Research on Influencing Factors of Deep Learning Among High School Students in Western China

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Abstract: To clarify the influential factors of deep learning among high school students in Western China and promote the high-quality development of basic education in Western China. This study adopts the method of stratified sampling and selects high school students at different altitudes as the research object. The results show that the high school students in the western region are in the middle level of deep learning. There are differences in gender, altitude, and other variables in deep learning of students. A multiple linear regression model was used to analyze the influencing factors of deep learning for high school students in Western China. The model shows that teacher-student interaction and teacher feedback are the main influencing factors of deep learning for high school students in Western China, while parental support and classroom teaching are secondary factors.

Keywords: Western region; High school students deep learning; Influencing factors

1. Introduction

Due to its special natural conditions and geographical environment, the development of social economy and education in the western region is relatively slow. In 2015, The State Council issued the Decision of The State Council on Accelerating the Development of Education for Ethnic Minorities, which proposed that "the state's education funds should be tilted to border provinces and regions, and the education funds of border provinces and regions should be tilted to border counties, and the equalization of basic public education services in ethnic minority areas should be accelerated" [1]. Education in the western region has experienced a glorious course from scratch, from weak to strong. Exploring the influencing factors of deep learning of basic education students in Western China in the new era will be beneficial to promoting the high-quality development of basic education in ethnic minority areas.

1.1. Deep learning-related research

According to the academic consensus, deep learning in the field of education can be traced back to the

1970s, when the famous Swedish psychologists Frans Marton and Roger Saljo found and first proposed two kinds of learning processes, Deep Level Processing and Surface Level, through an educational experimental study, and defined and discussed the relationship between learning process and learning result [2]. Domestic research on deep learning started relatively late. Li proposed that deep learning refers to the process in which individual students transfer and transform knowledge, then make corresponding decisions and solve problems, and meaningful learning based on understanding [3]. Some scholars have made a comprehensive analysis of the influencing factors of deep learning from different perspectives. Postareff *et al.* explored the factors that lead to the change of deep learning styles in different learning environments through interviews [4]. Sadeghi *et al.* investigated and studied the influencing factors of deep learning and found that the influencing factors of students entering deep learning include characteristics of teachers and students, learning goals, learning strategies, and academic activities [5]. In China, Wang *et al.* explored the influence of behavioral input on the deep learning effect and conducted empirical measurements of the deep learning effect, and the results showed that behavioral input had a significant promoting effect on deep learning [6]. Li *et al.* adopted linear regression analysis and research methods to find that the influencing factors of deep learning in flipped classroom teaching mode include communication, knowledge processing level, and reflection evaluation level [7].

To sum up, this study mainly focuses on the following three questions: First, what is the level of deep learning of high school students in Western China? Second, are there differences in the variables of gender, grade, altitude, class leader, and parents' education level in deep learning of high school students in Western China? Third, what are the influencing factors of deep learning among high school students in Western China? What are the differences among the influencing factors?

2. Research tools and methods

2.1. Research objects

In this study, a stratified sampling method was adopted to randomly select 5 high schools in 3 cities of Z, L, and N for a paper questionnaire survey. A total of 700 questionnaires were distributed and 662 valid questionnaires were recovered, with a valid questionnaire rate of 94.6%.

2.2. Measurement tools

2.2.1. Deep learning level scale

The deep learning questionnaire of primary and secondary school students compiled by Zheng is adopted [8], which includes deep involvement (vitality, dedication, concentration), deep cognition (association strategy, integration strategy, reflection strategy), and deep result (understanding and transfer ability, critical and creative ability, collaboration and communication ability). All the indexes reached the acceptable level (χ^2 / df = 2.246, RMSEA = 0.043, CFI = 0.971, TLI = 0.964, SRMR = 0.034), indicating a good fit of the model. The Cronbach's α of deep learning level scale was 0.946.

2.2.2. Deep learning influencing factors questionnaire

Referring to a previous study on the influential factors of deep learning for high school students, the results of validation factor analysis in this study showed that all indexes reached an acceptable level (χ^2 / df = 2.465, RMSEA = 0.047, CFI = 0.977, TLI = 0.969, SRMR = 0.043), indicating that the questionnaire had good structural validity. Cronbach's α of the questionnaire was 0.862.

3. Survey results and analysis

3.1. Common method deviation test

Harman single factor analysis was used to conduct a common method bias test on the collected data. The unrotated exploratory factor analysis results extracted 7 factors with feature roots greater than 1, and the variance explanation rate of the first factor was 32.61%, less than the critical value of 40%, so the common method bias in this study was not obvious.

3.2 Difference analysis of "deep learning" in relevant variables

3.2.1. Gender

An independent sample t-test was used to analyze the gender differences in deep learning levels of high school students in Western China. There were significant differences in integration strategy and critical and creative ability. In terms of integration strategy, the performance of female students (M = 3.79) was significantly better than that of male students (M = 3.62), indicating that female students were more active and focused on learning than male students. They also have higher expectations for their academic performance [9]. In terms of critical and creative ability, the performance of male students (M = 3.22) is significantly better than that of female students (M = 2.95). Under the traditional cultural background of Chinese society, male students tend to reflect and question, are good at abstract thinking, and are active in class, actively participate in class discussions, and express different views, while female students follow the rules. This is consistent with the previous research results [10].

3.2.2. Class leader

To understand the difference in the deep learning level of high school students in Western China in being class leaders or not, the study adopts an independent sample t-test for analysis.

Table 1. Deep learning difference test of high school students in Western China (mean ± SD)

	Deep involvement	Deep understanding	Deep outcomes	Total deep learning levels
Class leader	3.70 ± 0.99	3.70 ± 0.65	3.42 ± 0.76	3.61 ± 0.63
Not class leader	3.61 ± 0.69	3.66 ± 0.64	3.27 ± 0.74	3.51 ± 0.60
t	1.373	1.784	2.441*	1.848

Table 1 shows that whether students are class leaders or not has a significant difference in the deep outcome dimension. The students who are class leaders are significantly higher than the students who are not class leaders in the two indexes of "critical and creative ability" and "cooperation and communication ability." The results of the survey are consistent with the existing studies: The experience of serving as a class leader can cultivate children's leadership ability and make them more flexible and inquisitive during the growth process, which also promotes the positive development of critical thinking [11]. Yin's research found that students with class leadership experience have a higher tendency to critical and creative thinking, which has an obvious positive impact on students [12]. Most of the students who serve as class leaders are students with excellent academic performance. They should play the role of role models in the class, and at the same time, they should assist teachers in class management, which is the link between teachers and other students. Therefore, working as class leaders can also improve students' ability of cooperative learning, self-expression, and communication.

3.2.3. Altitude

In this study, altitude is taken as a statistical variable. In terms of deep involvement (**Table 2**), the deep involvement of City L is significantly higher than that of City Z and City N. In the deep understanding dimension (**Table 2**), the deep understanding in City L is significantly higher than in City Z and City N. The average altitude of the western region is more than 4,000 meters, the ultraviolet radiation is strong, the climate is cold and dry, and the air has low oxygen content. The harsh natural environment poses a serious threat to the cognitive ability of the adolescent brain. Living at high altitudes for a long time can lead to cognitive impairments such as loss of attention [13], reduced memory [14], prolonged reaction time, and decreased motor coordination. The decline in cognitive ability will inevitably affect the level of deep learning.

Table 2. Altitude difference test of high school students in Western China (mean ± SD)

	Deep involvement	Deep understanding	Deep outcomes
2,000–3,000 meters	3.51 ± 0.81	3.59 ± 0.74	3.38 ± 0.85
3,000–4,000 meters	3.84 ± 0.74	3.81 ± 0.53	3.32 ± 0.66
Above 4,000 meters	3.60 ± 0.62	3.63 ± 0.58	3.21 ± 0.70
F	12.225***	7.474**	2.692
Post hoc	A < B, B > C	A < B, B > C	

Note: A, 2,000–3,000 meters; B, 3,000–4,000 meters; C, Above 4,000 meters.

3.3. Model analysis of influencing factors

Table 3 shows that the correlation coefficient R is 0.721, the adjusted R^2 is 0.517, and the Durbin-Watson value is 1.878, indicating that the standardized residual follows a normal distribution. It can be seen that the goodness of fit of the model of the total state of deep learning is good, and the four variables together explain 51.7% of the deep learning, and the fitted model is statistically significant. The final regression equation was established according to the standardized coefficient:

Deep learning level = 1.326 + 0.286 (Teacher-student interaction) + 0.065 (Classroom instruction) + 0.2 (Teacher feedback) + 0.086 (Parent support)

Table 3. Summary of deep learning models

Models	R	R^2	R^2 after adjustment	Errors in standard estimates	Durbin-Watson
1	0.721	0.520	0.517	0.423	1.878
Predictor variables: (Constant), FM, SS, KT, JS					
Dependent variable: Total level of deep learning					

4. Conclusions and recommendations

The research conclusions have important implications for improving the deep learning level of high school students in Western China. Given this, the following suggestions are put forward.

Firstly, good teacher-student interaction is an effective way to enter the deep learning state. For a long time, the quality of classroom teaching in Western China has achieved little effect, mainly because the traditional ethnic culture in the classroom and the psychological characteristics of ethnic minority students have not been paid enough attention to. Therefore, teachers design ethnic cultural situations and teaching cases of relevant disciplines, integrate book knowledge into the ethnic culture familiar to students, and establish

a close connection between real life and classroom knowledge, thereby better knowledge dissemination, comprehension, and application.

Last but not least, since most senior high schools in minority areas are boarding schools, teachers are the main "guardians" of students' daily study and life, and teachers' feedback has a greater impact on senior high school students' subjective well-being [15]. Providing positive teacher feedback in time can help stimulate students' learning motivation, which is of great significance for promoting students' deep learning. In actual teaching, teachers should provide students with positive emotional experiences, evaluation, and incentive mechanisms, which are conducive to promoting the holistic development of high school students' deep learning.

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