



Construction and Practice of Gamified Teaching Mode Integrating ARCS Motivation Strategy

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Abstract

In order to thoroughly implement the Opinions on Promoting the High Quality Development of Modern Vocational Education issued by the General Office of the State Council, optimize teaching modes and improve teaching methods. The paper integrates Professor Keller's ARCS motivation model and constructs a gamified teaching model that incorporates ARCS motivation strategies based on gamified teaching. The paper mainly introduces the selection characteristics of gamified platforms, the correct use of gamified elements, the definition of gamified teaching processes, the construction and implementation process of the integration mode of the two. The research results indicate that a gamified teaching model that incorporates ARCS motivation strategies can achieve an appropriate connection between gamification and ARCS motivation, thereby enhancing students' learning motivation, increasing learning interest, improving learning atmosphere, and guiding them to make correct attributions.

Subject Areas

Applications of Communication Systems, Artificial Intelligence, Game Design, Information Science

Keywords

ARCS Motivation Model, Gamified Teaching, Schema Construction, Secondary Vocational Education, Web Page Production and Training

1. Introduction

The term "gamification" has been widely used in teaching research, aiming to create a highly interactive and situational teaching environment, and stimulate students' interest in learning. The emergence of the term "ARCS motivation"

provides scholars with a teaching strategy paradigm aimed at optimizing teaching materials, improving teaching evaluation methods, and enhancing student learning motivation. The integration of the two has become a research topic in recent years, but some of the problems that exist have not been systematically addressed. 1) How to choose the appropriate gamification platform; 2) How to correctly select gamified elements; 3) The definition method of gamified teaching process; 4) The integration of ARCS motivation strategy and gamified teaching. Firstly, gamified platforms should have features such as interactivity, fun, and knowledge relevance. Secondly, gamification elements should be reflected in forms such as rewards, rankings, and fun mini games. The third is that the definition of gamified teaching should be presented in three stages: pre-class, in-class, and post-class, with each stage incorporating gamified teaching features and ARCS motivational elements. Finally, the integration of the two should be based on a gamified platform as the framework, with pre-class, in-class, and post-class stages as the teaching process, incorporating gamified elements and ARCS motivation strategies to construct a teaching model.

To further discuss the research topic, the paper provides a literature review on the current research status of “ARCS Motivation Theory”, “Gamification”, and the integration of the two. This will provide necessary theoretical support and research trends for the construction of teaching models. Especially through the analysis of the current research status of the fusion of the two, we can further understand whether the fusion of “ARCS” and “gamification” has exclusivity, thereby further narrowing the fusion differences between the two.

1.1. Research Status of the “ARCS Motivation Model”

In 1983, Professor Keller of Florida State University proposed the “ARCS Motivation Model” [1], which includes four dimensions, namely Attention, Relevance, Confidence, and Satisfaction, and its theoretical basis covers the expected value theory, reinforcement theory, intrinsic motivation theory, and cognitive evaluation theory [2]. Since the model was proposed, many scholars have begun to apply it to various fields for in-depth research; according to the latest CNKI data, the subject education and teaching field accounts for the highest proportion, and 72 subject education and teaching papers have been published, and the number of published articles has increased year by year. The distribution of literature topics focuses on the improvement of learning motivation, which is mostly found in research articles, including 8 articles published by domestic scholar Zheng Yanlin (Northeast Normal University), 5 articles published by Liao Minxiu (Xiangtan University Library), 2 articles published by foreign scholar Idris Goksu, and 2 articles published by Kumar Rajesh.

1.2. Current Status of Research on “Gamification”

Gamification refers to the phenomenon of using game mechanisms, or more precisely, creating game experiences, in non game environments. Its theoretical

basis is interactive learning theory, motivational psychology, and situational cognition theory. Gardner predicts that by 2015, gamification will also emerge in the field of education because it can support and motivate students, leading to enhanced learning processes and outcomes [3]. At the same time, according to data from China National Knowledge Infrastructure (CNKI), the number of publications on gamification as a theme has been increasing year by year since 2005, with a focus on early childhood education and 4038 research papers. Domestic scholar Shang Junjie (Peking University) has published 34 papers, while foreign scholar Juho Hamari has published 27 papers.

1.3. Current Status of “Gamification” Research on the Integration of “ARCS Motivational Strategies”

The latest CNKI data shows few pieces of literature on the theme of “ARCS motivation model + gamification,” and there are a total of 10 academic journals and dissertations, all of which are used in the field of education. In his article “Enhancement of the ARCS Model for Gamification of Learning,” Malaysian scholar Hamzah discussed the integration of “the ARCS motivation model” and “gamification” and named it “ARCS + G”. The theoretical basis of the ARCS + G model is the combination of the ARCS motivation model and gamification, including constructivist learning theory, expected value theory, immersion theory, and multiple intelligence theory, which mainly focused on two questions: 1) What are the appropriate design characteristics suitable for gamification learning? 2) What is the design process of a game-based learning system [4]? To solve these two problems, Hamzah used the MDA framework based on game design theory and the strategy scope of ARCS to design the “ARCS + G” model matrix, the “ARCS + G” model process, and the “ARCS + G” implementation process. The “ARCS + G” model matrix designed by Hamzah, as shown in **Table 1**, incorporates gamification elements based on the dynamic characteristics of the game into the fusion model of ARCS and gamification, such as reward, status, competition, achievement, self-expression, and altruism. However, not all

Table 1. ARCS + G model matrix.

Pattern	ARCS category			
	Attention	Confidence	Relevance	Satisfaction
Technology				
ARCS	1. Awakening of consciousness 2. Inquiry arousal 3. Variation	1. Goal-oriented 2. Motivation matching 3. Familiarity	1. Study requirements 2. Chances of success 3. Personal Liability	1. Intrinsic reinforcement 2. Extrinsic rewards 3. Fairness
Gamification			1. Rewards 2. Status 3. Competition	1. Achievement 2. Self-expression 3. Altruism

gamification elements can be adopted by this model, and only the main elements of human desire and game interaction can be absorbed and accepted [5]. The design process of the “ARCS + G” model, as shown in **Figure 1**, consists of 10 steps, including obtaining course information, obtaining user groups, analyzing user groups, analyzing existing materials, listing objectives and evaluation content, listing potential strategies, selecting and designing strategies, design integration, selection and design strategies, selection and development of materials, evaluation and revision, and this design process shows how to identify motivational problems and goals, and how to develop a learning environment with motivational elements to motivate and maintain learners’ motivation [6].

Through the relevant information obtained from the literature review, it can be seen that the use and research of “gamification” in the field of education has become an emerging development trend. The integration of the ARCS motivation model and gamification has begun to take shape, especially after the “ARCS + G” model was proposed. It provides a reference paradigm for subsequent researchers, but the model integration is not thorough enough. This study will reconstruct a new “ARCS + G” model on this basis. It includes the selection of gamification platforms and integrating gamification elements into the whole process of the ARCS motivation strategy.

2. Construction of a Gamified Teaching Model Integrating ARCS Motivation Strategy

Given the current integration method of “ARCS + G,” in addition to integrating gamification elements into the satisfaction and self-confidence strategies, this study also integrates gamification elements into attention strategy and related strategies. In terms of gamification platform selection, this study extracts the characteristics of gamification platforms to generate an established reference model. Researchers can select a gamification platform that matches the discipline or practical course according to the reference model. **Figure 2** shows the construction diagram of the gamified teaching mode integrated into the ARCS

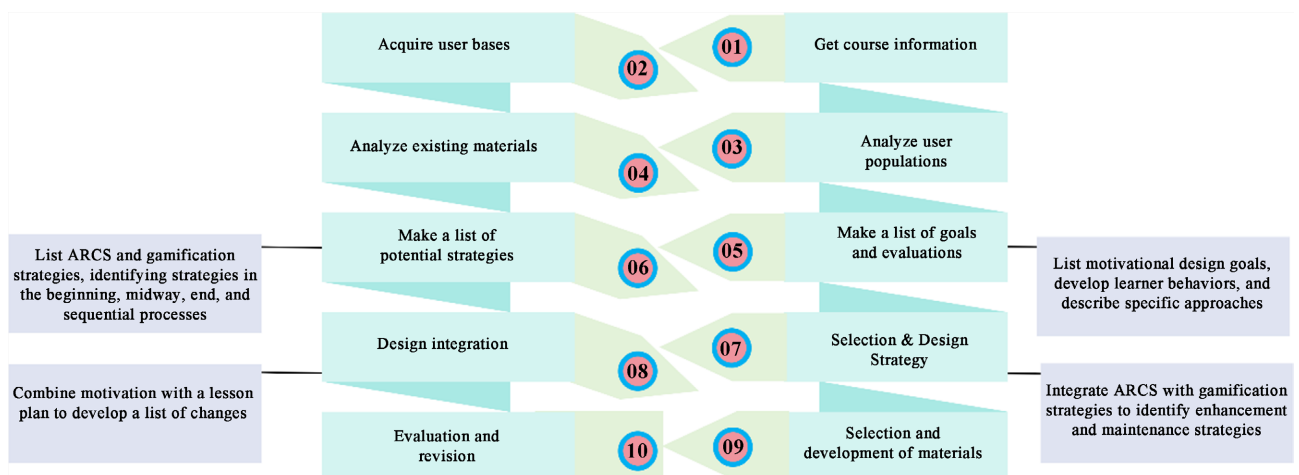


Figure 1. The design process of the ARCS + G model.

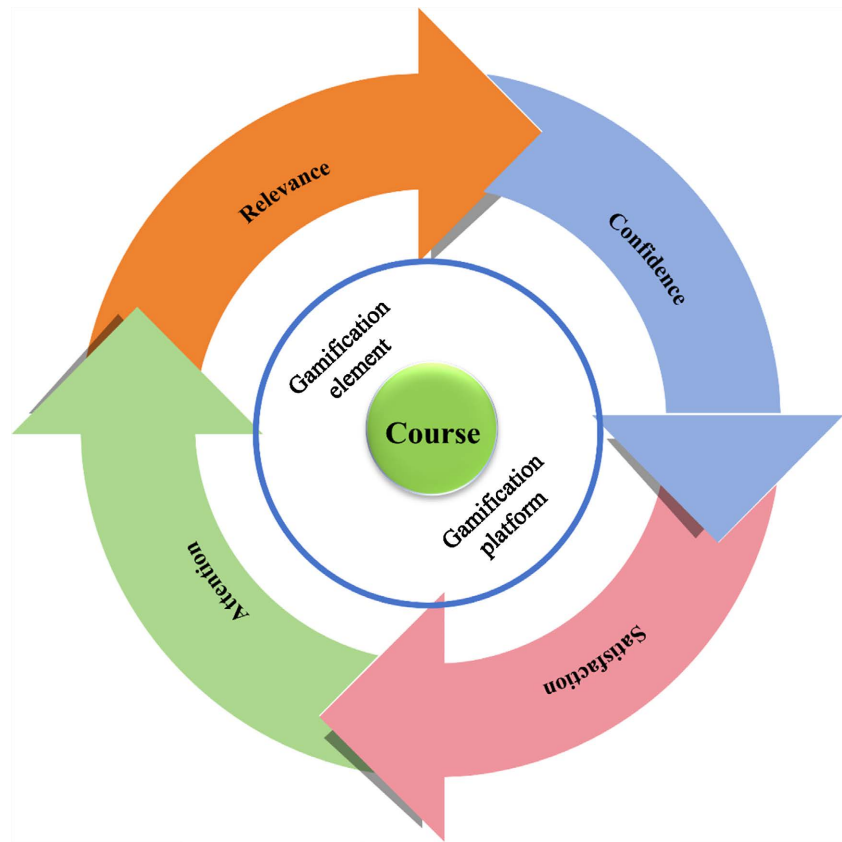


Figure 2. Construction diagram of a gamified teaching model integrated with ARCS motivational strategies.

motivational strategy, which is a carefully selected closed-loop process, which means that the ARCS motivational strategy can be reused several times, in which the gamification elements and the gamification platform are used as the embedded components and scaffolds of the model construction. The whole process has participated in the entire process to help the efficient generation and implementation of curriculum teaching.

To further refine the process of teaching mode construction, the paper provides an instructional design flow chart, as shown in **Figure 3** which can help to deeply analyze the “ARCS + G” integration mechanism studied in the paper and its use in course teaching. Like traditional teaching, the instructional design process is divided into three parts: before, during, and after class.

The pre-class preparation stage includes the analysis of the learning situation, the analysis of teaching materials, and the distribution of pre-class preview materials; the content of the pre-class preview materials includes the introduction video of the gamified platform, which can help students understand the rules of the platform and the characteristics of the game in advance, and prepare for the formal teaching in the classroom. In this process, attention strategies and related strategies need to be introduced; the use of attention strategies is to introduce new and diverse materials, arouse students’ interest in learning, and maintain attention, and the use of related strategies is to connect students’ old knowledge

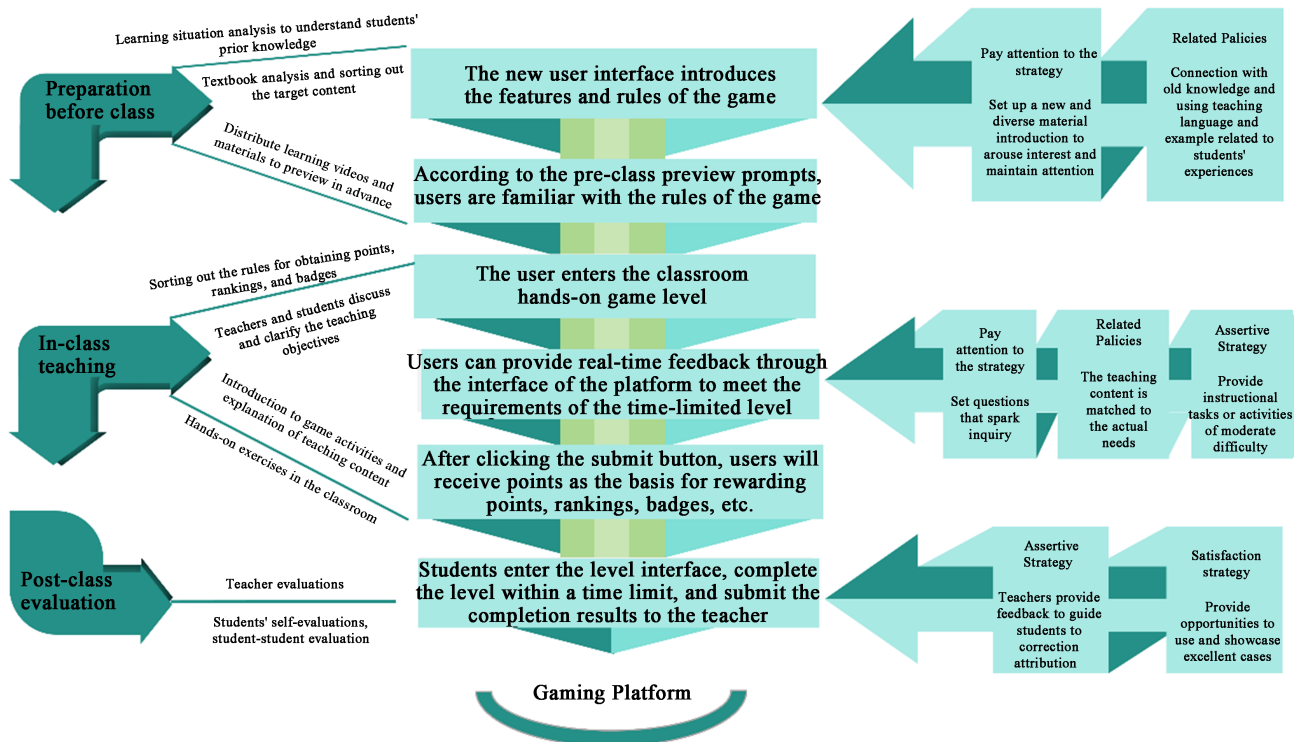


Figure 3. Instructional design flowchart.

and use teaching language and examples that students are familiar with and related to experience.

The in-class teaching includes the sorting out of the rules for obtaining points, rankings, and badges, as well as the introduction of game activities, the explanation of game content, and the clarification of game goals. As the core part of the teaching process, the teacher-student discussion has become one of the characteristics of this link, which helps students master the learning content and achieve the learning goals through the “dual-master construction” method. The real-time feedback function of the game platform can help students understand the current progress and completion, and if the problem cannot be solved, students can discuss it with students or teachers and students to jointly help achieve the time-limited requirements. At the end of the level, the user, *i.e.*, the student, clicks the submit button to get the score and uses it as the basis for rewarding points, rankings, badges, etc. In this session, attention strategies, related strategies, and assertive strategies need to be used. Attention strategies are designed to set questions and stimulate students’ desire to explore, related strategies are designed to match the teaching content to actual needs, and confidence strategies are designed to provide teaching tasks or activities of moderate difficulty.

The after-class evaluation includes teacher evaluation, student self-evaluation, and student-student mutual evaluation. After the teacher assigns homework, students enter the level interface according to the homework arrangement after class and submit the completed results to the teacher. Teachers will score the submissions, students will evaluate each other’s works, and students themselves

can also make objective and fair evaluations of their works and finally select excellent results to be rewarded for improving learning satisfaction. In this session, the use of the confidence strategy is to use the feedback provided by the teacher to guide students to attribute correctly, and the use of the satisfaction strategy is to provide students with the opportunity to use their skills and show excellent work.

3. Gamified Teaching Practice Integrated with ARCS Motivational Strategies

For example, on October 12, 2021, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued the “Opinions on Promoting the High-quality Development of Modern Vocational Education” (from now on referred to as the “Opinions”) [7], which pointed out that it is necessary to deepen the teaching reform. Innovate teaching models and methods, promote the deep integration of modern information technology and education and teaching, and improve the quality of classroom teaching. To thoroughly implement the ideas of the “Opinions,” optimize the teaching methods of secondary vocational colleges, and improve students’ learning motivation, this paper takes students in secondary vocational colleges as the practice objects in the form of course teaching and carries out practical research. Since the field of secondary vocational education involves many types of courses and rich teaching materials, this paper combines the characteristics of strong practicality and practical connection of secondary vocational college courses in the selection of practical courses. It selects the course “Web Production and Practical Training” as the teaching practice textbook.

3.1. Introduction to the Academic Situation

The subjects of this teaching experiment are the students of Class 1 and Class 2 of the 2021 computer major at a vocational and technical college in Guizhou, with a total of 65 students. The overall learning motivation of students is not high, the desire to learn is not strong, the learning habits are poor, and they have been exposed to and learned the relevant knowledge of web page production, including the characteristics of HTML language, the use of HTML tags and the basics of CSS style, but they cannot use it flexibly. Most students can’t correctly interpret the correspondence between code and interface, and they only train mechanically and need help understanding the theoretical and practical significance of what they have learned.

3.2. Textbook Analysis

As the textbook of the “13th Five-Year Plan” of secondary vocational education, the book is written according to the “project-task” driven teaching model, and several practical projects are used as carriers to guide students to complete the project and master the production methods and skills of the web page. This book

aims to expand students' professional skills, master the methods and skills of web page production, cultivate students' ability to collect, analyze, and express information, and further cultivate students' practical skills and innovative capabilities.

As shown in **Table 2**, the teaching content of this book is divided into eight items and one appendix. Items 1 and 2 focus on theoretical description, and HTML language definition, grammatical structure, and tag use are the key learning content in this part. Projects 3 and 4 focus on practice, and form and multimedia design can help build richer web interfaces and enhance experience and interactivity. Project 5 focuses on practice, and the canvas element, as a more commonly used label element in web design, is based on code operation, which can not only train students' professional computer skills but also easily modify the drawing interface by modifying the code. Projects 6 and 7 focus on practice and describe in detail the classification and use of CSS style sheets, which can enrich the interface format and create a more concrete and attractive interface. Project 8 focuses on practice, and after mastering the key technologies of static websites, the HTML language, and CSS style tables, students can design a microsite based on the textbook's content [8]. The appendix focuses on the theory, gives a brief introduction and description of JavaScript, and the JavaScripting language can realize the interactive window, which has an important purpose for the interface construction of the website and can be used as a reference and exploration source for students' subsequent learning.

3.3. Introduction to Gamification Platforms

The gamified teaching platform used in this research is CSSBattle, a code golf game developed for CSS enthusiasts, and players can intuitively replicate goals with minimal CSS code. The CSSBattle platform uses React, Firebase, Firestore, and SCF. As shown in **Figure 4**, players can choose the game they want to beat in the Battles column of this platform; there are a total of 27 major levels, and

Table 2. Curriculum.

Catalogue	Course content	Teaching method
Project 1	HTML foundation	Emphasis on theory
Project 2	HTML5 build a website	Emphasis on theory
Project 3	Create a mobile device Web Forms	Practice-oriented
Project 4	HTML5 multimedia design	Practice-oriented
Project 5	Use canvas element drawing	Practice-oriented
Project 6	CSS style basics	Practice-oriented
Project 7	CSS positioning and layout	Practice-oriented
Project 8	HTML5 design microsites	Practice-oriented
Appendix	JavaScript brief introduction	Emphasis on theory

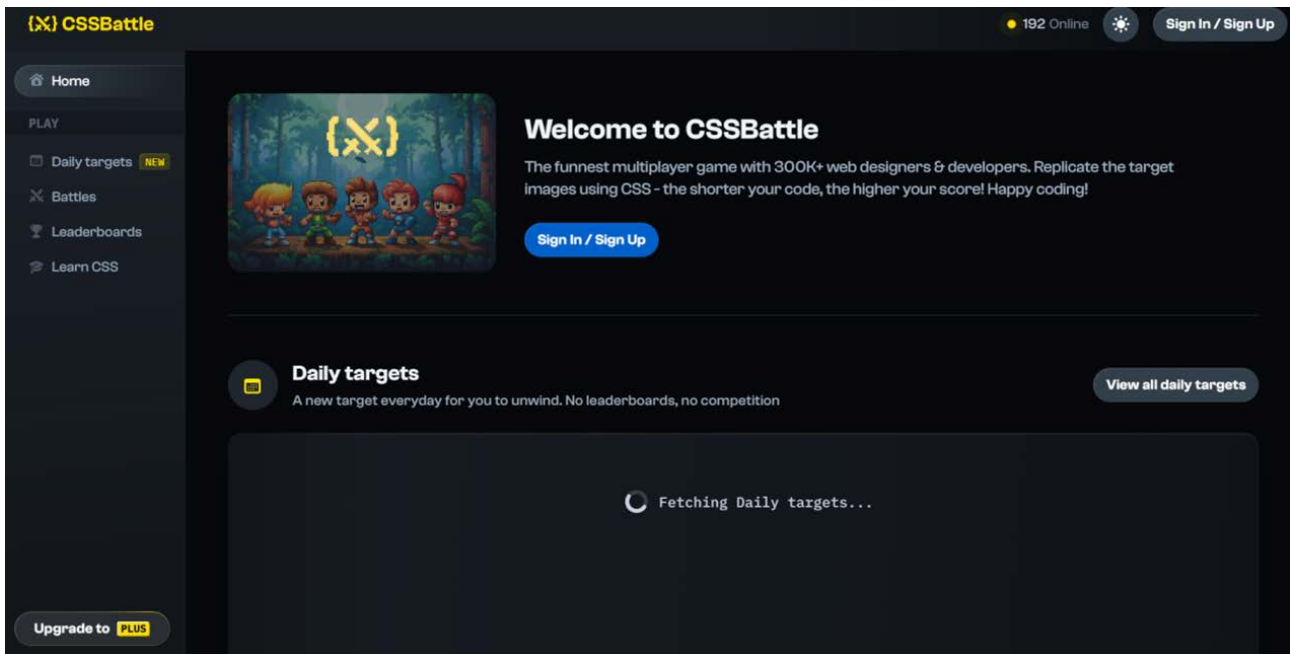


Figure 4. CSSBattle homepage.

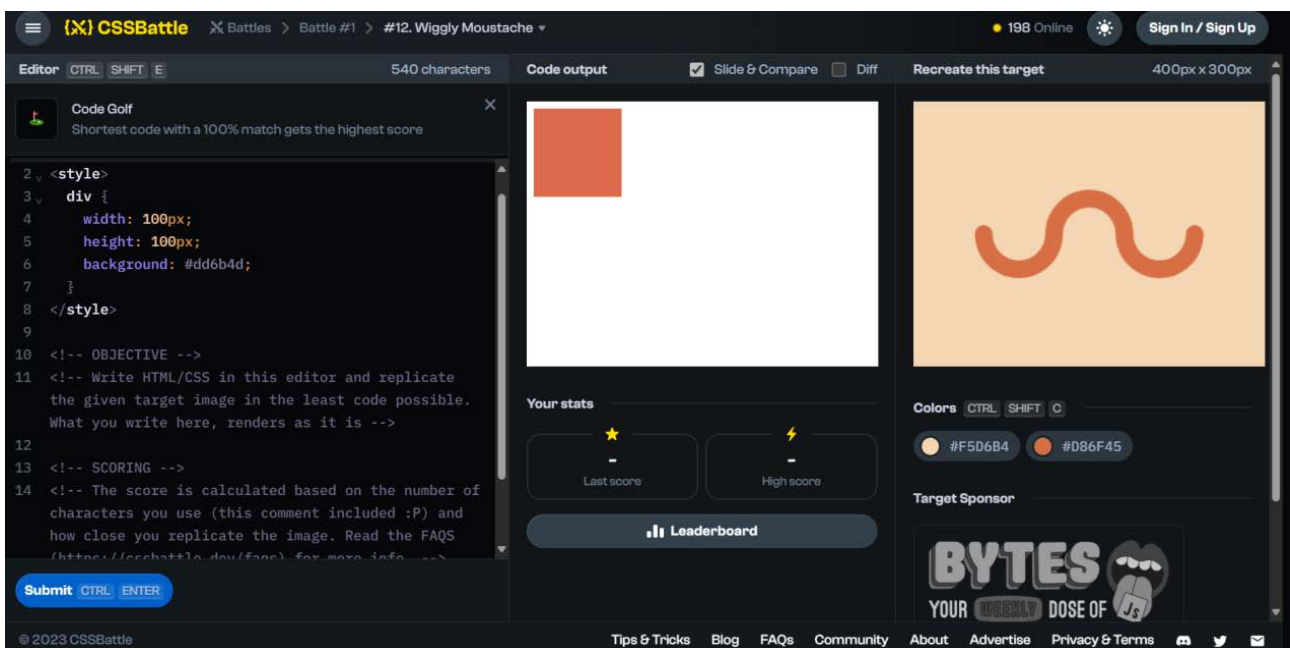


Figure 5. CSSBattle page.

each level has several small levels, in addition to learning CSS language in the Learn CSS column of the CSSBattle platform. Click into the Battles column and select one of the levels to complete; the level interface is shown in **Figure 5**, divided into three sections: code page, rendering page, and target page. The player can code in the editor area of the code page on the left, and when the player starts typing, the output area in the middle will start rendering the code. When the output is confident that it matches the target image, the stand-alone Submit

button submits and sees the score. Players can observe the completion of the current progress in real time during this process. The whole process is fully implemented in CSS code language, which can not only exercise students' web page production level but also improve their understanding of CSS language; however, it should be noted that players should choose matching game levels according to their current awareness to challenge them.

4. Teaching Practice Process

The teaching practice process is divided into three parts: pre-class preparation, in-class teaching, and post-class evaluation, and each covers teacher-student activities, gamification, and the use of ARCS motivational strategies. Teachers can choose appropriate gamification elements and ARCS motivation strategies according to the needs of the actual teaching process.

4.1. Preparation before Class

The first is teacher activities. First, teachers should do a good job of learning situation analysis and textbook preparation in advance and distribute videos based on the CSSBattle platform to students. Second, the teacher assigns the preview task "Project 7 CSS Positioning and Layout" in advance to help students prepare for class.

The second is student activities. First, students watch videos based on the teaching materials provided by the teacher and extract interface operation information and operation procedures. Second, students preview "Project 7 CSS Positioning and Layout" in advance.

Finally, gamification and ARCS motivational strategy usage. First, gamification usage. This session will only cover the use of the gamification platform CSSBattle. Second, the use of ARCS motivational policies. 1) Attention strategy: video import to enhance students' interest; 2) Related strategies: Select the teaching content related to students' experience, "CSS Positioning and Layout of Project 7", as the preview object.

4.2. In-Class Teaching

4.2.1. Teacher Activities

Firstly, the teacher asks questions:

- 1) What do you know about the CSSBattle platform through the pre-class preview?
- 2) What are the main contents of Project 7?
- 3) Do you have the confidence to master the knowledge and skills of this lesson and cooperate with your classmates?

Secondly, the teacher sets the content of the sketch board in advance and asks students to guess what knowledge they have learned in the web design diagram in the sketch board to understand the current level of knowledge of the students. In this process, the teacher and the students discuss and clarify the teaching objectives of this lesson:

- 1) Knowledge objectives: master the positioning and layout of CSS;
- 2) Ability Objective: Be able to apply the knowledge learned in this lesson to the 37th level challenge of CSSBattle;
- 3) Literacy objectives: cultivate students' awareness of cooperative inquiry and improve their ability to apply knowledge comprehensively.

Thirdly, the teacher introduces the rules for obtaining points, rankings, and badges and explains in detail the game levels that need to be challenged in this lesson. And the teacher should also teach the students the knowledge points corresponding to the code individually.

4.2.2. Student Activities

- 1) Students explore and answer the teacher's questions together through cooperative racing games, review what they have learned, and guess the content of the drawing board according to the teacher's prompts.
- 2) Students should complete the classroom practice according to the teacher's explanation and the lesson's objectives and discuss with their classmates or raise their hands if they encounter problems.
- 3) Students follow the rules and process and click the submit button to get points, rankings, points, and badge rewards.

4.2.3. Gamification and ARCS Motivational Strategy Usage

Firstly, gamification use cases include:

- 1) Gamification platform—CSSBattle;
- 2) Game activities: cooperative racing, guessing the drawing board;
- 3) Gamification Elements: Points, badges, rankings.

Secondly, the use of ARCS motivational policies.

- 1) Attention strategy: Teachers stimulate students' sense of inquiry by setting questions;
- 2) Related strategies: CSS positioning and layout is not only one of the important contents of this book but also the core content in the field of netizen production, which meets the needs of actual teaching and professional application.
- 3) Assertive Strategy: After the teacher understands the student's prior knowledge level, they provide a teaching task of moderate difficulty and Activity—Project 7 CSS Positioning and Layout and Level 37 Challenge.

4.3. Post-Class Evaluation

The first is teacher activities. First, teachers give evaluation and feedback based on students' homework completion after class. Second, teachers set up a display session for excellent works, select the best works, get points and candy rewards, and guide students to attribute them correctly.

The second is student activities. First, students race for a limited time to practice after-class tasks and submit screenshots of their works on Superstar Learning Pass. Second, students actively participate in the exhibition of excellent works and give evaluations of self-performance, correct attribution, not arrogant

or impatient, and continue to work hard.

Finally, gamification and ARCS motivational strategy usage. First, the use of gamification:

- 1) gamification elements: points, candy rewards;
- 2) Gamification platform—CSSBattle;
- 3) Game Event: Time Limit Racing.

Secondly, the use of ARCS motivational policies.

1) Self-confidence strategy: Teachers give fair and just feedback and encouragement according to the students' submissions and guide students to attribute correctly, that is, to the level of effort;

2) Satisfaction strategy: Teachers allow students to use it in the form of homework assignments, display excellent works, guide correct attribution, and improve students' learning satisfaction.

5. Assessment of Learning Satisfaction

In order to evaluate the implementation of this study, a questionnaire on the implementation effect and satisfaction of gamified teaching integrating ARCS motivational strategies was issued, detailed in Appendix 1, and contains 10 questions. A total of 65 valid questionnaires were collected in this questionnaire survey. The descriptive statistical analysis of the questionnaire is shown in **Table 3**, through which it can be seen that the average value of each item is about 1, which indicates that the student's overall satisfaction with course learning is good. Using the new teaching mode has improved the students' interest in learning, enhanced their learning confidence, improved their learning motivation and efficiency, and created a good atmosphere in the teaching process.

6. Conclusion

This study focuses on the theme of "Gamified Teaching Model Integrating ARCS Motivational Strategies", which is consistent with the traditional teaching process in the actual operation process. It is divided into before, during, and after class. Still, the difference between the two is that the teaching model concept constructed in this paper is derived from constructivism and flow theory, which pays more attention to immersive learning and the fit with prior knowledge and constructs a more friendly, warm, but competitive learning environment. In the field of secondary vocational education, which has been marginalized for a long time in the past, many scholars prefer the K12 category in education and teaching research. Still, in fact, the updating of the teaching method of secondary vocational education is the most urgent and needed, which is also the key to the selection of this field as the research paradigm in this paper. Practical research has proved that the teaching model constructed by the paper can help students better understand subject knowledge, master professional skills, and create a harmonious and friendly learning atmosphere. Students also enjoy the gamified learning process, especially when receiving awards. However, this study also has

Table 3. Descriptive statistical analysis of the questionnaire.

Name	Minimum	Maximum	Average	Standard Deviation
1. Do you think the implementation of gamified instruction incorporating ARCS motivational strategies has had a positive impact on your learning motivation?	1.000	2.000	1.062	0.242
2. Did you feel the attention and support of teachers during your participation in the implementation of gamified teaching that integrated ARCS motivational strategies?	1.000	2.000	1.062	0.242
3. Do you think the implementation of gamified teaching that incorporates ARCS motivational strategies has increased your interest in learning?	1.000	2.000	1.062	0.242
4. Do you think the implementation of gamification that incorporates ARCS motivational strategies has boosted your confidence in learning?	1.000	2.000	1.062	0.242
5. Do you feel that the difficulty of the learning tasks matches your ability during your participation in the implementation of gamified teaching that incorporates the ARCS motivational strategy?	1.000	2.000	1.092	0.292
6. What is your overall satisfaction with the implementation of gamified teaching that incorporates the ARCS motivational strategy?	1.000	4.000	1.277	0.673
7. Do you think the implementation of gamification that incorporates ARCS motivational strategies will improve your motivation to learn?	1.000	2.000	1.015	0.124
8. Are you satisfied with the content that you have implemented in gamified instruction that incorporates the ARCS motivational strategy?	1.000	4.000	1.262	0.644
9. Did you feel the friendliness and comfort of the learning environment when you participated in the implementation of gamified teaching that incorporated the ARCS motivational strategy?	1.000	2.000	1.015	0.124
10. Do you think the implementation of gamification in teaching that incorporates ARCS motivational strategies will improve your learning attitude?	1.000	2.000	1.031	0.174

the problems of a short research cycle, small sample size, and few practical courses, so it should be continuously improved and improved in the follow-up learning and work.

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Ethical Approval

The research was approved by the Guizhou Normal University Institutional Research Ethics Committee and was conducted in compliance with international standards for human subject research ethics.

Conflicts of Interest

The authors declare no conflicts of interest.

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Appendix

Appendix A. List of Gamification Teaching Implementation Effect and Satisfaction Questionnaire Integrating ARCS Motivation Strategies

Dear students, in this semester's "Web Production and Training" study, we have carried out gamified teaching integrating ARCS motivation strategies with the help of ARCS motivation strategies CSSBattle platform. Now, we are investigating the implementation effect and satisfaction of the course and asking students to actively participate and cooperate so that teachers can improve teaching methods and teaching quality in the future.

1. Has the implementation of gamified instruction incorporating ARCS motivational strategies had a positive impact on your learning motivation? ()
A. Yes B. No
2. Did you feel the attention and support of teachers during your participation in the implementation of gamified teaching that integrated ARCS motivational strategies? ()
A. Yes B. No
3. Do you think implementing gamified instruction incorporating ARCS motivational strategies has increased your interest in learning? ()
A. Yes B. No
4. Do you think the implementation of gamified instruction that incorporates ARCS motivational strategies has boosted your confidence in learning? ()
A. Yes B. No
5. Do you feel that the difficulty of the learning tasks matches your abilities during your participation in the implementation of gamified teaching that integrates ARCS motivational strategies? ()
A. Yes B. No
6. How satisfied are you overall with implementing gamified instruction that incorporates ARCS motivational strategies? ()
A. Very satisfied B. Satisfaction C. General
D. Dissatisfied E. Very dissatisfied
7. Do you think implementing gamification that incorporates ARCS motivational strategies will improve your motivation to learn? ()
A. Yes B. No
8. Are you satisfied with the content you implemented in gamification that incorporates the ARCS motivational strategy? ()
A. Very satisfied B. Satisfaction C. General D. Dissatisfied
9. Did you feel the friendliness and comfort of the learning environment during

your participation in the implementation of gamified teaching that incorporated the ARCS motivational strategy? ()

A. Yes B. No

10. Do you think the implementation of gamification in teaching that incorporates ARCS motivational strategies has improved your attitude towards learning? ()

A. Yes B. No