

## A Longitudinal Study of Self-Regulated Learning in an Online Game-Based EFL Formative Assessment Blended Learning Environment

YANG Manzhen<sup>[a]</sup>; LIANG Li<sup>[b],\*</sup>

<sup>[a]</sup>Associate Professor, School of English and Education, Guangdong University of Foreign Studies, Guangzhou, China.

<sup>[b]</sup>Lecturer, School of English and Education, Guangdong University of Foreign Studies, Guangzhou, China.

\*Corresponding author.

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### Abstract

Self-regulated learning (SRL) is one of the central parts of online formative assessment and well-worth an in-depth study. But it is noted that some essential issues of formative assessment remain rarely touched yet, such as the question of how online formative assessment interacts with the learners' motivation, self-efficacy beliefs, and regulation of learning, and so on. Given the above question mentioned, this paper reports a case study of SRL in an online blended formative assessment module in the context of non-English-major college English learning. The intent of the present research is to exemplify how SRL, an active area in educational psychology, can help to investigate the mechanism and process of SRL in the online formative assessment environment over a long period of time.

**Key words:** Self-regulated learning; Online formative assessment; College education

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### INTRODUCTION

Internet technologies have been forging pervasive learning spaces and experiences in a novel phase of

digital technology-enhanced learning worldwide (eg. Galebakhtian et al., 2015; Liaw et al., 2010; Chen et al., 2008). The China Internet Network Information Center estimates that China's student web users at college age account for over 146 million (51.1%) in 2015 (CNNIC, 2015).

Given the major percentage of college student web users, it is significant to explore and understand the college student web users' main characteristics in technology-enhanced learning. Learners have been assumed to be the masters (agents) of their technology-assisted learning and technologies can be used not only as cognitive tools but also as metacognitive tools (Chen et al., 2008). Thus, internet technology-enhanced learning environment provides a means with which learners can exercise agency to manage their actual learning. When the learners actively participate in their learning in terms of motivation, meta-cognition and behavior, independent of the teachers or others, they can be called self-regulated learners (Zimmerman, 1986, 1989). Therefore, further research is in need to explore the learners' key psychological characteristics such as motivational strategies in the new context of learning to understand the mechanisms and processes of internet technology-enhanced learning. Given the above mentioned, the aim of the present research is to illustrate how the theories of self-regulated learning (SRL), a significant area of educational psychology, can explicate the college students' motivational strategies and the mechanisms of the online game-based formative assessment environment in the case of EFL study.

### 1. LITERATURE REVIEW

#### 1.1 Game-Based Blended Formative Assessment Environment

In recent decade, game-based online learning has become a widely discussed issue. When people play

games, they often experience sense of happiness and enter a concentrating state of flow (Csikszentmihalyi, 1990). Garris and Driskell (2002) found that games can effectively stimulate participants' intrinsic motivation. Along with the development of digital technologies in the recent decade, numerous game-based online courses popped up in different fields of education worldwide. Sharples (2000) investigated how to apply the game-based digital technologies in life-long education. Yang (2012) investigated the influence of a web-based game on students' problem-solving skills and learning achievement. It was found that the web-based games helped to improve students' problems-solving skills though no significant improvement was found in the students' academic achievement. Plenty of studies have investigated the technology-enhanced educational games for various specific courses such as mathematics (Lowrie & Jorgensen, 2011), and computer science (Papastergiou, 2009). Researchers discovered that games can help to improve learners' academic achievement,

motivation and participation in classroom activities, so online game-based learning can be involved in the traditional classroom to promote students' motivation and active attendance (eg. Carnevals, 2005; Wang et al., 2014). Wang (2008) investigated the web-based quiz-game-like formative assessment and showed that game-based formative assessment could improve learners' motivation to use online assessments. However, among the researches so far, the interaction of the mechanisms of game-based online formative assessment module has remained an unknown issue. Given the above mentioned, our research group has carried out a game-based blended formative assessment educational reform in an effort to integrate the ideology of games with in-class and online blended-teaching formative assessment for over two years. An online platform (<http://evaluate.fifedu.com>, as seen in Figure 1) has been developed to meet the requirements of the game-based teaching and learning for different courses within the formative assessment module.

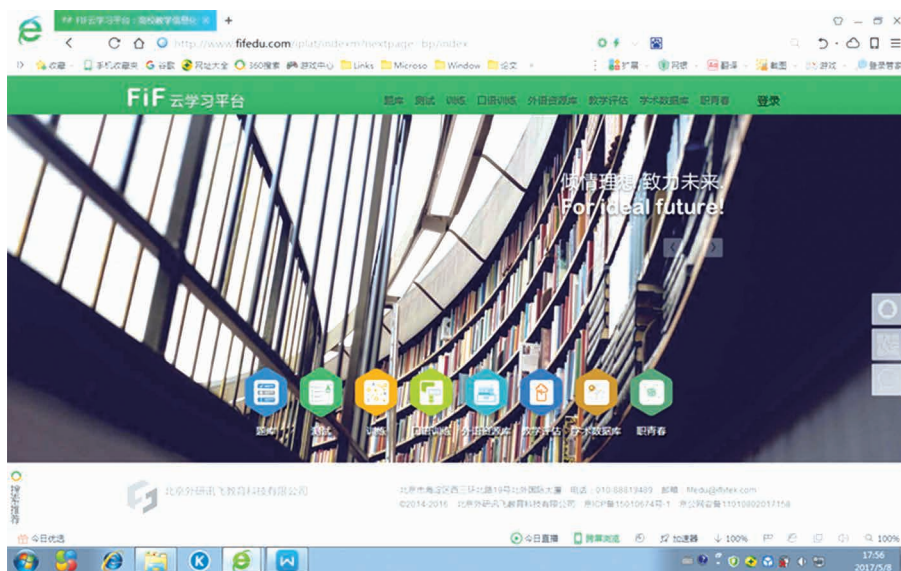


Figure 1  
Fif Formative Assessment Online Platform

## 1.2 Self-Regulated Learning

Self-regulation incorporates a series of sophisticated super-ordinate functions such as cognition, metacognition, problem-solving and motivation. Self-regulated learning (SRL), a key section in formative assessment module, is a sub-construct under the concept of self-regulation (Boekaerts & Corno, 2005). As basically a process of applying cognitive and meta-cognitive strategies in learning, this paper adopts the theoretical framework of Bandura's social cognitive theory (Bandura, 1986, 2001; Zimmerman, 2008). According to this theory, the environment influences people's cognition and behavior, while people are viewed as both products and producers of the environment in which their cognitive and behavioral functions are decided. The views about SRL are essentially

focused on the concept of agency. Agency determines the environment and is decided by the environment. Agency possesses four features: intentionality, forethought, self-reactiveness, and self-reflectiveness. In this sense, human agency refers to an emergent ability of a person to make choices and to act on these choices through interaction between mind and sociocultural contexts (Bandura, 2001). In the case of SRL in this paper, the learners participate in study activities with certain purpose and their learning behaviors are directed by their anticipated goals, outcomes and plans. The learners are not just the agents of study but also self-examiners of their study. Thus, the concept of agency indicates that we need to investigate two key elements of SRL—motivation and metacognition.

### 1.3 Motivation & Metacognition

Metacognition refers to the investigation of people's knowledge of their cognitive and memory processes, and also how they apply the metacognitive knowledge in their information processing and behavior (Koriat, 2007). Schunk et al. (2008, p.4) define motivation as "the process whereby goal-directed activity is instigated and sustained". Thus, learners' motivation, can be inferred from its products as an inner psyche process—observable behavior such as the choice of learning tasks, how to deal with problems and the length of time allocated for study. Motivation can be divided into intrinsic and extrinsic motivation. The impact of motivation on learning mainly lies in behavioral and cognitive engagement (Linnenbrink & Pintrich, 2003). Besides that, self-efficacy is also a significant motivational construct of human agency as it is discovered that learners with high self-efficacy beliefs are more willing to spare more effort in overcoming difficulties and persist at learning tasks. Based on social cognitive theory, self-efficacy refers to a belief about one's ability to accomplish a learning task (Bandura, 1986). Shen et al. (2013) found that the online learning self-efficacy is multidimensional and predictable with demographic variables such as gender and academic status. It was also revealed that the online learning self-efficacy explained the students' online learning satisfaction. Li and Liu (2015) reviewed the researches on Chinese EFL learners' motivation from 2004 to 2013 and noted the problem of limited perspectives and few longitudinal empirical researches. Besides that, little is known about to what extent the students' self-efficacy, intrinsic and extrinsic motivation can predict their strategic regulation of learning in the game-based blended formative assessment module yet.

In consideration of the above mentioned, we designed a system of credit-coin game rules for the in-class and online blended formative assessment environment. The teachers assess the students' learning performance and efforts in terms of credit coins accumulated in the online platform. For example, student hand in homework as required will be awarded ten credit coins in the credit coin account on the online platform and the A level homework will get an extra award of 15 coins. Therefore, the amount of credit coins shows the levels of one's learning efforts and outcomes.

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## 2. METHOD

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### 2.1 Research Questions

This study mainly focuses on the relations among the learning outcomes, length of time for participation and the four subscales of SRL motivational strategies. The research questions are:

What are the differences, if any, among the four variables of SRL for the students with different learning outcomes?

What are the differences, if any, among the four variables of SRL for the varied length of participation time of this game-based blended formative assessment module?

To what extent do the SRL motivational variables predict the metacognitive variable (strategic regulation of learning)?

### 2.2 Participants

The participants ( $N=358$ ) were first-year non-English-major college students in a Cantonese university in the academic year of 2014-2015, the majors of whom include accountant, finance and business management. There were 107 male students and 257 females, who were from urban and rural areas throughout China. The survey statistics indicated that there was no significant differences in the SRL motivational and metacognitive variables between the two genders ( $p>.05$ ). Those who took part in the game-based blended formative assessment module for one term accounted for 152 (three classes of students), while the number of those who participate in this educational reform module for two consecutive terms were 206 (five classes of students).

### 2.3 Procedure

An extensive online survey from sojump.com was designed and carried out among the eight classes of freshman students participated in the game-based blended formative assessment module in the academic year of 2014-2015. The survey was piloted on a sample of ten students and two teaching-research staffs. Then the survey was modified by deleting or changing some items and wording. Three out of the eight classes of students joined this educational reform module for one term and the other five classes participated in this reform module for two terms. The survey was administered anonymously online twice separately at the end of each term of this academic year (i.e., December 2014 and June 2015).

### 2.4 Data Collection

The quantitative measurement in this paper can be grouped into three categories: the students' self-report surveys, weekly length of time online on average and learning outcome (number of credit coins gained in the individual account in the online platform). The number of valid questionnaires collected was three hundred and fifty-eight. First, the 5-point Likert scale survey was developed on the basis of the MSLQ (Duncan & McKeachie, 2005; Pintrich et al., 1993). Then the survey was administered in the classes anonymously twice. This survey measures three motivational variables (self-efficacy (SE), intrinsic motivation (IM), and extrinsic motivation (EM)) and one metacognitive awareness

variable (strategic regulation of learning). There are twenty-three items in the four subscales of this survey and all items are directly defined in the context of EFL learning, transforming the widely used instrument for measuring motivated strategies for learning MSLQ questionnaire into an appropriate scale for this context of game-based EFL blended classes. The students were required to select an answer from the five options in the 5-point Likert scale: strongly agree, agree, neutral, disagree, and strongly disagree, which were coded as 1,2,3,4,5 respectively in the data analysis. Thus, the higher score in a subscale one reported, the lower value he or she would have in that subscale. The Chronbach's alpha value of the total questionnaire is .768 and the standardized alpha value is .772, which indicates that the scores in the questionnaire are reliable.

The present study uses SPSS Statistics 16 to analyze the data: (a) ANOVA was used to analyse whether the students with different learning outcomes would differ in their SRL motivational strategies; (b) independent *t*-test was used to explore whether the students' different length of time of participation in this game-based blended formative assessment module would influence their SRL motivational strategies; (c) Pearson correlates analysis was employed to examine the correlations among the four variables; (d) multiple regression analysis were used to check to what extent

the three motivational strategies influenced the strategic regulation of learning (metacognitive awareness variable).

### 3. RESULTS

#### 3.1 Research Question 1: Predictors of Students' Learning Outcomes

As the students did not know their exact final regular grade for their college EFL course yet when they took the survey toward the end of the term, we divided the total amount of credit coins into five ranges (a.0-100 coins; b.100-200 coins; c.200-300 coins; d.300-400 coins; e.over 400 coins) and the students made the corresponding choice based on the number of coins in their accounts in the online platform by that time. As shown in Table 1, ANOVA analysis indicates that there is no significant predictors in the three variables (intrinsic, extrinsic and strategic regulation of learning), while a significant predictor is found in the variable—self-efficacy. Scheffe post hoc analysis in Figure 3 further illustrates that self-efficacy in the group e (over 400 coins) appears to be significantly higher than the group b (100-200 coins). The students who achieved excellent learning outcomes also possess significantly high level of self-efficacy.

**Table 1**  
**ANOVA Analysis: Predictor of Students' Learning Outcomes**

	Self-efficacy	Intrinsic motivation	Extrinsic motivation	Strategic regulation of learning
<i>F</i> -test	3.096	2.280	.521	1.582
Significance	.016	.060	.720	.179

#### 3.2 Research Question 2: Different Length of Time in Participation

It is estimated that the number of students who participated in this game-based blended formative assessment module for one term is 152 and those participated for two terms is 206. Independent *t*-test analysis indicates that there is no significant difference in the three variables (intrinsic motivation, self-efficacy and strategic regulation of learning). For the variable—extrinsic motivation, the two-tail *t*-test analysis ( $t=-1.993$ ,  $df=356$ ,  $p=0.047<0.05$ ) proves that there is significant difference in the variable (extrinsic motivation) for the students with different length of participation time. The mean difference between those participated for one term and two term is -0.66217, which means that those participated for two terms had a higher score in extrinsic motivation. It is noted here that the higher score in a subscale of this MSLQ one reported, the lower value he or she would have in that subscale. Thus, there exists negative correlation between the students' extrinsic

motivation and their length of time in participation. In other words, the students participated for one term had significantly higher extrinsic motivation than those participated for two terms.

#### 3.3 Research Question 3: Prediction of Strategic Regulation of Learning

The students' strategic regulation of learning affects their specific regulative behavior in learning such as dealing with the problems and the arrangement of time for study. Yet little is known about to what extent the students' self-efficacy, intrinsic and extrinsic motivation can predict their strategic regulation of learning in the game-based blended formative assessment module. Therefore, multiple regression analysis was conducted with each for the three variables (self-efficacy, intrinsic and extrinsic motivation) as the independent variable. The multiple correlation coefficient of the independent and dependent variables ( $R=0.657$ ,  $R^2=0.432$ ) shows that the three independent variables can predict 43.2% of the variation in the

dependent variable—strategic regulation of learning. Anova<sup>b</sup> significance test of regression equation shows that the total variance of this regression model reached a statistically significant level ( $F=89.569$ ,  $\text{sig}=0.000<0.001$ ). Significance of coefficient  $\alpha$  ( $\text{sig}=0.000<0.05$ ) and the constant term (4.206) indicates that the regression coefficient reaches the level of significance. The standardized regression model is: strategic regulation of learning  $=0.283 \times \text{SE} + 0.358 \times \text{IM} + 0.177 \times \text{EM}$ . The three independent variables can explain the variation in the dependent variable (strategic regulation of learning) and

have significant impact on it. The standardized regression coefficient of the three independent variables is positive numbers, which illustrates that the impact from the three independent is positive. The higher the absolute value of the standardized regression coefficient ( $\beta$ ) is, the larger impact the independent variables have on the dependent variable. As shown in Table 3, the absolute values of standardized regression coefficient ( $\beta$ ) for self-efficacy and intrinsic motivation are larger, which indicates these two variables are stronger predictors for the strategic regulation of learning.

**Table 3**  
**Multiple Regression Analysis**

Independent variable	<i>B</i>	Standard error	Beta ( $\beta$ )	<i>t</i> value
Intercept	4.206	.682		6.171
Self-efficacy	.360	.065	.283	5.581***
Intrinsic motivation	.417	.058	.358	7.207***
Extrinsic motivation	.193	.047	.177	4.099***

$R=.657$   $R^2=.432$  adjusted  $R^2=.427$   $F=89.569$ \*\*\*

Note. \*\*\* $p<.001$

## 4. DISCUSSION

### 4.1 Learning Outcome and SRL Variables

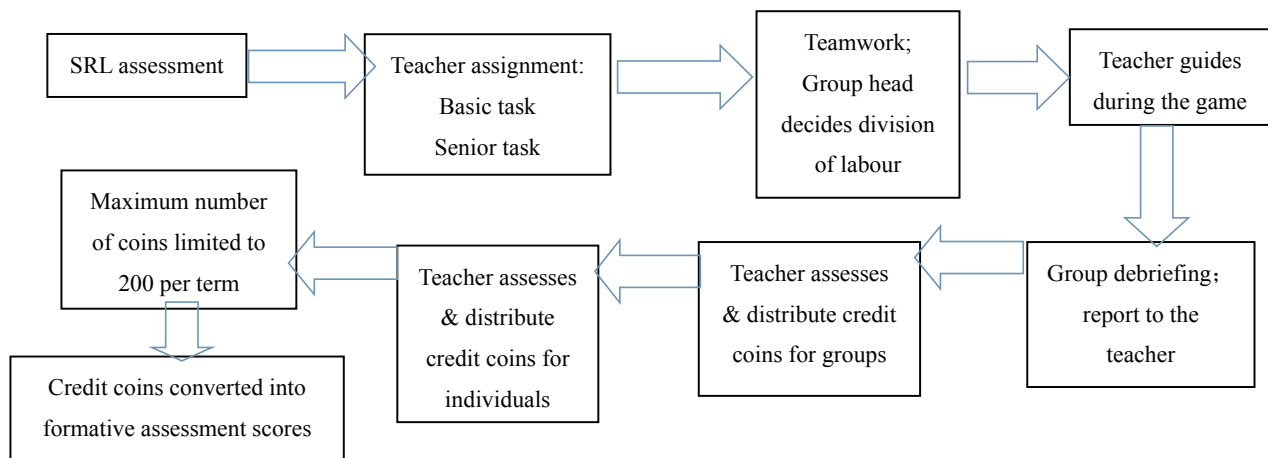
During the process of SRL, the learners' level of motivational strategies correspond with their level of SRL outcome and behavior. In this context of game-based EFL online formative assessment module, the university students with different ranges of credit coins do not exhibit significant difference in their strategic regulation of learning, intrinsic and extrinsic motivation. This means that pure rely on the teachers' praise alone does not necessarily lead to significant improvement in university students' learning achievements.

The students of different levels of learning outcomes differ in their levels of self-efficacy in the game-based formative assessment context. The stronger self-efficacy the students have, the better learning outcomes they achieve. This echoes Komarraju and Nadler's (2013) discovery about the relationship between self-efficacy and learning outcomes. The students of stronger self-efficacy tend to more often use cognitive and meta-cognitive strategies to use learning resources, manage extrinsic stimulation and overcome difficulties in order to achieve good learning outcomes. So for the success in the reform for better learning outcomes, what matters is not to boost the extrinsic motivations, but to use appropriate teaching pedagogy to improve the students' self-efficacy. The educational reformers need to take it into serious consideration while designing the functions of the online platform and specific pedagogical schemes for online

game-based curriculum.

How can we improve the students' self-efficacy in the context of online game-based learning then? Cigdem et al. (2015) investigate a key step in the game-based learning situation—the impact of debriefing on the students' self-efficacy and motivation in different contexts. Here debriefing refers to the reflection with guidance and support during the process of learning. Their research demonstrates that the effect of group debriefing is better than the individual debriefing and during-the-game debriefing is more effective than after-the-game debriefing. Therefore, when the teachers design the specific game-based teaching activities, they need to value the group collaborative debriefing step during the activity. The recount, mutual reflection and comments among the group members can lead the students to normalize their perception of reaction to learning behavior, be prepared mentally for future perfection and improve their confidence in fulfilling the SRL tasks by themselves.

Given the above mentioned, we designed the credit coins online game-based teaching activity module (Figure 2) to have teacher-student and student-student debriefing during the game in order to improve the students' self-efficacy. The students are required to finish some in-class or extracurricular learning tasks and gain certain number of credit coins. The gained credit coins will be automatically converted into their formative assessment scores in the online platform to provide the students instant feedback.



**Figure 2**  
**The Credit Coins Online Game-Based Teaching Activity Module**

#### 4.2 SRL Variables and Participation Time

Among all the surveyed university students, the number of those participated in this online game-based formative assessment module for one term is one hundred and fifty two, while that of those participated for two terms is two hundred and six. The different lengths of time do not have significant impact on the university students' inner motivation, self-efficacy and strategic regulation of learning. However, negative correlation exists between the students' extrinsic motivation participation time. The longer the university students participate in the online game-based formative assessment module, the lower level of their extrinsic motivation will be. This indicates that the teaching methods stimulating the university students' extrinsic motivation, will be less effective as time goes by. So the lesson for the educational reformers and teachers is that the students' long-term motivation should not be stimulated through extrinsic motivation, but other aspects such as the students' interests, needs, characters, etc.

#### 4.3 Prediction on Strategic Regulation of Learning

The results of multiple regression analysis indicate that self-efficacy, inner and extrinsic motivation have significant influence on strategic regulation of learning as these three variables can explain the variation in the dependent variable—strategic regulation of learning. Among these three variables, self-efficacy and inner motivation have higher explanatory power for strategic regulation of learning. It is found that the adoption of proper digital games in classroom teaching is an effective method to promote the students' inner motivation (Garries et al., 2002; Carnevale, 2005). Therefore, how to modify the online game-based teaching on the spot according to the students' actual learning response is a problem we need to tackle in the future.

#### CONCLUSION

This research discovers that the students of different credit-coin totals have significant difference in their levels of self-efficacy. The students with different lengths of participation time vary in their extrinsic motivation and there is negative correlation between their extrinsic motivation and different lengths of participation time. Self-efficacy, inner and extrinsic motivations have significant impact on strategic regulation of learning. Self-efficacy and inner motivation have higher explanatory power for strategic regulation of learning. Self-efficacy is the crucial variable for the SRL outcomes and regulation. Debriefing adopted in the game-based formative assessment module is an effective way to improve the students' self-efficacy. More research should be done to explore some feasible ways to encourage autonomous self-regulated learners.

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