



Gamification and Students' Creativity: Multivariate Linear Regression Method Based on SPSS Analysis on the Mediating Effect of Learning Immersion

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Abstract. In this paper, the data of gamification, learning immersion and creative ability of 419 students are taken as samples, and the multivariate linear regression method is used to establish the mediating model and observe the multivariate linear regression relationship. The results show that: (1) there is a positive correlation between learning immersion and students' creativity; (2) There is a positive correlation between gamification and students' creativity; (3) There is a mediating effect between learning immersion in games and students' creativity.

Keywords: Gamification · Creative Ability · Learning Immersion · Multiple Linear Regression · Mediating Effect

1 Introduction

Creativity plays an important role in individual adaptation to the world and future development, and is the core ability of students [9]. Gamification can stimulate students' innovative ability by introducing game elements into the learning process [13]. In this process, we need to constantly pursue the peak experience and immersion experience of learners. Therefore, immersive learning has become an important factor in promoting the effect of Gamification [2].

Some literatures at home and abroad have done corresponding research on the relationship between Gamification and creativity, immersive learning and creativity. However, the existing literature mostly discusses the impact of Gamification and creativity, immersive learning and creativity from a theoretical perspective, and there is a lack of corresponding empirical research. In addition, what is the mechanism of learning immersion in the relationship between Gamification and creativity? The existing literature is still lack of empirical verification.

Therefore, based on the shortcomings of the existing research, this paper will deeply analyze the mechanism of learning immersion in the relationship between gamification and students' creativity. Including, first, does the way of playing have an impact on students' creativity, and to what extent? Second, does learning immersion affect students' creativity and to what extent? Third, does learning immersion play a mediating effect in the relationship between gamification and students' creativity?

2 Theoretical Review

2.1 Gamification

In the 1980s, the application of games in education and learning attracted the attention of scholars. Gee (2003) emphasized the role of games in the cognitive process and the potential possibility of applying games to the learning process. This view is not only a classic basis in the field of Gamification research, but also points out the prospect of Gamification learning. At present, Gamification has gradually become an independent research topic. The term Gamification was widely used around 2011 [11].

The predecessor of gamified learning is game based learning (GBL), education game and serious game. Game learning takes learners as the center, designs learning content according to game thinking and game mechanism, creates fascinating learning scenes by using intelligent technologies such as augmented reality such as intelligent network, cloud technology and artificial intelligence, and understands and applies knowledge content with the help of game mechanism, which can improve learners' learning stickiness. Gamification can cultivate creativity, empathy and social skills, and create a zone of proximal development, thereby promoting students' knowledge co creation [12].

Deterding et al. (2011) Systematically explained the connotation of gamification and further defined the essence of gamification as "using game design elements in non game situations", which is recognized by many scholars in academia and industry. Based on these discussion, gamification has the following characteristics: (1) emphasizing the use of game design elements rather than their expansion; (2) Emphasize game design rather than game based technology or other related practices; (3) Emphasize game elements rather than complete and mature games; (4) Emphasize game features rather than simple entertainment; (5) Emphasize the use in non game situations, not limited to specific purposes, situations or media [6].

2.2 Creativity

Gilford put forward the idea of creativity in 1950, and many scholars began to study it. However, there is no consensus on the definition of creativity in academic circles. In the early stage, it was mainly studied from a single perspective, including personal characteristics and situational levels. In recent years, scholars have emphasized that creativity is the performance of an individual as a whole and a mixed orientation that takes into account various factors such as individual and environment (Sternberg and Lubart 1999), and believe that the display of creativity needs to be stimulated by the environment, sufficient space and time, etc.

Students themselves, teachers, campus environment, educational methods, educational administration and family conditions will all affect students' creativity. Among them, game learning plays an important role. In the teaching process, the game learning methods that adapt to time and change will help inspire students' creative opportunities and creative performance.

Creativity is the product of the interaction between ability, process and environment, and the ability to produce novel and applicable products accepted by a specific social culture [16].

Creativity plays an important role in individuals' adaptation to the world and future development, and is regarded as the core ability of teenagers to win in a rapidly changing environment [9]. Creativity is a highly complex ability, and its development is closely related to the environment, especially the teaching methods of teachers. Because social support is a key factor affecting the development of creativity [1]. The supportive environment in the school environment comes from teachers on the one hand, and from peers on the other hand. Teacher support and peer support play an important role in the development of students' creativity.

2.3 Learning Immersion

Csikszentmihalyi (1975) found through interviews with climbers, art practitioners and other personnel that they produce a special emotional experience that makes them focus during activities, so they are willing to and adhere to these activities [3].

Csikszentmihalyi calls such emotional experience flow experience, which refers to the emotional experience that shows a strong interest in an activity or thing and can promote individuals to fully participate in the activity. This experience is triggered by the activity itself rather than other external purposes. Csikszentmihalyi (1990, 2002) proposed the dimension of immersion experience, including the balance between skills and challenges, the integration of action and consciousness, clear goals, clear feedback, focusing on the task at hand, a sense of control, loss of self-awareness, loss of sense of time, and the experience of automatic purpose [4, 5].

The existing research mainly focuses on the role of immersion experience in learning. For example, Egbert (2003) found that: It is believed that immersion experience can predict academic achievement, and individuals who have procrastination behavior in learning usually lack motivation for autonomous learning and obtain less immersion experience. [8] In addition, self leadership and academic self-efficacy can predict learning immersion experience. In cooperative learning, professional satisfaction and learning satisfaction are also important predictors of learning immersion. At the same time, the application of immersion theory to create a sports environment that produces immersion experience can improve individual sports level. Immersion experience can not only improve the intrinsic motivation of individuals, but also make learning cognition more positive and autonomous learning easier.

3 Research Hypothesis

3.1 Learning Immersion and Students' Creativity

Lung et al. (2010) believe that when people are immersed in learning or work, they will feel less effort and experience happiness in it. When an individual is immersed and has advantages that are appropriate to the difficulty of learning, he or she will devote himself or herself to learning and work, generate positive feedback in the learning process, and encourage students or employees to put forward creative ideas and behaviors [15].

As a positive emotion, learning immersion can enhance cognitive flexibility, make individuals think more comprehensively, so as to switch to different scenes, generate more innovative points, and stimulate students' creativity [10]. Moreover, when

immersed in a certain work, there will be an internal work learning motivation to explore according to their own interests, master new skills and try new experiences, so as to show strong interest and confidence, and play a better level and more unique creativity. Based on this, this study proposes that learning immersion has a positive effect on students' creativity. Therefore, this study proposes assumptions:

H1: learning immersion has a positive impact on students' creativity.

3.2 The Intermediary Role of Learning Immersion

First of all, the application of Gamification in curriculum teaching will produce the "achievement achievement" effect, so as to strengthen students' learning willingness, make them pay more efforts and improve learning performance (Stansbury and East 2016).

According to the self-determination theory, meeting the competency needs will enhance the individual's sense of control and internal motivation, stimulate the individual's curiosity and desire for exploration (Wu Zhizhi et al. 2018), and the application of game elements can meet the competency needs, so as to encourage individuals to make greater efforts for innovation activities and improve their creativity. De dreu et al. (2008) put forward a two-way theory that affects creativity, and emphasized that interpersonal interaction can strengthen individual cognitive richness and flexibility, thereby improving their creativity [7].

Secondly, Jackson (1998) showed that motivation can affect immersion experience through a study of 398 athletes. Intrinsic motivation can produce excitement and pleasure. Among them, the increase of game motivation will improve the willingness of the subjects to participate in the game. More in-depth game involvement makes it easy for the subjects to have more game immersion experience [14].

At the same time, the immersion experience returns to act on the game motivation and improve the subjects' game motivation. The relationship between the three is mutual promotion and restriction (Xu 2007). Therefore, this paper proposes the following assumptions:

H2: learning immersion plays an intermediary role between the way of playing games and students' creativity.

4 Empirical Analysis

4.1 Model Building

In order to study the relationship between gamification and students' creativity, and the mediating effect of learning immersion between the two, this paper conducts an empirical study by setting econometric models. According to the suggestion of Baron and Kenny, the existence of the mediating effect must meet the following conditions: (1) the independent variable has a significant impact on the dependent variable; (2) the independent variable has a significant impact on the mediating variable; (3) the mediating variable has a significant impact on the dependent variable; (4) When the independent variable and the mediating variable enter the regression equation at the same time to

explain the dependent variable, the effect of the mediating variable is significant and the effect of the independent variable disappears (complete mediation) or weakens (partial mediation). Therefore, this paper establishes the following models:

$$\text{Creativeability} = \alpha_0 + \alpha_1 \text{gamification} + \varepsilon_{i,t} \quad (1)$$

$$\text{balance} = \alpha_0 + \alpha_1 \text{gamification} + \varepsilon_{i,t} \quad (2)$$

$$\text{integration} = \alpha_0 + \alpha_1 \text{gamification} + \varepsilon_{i,t} \quad (3)$$

$$\begin{aligned} \text{Creativeability} = & \alpha_0 + \alpha_1 \text{gamification} \\ & + \alpha_2 \text{balance} + \alpha_3 \text{integration} + \varepsilon_{i,t} \end{aligned} \quad (4)$$

Model (1) is the regression of the independent variable on the dependent variable. Gamification represents the independent variable, and Creative ability represents the explained variable. Model (2) and model (3) are the regression of the independent variable on the mediator variable. Balance and integration represent the two dimensions of the mediator variable learning immersion, which are the Task and skill balance and the Integration of consciousness and action, respectively. Model (4) is the regression of the independent variable and the mediator variable on the dependent variable at the same time.

4.2 Variable Measurement

4.2.1 Gamification

Since the Gamification method studied in this paper is mainly an integral evaluation system based on the situation of students' solving tasks, the integral ranking will be published in the game. Students with higher ranking can not only obtain higher internal innovation power, but also get more attention from other students. Therefore, this paper uses the total amount of current points obtained by students in the way of Gamification as a measure of Gamification level.

4.2.2 Learning Immersion

According to Ye Jinhui's research, the scale includes two dimensions, namely, the balance of tasks and skills and the integration of consciousness and action. There are 8 items in the scale, which are scored by Likert at 5 points.

4.2.3 Creativity

Williams' creativity tendency test compiled by Williams and revised by Lin Xingtai is used to measure students' creativity level. This scale finds that individuals with high creativity tend to be adventurous, imaginative, have a strong thirst for knowledge and dare to challenge, while individuals with low creativity follow rules. Therefore, students' creativity level is measured by testing their personal characteristics such as adventure, curiosity, imagination and challenge. There are four aspects in this scale. The higher the total score, the stronger the creativity of students.

Table 1. The basic structure of the samples

| Statistical variables | Statistical variables | Quantity | Percentage (%) |
|-----------------------|-----------------------|----------|----------------|
| Grade | Freshman | 94 | 22.43 |
| | Sophomore | 102 | 24.34 |
| | Junior | 98 | 29.83 |
| | Senior | 125 | 37.40 |
| Gender | male | 203 | 48.45 |
| | female | 216 | 51.55 |

4.3 Samples and Data

In order to test the research hypotheses proposed above, large sample empirical research methods are used. In this study, questionnaires were distributed through classroom survey, campus survey and e-mail. The subjects of the questionnaire were college students to collect data on variables such as enterprise Gamification, learning immersion and creativity.

A total of 600 questionnaires were distributed, and 514 were recovered, with a recovery rate of 85.7%. Then we screen the questionnaire according to three criteria: first, the respondents did not fill in the questionnaire carefully, for example, all items chose the same score; Second, there is a contradiction in the choice score of the respondents when answering the paper. As for the same content item, the difference between the front and back choice scores is too large; Third, there are missing items in the questionnaire, which affects the effectiveness of data analysis. According to these three criteria, 419 valid questionnaires were selected, and the effective questionnaire rate was 69.8%. From the basic structural characteristics of the sample (as shown in Table 1), the distribution in grade and gender is reasonable and representative, which meets the requirements of the object of this study.

4.4 Reliability and Validity Analysis of the Questionnaire

A total of 419 sample data were collected in this study, and spss23.0 software was used to analyze the reliability and validity of the questionnaire data. Through Cronbach α Coefficient and total correlation coefficient (CITC) are two indicators of evaluation reliability. Analysis found that Cronbach of each variable α The coefficients are greater than 0.7, and the CITC of each item is greater than 0.5, indicating a high consistency of internal structure. On the basis of KMO measure and Bartlett's sphere test, principal component analysis is used to analyze. The results show that the measurement of each variable has good validity. The reliability and validity values of each variable are shown in Table 2.

Table 2. Reliability and validity of variables

| Variable | Cronbach α | KMO |
|--------------------|-------------------|-------|
| Gamification | 0.956 | 0.914 |
| Learning immersion | 0.943 | 0.903 |
| Creative ability | 0.959 | 0.919 |

Table 3. Intermediary effect test results

| Variable name | Task and skill balance | Integration of consciousness and action | Creative ability |
|---|------------------------|---|---------------------|
| | M1 | M2 | M3 |
| Independent variable | | | |
| gamification | 0.549** (2.143) | 0.447* (1.972) | 0.345** (1.854) |
| Intermediary variable | | | |
| Task and skill balance | | | 0.656*** (3.119) |
| Integration of consciousness and action | | | 0.593*** (3.027) |
| R ² | 0.412 | 0.441 | 0.464 |
| After adjustment R ² | 0.081 | 0.089 | 0.135 |
| F | 153.201*** | 164.354*** | 169.122*** |

Note: (1) * * * indicates $p < 0.01$, * * indicates $p < 0.05$, * indicates $p < 0.1$; (2) The numbers in brackets are t values.

4.5 Intermediary Effect Analysis

By using the SPSS software, the experimental data are analyzed by Mediation regression analysis. The results are shown in Table 3.

Model 1 is the regression of independent variables to intermediary variables (task and skill balance), model 2 is the regression of independent variables to intermediary variables (integration of consciousness and action), and model 3 is the regression of independent variables and intermediary variables to dependent variables. Hierarchical regression results are shown in Table 3.

Through Model 1, it is found that gamification has a significant positive impact on the Task and skill balance, and Task and skill balance has a significant positive impact on the growth of new companies. When the mediating variable is put into the regression equation, the influence of gamification on creativity is significantly reduced, and it can be judged that the Task and skill balance plays a mediating role. Similarly, the Integration of consciousness and action mediates the relationship between gamification and creativity.

5 Research Conclusion and Enlightenment

This study shows that for digital start-ups, gameplay has a positive impact on students' creativity, and learning immersion in gameplay plays an intermediary role between students' creativity. There are still some deficiencies in this study. Based on survey samples.

The adaptability of the conclusion needs further verification and discussion; Secondly, this study only discusses the mediating effect of learning immersion in the relationship between gamification and students' creativity, and whether there is a moderating effect, limited to the complexity of data processing, has not been discussed in depth.

This paper expands the research on the influence mechanism of Gamification on creativity, and confirms the mediating role of learning immersion,

The research conclusion of this paper has the following enlightenment in practice:

In the process of learning, students need to produce a positive emotional feeling and experience related to tasks in order to obtain innovation: they are therefore willing to and adhere to these activities. Through the behavior itself rather than other external purposes, let students show high interest in a certain behavior, and enter this activity wholeheartedly, and let students immerse themselves in learning. Through digestion, assimilation, absorption, transformation and utilization, they can fully explore the value of new knowledge, enhance their knowledge absorption ability, and finally, it will be transformed into its own innovation output.

In the era of innovation, we should be good at using the dimension of Gamification, through a series of Gamification means, arouse students' learning interest and internal motivation to complete learning goals, enhance their sense of self-control and competence, and strengthen their cognitive flexibility and richness, so as to continuously improve students' creativity and achieve innovation goals.

The influence of Gamification on students' creativity is a long-term and systematic process. We should strengthen the network connection between the main bodies of Gamification and R & D. In the network and information age, on the one hand, we should pay attention to the establishment of a game sharing platform in order to apply resources from different sources and encourage integrated learning between different subjects.

On the other hand, the school needs to establish the corresponding overall strategy of Gamification according to the actual needs of students' innovation, and formulate a series of operable tactics to promote the cooperation, interaction and coordination between various Gamification subjects.

While the school has good internal and external resources, it also needs to constantly obtain the game resources outside the network, form its own unique game mode, and constantly improve students' adaptability, application ability and innovation ability to the new game mode.

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