Investigating the Impact of Online Interactive Games on Motivation and Engagement in a Secondary School Business Data Analysis Course

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Abstract: As an emerging teaching tool, online interactive games demonstrate unique value in the business data analysis course for secondary vocational schools. Integrating business scenarios into game design can effectively meet students' needs for autonomy, competence and relatedness, thus stimulating their intrinsic learning motivation.Gamified teaching significantly enhances students' cognitive engagement, emotional experience and behavioral participation through real-time feedback mechanisms, adaptive difficulty adjustment and progress visualization design. In view of the practical predicament of insufficient digital resources in rural secondary vocational schools, online interactive games provide a low-cost and highly interactive solution.Studies show that hierarchical task design based on students' academic differences, an online-offline blended teaching model and the establishment of a formative assessment system can sustain students' learning interest, improve their course participation, and ultimately promote the substantive improvement of their business data analysis capabilities.

Keywords: Online Interactive Games; Secondary Vocational Education; Business Data Analysis; Learning Motivation; Participation

1. Introduction

With the rapid development of the digital economy, business data analysis capability has become a core literacy for modern business talents. However, secondary vocational students generally face problems such as weak learning foundation, insufficient abstract thinking ability and lack of learning motivation, and traditional lecture-based teaching is difficult to arouse their learning enthusiasm.This problem is exacerbated in rural secondary vocational schools due to the shortage of digital teaching resources. Online interactive games deeply integrate knowledge learning with game mechanisms, and provide new ideas for solving the teaching difficulties of the business data analysis course in secondary vocational schools through contextualized tasks, real-time feedback, competition and collaboration designs[1].Exploring how gamified teaching affects learning motivation and participation is of great theoretical and practical significance for improving the quality of secondary vocational education.

2. Application of Online Interactive Games in the Business Data Analysis Course for Secondary Vocational Schools

2.1 Games Stimulate Students' Intrinsic Motivation from the Perspective of Self-Determination Theory

Self-Determination Theory holds that an individual's intrinsic motivation stems from the satisfaction of three basic psychological needs: autonomy, competence and relatedness. Online interactive games effectively meet the need for autonomy by giving students the right to choose tasks independently and set their own learning pace.The level design in games progresses from simple data entry to complex sales forecast analysis, and the progressive difficulty system allows students to gain a sense of accomplishment through constant challenges, satisfying the need for competence.At the same time, the built-in team collaboration mode, ranking mechanism and social interaction functions of games make students feel a sense of collective belonging when completing business data analysis tasks, enhancing their social motivation for learning.Compared with the passive knowledge acceptance in traditional classrooms, the gamified environment positions students as active explorers, transforming external learning requirements into internal exploration desires. This motivation transformation is particularly important for

secondary vocational students with weak learning foundations and low self-efficacy, and can fundamentally change their stereotyped impression that the business data analysis course is "boring and difficult to learn".

2.2 The Promoting Effect of Gamified Teaching on Cognitive, Emotional and Behavioral Participation

Gamified teaching enhances student learning immersion by many folds using multi-dimensional mechanisms of involvement[2]. At the cognitive level, game tasks will be used to convert the abstract concepts of data analysis into particular entrepreneurial problems. As an illustration, a simulation characteristic of the sales data analysis of a supermarket to give the inventory turnover rate will assist students to draw relationship between knowledge and practice, as well as facilitate deep thinking. The use of data visualization tools in games allows students to perceive the interpretation of the statistical charts intuitively and facilitate the load on the brain. Emotionally, rewarding game design, point rewards and the feeling of achievement by passing the level through it may foster constant interest in learning among students, and the anxiety and frustration by learning to enjoy the challenges. The interaction nature of the games at the behavioral level enforces the students to act actively and repeat, which greatly raises the time spent in the classroom setting and the rate of a task accomplishment. Statistics indicate that on a mean basis, the students in the classes that have switched to gamified teaching have spent over 40 percent of their total time practicing computers and the number of classes during which students undertake active after-class reviews has been overly elevated.This synergistic participation in cognition, emotion and behavior forms a complete chain of deep learning[3].

2.3 The Impact of Shortage of Digital Resources in Rural Secondary Vocational Schools on Learning Motivation

Rural secondary vocational schools are faced with a severe shortage of digital teaching resources, which directly affects students' learning motivation and teaching effects. Problems such as outdated hardware equipment, limited network bandwidth and lack of teaching software are widespread, making it difficult to carry out practical teaching in the business data analysis course.Students lack the opportunity to access real business data, and their understanding of data analysis remains at the theoretical level, making it hard for them to realize the practical value of knowledge, which naturally leads to low learning motivation.Restricted by resource conditions, teachers can only adopt the traditional method of "explaining cases on the blackboard", unable to provide a highly interactive and well-visualized learning experience. As a lightweight and cloud-based teaching tool, online interactive games can solve the problem of resource shortage at a low cost.Students can access rich business databases and analysis tools with only networked devices, and experience teaching resources equivalent to those in urban schools. The improvement of such resource accessibility not only narrows the urban-rural education gap, but more importantly, makes rural secondary vocational students see the value and possibility of learning and rekindle their learning enthusiasm.

3. The Impact of Online Interactive Game Design on Learning Motivation and Participation

3.1 Embedding of Business Scenarios in Meeting the Need for Task Meaning and Autonomy

It is the true re-creation of business situations that will be the distinguishing characteristic of online interactive games and conventional exercises. Games put the prior knowledge of the analysis of abstract data into practical business tasks: operation of e-commerce, management and optimization of chain supermarket, and distribution of logistics thus giving the students the opportunity to master the skills in the process of their practical solution. As an example, in the task according to which the Double 11 Promotion Strategy, students should be able to analyze the past sales records, future demand of various products and to develop purchases and prices strategies. This designed in context gives meaning to learning activities, and students no longer learn to get marks but learn to explore to find a solution to the real world. Studies Authenticity of tasks improves the role identity of student; they will consider themselves as data analysts instead of students. Such identity transformation highly activates intrinsic

motivation to learn. Simultaneously, games offer an option of various business scenarios and students may select data analysis activity in such industries like retail, logistics and finance depending on their interests. This independent choice, further fulfills the need of autonomy, and thus, learning becomes a tailored one, view Figure 1.

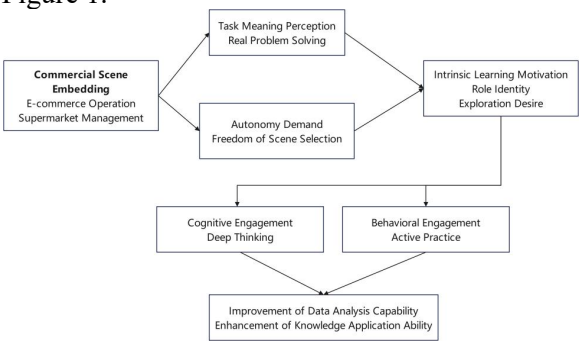

Figure 1. The Influence Path of Business Scenario Embedding on Learning Motivation

3.2 The Impact of Adaptive Difficulty Adjustment on the Sense of Competence and Engagement in Challenges

The essence of online interactive games as a technical advantage is adaptive difficulty adjustment. It is able to dynamically modulate the level of challenging the students based on their real-time performance in order to make sure that the students are always in the zone of proximal development. Games with students with a weak background begin with simple data entry and simple calculations and add new functions (sorting, filtering etc) one at a time; with students with greater abilities, they do not provide any embedded support; instead, they simply present challenging problems (complex data analysis and predictive modelling) and leave the students to solve them. This individualized difficulty level helps to avoid the problem of polarization brought about by the one-size fits all teaching- students who have high abilities will not be bored and students with low abilities will not give up in frustration. Students do not develop a true sense of competence and accomplishment when they perform tasks even below their capabilities. This good experience reinforces the self-efficacy belief of I can well learn data analysis. Meanwhile, moderate challenge keeps the level of psychological arousal in students would to continue with it and would trigger the desire to do so. The game system is also able to detect weak links by recording operation data of the students and automatically to push desired exercises to ensure precise learning support.

3.3 The Sustaining Effect of Real-Time Feedback and Progress Visualization on Learning Motivation

Gamified teaching involves the use of the real-time feedback mechanism to maintain learning motivation. In the traditional classes, students may sometimes take days to receive feedback on their homeworks by the teacher and even then, the feedback is not prompt and cannot be easily integrated into a learning closed loop. However, online interactive games provide the correct/incorrect judgment immediately, the score prompts and improvement suggestions at the end of the operation of each student which helps students to be familiar with their learning status in time and soon and correct the inaccurate perceptions. Not only does this enhance the efficiency of learning, but it is also important as it fulfils the psychological needs of students of certainty and mitigates anxiety and lack of understanding during the learning process. Progress visualization design is an approach to abstract learning that exists as concrete forms of presentation by providing experience bars, badge systems, and competency radar charts.Students can clearly see their trajectory from being a "novice" to a "data analyst", and every small progress is recognized visibly.This visualized growth record has a strong incentive effect, keeping students with a sense of goal and direction in the long learning process. Data shows that in games with a sound feedback and visualization system, students' average learning persistence time is extended by more than 60%,see Figure 2.

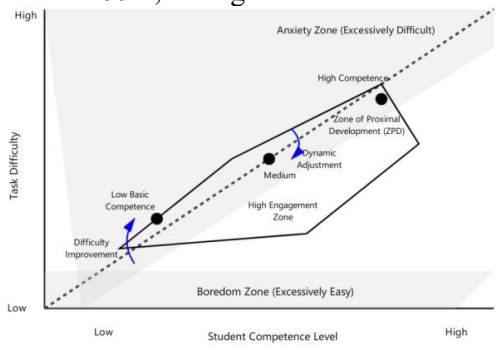

Figure 2. The Relationship Model of Adaptive Difficulty Adjustment and Learning Participation

4. Gamified Teaching Strategies to Improve Participation in the Business Data Analysis

Course for Secondary Vocational Schools

4.1 Hierarchical Design of Game Tasks and Personalized Learning Path Planning Based on Academic Differences

There are significant differences in secondary vocational students' learning foundations, cognitive styles and interest preferences, and unified teaching content is difficult to meet the needs of all students. Gamified teaching should construct a hierarchical task system[4], and design the core knowledge points of the business data analysis course into multiple task modules with different difficulty gradients.Basic-level tasks focus on operational skills such as standard data entry and the application of basic Excel functions, suitable for zero-based students to build confidence; intermediate-level tasks involve comprehensive applications such as pivot tables, chart making and trend analysis, meeting the improvement needs of medium-level students; advanced-level tasks include high-level content such as the use of business intelligence tools and predictive model construction, providing extension space for excellent students.At the same time, games should support the customization of personalized learning paths. Students can choose special themes such as retail data analysis, e-commerce operation analysis or financial data analysis according to their interests, and conduct in-depth exploration in the fields they are interested in.Through learning data analysis, the system dynamically recommends suitable learning resources and practice tasks to realize personalized learning of "one person, one path". Teachers then transform from knowledge transmitters to learning guides, accurately identify students with learning difficulties based on the game background data and provide targeted tutoring.

4.2 An Online-Offline Blended Teaching Model of Online Games and Offline Collaboration

Pure online game learning may lead students to indulge in the virtual environment and ignore real communication[5]. Therefore, it is necessary to construct a deeply integrated online-offline blended teaching model.In the pre-class session, teachers release preview tasks through the game platform, students complete basic knowledge learning and initial exploration in the game, and the system automatically collects learning data and generates diagnostic reports.In the in-class session, teachers explain key and difficult points in a targeted manner according to students' game performance, organize students to discuss business problems encountered in the game in groups, and carry out collaborative exploration of real data analysis projects. In an example, the real enterprise data belonging to various industries are chosen by each group, methods studied during the game are applied to them, and in the end, achievement display and mutual assessment are held. Not only can such offline work out teamwork and expression skills of the students, but more to the point the virtual experience in the game will be transferred to real-life conditions, which will encourage thorough comprehensiveness and adaptable understanding of knowledge. During the after-class session, students proceed with consolidation work and prolonged learning in the game, and fulfill independent assignments. This organically integrated learning of an online and offline nature provides the curious and accommodating benefits of games, and preserves the social and instructive benefits of classroom education, which attain complementary benefits.

4.3 A Learning Achievement Evaluation System Combining Formative and Summative Assessment

The traditional final exam evaluation method is difficult to fully reflect the real development of students' abilities in the business data analysis course. Gamified teaching needs to establish a more scientific evaluation system.Formative assessment automatically records students' learning trajectories through the game system, including multi-dimensional data such as the number of completed tasks, operation accuracy, learning duration, choice of challenge difficulty and number of times helping others, forming a continuous growth file.Not only do these data give the teachers a chance to have a picture of the learning situation of students, but also enable the latter have a clear picture of their lines of progress and make their learning gains more pronounced. Consimultaneously, staged badges of achievement and competencies are installed, including Data Cleaning Expert and Chart Master and Analysis Expert to provide sufficient feedback to pupils on their gradual progress. Summative assessment follows the technique of real business case examination, in which Pupils are obligated to more thoroughly apply the discovered knowledge to resolve realistic issues,

interested in the appreciation of data analysis thinking and problem solving skills as opposed to the memorization knowledge. It is suggested that the assessment weight should be divided into the following percentages: 40 percent pertaining to game performance, 30 percent to phased projects and 30 percent to the overall final case. The given assessment system is based on the process of learning and not on one of the findings, it motivates the learners to keep engaging in it and develop in a diversified manner, which is effective in eliminating anxiety associated with exams and facilitating the process of deep learning, see Figure 3.

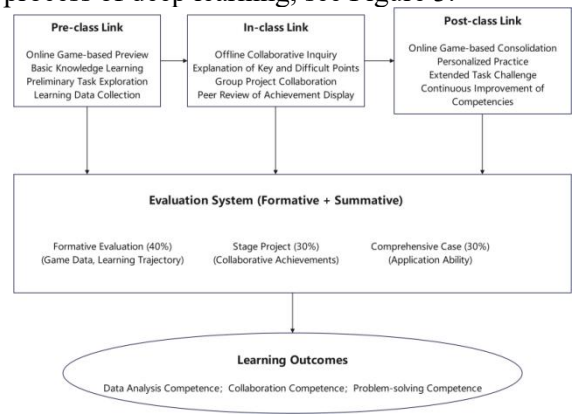

Figure 3. The Framework of Blended Gamified Teaching Model

5. Conclusion

Online interactive games provide an innovative path for the business data analysis course in secondary vocational schools. By meeting students' needs for autonomy, competence and relatedness, gamified teaching effectively stimulates intrinsic learning motivation.The real embedding of business scenarios, adaptive difficulty adjustment and real-time feedback mechanisms significantly improve students' cognitive, emotional and behavioral participation. In view of the resource shortage in rural secondary vocational schools, online interactive games effectively narrow the urban-rural education gap with the advantages of low cost and high interactivity.Practice shows that hierarchical design based on academic differences, an online-offline blended teaching model and a scientific evaluation system can sustain students' learning motivation. In the future, we should continue to optimize game content design, strengthen the training of teachers' gamified teaching abilities, and establish a sound learning data analysis mechanism.We will truly realize the value of gamified teaching in improving the quality of secondary vocational education, and lay a solid foundation for cultivating high-quality skilled talents with data analysis capabilities.

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