

Research on the Scale of Students' Learning Engagement in Blended Learning Environments

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Abstract: With the continuous deepening and development of blended learning research, students' learning engagement in blended learning contexts has become an increasingly important research issue, but there is no unified and standardized scale of students' learning engagement. This research attempts to explore the dimensions and indicators of the scale of students' learning engagement in blended learning contexts based on the theory of learning engagement at home and abroad, traditional learning engagement scale and online learning engagement scale, and form the initial scale of students' learning engagement in blended learning contexts; Then, taking students with blended learning experience in S University as the object, the scale was initially tested and formally measured by random sampling. Through factor analysis, reliability and validity analysis, a stable scale of students' learning engagement in blended learning contexts was finally formed. The scale is composed of four first level indicators including behavioral engagement, cognitive engagement, emotional engagement and social interaction engagement, and 11 second level indicators. It has good reliability and validity, and can be used as a measuring tool for students' learning engagement in open blended learning contexts.

1. Introduction

Learning engagement is the key to college students' academic achievement, and an important factor to promote college students' academic success and improve the current quality of education in colleges and universities[1]. Learning engagement has been paid more and more attention by scholars as a way to improve low level academic performance, high level students' boredom and dissatisfaction, and high dropout rate in urban areas. In order to enable students to truly achieve academic success, scholars began to study the Student Learning Engagement Scale very early[2].

Based on the research at home and abroad, the learning engagement scale can be divided into two categories. One is based on traditional school learning, and the main representative achievements are the Utrecht Work Engagement Scale Student (UWES-S) developed by the Dutch scholar Schaufeli et al. The National Survey of Student Engagement The classroom engagement scale designed by Fredricks an American scholar, and the NSSE China and the China College Student Survey (CCSS), which are suitable for Chinese college students, proposed by the research

team of Tsinghua University Shi Jinghuan et al. The other is based on online learning engagement, and the main representative achievements are Online Student Engagement Scale (OSES) developed by American scholar Dixson et al. and the distance learning engagement scale (SEDE) developed by American scholar Sun et al. As well as the distance learning engagement scale formed by Chinese scholar Li Shuang on the basis of OSES and the online learning engagement structure model proposed by Yin Rui. Among them, NSSE is the most influential learning engagement measurement tool, and all the scales that appeared later were put forward on this basis[3].

With the rise of "online+offline" blended learning, a large number of empirical studies have shown that blended learning has significantly improved the teaching effect in universities. For example, the University of Maryland in the United States, York University in Canada, the University of Glasgow in the United Kingdom, Tsinghua University and other schools have common understanding and practice in blended learning[4]. However, many teachers still question the effectiveness of blended learning and believe that teachers and students have invested more time and energy in the process of blended learning[5]. The researchers used the existing scale of learning engagement at home and abroad and other relevant measurement tools to measure the state and characteristics of students' learning engagement in blended learning contexts. Gong Shaoying, a domestic scholar, and others respectively used the self-efficacy scale, the task value scale, the motivation adjustment scale, and the traditional learning engagement scale as measuring tools to study the relationship between motivation beliefs and motivation adjustment and learning engagement in blended learning contexts[6]. Zhou Yuan et al. formed three independent measurement tools from three different aspects: learning behavior engagement of the learning platform, cognitive engagement of content analysis and emotional engagement of self-reported learning to study the learning engagement of students in blended learning activities[7].

To sum up, the current research on measuring tools for students' learning engagement in blended learning contexts is still limited to the combination of existing traditional learning engagement scales or online learning engagement scales with other relevant scales, lacking effective integration of traditional learning and online learning engagement scales, and has not yet formed a standardized and stable learning engagement scale suitable for blended learning contexts. Therefore, this study tries to find out the dimensions and indicators of the scale of students' learning investment in blended learning contexts by drawing on existing theories and practices, and constructs an effective scale of students' learning investment in blended learning contexts[8].

2. Research Basis

2.1 Definition of Blended Learning

Blended learning means that the learning process can be the combination of any form of teaching technology (such as video, Web based resources, etc.) and face-to-face teacher based teaching methods; It can also be the combination of multiple teaching methods (such as constructivism, behaviorism and cognitivism) and teaching technology (or non teaching technology). Blended learning in this study refers to the organic combination of traditional face-to-face learning and online learning. It can not only make full use of the advantages of online learning across time and space, rich digital learning resources and powerful network interaction functions, but also give play to the leading role of teachers in the teaching process, giving full play to the initiative, enthusiasm and creativity of students in learning[9].

2.2 Learning Engagement Theory

In 1930, Tyler, an educational psychologist, first used the concept of "learning engagement" and defined it as "time for tasks", describing how much time students spend on their studies and the impact on their studies [10]. It has successively experienced the development of learning engagement theories such as Pace's "quality of effort" and Astin's "engagement theory". Fredricks (2004 [22]) further enriched and enriched the dimensions of learning engagement. Kuh further improved the theory of learning engagement on the basis of summarizing previous research results [11].

2.3 Learning Engagement Scale

The scale of learning engagement compiled by Fredricks, an American scholar, is relatively representative [12]. He believes that learning engagement is a multidimensional structure, including behavioral engagement, cognitive engagement and emotional engagement. Fredricks developed a scale for measuring pupils' classroom learning engagement based on the division of learning engagement dimensions and the analysis of some measuring tools [13]. The scale includes three dimensions of behavior, cognition and emotion, with 19 items in total. Among them, behavioral engagement is described as students' dedicated efforts and perseverance in learning [14]; Cognitive engagement is described as the application of deep cognitive strategies and effective self-monitoring and regulation of learning [15]; Emotional engagement is described as students' experience of the value of learning and their strong interest in learning. The scale adopts the Likert 4-point scoring method, and students will score according to the topic and their own actual choice. The research shows that the scale can fully reflect the state of students' learning engagement in the classroom [16].

2.4 NSSE Questionnaire

NSSE is a questionnaire compiled by Indiana University in the United States based on Coates' five dimensional framework theory of student engagement and the effective educational practice theory proposed by British scholar Kuh to measure the learning engagement of college students [17]. The questionnaire includes four topics: academic challenge, peer learning, teacher experience, campus environment and 10 secondary engagement indicators. That is, academic challenges include high-level learning, reflective and comprehensive learning, quantitative reasoning and learning strategies; Peer learning includes collaborative learning and discussion with others; Teachers' experience includes the interaction between students and teachers, and effective teaching practice; The campus environment consists of interactive quality and supporting environment [18]. The questionnaire mainly reflects the results of students' and schools' behaviors and learning engagement, and the survey results can accurately reflect some important issues in learning engagement [19].

3. Research Methods

3.1 Study Procedure

In order to improve the research quality of the scale, this study used quantitative research methods and SPSS tools to process and statistically analyze the data [20]. The specific ideas are as follows: First, by collecting and analyzing the classic learning engagement scales at home and abroad, the dimensions, indicators and topics of the initial scale of students' learning engagement in

blended learning contexts are drawn up; Secondly, the preliminary survey was conducted and the data collected in the preliminary survey were analyzed by SPSS for items, factors, reliability and validity of the scale, thus forming the preliminary survey table; Finally, the formal measurement was carried out and SPSS was used to analyze the items, factors, reliability and validity of the scale. Finally, a stable scale was formed[21].

3.2 Develop Research Tools

Based on the analysis of the existing learning engagement scale, it is found that the traditional learning engagement scale is designed according to the traditional learning situation, and the topics are compiled according to the students' performance, behavior and feelings in the classroom. The online learning engagement scale is based on online learning contexts and traditional learning engagement scale, such as the OSES online learning engagement scale compiled by Dixon et al. Traditional face-to-face learning, online learning and learning engagement in a blended learning environment have both connections and differences[23]. The evaluation intentions, indicators and topic descriptions of the first two types of learning engagement scales do not conform to the reality of learning engagement in a blended learning environment. Therefore, the design of blended learning engagement scale should not only be based on the mature traditional face-to-face learning and online learning engagement scale, but also combine the characteristics of blended learning contexts and students' learning engagement to redefine the indicators of learning engagement and elaborate the topics in the original scale[24].

In this study, the indicators and topics in the initial scale of blended learning engagement were constructed by referring to the measurement items used in the existing relevant research and 5 topics were designed for each secondary indicator to reflect the indicator, as shown in Table 1.

Table 1: Dimensions and indicators of the initial scale of students' learning engagement in blended learning contexts

	Level I indicators	Secondary indicators	Number of questions	Reference source
Blended learning engagement	Behavioral engagement	participate in	5	NSSE, OSES UWES-S
		strive	5	
		absorbed	5	
	Cognitive engagement	cognitive strategy	5	MSLQ, SEDE
		Metacognitive strategies	5	
		learning motivation	5	
	Emotional engagement	Self-efficacy	5	MSLQ, SEDE, OSES
		interest	5	
		Self-regulation	5	
	Social interaction engagement	Teacher student interaction	5	MSLQ, NSSE
		Student student interaction	5	

In order to adapt to the blended learning situation, after soliciting the opinions of relevant experts, some topics were modified in the language description to make the content expression more clear and concise. Finally, 55 topics were determined to form the initial scale of students' learning engagement in the blended learning situation. Some topics were scored in reverse, and all topics were randomly arranged. Likert 5-point scoring was adopted for the scale, and participants scored

from "very inconsistent=1" to "very consistent=5" according to the consistency between the scale description and themselves.

3.3 Survey Implementation

S University adopts a blended learning mode of "online+offline" for multiple general education elective courses. This research takes students in school as the research object, and uses questionnaire stars to conduct online surveys[25]. Two rounds of investigation were carried out; The second round was a formal measurement to test the stability of the blended learning engagement scale. 298 students were randomly selected in the preliminary test, including 126 boys, accounting for 42.28% of the participants in this study, and 172 girls, accounting for 57.71% of the participants; There are 165 freshmen, 90 sophomores and 43 junior college students. Excluding 95 people without blended learning experience, 203 people finally participated in the survey, accounting for 68.12%. 315 students were randomly selected from the formal test, including 125 boys, accounting for 39.68% of the participants in this study, and 190 girls, accounting for 60.32% of the participants; There are 135 freshmen, 90 sophomores, 75 junior students and 24 senior students. After removing 90 people without blended learning experience, the final effective number of people participating in the survey was 225, accounting for 71.43%.

4. Data Analysis and Verification

SPSS was used to conduct item analysis, factor analysis, reliability and validity analysis on the two rounds of data collected from the initial and formal measurement, and the results of the analysis indicators are shown in Table 2.

Table 2: Results of the initial and formal measurement items, factors, reliability and validity analysis indicators

Inspection type	Inspection type		Formal measurement
Project analysis	Delete the questions whose correlation coefficient between the question and the total score of the project is less than 0.4 and which do not reach the significant level		
factor analysis	KMO value	.923	.910
	Significance	.000	.000
Reliability Analysis	Reliability statistics		
	Cronbach's α	.946	.954

In the initial test analysis, the correlation coefficient between 55 items in the initial scale and the total score of the scale was first calculated. Through the correlation analysis, the results showed that the correlation coefficient between the scores of eight items and the total score of the scale was lower than 0.4, including b1 of the participating factors, b11 and b15 of the effort factors, b20 of the metacognitive factors, b36 and b40 of the self-regulation factors, b44 of the interest factors, and b51 of the student interaction factors, The items of the scale are not homogeneous, so consider deleting these 8 items. The remaining 47 topics are relatively ideal and meet the project analysis standard. Secondly, using exploratory factor analysis, the KMO value was .923, the significance was .000 all meet the standard requirements, indicating that there are common factors among variables, which is suitable for exploratory factor analysis. By using the principal component analysis method, the remaining 47 items were analyzed by exploratory factor analysis. A total of 10 factors were selected. The cumulative interpretation rate of the total variance was 72.58%, indicating that the variables in the scale and its item design had good structural validity. In the exploratory factor analysis, the final

scale was revised to 33 items after the items with factor coefficients less than 0.5 were deleted. Among them, there are 10 questions about behavioral engagement, 9 questions about cognitive engagement, 6 questions about emotional engagement, and 8 questions about social interaction engagement. The structure of the scale remains unchanged. Finally, the reliability of Cronbach's scale was analyzed α . The coefficient value is 0.946, Metrical α . All values reached a good level, indicating that the scale has good stability and internal consistency.

After the preliminary analysis, all the questions contained in the self-regulation factors of the secondary indicators in the scale have been deleted. Therefore, after another conversation with experts and students, the appropriateness, representativeness, connotation and expression of the scale topics were improved and modified. Further ensure that the content of the scale can comprehensively and accurately reflect the students' learning engagement in the blended learning situation. In the formal measurement and analysis, the KMO value of the scale was 0.910, and the significance was 0.000. All of them met the standard requirements. A total of 11 factors were selected, and the cumulative interpretation rate of total variance was 83.52%. Cronbach's of the scale α . The coefficient value is 0.954. The final formal scale consists of 29 questions, as shown in Table 3. Among them, behavioral engagement includes 9 questions, cognitive engagement includes 6 questions, emotional engagement includes 6 questions, and social interaction engagement includes 8 questions. The formal scale structure is consistent with the initial scale.

Table 3: Dimensions and indicators of the formal scale of students' learning engagement in mixed learning contexts.

	Level I indicators	Secondary indicators	Number of questions
Blended learning engagement	Behavioral engagement	participate in	4
		strive	3
		absorbed	2
	Cognitive engagement	cognitive strategy	2
		Metacognitive strategies	2
		learning motivation	2
	Emotional engagement	Self-efficacy	2
		interest	2
		Self-regulation	2
	Social interaction engagement	Teacher student interaction	4
		Student student interaction	4

After two rounds of measurement and analysis, the results show that the theoretical concept of students' learning engagement in blended learning contexts and the scale and topic description designed in this study meet the measurement needs of students' learning engagement in blended learning contexts, and have good content validity and structure validity.

5. Conclusions

Students' learning engagement in the blended learning situation is a problem that needs to be solved in the blended learning situation. Scientific and effective analysis and measurement of students' learning engagement is the basis for improving the effect of blended learning. This study conducted a preliminary study and exploration on the preparation of the scale of students' learning engagement in blended learning contexts, drawing on the more mature and influential traditional learning and online learning engagement scales at home and abroad, as well as the measurement dimensions, indicators, problem description and scoring methods. The scale adopts the classic four dimension learning engagement framework of behavioral engagement, cognitive engagement,

emotional engagement, and social interaction engagement" and 11 indicators. Based on the analysis of the connotation and measurement of the four dimensions, and combined with the experience of students' learning in blended learning contexts, the scale of blended learning engagement is developed. Through preliminary and formal measurement, it shows that the scale has good content validity and structure validity, and can comprehensively and effectively measure students' learning engagement in blended learning contexts.

The sample sampling area of this study has certain limitations, and the proportion of men and women has a large difference. Considering that the blended learning engagement of students will be affected by learning contexts, teaching methods, learning habits and tendencies, the follow-up research can expand the sample to further verify the effectiveness of the blended learning engagement scale, and constantly revise and verify it as needed to ensure that the scale can accurately evaluate the indicators of students' learning engagement in the blended learning contexts, Regression analysis can also be used to study the influencing factors of blended learning engagement and to deeply explore the relationship between each factor and blended learning engagement.

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