Research on the Influence Mechanism of College Students' Academic Emotion on Learning Effect in Blended Learning

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Abstract. This article focuses on the academic emotion of college students in Blended Learning, and explores the influence mechanism of academic emotion on learning effect. The Blended learning situations are divided into student-content interaction, student-student interaction and student-teacher interaction. The quantitative research method is used in paper. Research finds that the academic emotion of college students in BL is at the medium level, and the positive academic emotion is more than the negative academic emotion. Students' academic emotion can directly affect the learning effect, and can also indirectly affect it through self-regulated learning strategies and self-efficacy. Positive academic emotion can promote the learning effect, while negative academic emotion makes learning effect worse. It is worth noting that, in different interactive situations, the mechanism of positive academic emotion affecting learning effect is similar, but the mechanism of negative academic emotion affecting learning effect is different. Specifically, college students' negative academic emotions do not have a significant impact on deep learning in the context of SC interaction and ST interaction, but have a significant inhibitory effect in SS interaction. There may be various reasons for this phenomenon, such as the low level of negative academic emotion, the mutual offset of different emotional effects, and the reduction of negative academic emotion by teacher guidance. These findings point to the importance of teacher guidance and blended instructional design. Finally, based on the research findings, the paper puts forward some suggestions to promote the learning effect in BL.

Keywords: Blended Learning · academic emotion · learning effect · deep learning · self-regulated learning

1 Introduction

Blended Learning (BL) is an essential focus of the current higher education reform. The purpose of BL is not only to understand and master knowledge, but also to emphasize the realization of high-level goals, the improvement of problem-solving ability, and to help students achieve the best learning effect and reach the level of in-depth learning. BL has indeed improved the academic performance, knowledge level and comprehensive

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ability of college students, and has a positive effect on teaching level and talent training quality. However, in practice, BL is often in the situation of "lively scene and insufficient connotation", resulting in the decline of the effect of in-depth learning. Among the factors that affect the learning effect of college students in BL, academic emotion is closely related to students' in-depth learning. In BL, how does the academic emotion of college students affect the learning effect? The answer to this question may provide some reference for improving the learning effect.

2 Literature Review

The purpose of BL is to change the way of teaching and learning, improve the learning effect and the quality of education. Therefore, whether the BL has achieved the desired effect is the question that many studies try to answer. Many studies have shown that BL is beneficial to students' academic achievement and ability development [1]. But some scholars have found that the effect of BL is unsatisfactory. It is necessary to clarify the factors affecting the effect of BL and take targeted measures.

There are many factors that affect the effect of BL. Some studies have pointed out that learning interaction helps to create a good learning atmosphere and improve students' learning effect. The level of learning interaction depends on students' emotional experience to some extent. Therefore, in BL, the emotion of college students may affect the learning effect through the process of teaching interaction. As a subordinate concept of emotion, academic emotion has also been proved to have an important impact on college students' cognitive activities, collaborative ability, learning engagement and academic performance [2, 3]. Therefore, this paper predicts that:

H1: Students' academic emotion can predict students' learning effect in BL.

In the BL interaction situation, is there any other variable in the process of students' academic emotion affecting learning effect? The study found that the positive academic emotion was significantly positively correlated with their self-efficacy, and the negative academic emotion was significantly negatively correlated with their self-efficacy. Meanwhile, self-efficacy can predict deep learning. In online learning, academic emotion can predict students' test scores and learning investment through self-efficacy. Whether these relationships are established in BL needs to be verified. Therefore, this paper assumes that:

H2: The self-efficacy in BL is the intermediary variable between academic emotion and learning effect

Academic emotions such as enjoyment and depression can positively predict college students' self-regulated learning strategies (SRLS), while boredom can negatively predict SRLS [4]. Students with strong autonomy and high level of learning strategy application are more active in learning and have better performance [5]. In online learning and face-to-face teaching, academic emotion also can affect learning effect through self-regulated learning process [6].

H3: The SRLS in BL is the intermediary variable of academic emotion and learning effect

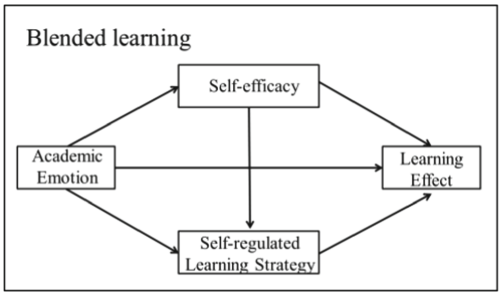

Fig. 1. Research Model

At the same time, self-efficacy can positively predict SRLS, promote students' self-management ability. There is a positive correlation between self-efficacy and SRLS. This article assumes that:

H4: The self-efficacy and SRLS in BL are the chain intermediary of academic emotion and learning effect

The research models can be built as Fig. 1.

By combing the literature, this paper finds that the research on academic emotion in the field of higher education focuses on online teaching and face-to-face teaching, and there are few articles on college students' academic emotion and its influence mechanism on learning effect in BL. In the learning interaction, there is a tendency of "emphasizing cognition and neglecting emotion" to a certain extent. Therefore, there is still much room for discussion on the academic emotion in the process of BL interaction and its impact on the learning effect. Therefore, this paper expects to provide reference for improving the learning effect of college students in BL by exploring the influence mechanism of college students' academic emotion on learning effect.

3 Method and Materials

This paper divides college students' academic emotion into "positive academic emotion" and "negative academic emotion". The learning effect is reflected by the depth of cognitive processing, which is divided into "surface learning" and "deep learning". In addition, on the basis of investigation before, this paper determines three main learning scenarios in BL: student-content interaction (SC), student-student interaction (SS) and student-teacher interaction (ST), and explores the mechanism of college students' academic emotion on learning effect in every interaction process. The research questions are:

1) What is the influence mechanism of college students' academic emotion (positive academic emotion and negative academic emotion) on learning effect in BL interaction?
2) Is there any difference in the influence of college students' academic emotion on learning effect in different interactive situations?

This study adopts quantitative research methods and collects data through questionnaires. On the basis of referring to the existing maturity scale, the author compiled a preliminary questionnaire, and formed the final questionnaire (alpha = 0.882) after expert review, questionnaire modification and small-scale trial. This paper adopts the methods of random sampling and stratified sampling to conduct a questionnaire survey on college students. 871 questionnaires were distributed online and offline and 610 questionnaires were recovered, with a recovery rate of 70%. The questionnaire passed the reliability and validity test.

4 Research Results

4.1 Descriptive Statistics

The score of positive academic emotion is between 3 and 4, and the score of negative academic emotion is below 3. College students experience more positive academic emotions than negative academic emotions in the three situations. The average value of surface learning and deep learning is greater than 3, and the score of surface learning is slightly higher than that of deep learning. See Table 1 for details.

4.2 Direct Effect

In the SC, SS and ST interactions, there are significant correlations among the variables. Positive academic emotion is positively correlated with self-efficacy, SRLS, surface learning and deep learning; Negative academic emotion is negatively correlated with these variables.

On this basis, this paper constructs six linear regression models to test the direct effect of college students' academic emotion on learning effect by taking their professional disciplines, regions, grades and gender as control variables, positive academic emotion and negative academic emotion as independent variables, and surface and deep learning as dependent variables.

Table 1. Descriptive statistics of academic emotion

	Variable	AVE	SD
SC	Positive academic emotion	3.51	0.66
	Negative academic emotion	2.80	0.78
SS	Positive academic emotion	3.41	0.66
	Negative academic emotion	2.75	0.75
ST	Positive academic emotion	3.55	0.61
	Negative academic emotion	2.63	0.75
Surface learning		3.52	0.63
Deep learning		3.36	0.72

Table 2. Multiple regression analysis of college students' academic emotion predicting learning effect

Regression Model	SC				SS				ST			
	Model 1(surface learning as dependent variable)		Model 2(deep learning as dependent variable)		Model 3(surface learning as dependent variable)		Model 4(deep learning as dependent variable)		Model 5(surface learning as dependent variable)		Model 6(deep learning as dependent variable)	
	β	T	β	T	β	t	β	t	β	t	β	t
Positive academic emotion	0.43	10.99***	0.42	10.15***	0.37	9.51***	0.38	9.31***	0.44	11.42***	0.39	9.70***
Negative academic emotion	−0.10	−2.55*	−0.03	−0.65	−0.14	−3.66***	−0.10	−2.38*	−0.08	−2.18*	−0.03	−0.73
R2	0.26		0.19		0.24		0.19		0.26		0.17	
F	26.38		17.70		23.22		17.73		26.09		15.80	
D- W test	2.03		2.11		2.05		2.05		2.01		2.08	
P	<0.001		<0.001		<0.001		<0.001		<0.001		<0.001	

* Relevant conditions of control variables are omitted in the Table 2 to show the relationship between independent variable and dependent variable clearly.

As shown in Table 2, the positive academic emotion of college students has a significant positive effect on the learning effect in the three learning situations; Negative academic emotions have a negative impact, but not all of them are significant. In the context of SC interaction and ST interaction, the negative impact negative academic emotion on deep learning is not significant. In conclusion, H1 is assumed to be true.

4.3 Intermediary Effect Test

This study uses the process plug-in of SPSS to test the mediating effect between self-efficacy and SRLS on college students' academic emotion and learning effect by using the deviation corrected percentile bootstrap (repeated sampling for 5000 times). Model 6 is selected. The analysis results are shown in Table 3.

College students' self-efficacy and SRLS play a significant intermediary role between Academic Emotion and learning effect. Specifically, they play a mediating role between positive academic emotion and learning effect; it plays a complete intermediary role between negative academic emotion and learning effect.

In the three interactive situations, there are three main ways in which academic emotions indirectly affect learning effects: the independent mediation of self-efficacy (path 1), the independent mediation of SRLS (path 2), and the chain mediation of self-efficacy and SRLS (path 3). In terms of the proportion of effects, the proportion of path effects mediated by SRLS is the largest, which is more than 50%. Secondly, self-efficacy and SRLS are the chain intermediary paths, and the effects account for more than 30%. Finally, the path of self-efficacy as an intermediary variable, the effect accounted for the lowest proportion.

Table 3. Test of mediating effect between self-efficacy and autonomous learning strategies

	Independent Variable	Dependent Variable	Category	Effect	BootSE	95% confidence interval		Proportion
						UP	LO	
SC	Positive Academic Emotion	Surface learning	Indirect effect	0.19	0.03	0.14	0.24	41%
			Direct effect	0.27	0.04	0.20	0.34	59%
			Total effect	0.46	0.03	0.39	0.52	100%
		Deep learning	Indirect effect	0.19	0.03	0.13	0.26	40%
			Direct effect	0.28	0.04	0.19	0.36	60%
			Total effect	0.47	0.04	0.39	0.55	100%
	Negative Academic Emotion	Surface learning	Indirect effect	−0.17	0.02	−0.22	−0.13	75%
			Direct effect	−0.06	0.03	−0.12	0.00	25%
			Total effect	−0.23	0.03	−0.29	−0.17	100%
		Deep learning	Indirect effect	−0.18	0.02	−0.23	−0.14	99%
			Direct effect	0.00	0.04	−0.07	0.07	1%
			Total effect	−0.19	0.04	−0.26	−0.11	100%
SS	Positive Academic Emotion	Surface learning	Indirect effect	0.20	0.03	0.15	0.25	48%
			Direct effect	0.22	0.04	0.15	0.29	52%
			Total effect	0.41	0.04	0.35	0.48	100%
		Deep learning	Indirect effect	0.19	0.03	0.14	0.25	42%
			Direct effect	0.26	0.04	0.17	0.34	58%
			Total effect	0.45	0.04	0.37	0.53	100%
	Negative Academic Emotion	Surface learning	Indirect effect	−0.19	0.02	−0.24	−0.15	77%
			Direct effect	−0.06	0.03	−0.12	0.01	23%
			Total effect	−0.25	0.03	−0.31	−0.19	100%
		Deep learning	Indirect effect	−0.20	0.03	−0.25	−0.15	84%
			Direct effect	−0.04	0.04	−0.11	0.04	16%
			Total effect	−0.24	0.04	−0.31	−0.17	100%
ST	Positive Academic Emotion	Surface learning	Indirect effect	0.18	0.03	0.13	0.24	36%
			Direct effect	0.31	0.04	0.24	0.38	64%
			Total effect	0.49	0.04	0.41	0.56	100%
		Deep learning	Indirect effect	0.18	0.03	0.13	0.25	38%
			Direct effect	0.29	0.05	0.20	0.38	62%
			Total effect	0.47	0.04	0.39	0.56	100%

(*continued*)

Table 3. (*continued*)

	Independent Variable	Dependent Variable	Category	Effect	BootSE	95% confidence interval		Proportion
						UP	LO	
	Negative Academic Emotion	Surface learning	Indirect effect	−0.18	0.02	−0.23	−0.13	84%
			Direct effect	−0.03	0.03	−0.10	0.03	16%
			Total effect	−0.21	0.03	−0.28	−0.15	100%
		Deep learning	Indirect effect	−0.19	0.03	−0.24	−0.14	91%
			Direct effect	0.02	0.04	−0.06	0.09	9%
			Total effect	−0.17	0.04	−0.25	−0.10	100%

Therefore, the self-efficacy of college students in BL interaction situation is only an intermediary variable between negative academic emotion and surface learning, and H2 is partially true. The hypothesis H3 and H4 are both valid.

5 Discussion and Suggestions

5.1 Current State of Academic Emotion and Learning Effect in BL

In BL interaction situation, college students' academic emotion is at the medium level, and the positive academic emotion is more than the negative emotion. But in general, the score of academic emotion is not high, and there is room for improvement. At the same time, from different interaction situations, positive academic emotions are the highest, negative academic emotions are the least in ST interaction, and emotional experience is better. However, when interacting with other students, the positive academic emotion of learner is the least, and the negative academic emotion is more. The expression and sharing in cooperation in BL can help learner to achieve high-level goals, so SS interaction needs more attention in practice.

In addition, this paper finds that in BL, although the score of college students' learning effect is above the medium level, their understanding of knowledge is more shallow and scattered. BL can promote in-depth learning in theory, but the research shows that it may not meet this expectation in practice.

5.2 The Direct Effect of Academic Emotion on Learning Effect in BL

In BL, the positive academic emotion of college students can directly promote the learning effect, while the negative academic emotion can directly inhibit it. The reason is that positive academic emotions can lead college students' attention to the task itself, improve the access and operation efficiency of information, and produce a more creative way of thinking [7]. It can also enhance individuals' sense of control over actions; affect students' persistence in learning and their ability to cooperate [8]. Therefore, in BL,

the positive academic emotions of college students can produce good learning results. Negative academic emotions are the opposite.

5.3 Similarities and Differences of the Effects in Different Interaction Situations

The mechanism of the influence of college students' positive academic emotion on learning effect is similar in different situations, that is, college students' positive academic emotion can significantly improve learning effect in SC, SS and ST interactions. However, the effect of negative academic emotion is quite different in different situations. The influence of negative academic emotion is not significant in the SC and ST interaction situations. According to the findings of this paper, there are various emotion in SC interaction. At the same time, the influence mechanism of negative academic emotion is more complex, and there may be a phenomenon that the effects of different emotions offset each other. The complex emotional experience of college students at the stage of autonomous learning reflects that they are not quite adapted to this teaching method. They may need more learning guidance to achieve real "autonomous" learning. In the interaction between teachers and students, the level of negative academic emotions is low, which may not be enough to have a significant impact. In addition, students' negative emotions will decrease or even disappear after teachers' guidance, which may reduce the negative impact of college students' negative academic emotion on deep learning.

5.4 Influence Difference of Mediating Variables

Overall, the mediating effect of self-efficacy and SRLS passed the significance test. However, SRLS are the most important mediating variable for college students' academic emotion to affect learning effect in BL, and the mediating effect of self-efficacy is weak. It may be that there is a big gap between "ideal learning" and "realistic learning" in BL. That is to say, in BL, college students show high expectations for learning and have good confidence in their own abilities and efforts. However, they may not be familiar with the learning environment and the use of learning strategies, resulting in the possibility of active learning and persistent learning is low. Only focusing on College Students' self-efficacy has no significant effect on their learning effect.

It is worth noting that self-efficacy, as a subjective feeling, can have a great impact on the learning effect when finding a "landing point" or "medium". In this study, this "medium" is self-regulated learning strategy. Therefore, if we want to promote learning effect through self-efficacy, the key is to improve self-regulated learning strategies to control learning.

Based on the above discussion, this paper puts forward the following suggestions.

Improve teachers' instructional design ability in BL to guide students' in-depth learning. The research results have found the importance of teachers' instructional design in BL. To improve college students' academic emotional experience and learning effect in BL, teachers may need to improve the teaching design. However, teachers' teaching design and organization may be one of the obstacles to the effectiveness of BL. Therefore, teachers need to change their teaching concepts and roles, master relevant knowledge (such as TPACK), adjust teaching strategies, objectives, course content, evaluation

methods, etc., to guide students to adapt to the BL environment and improve learning results.

Guide college students to learn to adjust their emotions and maintain a good learning state in BL. Students' academic emotion can not only directly affect the learning effect, but also affect the learning effect through intermediary variables. In BL, teachers need to be aware of students' emotional changes, master certain intervention skills, increase students' positive academic emotions, and reduce their negative ones. More importantly, let students learn to manage their academic emotions in BL. Universities can organize activities to strengthen the psychological health education and emotion management ability of students, help them learn to adjust their academic emotions and be the master of their emotions, so as to maintain a good learning state in BL.

Strengthen the guidance of learning methods for college students and help them build confidence in BL. This paper finds the importance of self-regulated learning strategies in BL. Therefore, teachers can help students in learning goals, plans and strategies. At the same time, college students should consciously enhance learning ability. Although the mediating effect of self-efficacy between academic emotion and learning effect is weak, self-efficacy can play an essential role in learning effect through some "media" (such as self-regulated learning strategies). Therefore, in BL it is also necessary for teachers to assist students build self-confidence, believe in their own ability and efforts, and then take active action in learning.

6 Conclusion

This paper focus on the influencing mechanism of academic emotion of college students on learning effect in BL. Students' academic emotion can directly affect the learning effect, and can also affect it through self-regulated learning strategies and self-efficacy. Positive academic emotion can promote the learning effect, while negative emotions can lead to poor learning results. In different interactive situations, the mechanism of positive academic emotion affecting learning effect is similar, but the mechanism of negative academic emotion affecting learning effect is various. It may be necessary to have a more detailed classification of academic emotions and carry out research in future.

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