An ANOVA-Based Study on the Factors Influencing College Students' English Learning Attitudes in an Intelligent Environment

Jing Zhang and Yinan Guo(✉)

Jiaying University, Meizhou, China
gyncn@163.com

Abstract. With the acceleration of the deep integration of information technology and education teaching, the blended intelligent teaching based on intelligent learning environment will become the new normal of school teaching. This paper selects a typical teaching class of non-English majors in Jiaying University in eastern Guangdong as the sample source and uses ANOVA analysis of variance model to analyze the influencing factors of college students' English learning attitudes in the intelligent learning environment, in order to provide reference for improving the quality of college English teaching in the intelligent environment.

Keywords: ANOVA · intelligent environment · English learning · learning attitude

1 Introduction

With the widespread application of new technologies such as artificial intelligence, big data, cloud computing and Internet of Things in education [3], China's education informationization has entered the 2.0 era, starting a new journey of educational transformation in the intelligent era. [11].

Learning attitude, as a stable disposition towards learning and its manifestation and reflection in the learning process, is a comprehensive system of indicators reflecting the effectiveness and quality of learning. In the horizontal composition of the professional individualized type of learning attitude, the English learning attitude of college students has more obvious identity specificity and greater difficulty in establishing. In the view of learning theory and practice, students are the subjects of learning, and no matter what kind of teaching methods and learning strategies are inseparable from the active participation of the subjects [1], and the same is true for college English teaching and learning in an intelligent environment. To understand the English learning attitudes of college students in an intelligent learning environment objectively, we must face two crucial issues: the basic composition of the main components of learning attitudes, and the real status of the main components of learning attitudes.[8].

This study selects a typical teaching class of non-English majors in Jiaying University in eastern Guangdong as the sample source and uses ANOVA analysis of variance model

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to analyze college students' attitudes toward English learning in an intelligent learning environment, in order to provide reference for improving the quality of college English teaching in an intelligent environment and exploring a more appropriate English teaching model. [2].

2 Research Design

2.1 Data Sources

The English grading typical teaching classes in Jiaying University were chosen as the sample source for this study. Jiaying University started to implement English grading in 2007, and students were divided into A, B, and C classes according to their entrance grades. The number of students in Class B accounts for about 65% of the total number of students, and their learning attitudes represent the English learning status of most students in Jiaying University. A survey was conducted on 110 non-English majors in Class B using a principal component questionnaire [5]. Out of 110 questionnaires, 108 questionnaires were returned, with a validity rate of 98%.

2.2 ANOVA Analysis of Variance Model Test

Analysis of variance (ANOVA), also known as "analysis of variance", is a statistical method proposed by the famous British statistician and geneticist Fishel to determine whether there is a causal relationship between variables [6]. It can effectively deal with multiple levels of dependent variables. ANOVA is divided into one-factor ANOVA and multi-factor ANOVA in terms of the number of influencing factors involved [10], and this paper focuses on the one-factor case.

Assuming that the independent variable is X and the dependent variable is Y. The main objective of the ANOVA is to test whether changes in X at different levels (Xi, i $= 1, 2, \cdots, M$) have a significant effect on Y. The criterion is that the variation in Y is mainly caused by the variation in X, which requires the calculation of the total variation in Y. The true Y is unknown, and the only way to calculate the variation of Y is to obtain the observed data by sampling means, through a sample. The sample has the following assumptions: Y obeys a normal distribution, the samples are independent of each other and identically distributed, and if the assumptions do not hold, a nonparametric test is chosen [4].

3 Analysis and Discussion

Now let's test the interrelationships between the main components that constitute learning attitudes and only when their relationships are clarified, college students' English learning attitudes can be analyzed. The hypothesis test is noted as:

Test the statistic of H_0: $\alpha\_i = 0$,(i = 1,2,…,m)

$$F = \frac{R_A/(m-1)}{R_W/(n-m-1)} \sim F(m-1, n-m-1)$$

Table 1. Test table for the analysis of covariance model

Source of variance	Modified Sum of Squares	Correction of degrees of freedom	Mean Square	F ratio	Threshold	Significance
between classes	$R_A = R_r - R_W$	$m - 1$	$V_A = \frac{R_A}{m-1}$	$F_A = \frac{V_A}{V_W}$	$F_\alpha = (m-1, n-m-1)$	
In Class	$R_W = S_{yyw} - \frac{S^2_{xyw}}{S_{txw}}$	$n - m - 1$	$V_W = \frac{R_w}{n-m-1}$			
Total	$R_T = S_{yyT} - \frac{S^2_{xyT}}{S_{txT}}$	$n - 2$				

And covariance model was analyzed in Table 1.

Of which:

$$n = \sum_{i=1}^{m} n_i,\ \overline{x}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} x_{ij},\ \overline{y}_i = \frac{1}{n_i}\sum_{j=1}^{n_i} y_{ij},\ \overline{x} = \frac{1}{n}\sum_{i=1}^{m}\sum_{j=1}^{n_i} x_{ij}$$

$$\overline{y} = \frac{1}{n}\sum_{i=1}^{m}\sum_{j=1}^{n_i} y_{ij},\ S_{xxi} = \sum_{j=1}^{n_i}(x_{ij} - \overline{x_i})^2,\ S_{yyi} = \sum_{j=1}^{n_i}(y_{ij} - \overline{y_i})^2$$

$$S_{xyi} = \sum\nolimits_{j=1}^{ni} \left(X_{ij} - \overline{X}\right)\left(y_{ij} - \overline{y_1}\right),\ S_{xxT} = \sum\nolimits_{i=1}^{m}\sum\nolimits_{j=1}^{n_i} \left(X_{ij} - \overline{X}\right)^2$$

$$S_{yyT} = \sum\nolimits_{i=1}^{m}\sum\nolimits_{j=1}^{n_i} \left(y_{ij} - \overline{y}\right)^2,\ S_{xyT} = \sum\nolimits_{i=1}^{m}\sum\nolimits_{j=1}^{n_i} \left(X_{ij} - \overline{X_1}\right)\left(y_{ij} - \overline{y_1}\right)$$

$$S_{xxw} = \sum_{i=1}^{m} S_{xxi},\ S_{yyw} = \sum_{i=1}^{m} S_{yyi},\ S_{xyw} = \sum_{i=1}^{m} S_{xyi}$$

In this paper, an ANOVA model was developed to capture the linear effects [9] of college students' attitudes toward English learning in an intelligent environment by using five types of questions (motivation, autonomy, intelligent learning styles, learning strategies, and self-evaluation) and three types of subjects (classes A, B, and C) in a valid questionnaire. According to the two-factor observations experimental results A factor contains six level measures, i.e., $a = 6$; B factor contains three level measures, i.e., $b = 3$, for a total of 18 observations. According to the mathematical model [7]of the two-factor observation experiment: $X_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$, where μ is the total mean, α_i, β_j are the effects of A_i and B_j, respectively, μ_i、μ_j are the overall mean of α_i, β_j, observations, respectively, and $\sum \alpha_i = 0$, $\sum \beta_j = 0$, ε_{ij} are random errors

Table 2. Analysis of variance table

Source	Degree of freedom	Square sum	F-value	P	R (%)
Factor A	4	61462.75	9.6	< 0.0001	6. 18
Factor B	1	85256.4	50. 76	< 0.0001	18.44
A*B	4	5100. 71	0. 67	0.554	0.57
Factor C	4	165035.73	15.83	< 0.00011	11.32
Factor D	2	91065.45	28.56	< 0.00011	10.31
Factor F	2	299604.77	80.3	< 0.00012	9
Error	191	324001.93			
Total	208	916479.2			

and independent of each other, and N $\left(0,\ \sigma^2\right)$. This gives the sum of squares and the associated degrees of freedom for each.

$$C = \frac{x^2..}{ab} = 106435.3378;\ SS_T = \sum\sum x^2ij - C = 1748.8989;$$

$$SS_A = \frac{1}{b}\sum x^2 i_1 - C = 1446.2032;\ SS_B = \frac{1}{a}\sum x^2 j_1 - C = 142.5445;\ SS_e = SS_T - SS_A - SS_R = 160.1512$$

The ANOVA table (Table 2) was presented based on the above calculations and the final F-test was performed.

From the value of contribution rate R in Table 2, the contribution rate of learning motivation (B) on college students' attitude toward English learning is greater than that of autonomous ability (A). In terms of F-value, motivation is more influential than self-directed learning ability. From the F-value and the probability of companionship P, the P-value of A*B interaction is 0.554, which indicates that the interaction between the two has no significant effect on college students' English learning attitudes, so we can conclude that there is no interaction between the influence of independent learning ability and learning motivation on college students' English learning attitudes. The contribution of intelligent learning style (C) is 11.32 and the contribution of learning strategy (D)is 10.31, so the contribution of intelligent learning style to college students' English learning attitudes is greater than that of learning strategy, and among the five influencing factors, the contribution of learning motivation and intelligent learning style to college students' English learning attitudes is the greatest, while the contribution of self-evaluation(F) to college students' English learning attitudes is the least.

4 Conclusion

The principal component analysis of learning attitudes shows that non-English majors at Jiaying University have the following characteristics in their English learning: (1) they have clear motivation to learn English. (2) Weak self-directed learning ability. (3) Intelligent learning method breaks through the limitation of time and space, which is very helpful to college students' English learning (4) Lack of teamwork spirit. (5) Poor self-evaluation ability of learning, leading to stagnant learning performance.

References

1. Bloom. New views of the leader: Implications for Instruction and Curriculum. Published at Educational leadership of America .1978:3~8
2. *Douglas,* C. Montgomery, Design and Analysis of Experiments [M] John Wiley & Sons Inc., U.S.A., 1991:369–385
3. He Kekang. How to realize the "deep integration" of information technology and education [J]. Curriculum - Teaching Materials - Teaching Method, 2014 (2).
4. Liu ZJ, Wei Lan, Xiang Yuanzhang. Statistics [M]. Beijing: Tsinghua University Press, 2017: 128–131
5. Mathur, R. & Oliver, L. (2007). Developing an International Distance Education Program: A Blended Learning Approach, Online Journal of Distance Learning Administration, 10(4)
6. *Mao Shisong. Probability Theory and Mathematical Statistics [M]. Beijing: Higher Education Press, 2004: 335-356.*
7. Wang X, Chu TJ. Nonparametric statistics [M]. Beijing: Tsinghua University Press, 2014: 60-101.
8. Xu Jinfen, Peng Renzhong, Wu Weiping. Survey and Analysis of Independent English Learning Ability of Non-English Major College Students. Foreign Language Teaching and Research, 2004(1):64-68
9. Yang Wenli. Introduction to Linear Models [M] Beijing: Bejing Normal University Press 1998.166–211
10. Zhang X, Li L. Research on the relationship between environmental quality and economic growth in Anhui Province [J]. Journal of Anqing Normal University (Natural Science Edition), 2018, 24(3):48-52.
11. Central Committee of the Communist Party of China, State Council. The State Council on the issuance of a new generation of artificial intelligence development plan notice. (2007). http://www.gov.cn/ zhengce/content/2017–07/20/content_5211996.htm.