Gamification Teaching Design and Application Based on Self-determination Theory

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Abstract. Taking Chinese reading class in primary school as an example, gamification teaching is combined with self-determination theory, and a student's learning motivation is first encouraged to be internalized in accordance with the demands of talent cultivation in the new era. The findings demonstrate that a self-determination theory-based gamification teaching strategy was developed and put into practice using questionnaire survey, interview, and quasi-experimental methods. The findings demonstrate that self-determination theory-based gamification instructional designs can enhance students' academic performance. The findings demonstrate that self-determination theory-based gamification teaching designs can enhance students' academic performance and encourage the internalization of learning motivation.

Keywords: gamification of teaching · Self-determination theory · the teaching design · learn to internalize motivation

1 Introduction

Study on game-based teaching has emerged as one of the most significant research areas in education since the new curriculum and teaching reform, with the rise in demand for "teaching for fun." Gamification transforms instruction into a joyful activity that captures students' attention and keeps them actively involved. However, despite the advantages of game-based learning for both teachers and students, there are some issues as well. How to encourage the internalization of motivation in game-based learning so that students' learning becomes autonomous is one such issue. Three fundamental psychological requirements of students—autonomy, competence, and relatedness—should be satisfied in order to encourage the integration of intrinsic motivation and internalization of extrinsic motivation [1, 2].

An urgent issue for many teachers and academics is how to efficiently create and organize teaching activities that are conducive to students' independent learning and enhance students' internalization of learning motivation in game-based teaching that is based on self-determination theory. This study, which is based on game-based learning, is informed by the self-determination theory and focuses on the fundamental problem of "promoting students' internalization of learning motivation and improving learning

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efficiency in game-based teaching," using the first grade language reading class of primary school as an illustration. (1) How may self-determination theory be used to create a gamified teaching strategy? (2) How can self-determination theory be used to design a gamification strategy that will encourage students to internalize their learning motivation and accomplish independent learning?

2 Concept Definition

2.1 Game-Based Teaching

Gamification is the application of game design, gaming concepts, and game features to contexts that are not game-specific [3].

Gamification is the organic integration of games into classroom teaching and learning in order to foster a more harmonious and enjoyable learning environment, to pique students' curiosity and interest in their studies, to encourage more active participation in class, and to help them master subject matter more quickly, firmly, and effectively [4]. Aside from variations in play styles and sophisticated strategies, all games share four key elements: objectives, rules, feedback mechanisms, and voluntary participation [5].

2.2 Self-determination Theory

The dynamics of well-being in human wants, motivation, and social culture are systematically addressed by self-determination theory, a motivational theory [6]. Deci and Ryan, two psychologists from the United States, created the self-determination theory [7]. To specifically explain students' intrinsic drive, Deci and Ryan created the self-determination theory [8]. A student's interests, curiosity, want to learn, desire to better their abilities, and other elements coming from internal values are examples of intrinsic requirements that drive motivation [9]. The internalization of motivation process is what the self-determination theory calls the ability for people to behave in an intrinsically motivated manner [10].

Three fundamental human psychological needs—self-motivation, self-determination, and wellbeing—are addressed by the self-determination hypothesis. Competence is the need to feel competent, effective, and challenged; relatedness is the need to interact with people; and autonomy is an experience of freedom and choice that enables individuals to take responsibility in voluntary action [11–13]. These three fundamental psychological needs must be met in order to promote the internalization of student motivation for learning and to change external motivation into a more integrated form of motivation.

3 The Construction of a Gamification Teaching Strategy Based on Self-determination Theory

A game-based teaching strategy based on self-determination theory is developed to provide strategic support for the creation and implementation of subsequent teaching cases by fusing the aforementioned descriptions of the characteristics of game-based teaching

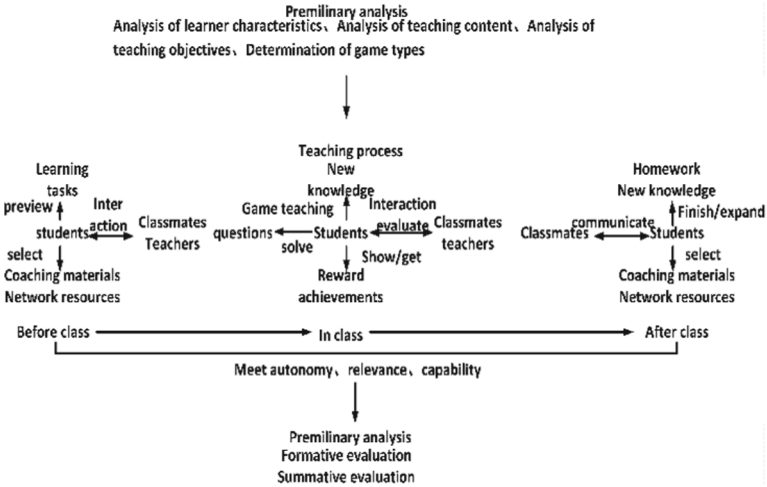

Fig. 1. Gamification teaching strategies based on self-determination theory

and learning with the implications of self-determination theory. Pre-analysis, the teaching process, and evaluation make up the three steps of the course design in general. The pre-analysis examines the learner characteristics, the instructional materials, the learning objectives, and the game kinds. The teaching process is broken down into three stages: before, during, and after the lesson, and each of these stages includes eight activities: independent pre-study, teacher-student interaction, teamwork and competition, teacher evaluation, self-evaluation and student mutual evaluation, and prize giving. Formative and summative evaluation are the two basic categories of teaching evaluation. "Fig. 1" depicts the self-determination theory-based gamification teaching technique.

3.1 Autonomy in Gamification Teaching

Provide learning options, provide a theoretical foundation for learning, and organize learning in accordance with learners' views and interests are three primary ideas that can be used by teachers to encourage student autonomy [14, 15].

Students are given a manageable amount of work, their opinions are completely respected, and the teaching approach makes use of their curiosity and drive to learn to pique their interest and help them learn not just how to pass the course evaluation but also how to clear up their deepest doubts [16]. Therefore, throughout the instruction phase, teachers have to give pupils with the conditions for autonomy. Students are free to select their teammates, organize their own learning sequence, select their own learning tools, and discuss what they want to learn in the course during the lesson. Prior to the lesson, students can complete the assignments set by the teacher by using their own pre-reading strategies, learning resources, and materials, such as watching instructional videos and asking their classmates, parents, and teachers. Following the course, students develop their own learning goals relevant to their particular circumstances, plan their own time, and In order to finish their assignments, consolidate their practice, and expand their

learning, students define their own learning objectives and choose their own time and study methods after the session. For instance, people divide up the learning exercises according on their level of expertise and progress at their own rate.

3.2 Competence in Play-Based Teaching

According to Stroet, Opdenakker, and Minnaert (2013) [17], competency offers people the support they need to be motivated to study. According to the self-determination hypothesis, social contextual elements including communication, feedback, and rewards help people feel competent. Teachers should therefore give pupils the conditions that satisfy their competency during the instructional phase. Prior to the session, the instructor breaks down the material in accordance with the learning goals and gives the students the opportunity to conduct their own independent practical research to pique their interest in the material. The instructor assesses the students on many different levels throughout the course, supports their development, and gives quick feedback on any issues that may arise. In accordance with how they complete the activities and the percentage of accuracy, the teacher gives pupils punch cards, incentives, and praise at the conclusion of the class.

3.3 Relevance in Gamified Teaching and Learning

A general desire to interact and connect with others, to care about their lives, and to have meaningful and related experiences are all components of relevance [18]. People are more likely to be motivated by autonomous motivation when their relevance is satisfied [19]. In order to fulfill the relevance of the pupils, teachers should set the circumstances for learning during the teaching phase. Before the lesson, students can ensure their relevance by interacting with others, asking those who are more knowledgeable than them to accomplish the learning activity, or asking their classmates. Teachers should encourage group work, debates, competitions with prizes, and other forms of communication with students during the lesson [20]. They can also include their own empathy and understanding into the process of teaching and learning, which will help to create a peaceful and emotionally stimulating environment [21]. After the session, teachers can assign students group projects and offer them the tools they need to complete them.

4 Implementation of Gamification Teaching Strategies Based on Self-determination Theory

4.1 Implementation Methods

Interviews, classroom scales, questionnaires, and quasi-experimental techniques were all used in this study. A pre-survey and a post-survey are included in the questionnaire survey; the pre-survey is used to determine whether the teaching environment is appropriate for game-based learning, and the post-survey is used to test the learning impacts on the students and to analyze the experimental data later. Students' participation, cooperation, and activity were evaluated using the classroom scale technique; the impact of

gamification based on the self-determination theory was investigated using the interview method. To investigate whether gamification teaching based on self-determination theory may encourage students' internalization of learning motivation, the quasi-experimental technique involves carrying out various teaching tactics for the experimental and control groups.

4.2 Target of Implementation

Two Grade 1 classes in parallel from Chang Sheng Road Experimental Primary School in Gaobeidian City were chosen for this study's teaching subjects, and the reading assignment "The Animal Kingdom Opens a Conference" was picked as the lesson's subject. There were a total of 80 students registered in the two groups, 40 of whom made up Class A, the experimental group, and 40 of whom made up Class B, the control group. The pre-test results of the two groups did not significantly differ, indicating that before the training experiment, the two groups' levels of language learning were comparable.

4.3 Implementation Process

1) Teaching content analysis: Teaching Chinese offers particular advantages over teaching arithmetic, physics, and chemistry. Due to the uniqueness of the language, it is essential that students learn through experience and experience-based learning in order to encounter and master the humanistic meaning of the language. The classic lesson "Having a Conference in the Animal Kingdom" teaches kids vocabulary and information about animals while also demonstrating how to report an event in an accurate and understandable manner through practical application.

2) Learner profiling: This lesson is intended for Primary 1 children, many of whom have a limited vocabulary and understanding of the terms used to describe animals. They are curious to learn more about the topic and the study of languages at the same time. This lesson's main goals are to pique students' interest in learning, show them how to fill out a notice in an accurate and understandable manner, and provide them the opportunity to apply what they've learned.

3) Determining the type of game: The principal game kinds that are frequently utilized in lower primary language classes are scenario-based, role-playing, competitive, etc. [22]. The foundation of game thinking is to play with deeper internal impulses (such as curiosity, fantasy, self-esteem, competition, cooperation, etc.) rather than to adhere to the exterior form of the game [23]. Our language instructors should create their own games based on the class, the lesson's subject matter, and other unique conditions.

4) Analysis of teaching objectives:

a) Knowledge Objectives: To recognise the vocabulary and words that appear in the article and to master the story described in the article.

b) Ability Objective: Read the text aloud with feeling and understand the text correctly.

c) Emotional Objective: Through this article, tell your child that notification must be clear about the time and place. Cultivate children's rigorous and comprehensive thinking.

5) Teaching process: The teaching and learning process is shown in "Fig. 2" and is divided into three main steps: pre-test, practical implementation and post-test.

The experimental and control groups underwent tests to determine their levels of course knowledge and learning motivation prior to the experiment. Aim 1: To guarantee that the experimental control group's pupils were all at the same level; Aim 2: To determine whether the self-determination theory-based gamified instructional design had a favorable effect on the students by comparing the pre-test and post-test results.

The specific implementation primarily involved the intervention of various teaching strategies for the experimental and control groups. The experimental group was using a gamified teaching design based on self-determination theory, which is characterized by: (1) students setting their own learning pace and approach with teacher assistance in completing learning tasks to satisfy relevance; and (2) teachers providing feedback, communication, and rewards to students to satisfy co-determination. The control group, on the other hand, received instruction in a conventionally gamified manner, in which the teacher did not set up the circumstances for independent learning and the students did as she instructed. The same teacher taught both the experimental and control groups for the same amount of hours on the same subject matter. The two groups of students' academic progress and changes in intrinsic motivation were compared using various teaching interventions.

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6) Teaching evaluation: The majority of teaching assessments are formative and summative. Through post-class tests, summative evaluation determines how well the pupils have mastered the material. Through classroom scales and post-lesson questionnaires, formative evaluation evaluates students' cooperation, involvement, and activity as well as their internalization of motivation.

5 Data Analysis

5.1 Reliability and Validity Analysis of the Questionnaire

As shown in Table 1, the reliability analysis showed a Cronbach coefficient of $0.805 > 0.6$, indicating that the questionnaire was credible.

As shown in Table 2, the KMO coefficient of $0.858 > 0.6$ indicates the validity of the questionnaire.

5.2 Comparative Analysis of Pre-test Results

The outcomes are displayed in Table 3. The control group's course subtest results were marginally better than those of the experimental group. The independent sample t-test of the experimental and control groups' course knowledge pre-test scores is displayed in Table 4, with $\text{Sig} = 0.567 > 0.05$ showing that the course knowledge scores of the two groups were equal prior to teaching. The independent sample t-test of the experimental

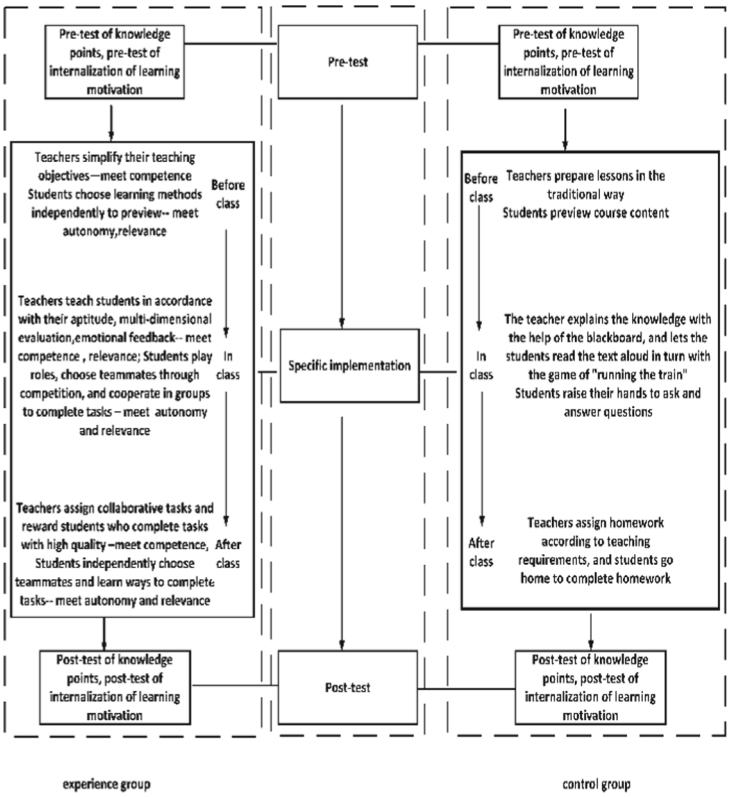

Fig. 2. Teaching flow

Table 1. Reliability analysis of the questionnaire

Reliability statistics	
Cronbach Alpha	***Number of items***
.805	20

Table 2. Validity analysis of the questionnaire

KMO and Bartlett's test		
KMO Number of sample suitability measurements.		.858
Bartlett *Sphericity* Test	***Approximate cardinality***	1707.453
	Freedom	120
	Significance	.000

Table 3. Comparison of mean scores on the pre-test of course knowledge between the experimental and control groups

Group Grade point average	Pre-test
Experimental group	78.65
Control group	78.72

a. Total score of 100 points

and control groups' pre-test scores for learning motivation is displayed in Table 5, with Sig = 0.421 > 0.05 suggesting that the two groups' levels of learning motivation before to instruction were comparable.

Table 4. Independent samples t-test for the pre-test scores of course knowledge for the experimental and control groups

Independent sample test						
		Levene's test for equivalence of variances		**Equivalence of means t-test**		
		F	***Significance***	***t***	***Freedom***	***Sig. (bobtail)***
Quiz results	***Assuming equal variance***	.162	.688	-.572	78	.567
	Does not assume equal variance			-.575	77.784	.564

Table 5. Independent samples t-test for pre-test scores of motivation in the experimental and control groups

Independent sample test						
		Levene's test for equivalence of variances		**Equivalence of means t-test**		
		F	***Significance***	***t***	***Freedom***	***Sig. (bobtail)***
Motivation for learning	***Assuming equal variance***	.327	.569	.152	78	.421
	Does not assume equal variance			.154	77.694	.424

Table 6. Comparison of mean scores on the post-test of course knowledge between the experimental and control groups

Group **Grade point average**	***Pre-test***	***Post-test***
Experimental group	78.65	92.48
Control group	78.72	83.27

Table 7. Independent samples t-test for post-test scores of course knowledge in the experimental and control groups

Independent sample test						
		Levene's test for equivalence of variances		**Equivalence of means t-test**		
		F	***Significance***	***t***	***Freedom***	***Sig. (bobtail)***
Quiz results	***Assuming equal variance***	.845	.361	47.025	78	.000
	Does not assume equal variance			47.027	77.181	.000

5.3 Comparative Analysis of Post-test Results

The outcomes are displayed in Table 6. On the course post-test, the experimental group outperformed the control group by 9.21 points. The results of the independent sample t-test for the course knowledge post-test scores for the experimental and control groups are displayed in Table 7 with Sig = 0.0000.05, indicating that there was a significant difference in the course knowledge post-test scores between the two groups following the implementation of the instruction. According to Table 8's independent sample t-test results for the post-test learning motivation scores for the experimental and control groups, Sig = 0.0000.05, there was a significant difference between the two groups' post-test learning motivation scores following the implementation of the instruction. There was a significant change in the experimental group's learning motivation following the implementation of the instruction, according to the results of the paired samples t-test for the post-test scores of learning motivation in the experimental group, which are shown in Table 9 with Sig = 0.0260.05.

Table 8. Independent samples t-test for post-test scores of learning motivation in the experimental and control groups

Independent sample test						
		Levene's test for equivalence of variances		**Equivalence of means t-test**		
		F	***Significance***	***t***	***Freedom***	***Sig. (bobtail)***
Motivation internalisation	***Assuming equal variance***	.276	.276	2.178	78	.000
	Does not assume equal variance			2.176	72.562	.000

Table 9. Paired samples t-test for post-test scores on motivation in the experimental group

Paired sample test			
	t	**Freedom**	**Sig.(bobtail)**
Pairing 1 Pre-implementation - post-implementation	9.692	19	.026

6 Conclusions of the Study

The experiment demonstrates how self-determination theory-based gamification teaching strategies can significantly enhance students' learning outcomes. In light of these findings, this study draws two conclusions: (1) gamified teaching strategies based on self-determination theory can effectively promote students' internalization of motivation and achieve independent learning; and (2) gamified teaching designs based on self-determination theory have a significant impact on improving students' academic performance.

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