reflective and integrative	0.064*		0.08**		0.065**		0.180***		0.225***		0.132***	
2	learning		0.159		0.115		0.078		0.049		0.086		0.029
	higher-order learning	-0.010		-0.002		0.084**		0.022		0.091**		0.054	

Discussion

The Characteristics of Students' VI Type. In the present study, higher scores in artistic and social types may be attributed to the common features of “post 90s”: open social atmosphere leads to their emphasis on individuality and self-expression. They are dynamic and active with vision more wide open, judgment more independent and criteria more diversified. They respect diversity of interests and establish their interpersonal communication in social nature more early. These are beneficial to the development of VI of artistic and social type. Furthermore, according to Holland’s VI theory, a socialization effect [12] will be exerted on students by their academic environment, in other words, a disciplinary environment focusing on research will have its students’ research capacity and VI of research type raised correspondingly. Most of the seven “211 Project” universities in this study are research oriented, therefore, to a certain extent the academic environment and atmosphere shaped by these universities will fall into research type. Students’ research interest will be developed and strengthened correspondingly in such environment.

Male college students score significantly higher than female students in pragmatic and research types, but much lower in artistic and general types, which is consistent with the findings of researches abroad and at home [7] [13].The reason may lie in differences in temperament, personality, and the way of thinking adopted by different genders. At the same time, different social expectations for both genders also become an important factor for their gap in the vocational interest [14]. Engineering students score significantly higher than liberal arts students in pragmatic and research types, but much lower in artistic, conventional and entrepreneurial types, which is consistent with the definition of vocational interest of different types and typical vocational interest. In two types of higher-order learning, college students of liberal arts score significantly higher than those of science and engineering, and the results are consistent with the research by Jin Zhaozong. It may be due to discontinuity and non-logical characteristics of liberal arts knowledge and divergent thinking and extensive knowledge of liberal arts students.

Relationship of Students' VI Type and Their DAL. The correlation and regression analysis of the relationship between students' VI type and DAL reveals that reflective and integrative learning and higher-order learning have a significant positive effect on vocational interest of research type. As mentioned above, a typical characteristic of deep learning is that the individual will link his own understanding, experience with practice as well as the surroundings and is able to view his existing beliefs and views in the sand-points of someone else'. He places emphasis on complicated cognitive tasks such as application, analysis, judgment and integration of knowledge. Deep learning is involved in the individual’s inner motivation. In order to satisfy his curiosity, the individual will try every possible way to solve the problem. Students using deep learning are more willing to learn highly structured knowledge and materials, individuals of research type are usually scientific oriented to discover new facts or propose new theories or analyze and interpret data. They tend to work independently. They are strong in analysis as well as generalization and competent in math and science. They value scientific research and dislike mechanical repetition. These are important features of individuals of research type.

Conclusions and Recommendations

The following conclusions are arrived at by this study: artistic type, social type and research type are main interest types for “211 Project” students; performance will differ significantly in pragmatic type, research type, artistic type and conventional type among students of different genders; major differences will lead to variations in pragmatic type, research type, artistic type, conventional type, entrepreneurial type and reflective as well as integrative learning; students from different places vary their performance in artistic type, reflective and integrative learning; students from families with income disparities will differ in entrepreneurial type and 2 types of deep learning; interest type, in particular research type and 2 types of deep learning have a significant predictive relations with each other. Accordingly, the present study recommends the following:

Breaking Disciplinary Boundaries, and Fostering Students’ Development of Diversified VI. In General, most students in science and engineering universities fall into artistic type, social type and research type. With the rapid development of China's economy and society, the trend of multidisciplinary, interdisciplinary or transdisciplinary integration is emerging with the increasing demand for compound talents. Therefore, the traditional perception of “professional counterparts” will be difficult to meet the new requirements of the times. As a result, we should not only focus on guiding university students to develop interests with artistic, social and research type characteristics, but also pay enough attention to other types of VI based on the features of students’ VI. Among them, an important means is to make full use of the “socialization” effect of disciplinary environment on the students to break the limitations of traditional disciplines, expand the breadth of disciplines and deepen the corresponding teaching content.

Optimizing the Evaluation Methods, and Enhancing the level of students’ DAL. The study shows that students from these seven “211 Project” universities are at the middle level in terms of their deep learning. A similar national survey on US college students [2] makes it easier to find the great gap in performance between college students in China and those in United States with regard to deep learning. The in-depth interview with the tested subjects reveals that in daily learning, passing the examination is the main learning and teaching goals both for students and teachers. Transfer of learning and problems resolving are not the focus of training, which also expose that to a certain degree, shallow learning still occupies the dominant position in the current teaching process in universities. According to educational psychologists, the evaluation of students will have a huge impact on their way of learning [1]. Therefore, to enhance students' deep learning level, we should focus on the following three aspects: first, we should guide students to develop their critical thinking as well as the ability to form new ideas or new understanding in the course of study; second, the ability to link self-learning with social phenomena, practical problems as well as existing experience and knowledge; third, the ability to integrate knowledge of different courses from different perspectives.

Emphasizing the Interaction between VI and DAL, and Promoting Common Elevation of Students' Academic Performance and Employability. There is a positive prediction between students' VI and deep learning, and change in one variable will cause variation in another. In terms of students’ learning level, deep learning, as an important means to enhance students’ learning performance has been supported by numerous empirical studies [15]. During the teaching process, proceeding from the students' VI, we can enhance the level of students' DAL by strengthening their VI, in particular research type as well as creating favorable academic environment. This is on the one hand con-formative to the development and orientation of universities themselves, on the other hand able to stimulate students’ intrinsic motivation for DAL by creating a favorable external academic atmosphere. In terms of the students' personal vocational development, sectors responsible for vocational guidance and relevant management personnel should take students’ learning methods as an important starting point to guide them in developing VI and vocational planning. For example, according to the findings of this study, if college students desire to engage in a stable, orderly and targeted tasks or activities (conventional type) in the future, then we should encourage them to make full use of higher-order learning; or if their vocational ambition is to engage in creative and independent thinking (research type), then higher-order learning as well as

reflective and integrative learning methods should both be encouraged.

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