



# An Evaluation of the Intervention Effect of Autonomous English Learning Motivation Based on Knowledge Map

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**Abstract.** In the past, the evaluation method of the intervention effect of Autonomous English learning motivation was not fluent because of the lack of correlation between autonomous learning ability and motivation factors. Therefore, this paper proposes an evaluation of the intervention effect of Autonomous English learning motivation based on knowledge map. Based on the different degree of connection, the knowledge map of self-learning ability and motivation factors is constructed. Combined with motivation intervention, the evaluation index of intervention effect is determined, the weight of different indexes is calculated, the comprehensive score is calculated for the index assignment, and the evaluation of intervention effect is realized by combining the intervention effect evaluation grade table. The experimental results show that compared with the traditional methods, the designed method based on knowledge map has better fluency.

**Keywords:** Knowledge map · Autonomy · English learning · Intervention effect evaluation

## 1 Introduction

Knowledge map is a modern theory that combines the theories and methods of Applied Mathematics, graphics, information visualization technology, information science and other disciplines with the methods of bibliometrics citation analysis and co-occurrence analysis, and uses the visualized map to vividly display the core structure, development history, front fields and overall knowledge structure of the discipline to achieve the purpose of multi-disciplinary integration [1–3]. It can provide practical and valuable reference for discipline research. Knowledge map integrates all disciplines to facilitate the consistency of user search, find more accurate information for users, make a more comprehensive summary and provide more in-depth information [4].

Motivation is the internal state that directly promotes the activities of organisms to meet the needs of individuals, and it is the direct cause and internal motivation of behavior [5]. The level and strength of motivation determine the quality, level and effect of individual activities. According to the role of motivation in learning, learning motivation is defined as: learning motivation refers to the internal motivation that directly promotes students to carry out learning activities [6]. Learning motivation can

explain why students study, how hard they work and what they are willing to learn. It is the core of the learning process, which is expressed in the form of learning intention, desire or interest, so as to stimulate students' enthusiasm for learning, so as to actively participate in learning activities and play a role in promoting learning. Generally speaking, the more correct the learning motivation, the stronger the learning requirements, and the higher the quality of learning. Students with strong motivation often have serious learning attitude and strong learning perseverance. The strength of students' dominant motivation will affect their academic performance. The relationship between learning motivation and learning effect is not only a one-way relationship, but also an interdependent two-way relationship [7]. Learning motivation can increase students' behavior to promote learning, but what students learn can in turn further increase learning motivation.

English learning motivation includes three aspects: attitude towards learning English, desire to learn English and efforts to learn English. Motivation is the internal motivation to promote English learning, and a psychological state of conscious initiative and enthusiasm of English learners in English learning activities [8].

At present, English learners have no long-term goals, their learning attitude is not positive, and their motivation for English learning is at a medium low level. Many learners learn English only for the purpose of examination or enrollment. This kind of instrumental learning motivation can't stimulate the learners' enthusiasm for learning English and keep their interest in learning for a long time. Once their performance is not ideal, their confidence in learning English will be hit and their enthusiasm for learning English will be reduced. Therefore, some scholars have intervened in different ways, and used the intervention effect evaluation method of Autonomous English learning motivation to evaluate the effect of Autonomous English learning after intervention. However, the method is not mature enough, because the relationship between autonomous learning ability and motivation factors is not close enough, making the evaluation method less fluent. At this time, we design a method to evaluate the effect of Autonomous English learning motivation intervention based on knowledge map to solve the above problems and promote English learners' autonomous learning.

## **2 Evaluation of the Intervention Effect of Autonomous English Learning Motivation**

### **2.1 Establish the Relationship Between Motivation Factors and Autonomous Learning Ability**

The relevance between autonomous English learning motivation and autonomous learning ability is based on the feedback of students' actual situation. A questionnaire survey was conducted among 220 sophomores in a university. The questionnaire is designed with reference to the relevant research at home and abroad. It consists of two parts: the basic information of the students and the multiple choice questions. The multiple-choice questions are all in the form of 5-point likert scale, which is divided into five grades: "very inconsistent with my situation e" to "very consistent with my situation a".

Items 1–15 survey students' autonomous learning ability, covering five aspects: first, making learning plans; second, using learning strategies effectively; third, self-monitoring learning process; fourth, self-assessment of English learning results; fifth, understanding teachers' teaching objectives and requirements. Items 16–27 investigate students' learning motivation, which mainly includes four main motivational factors: first, internal interest; second, self-efficacy (expectation of English level); third, potency (value and meaning of English learning); fourth, motivational behavior (effort level) [9]. After eliminating the invalid questionnaires, such as complete or partial unselected, completely identical and so on, 197 valid questionnaires were tested for consistency. The test results showed that the reliability coefficient reached 0.85. The data collected were analyzed by SPSS15.0.

According to the results of the questionnaire survey, the specific situation of College Students' autonomous learning ability and motivation level is listed in the table below (Table 1).

**Table 1.** Scores of independent learning ability and learning motivation factors

	Ability/factor	Average value	Standard deviation
Self-learning ability	Study plan	3.5	0.83
	Learning strategy	3.52	0.77
	Self-monitoring	3.34	1.0
	self assessment	3.19	0.77
	Understand learning teaching goals and requirements	3.45	0.81
Motivation factor	Intrinsic interest	3.22	0.77
	Self-efficacy	3.73	0.86
	Potency	3.59	0.89
	Motivational behavior	3.17	0.85

It can be seen from the data in the table that there is little difference in students' autonomous learning ability. In fact, the single factor analysis of variance shows that the mean difference between them is not significant. The average score of all items in the table is more than 3, indicating that students have certain autonomy and have great expectations for English learning, but lack of intrinsic interest. Using statistics to calculate the correlation coefficient between self-learning ability and motivation level reached 0.65. Statistically speaking, there is a significant correlation between them. According to the above analysis, students with different levels of learning motivation have different performance in autonomous learning ability. As shown in Table 2.

**Table 2.** Differences of autonomous learning ability in different levels of learning motivation

Self-learning ability	High grouping		Low grouping		p值
	M	SD	M	SD	
Study plan	3.56	0.77	2.81	0.76	0.00
Learning strategy	3.76	0.82	3.21	0.59	0.02
Self-monitoring	3.59	0.88	3.04	0.56	0.02
self assessment	3.46	1.1	2.81	0.82	0.03
Understand learning teaching goals and requirements	3.89	0.58	2.85	0.66	0.00

The students whose average score of motivation level is more than 3.43 (including 3.43) are divided into high group and the students whose average score is less than 3.43 are divided into low group. From the data in the table, it can be seen that there are significant differences in various autonomous learning abilities between the high-level group and the low-level group. The students in the low-level group have low scores of autonomous learning ability, which indicates that their autonomous learning ability is not strong and they lack effective self-monitoring and evaluation ability. Regression analysis is made on the influence of motivation factors on autonomous learning. The results are shown in Table 3.

**Table 3.** Regression of motivation factors to autonomous learning ability

Independent variable (motivation factor)	Beta value	T value	P value
Intrinsic interest	0.23	2.4	0.02
Self-efficacy	0.21	2.26	0.03
potency	0.2	2.18	0.03
Motivational behavior	0.32	3.0	0.00

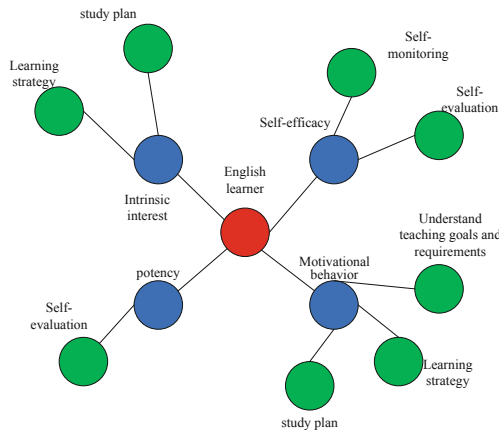
The results of regression analysis show that more than 80% of autonomous learning ability can be explained by the motivational factors of independent variables, and the influence of these four variables on the dependent variables is not repeated. T-test showed that four motivational factors, namely intrinsic interest, self-efficacy, potency and motivational behavior, were significant for regression. The results of multiple regression analysis in the table can be written into a standard equation: autonomous learning ability =  $0.23 \times$  internal interest +  $0.21 \times$  self-efficacy +  $0.2 \times$  potency +  $0.23 \times$  motivational behavior. Therefore, motivation factors will directly affect the ability of autonomous learning.

According to the analysis, it is determined that there is a correlation between the autonomous learning ability and the motivation factors. According to the correlation between the two, the evaluation index is determined by using the knowledge map.

### 2.2 Determination of Intervention Effect Evaluation Index Based on Knowledge Map

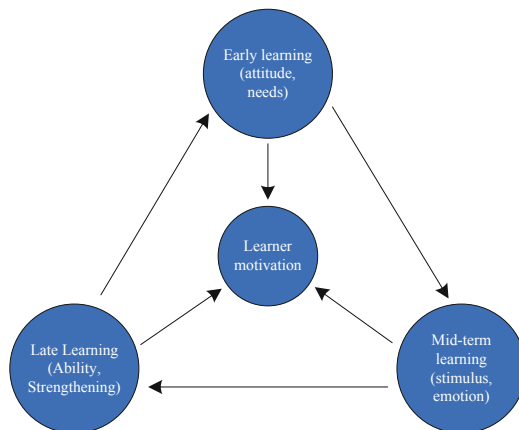
Knowledge map can show the relationship between knowledge development and structure through various graphics, describe knowledge resources and their carriers by using visualization technology, analyze, build, draw and display knowledge and their interrelations [10, 11].

Based on the correlation between the above-mentioned autonomous learning ability and motivation factors, a knowledge map of autonomous learning ability and motivation factors is constructed. As shown in the figure below.



**Fig. 1.** Knowledge map of autonomous learning ability and motivation factors

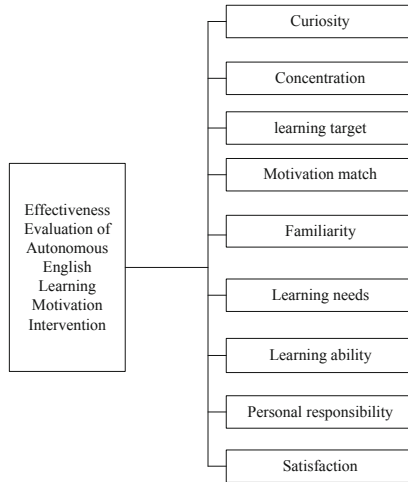
On the basis of the knowledge map of autonomous learning ability and motivation factors, it intervenes the learners’ English learning motivation from the early, middle and later stages of learning English. In the early stage of English learning, it mainly intervenes the learners’ learning attitude and demand; in the middle stage of English learning, it stimulates the learners’ emotion; in the later stage of English learning, it strengthens the learners’ learning ability. The role of the above different stages and the relationship with learning motivation are shown in the figure below.



**Fig. 2.** Motivation intervention in different stages of English learning

Combined with the information in Fig. 1 and Fig. 2, the evaluation indicators of the intervention effect of Autonomous English learning motivation are determined. Interest in learning: Learners' interest in English learning can be improved through novel, uncertain and inconsistent events; curiosity: to stimulate learners' information searching behavior through questioning and other ways, and then to stimulate curiosity; concentration: to maintain students' interest in English learning by changing various teaching elements and avoid attention Loss of strength; learning objectives: to provide students with a teaching objective and formulate reasonable methods to achieve these objectives, linking short-term objectives with long-term objectives; motivation matching: to match teaching with students' various learning needs through the use of various strategies; familiarity: to use students' familiar language and experience in teaching, and put teaching in the existing situation To help learners connect new knowledge with existing experience; learning needs: to set teaching objectives of different degrees of difficulty, to help students establish a positive and expected attitude to success; learning ability: the ability of learners to complete tasks with appropriate difficulty levels; personal responsibility: to let students realize the success of learning in teaching, is their own earnest efforts to study Result. Satisfaction: let the students use the new knowledge or skills to solve the problems in the real situation, provide feedback, praise and motivate the students in time in the learning process, let the students feel the fairness and consistency of the evaluation standards, and make the students always maintain a positive attitude.

After the above analysis, the evaluation indicators of the intervention effect of Autonomous English learning motivation are determined as shown in the figure below (Fig. 3).



**Fig. 3.** Evaluation indicators of intervention effect of Autonomous English learning motivation

After determining the evaluation index of the intervention effect of Autonomous English learning motivation, the weight of the evaluation index of the intervention effect is calculated to determine the level of the subsequent intervention effect.

**2.3 Calculation of Evaluation Index Weight**

In view of the relationship between different indicators of evaluation, motivation factors and self-learning ability, the method of questionnaire survey with experts as the object is adopted to assign values to the indicators. The evaluation index weight is calculated by using the evaluation matrix of expert scores. The matrix is as follows:

$$g = \begin{pmatrix} k_{11} & k_{12} & \dots & k_{1i} \\ k_{21} & k_{22} & \dots & k_{2i} \\ \dots & \dots & \dots & \dots \\ k_{j1} & k_{j2} & \dots & k_{ji} \end{pmatrix} \tag{1}$$

The elements of each column of the judgment matrix are treated as one

$$G_{ji} = \frac{k_{ji}}{\sum_{j=1}^j k_{ji}} (ji = 1, 2, \dots, r) \tag{2}$$

Sum the judgment matrix after normalization by rows:

$$G_j = \sum_{i=1}^r G_{ji} \tag{3}$$

For the normalization processing, the obtained feature is the weight.

$$G_i = \frac{G_j}{\sum_{j=1}^r G_j} \quad (4)$$

In the formula, there are different index scoring items  $k_{ji}$ , which  $ji$  are item number  $r$  and constant. In formula 2, they are rounded  $G_j$  to indicate the obtained characteristics and the calculated evaluation weight. According to the calculated weight quantitative evaluation index, calculate the index score value, quantitative evaluation index, and measure the intervention effect according to the quantitative score.

#### 2.4 Quantitative Intervention Effect Evaluation Index

The weight of the intervention effect evaluation index determined in the previous step is unified to prepare for the quantitative intervention effect evaluation index. Considering the counting habit of the percentage system, multiply the weight of each index by 100 to become the standard value of the evaluation result. The final score of each sub index is:

$$J_i = \sum_{n=1}^r G_{in} k_{jin} \quad (5)$$

In the formula,  $G_{in}$  indicates the weight value  $i$  of the sub indicator  $n$  and the score value of the expert for the sub indicator.  $k_{jin}$  represents the quantitative  $j$  score value of the calculated sub index  $i$ . Combining the weight obtained by the above calculation process  $J_i$  with the quantitative score value  $i$ , the comprehensive evaluation value of intervention effect is calculated by the weighted superposition method. The calculation formula is as follows.

$$C = G_i \frac{\sum_{i=1}^r J_i}{i} \quad (6)$$

The calculated comprehensive evaluation value of the intervention effect of Autonomous English learning motivation is corresponding to the intervention effect evaluation grade standard table, and the intervention effect grade standard is shown in Table 4. To evaluate the effect of Autonomous English learning motivation intervention.

**Table 4.** Evaluation level of Autonomous English learning motivation intervention effect

grade	Grading standards	Description	Level description
I	<1.5	The effect of the intervention is positive, and the learner has a longer learning motivation	Excellent
II	1.5–2.5	The effect of the intervention is a positive result, and the learner’s motivation for a short period of time	Good
III	2.5–3.5	The effect of the intervention is that there is no obvious guidance result, and the learner maintains the original state	Medium
IV	3.5–4.5	The effect of the intervention was negative, and the learners became lax about English learning	Worse
V	>4.5	The effect of the intervention was a negative result, and the learner’s learning intention approached zero	Very poor

According to the intervention effect evaluation grade standard in Table 4, the intervention effect evaluation of Autonomous English learning motivation can be realized. So far, the evaluation of the effect of Autonomous English learning motivation intervention based on knowledge map has been completed.

### 3 Experimental Study

#### 3.1 Experiment Preparation

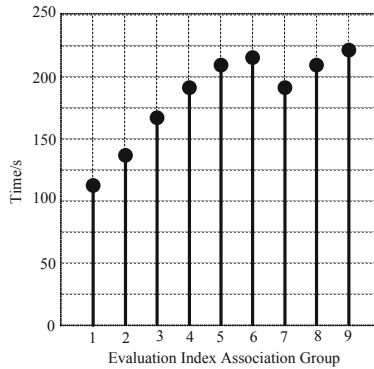
In UCI machine learning repository (<https://archive.ics.uci.edu/ml/datasets.html>) Select the experimental data. The goal of the experiment is 101 students from two classes in a high school. In the research, combined with the characteristics of senior high school students’ English learning and the current situation of teaching, some measures are adopted to intervene in students’ Autonomous English learning motivation. The intervention effect of Autonomous English learning motivation is evaluated by using the designed method based on knowledge map. At the same time, we use the traditional method to evaluate the effect of Autonomous English learning motivation intervention.

In the process of using different evaluation methods to evaluate the intervention effect, it is necessary to establish a connection between different evaluation indexes. The time consumed in this process is an important index affecting the fluency of evaluation methods. The longer the time is, the worse the fluency is, the shorter the time is, the better the fluency is. Therefore, fluency is chosen as a reference index to evaluate the intervention effect of different Autonomous English learning motivation.

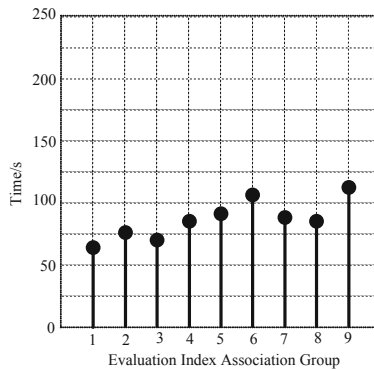
In the experiment, the computer is used as an assistant to process the experimental data through the software analysis system such as word and excel.

### 3.2 Experimental Results and Analysis

Using the traditional evaluation method of the intervention effect of Autonomous English learning motivation and the designed evaluation method of the intervention effect of Autonomous English learning motivation based on knowledge map, the experiment results are as follows.



(a) Experimental results of traditional evaluation methods of intervention effect



(b) Experimental results of intervention effect evaluation method designed

**Fig. 4.** Experimental results of different intervention Group effect evaluation methods

In the experiment, nine groups of experiments were carried out according to the evaluation indicators. The first group was set as no association between the indicators, the second group as the association between the two indicators, the third group as the association between the three indicators, and so on. The time of establishing the association between the indicators of different evaluation methods in each group of experiments was obtained.

The results in Fig. 4 show that the time of traditional intervention effect evaluation method is 115 s at least and 225 s at most. The average time is about 179.6 s after calculation. The results of the designed knowledge-based graph show that the

minimum time required for establishing the association of indicators is 60s, the maximum is 113 s, and the average time is about 84.7 s after calculation. The longer it takes to establish the association of evaluation indicators, the worse the fluency of the evaluation method. From the above data, it can be seen that the traditional evaluation method takes about twice as long as the designed evaluation method based on knowledge map, which shows that the designed evaluation method based on knowledge map is more fluent than the traditional evaluation method.

## 4 Concluding Remarks

In recent years, the research on students' Autonomous English learning motivation is fast, and has achieved fruitful results, which has a positive role in English teaching and research. However, there are still a lot of problems worthy of discussion, whether it is the focus groups or research methods. The emergence of the evaluation method of the intervention effect of Autonomous English learning motivation is of great significance to the research of students' Autonomous English learning motivation. This paper uses knowledge map to establish a close relationship between autonomous learning ability and motivation factors, so as to make the evaluation method more fluent. In the future research, we should take students as the main body, and teachers should guide them properly. We can try to introduce autonomous learning platform into reading strategy teaching, cultivate students' good English reading habits and improve their English level.

## 5 Fund Projects

1. Key R & D plan of Shandong Province (public science and Technology) 2019GGX105013.
2. Social science planning research project of Shandong Province 17CQXJ11.

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