The Effects of Achievement Emotions and Cognitive Appraisals on Self-Regulated Learning behaviors in Online Learning

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Abstract. The impact of achievement emotions and cognitive appraisals on students' learning behavior in the online environment has received less attention in this area. This study intends to examine the relationships between several distinct emotions related to achievement situations (boredom, anxiety, and frustration) and the strategies of self-regulated learning (elaboration and metacognition) during online courses. 109 university students in China who had experienced an online course were investigated, and the results revealed that elaboration and metacognition were negatively predicted by the negative deactivating emotion of boredom. Moreover, anxiety positively predicted the metacognition significantly. Surprisingly, frustration was found to be have a negative effect on metacognition which is not consistent with the control-value theory.

Keywords: self-efficacy; task-value; emotion; self-regulated learning; online learning.

1. Introduction

Distance education or online learning continues to grow these years, which means some tangible support provided by traditional classrooms are rare for online students. For example, traditional classroom education often provides students with a responsive teacher who can arrange and facilitate that learning and an organized time and area for study [1]. In the online environment, learning is mainly autonomous and lacks the ongoing and interactive support provided by a physically present instructor. Therefore, with the shift in the learning environment, students must understand that to be successful in autonomous online environments, effectively and actively engaged with self-regulated learning is more necessary than in face-to-face classrooms [1].

However, current research suggests that emotions can directly impact students' self-regulated learning behavior and academic achievement [3]. Boredom, anxiety, frustration, hopelessness, and shame predicted achievement attainment [3-6]. Moreover, research on educational technology suggests that the online learning environment may cause students to feel bad about their academic performance. For instance, the technical problems of learning management systems and the social withdrawal of "attending online classes" can cause stress, annoyance, and boredom [2]. Thus, it makes sense to suppose that, in autonomous online contexts, emotions have an essential effect on learning, self-regulation, and academic achievement.

1.1 Theoretical Framework

Self-regulated learning refers to a multidimensional construct describing how students become metacognitive and responsible for their learning process [8-10]. Although other theoretical models proposed different views of components in the self-regulated learning model [11], they broadly shared common features that effective learning strategies, such as elaboration and metacognition, will be utilized by self-learners to regulate and control their performance in the academic setting [12]. However, managing their learning in an online situation is challenging for many students [13]. Recent studies have revealed that emotional elements, such as student motivations and emotions, directly impact students' capacity for self-regulation and achievement, particularly in traditional, face-to-face classroom settings.

Achievement emotions are one of the affective factors that directly impact the self-regulated learning process. Self-regulation ability can be influenced by varios achievement emotions. In the

past 15 years, many researchers moved their interests toward the importance of emotions in academic settings, creating and modifying learning and motivational theories that incorporate the idea of achievement emotions [5, 14-19]. Pekrun [5] demonstrated a control-value theory, which divided achievement emotions into two types: emotions associated with the process of achievement-related activities and emotions related to achievement activities' outcomes. For the activity-related achievement emotions, for instance, a student may feel anxiety before tests, enjoyment or boredom during class, and frustration or anger when dealing with complex problems. Students' learning strategies using and cognitive appraisals of the educational environment induce different achievement emotions [5, 17]. Control-value theory suggests that competence perceptions of the outcome controllability on achievement activities (self-efficiency) and the values of outcomes activities (task value) are two contributions of cognitive appraisals.

Additionally, it is believed that emotions and cognitive assessments have a mutually beneficial relationship. In other words, cognitive appraisals impact achievement emotions, and achievement emotions can also impact cognitive appraisals [5]. In other words, individuals' self-efficacy could be affected by emotions with different valence and arousal level and cognitive assessments [4].

Taken together, valence (positive or negative) and arousal level (activating or deactivating) are two dimensions to determine discrete academic emotions. For example, anxiety and frustration can be seen as negative activating emotions, and boredom is a negative deactivating emotion [17]. It is believed that when negative emotions are activated, processing mechanisms like simple rehearsal become more inflexible and shallower. Similar theories suggest that negative emotions deactivate attention and cause people to employ more surface, shallow processing techniques [5]. Nevertheless, negative achievement emotions do not always have adverse effects. Students feeling anxious about an upcoming exam, for instance, is a negative activating feeling, but it can also motivate someone to study and get ready for the test. Engagement fostered by negative activating emotion can have a favourable overall impact on future learning and performance [5]. As a negative activating emotion, frustration can positively and negatively predict metacognition and elaboration [21]. As a negative deactivating feeling, boredom, on the other hand, negatively correlates with self-regulated learning behaviour [21, 22].

1.2 Aims and Hypothesis

Online learning requires effective self-regulation learning behavior to achieve success. Previous studies in face-to-face conditions showed that achievement emotions influence the use of self-regulated learning strategies. Students become the manager and monitors of learning process replace teachers, which means students often learn independently with no extra support in an online environment.

Although much has been learned about the emotional effects (positive and negative) on self-regulated learning behavior over the past 15 years, little research examined how negative emotions (boredom, anxiety and frustration) behave in online learning environments, where successful self-regulation is regarded as a crucial element of academic achievement. The present research will examine the impact of anxity, boredom and frustration on students' online self-regulated learning behaviors. Because many students experienced more negative emotions than positive ones in the online environment; specifically, 44% of the population felt depressed, and 42% felt anxiety in the online environment [7]. In addition, Pekrun et al. [17, 22] indicated that boredom is one of the most often experienced emotions in academic situations. Therefore, beaed on the control-value theory and previous research on the emotions' effects on academic performance; the following hypothesis were assumed:

H1: Anxiety positively predict metacognition and elaboration.

H2: Boredom negatively predict metacognition and elaboration.

H3: Frustration negatively predict elaboration but positively predict metacognition.

2. Method

2.1 Participants

Participants were 109 Chinese undergraduate students (60.5% female). The mean of age was 21.05 years old (SD =1.60), and ranged from 17 to 26 years. All participants completed the self-report questionnaires online volunterally.

2.2 Measures

The survey consisted of 35 items, it was composed of three self-reported questionnaires: the cognitive appraisals questionnaires (OLVSES), the achievement emotions questionnaires (AEQ), and the self-regulated learning questionnaires (MSLQ).

2.2.1 Cognitive Appraisals Questionnaires (OLVSES)

Measurements of cognitive appraisals were adopted from the Online Learning Value and Self-Efficacy Scale (OLVSES) [9]. OLVSE is a self-report measure used to assess students' cognitive appraisals. It is composed of 11 items extracted from the task-value and self-efficacy subscales: (a) a self-efficacy subscale assessed students' belief in their ability to masterwork (5 items). (b) a task value subscale assessed students' judgments of course value (6 items). Students were required to rate themselves on a 7-point Likert scale ranged from 1 (completely disagree) to 7 (completely agree). And Cronbach's α of task value and self-efficacy were .72 and .73 in this study.

2.2.2 Achievement Emotions Questionnaires (AEQ)

Measurements of achievement emotions were adopted from the Achievement Emotions Questionnaire (AEQ) [25]. AEQ is used to assess students' achievement emotions (anxiety, boredom and frustration). It comprises 14 items extracted from the class-related, learning-related, and test-related emotion subscales. Students were required to rate their achievement emotions on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α of anxiety, boredom and frustration were .74, .86 and .80 in this study.

2.2.3 Self-Regulated Learning Questionnaires (MSLQ)

Measurements of self-regulated learning behavior were adopted from the Motivated Strategies for Learning Questionnaire (MSLQ) [26, 27]. MSLQ is used to evaluate students' motivation and their use of self-regulated strategies. It comprises ten items from the elaboration and metacognition scales under the self-learning strategies section. Students were required to rate their self-regulated learning behavior on a 7-point Likert scale from 1 (not at all true for me) to 7 (very true of me).

Cronbach's α coefficient of metacognition and elaboration are below 0.7 in this study; this might be due to the translation problems as the questionnaire was translated to Chinese in the present study[12. Despite this, previous research found relatively high internal reliability of metacognition and elaboration (α =.86 and .81, respectively) in their study [1].

2.3 Data Analysis

The statistical software SPSS 26.0 was used to analyse the data. Specifically, Cronbach's alphas coefficient, descriptive statistics, Pearson correlations and regression analysis were used in data analysis.

3. Results

Table 1 displays descriptive statistics, and correlation analysis for academic emotions, cognitive appraisals, and self-regulated learning behaviors. As shown in Table 1, anxiety and boredom were statistically significant to each other (r =.56, p < .01). However, boredom was negatively related to elaboration (r = -.47, p < .01) and metacognition (r = -.58, , p < .01), anxiety was only negatively

related to elaboration (r = -.25, p < .05). Likewise, frustration was negatively related to both elaboration (r = -.32, p < .01) and metacognition (r = -.56, p < .01).

For each dependent variable, hierarchical regressions were run to explore the prediction of anxiety, boredom and frustration and cognitive appraisals on two self-regulated learning strategies.. And the regression analysis of metacognition and elaboration are summarized in Table 2. In the model of elaboration, gender and age were neither predict elaboration nor metacognition significantly. In step 2, the addition of task value and self-efficacy explained more 37% of elaboration's variance, and task value (β = .48, p < .001) and self-efficacy (β = .20, p < .05) positively predicted the elaboration. In step 3, adding anxiety, boredom and frustration explained more 6% of elaborations' variance. Task value still predicted elaboration positively (β = .39, p < .001), whereas boredom negatively predicted elaboration signiticantly (β = -.37, p < .01).

Also, in the regression model of metacognition. The addition of task value and self-efficacy explained an additional 24% of metacognition's variance. Like the results of elaboration, task value (β = .33, p < .01) and self-efficacy (β = .24, p < .05) positively predicted elaboration. After adding anxiety, boredom and frustration, more 21% variance of metacognition was explained. Meanwhile, boredom (β = -.31, p < .05) and frustration (β = -.35, p < .01) negatively predicted metacognition signiticantly.

Table 1. Descriptive statistics correlations for the main variables (N=109)

Variable	1	2	3	4	5	6	7
1. Task value	–	.54**	-.18	-.43**	-.38**	.59**	.45**
2. Self-efficacy		–	-.28**	-.40**	-.29**	.45**	.41**
3. Anxiety			–	.56**	.57**	-.13	-.25**
4. Boredom				–	.73**	-.47**	-.58**
5. Frustration					–	-.32**	-.56**
6. Elaboration						–	.53**
7. Metacognition							–
M	5.43	4.75	3.29	2.79	2.40	5.17	4.83
SD	0.76	0.96	0.79	1.06	0.91	0.91	0.83

Notes: ** p < .01.

Table 2. Regression of academic emotions and cognitive appraisals on self-regulated learning strategies

Variable	Elaboration			Metacognition		
	B	SE B	β	B	SE B	β
Step 1						
Gender	.04	.18	.02	-.12	.16	-.07
Age	.00	.16	.00	-.02	.05	-.04
Step 2						
Gender	.05	.15	.02	-.10	.15	-.06
Age	-.02	.05	-.04	-.04	.05	-.07
Task Value	.57	.11	.48***	.36	.11	.33**
Self-Efficacy	.19	.09	.20*	.21	.09	.24*
Step 3						
Gender	.05	.14	.03	-.02	.13	-.01
Age	-.01	.04	-.01	-.01	.04	-.02
Task Value	.47	.12	.39***	.14	.10	.13
Self-Efficacy	.15	.09	.16	.15	.08	.17
Anxiety	.17	.11	.15	.21	.10	.20*
Boredom	-.32	.10	-.37**	-.24	.10	-.31*
Frustration	.06	.12	.06	-.32	.11	-.35**
R^2 for the final model			.43*			.46***
ΔR^2 for Step 2			.37***			.24***
ΔR^2 for Step 3			.06*			.21***

Notes: * p < .05; ** p < .01; *** p < .001.

4. Discussion

In the situations of considering the effects of age, gender, and cognitive appraisals, anxiety still predicted the metacognition positively. This finding supported the hypothesis, and was consistent with control-value theory that negative activating emotions can lead to intense determination to avoid failing and are thought to encourage the use of inflexible strategies[3]. The relation describes above suggests that students who feel anxious about their online course are more likely to use metacognition as their learning strategy.

Notably, findings of boredom in the present study provided empirical evidence of control-value theory, which emphasize the role of deactivating and activating emotions. As expected, when considered the impact of age, gender, and cognitive appraisals, boredom still negatively predicted both elaboration and metacognition. This results showed that the negative deactivating emotion of boredom had stronger relationships with its results than the negative activating emotion of anxiety. Combining the findings of boredom, it could found that negative deactivating emotions have more significant and possibly more detrimental effects on student behaviour and learning. Students who find their online courses boring are generally less inclined to suggest helpful learning strategies. These results supported control-value theory and were compatible with the study's hypothesis.

Despite having a negative correlation between elaboration and metacognition, frustration turned out to be a poor predictor of metacognition when taken into account as a whole. This result is unexpected from hypothesis and did not support the previous research in a similar setting. Artino indicated that when boredom and task-value were included in the study, frustration acted as a positive predictor of metacognition due to suppressor variables [1, 21]. This is to say, the negative correlations between frustration and metacognition ceased until other variables (e.g., task value, self-efficacy, and/or boredom) were accounted for together. However, the results of this study on frustration seem to align with the findings from previous research done by Pekrun and his colleagues [8]. They suggested that negative deactivating emotions (e.g., boredom) have stronger and potentially more negative effects on students' learning behavior than negative activating emotions.

When taken as individually, boredom and frustration were negatively connected with elaboration and metacognition, but anxiety was negatively correlated with metacognition alone. But after the other factors were taken into consideration, frustration stopped being a negative indicator of elaboration. In contrast, anxiety was a significant positive predictor of metacognition, while boredom and frustration were significant negative predictors.

5. Limitations and Implications

The current study suffers several limitations. Firstly, the internal consistency of elaboration and metacognition is lower than the standard level (lower than 0.7); therefore, the measurement of elaboration and metacognition received poor reliability [28]. The original format of the MSLQ questionnaire had high internal reliability; however, it was translated into Chinese format in this study. Translation problems might be a potential explanation for poor internal reliability in the current study[12]. Second, the sample in recent research is relatively small. The lack of a significant enough sample size reduces the possibility of detecting a clinically significant effect, which is one ich the study's findings are constrained [30]. This could cause underwhelming results because a bigger sample size might reveal more pronounced variations between the two intensities and result in a discernible impact of phonological component creation on name accuracy [15]. Future work should benefit significantly by using a greater sample size across different countries.

6. Conclusion

In conclusion, until recently, although abundant research focused on the influence of achievement emotions and cognitive appraisals on students' online self-regulated learning behaviors, the setting of an online environment had mainly been neglected in this field. Current research aims to fill this

gap by investigating the impacts of negative emotions (anxiety, boredom, and frustration) on self-regulated learning strategies. Additionally, this research was based on the framework of the control-value theory, which categorized the valence of achievement emotions (positive vs negative) and the level of activation (activating vs deactivating). Overall, current research findings were consistent with the hypothesis and the control-value theory. A negative deactivating emotion (e.g., boredom) would impact the self-regulated learning strategies in the online learning situations, and a negative activating emotion (e.g., anxiety) may produce a beneficial effect on the use of metacognition strategies. The effect of frustration in this study is not apparent and needs further investigation in the future study.

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