Design and Practice of a Classroom Feedback Teaching Model with Skewness-Peakiness Test Method

Yi Ding, Ruogu Zhang(✉), Ningning Zhang, Zhuzhu Zhang, Qi Cheng, and Shu Zhang

School of Computer and Information Engineering, Hubei Normal University, Huangshi, China
2236549@qq.com

Abstract. Entering the metaverse era, immersive learning, as a unique and chic form of learning, has gradually become a normalized way of learning. Based on the flow theory, this research constructs a all-time, new-field learning metaverse teaching model to empower traditional classrooms, and analyzes the classroom effects of this teaching model using data generated from teaching practices as samples using SPSS24.0 software. The results show that the overall effect of the all-time, new-field learning metaverse model in the classroom is significant, and there is a positive relationship between learners' engagement in the all-time, new-field learning metaverse classroom and their immersion experience. There is a positive effect on the exercise of learners' thinking and the cultivation of their creative abilities.

Keywords: skewness-peakiness test · teaching model · all-time · new-field · learning metaverse

1 Introduction

In recent years, a variety of immersive theater, commercial streets, towns, theme parks, museums, restaurants, scenic spots and other industries have been emerging, and the immersion industry has extended to many fields both online and offline, and its connotation and extension have gone beyond the "immersion communication" represented by VR and AR with the help of technology, it can be seen as "a kind of experience activity built on digital quasi-objects with space creation as the core business mode; it allows the audience to enter the fictional world from the real experience, and conveys the creator's new interpretation and expression of self, everything, the world, the universe, etc." [1] The rise of the immersion industry is also accompanied by the introduction and popularity of the concept of metaverse, which presents rich, explorable and highly imaginative concepts and topics, but in its essence, "immersion" is the inescapable inherent characteristic of the metaverse.

In the metaverse era, immersive learning, as a unique and chic form of learning, has gradually become a normalized way of learning, which can stimulate learners' motivation more than traditional passive learning, so that they can't help but engage in learning

X. Yuan et al. (Eds.): ICEKIM 2023, AHCS 13, pp. 950–959, 2023.
https://doi.org/10.2991/978-94-6463-172-2_100

activities without being influenced by other distractions around them, and enter a state of "blocking out" all irrelevant perceptions and being highly focused on the learning goal. Based on the flow theory, this research constructs a all-time, new-field learning metaverse teaching model to empower traditional classrooms, and analyzes the classroom effects of this teaching model using data generated from teaching practices as samples using SPSS24.0 software.

2 Building a Teaching Model Based on Flow Theory

2.1 Application of Flow Theory in Teaching and Learning

Flow theory was first proposed by Mihaly, a professor of psychology at the University of Chicago, in 1975 to explain why people enter a state of immersion when performing certain activities [2]. In the field of pedagogy, flow theory has played a great role since its inception. In the 1960s, the Canadian government implemented immersive education in French language education with great success and development, and it has been borrowed from many countries and regions, which has greatly promoted practical education in classrooms and enhanced the effectiveness of education in many countries around the world [3].

With the development of technology, human beings have entered the information age, and immersive technology based on virtual reality technology has promoted the reform of classroom teaching, further improving learners' interest in learning and the efficiency of classroom teaching, and constructing an immersion teaching design model based on virtual reality technology [4]. Learners can take the opportunity to engage in a variety of simulation experiences that offer the possibility to actively engage in learning, build multidimensional and comprehensive competencies, and exercise creative thinking.

2.2 The Characteristics and Core of the Learning Metaverse

The learning metaverse is a learner-centric, high immersion virtual-real communication space for immersive learning experiences that helps learners activate motivation, awaken emotions, and engage in mind-flow experiences and interactive learning to achieve knowledge understanding and cognitive transfer [5]. Based on the analysis of flow theory combined with the definition of learning metaverse, we know that the learning metaverse has three major features, namely, high immersion, enhanced input, and interactive experience. High immersion is the primary prerequisite for building the learning metaverse, enhanced input is the goal of the learning metaverse created through immersion, and interactive experience is the way to enhance immersion in the learning metaverse, and the three are interlocked to form a closed loop of learning metaverse features and generate an immersion field.

3 Building a All-Time, New-Field Learning Metaverse Teaching Model

The essential feature of the learning metaverse is immersion, and the realization of immersion needs to rely on the context, which refers to the emotional atmosphere created by the teacher in the teaching process, including both the physical environment in

which the learners live and the various software facilities in the school. The relationship between "learner, teacher, and classroom" needs to be reconstructed. Based on flow theory combined with the characteristics and core of the learning metaverse, this research constructs a all-time, new-field learning metaverse teaching model.

3.1 All-Time Constituent Elements

The components of the all-time space mainly include three stages: before, during and after the class, each with clear tasks and goals, and each stage influences each other, progressively, and has an inner connection, as shown in Fig. 1. Learners are not only the participants of the classroom but also the creators of the field. As the leader who guides learners into the immersion experience, teachers are required to skillfully use the classroom field in the teaching process, combine various teaching methods, stimulate learners' interest in learning, and make learners enter a state of "immersion" experience, so as to improve the teaching. This will improve the level and effectiveness of teaching and learning.

Before the class, the teacher psychologically draws the learners' attention to the subject and prepares them for the immersion teaching. The teacher sends a video to the class group the day before the week's class begins, to arouse learners' interest and deepen their impression of the subject. The teacher also sets aside one to two reflection questions for the learners to explore and answer how to solve the problem practically and lay the groundwork.

In the class, the teacher sets up and incorporates formative assessment to repeatedly deepen learners' immersion and memory, and gives appropriate feedback to enhance learners' engagement, creating a new classroom environment full of positive and active activities. The teacher introduces the class by using the reflection questions given before the class as a guide and commenting on the various answers given by the learners. After completing the interaction, the teacher layers the content of the class, from the shallow to the deep, from the easy to the difficult, in a progressive and interlocking manner. After

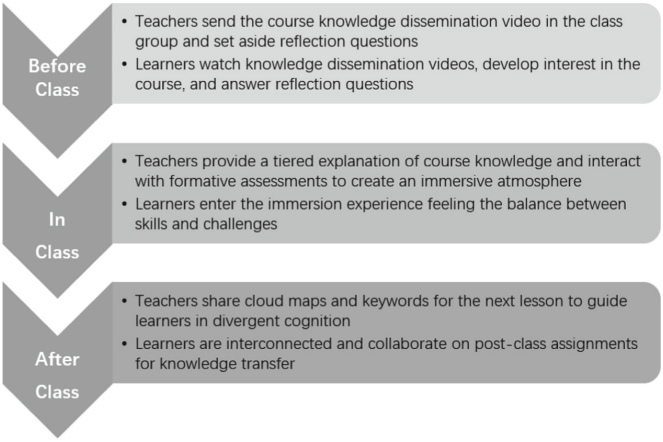

Fig. 1. All-time teaching design

each layer of knowledge is explained, 5 ~ 8 multiple choice or fill-in-the-blank questions are set and learners are allowed to answer them in 3 ~ 5 min using Rain Classroom.

The questions that teachers ask and interact with are not limited to the subject area, but lead learners to focus more on the field of knowledge to learn from a research perspective. For example, whether a problem can be solved, how it can be solved, and what methods can be used to solve it. After explaining the content of the class, the teacher inspires learners to move from solving the problems described in the class to solving other problems in their lives, leading them to transfer knowledge and developing their thinking and innovation skills. At the end of the class, a cloud map or mind map is given and the students are asked to do a targeted review after the class.

After the class, when assigning the homework for the week, the teacher encourages learners to carry out group collaboration, with 5 ~ 8 people, and asks learners to give certain thoughts and answers to other questions raised in the class and involving life, and share the key words of the next class to the class group, and in the next week's class one student from the group will be randomly selected by the teacher to express insights on behalf of the group to maintain the subsequent class immersion and the new field Continuity. At the end of this week's class, the teacher organizes the knowledge points that accounted for more incorrect answers in the class and adds them to the lecture content of the next class.

3.2 New-Field Composition Elements

In classroom teaching, teachers, learners, classrooms, teaching environment, teaching software and even social software all play an important role in influencing the teaching process. Through a reasonable combination of the above social objects, a new classroom field is formed that is different from the previous one (Fig. 2). The main condition of immersion experience as the entrance to the new classroom field is the balance between the operator's skills and challenges. With the help of teaching aids such as Rain Classroom, teachers can understand the learners' knowledge mastery and learning needs of the subject in order to design the best way of teaching interaction so that learners can feel the balance between skills and challenges in the learning process.

When the majority of learners in the classroom are above average, individual learners can enter a state of high excitement and concentration, and gain a kind of blissful experience of forgetfulness, when the creativity and potential of individual learners will

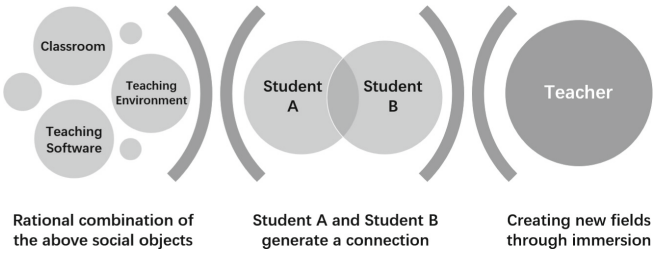

Fig. 2. New-field construction in the classroom

be greatly stimulated, [6] and a high level of immersion will become the dominant new field in the classroom.

3.3 Initial Application of Teaching Models

The development of education cannot be separated from advanced technology, and the exploration of the application of the teaching model of the all-time and new-field learning metaverse cannot be separated from the current development status of technology. With the help of rain classroom teaching aids to carry out learner-centered teaching design and empower learners in the existing traditional classroom, go to the initial exploration of the application of the current teaching model.

Based on this, a total of 30 learners were randomly selected from a major orientation course for undergraduate students in Year 2019 at University of H. The research constructed a all-time, new-field learning metaverse classroom, tracked the formative assessment scores of 30 learners in the course in the first semester of the academic year 2022 to 2023, and used SPSS 24.0 software to analyze the performance data in order to explore three questions: (1) How effective is the all-time, new-field learning metaverse teaching model constructed in this paper in the classroom overall? (2) How effective is this teaching model for weekly classes? and (3) How the immersion effect changes in the classroom?

4 Implementation Feedback and Data Analysis

The total number of hours for an undergraduate course in a specialization in the 2019 class at University H is 16, and the course is taught at a frequency of 2 h per week for a total of 8 weeks of classes.

4.1 Data Collection and Sample Profile

Based on the all-time, new-field learning metaverse teaching model constructed in the previous paper, 10 unit quizzes out of 100 points were set in each lesson, and two in-class formative evaluations were conducted in each week's lesson. 16 times of feedback data were collected to analyze the learners' mastery of what they had learned and the state of learning engagement in the classroom. Thirty learners were randomly selected from the 2019 undergraduate course of a specialization at University of H. The teaching practice was conducted in the first semester of the academic year 2022 to 2023, and the collected teaching data were analyzed using SPSS24.0 software.

4.2 Data Testing

A total of 480 formative evaluation scores were collected from the all-time, new-field learning metaverse teaching practice conducted in the first semester of the academic years 2022 to 2023, and the K-S test was conducted on the collected teaching data using SPSS 24.0 software to test whether the data conformed to a normal distribution, resulting in the formative evaluation score test data as shown in Table 1.

Table 1. Formative assessment performance test data

Variable Name	Size of Sample	K-S TEST
1.1	30	0.125(0.5068898049945733)
1.2	30	0.079(0.9403520456495376)
2.1	30	0.103(0.7790263794643102)
2.2	30	0.102(0.7609946041817263)
3.1	30	0.168(0.21146380306510804)
3.2	30	0.131(0.45798401974010505)
4.1	30	0.116(0.6425567017314996)
4.2	30	0.144(0.3278237339851291)
5.1	30	0.171(0.1716934078043587)
5.2	30	0.209(0.13566854581202004)
6.1	30	0.166(0.36324844004472945)
6.2	30	0.218(0.11014209620525339)
7.1	30	0.290(0.002580431453481191)
7.2	30	0.214(0.0442111253034112)
8.1	30	0.214(0.0442111253034112)
8.2	30	0.240(0.05834136870952933)

The K-S test mainly tests whether the research sample conforms to the normal distribution, assuming that the study object with a certain sample size n conforms to the normal distribution, the samples with sample size n are arranged in order of size, and then the value of the statistic is calculated according to the formula, and when the p-value > 0.05, the data conforms to the normal distribution. From the data in Table 1, a total of 16 K-S test results, 13 p-values > 0.05, 3 p-values < 0.05, 75% of the data of the sample in this research obeyed normal distribution.

4.3 Data Analysis

To verify the pedagogical effectiveness of the all-time, new-field learning metaverse instructional model and to answer the three questions mentioned previously, this research used SPSS 24.0 software to conduct Skewness-Kurtosis test on formative evaluation scores, yielding the median, mean, standard deviation, skewness, and kurtosis of a total of 16 formative evaluation scores in weekly classes as shown in Table 2.

The median, mean and standard deviation of the data in the table (see Fig. 3) show that the overall classroom effect of the all-time, new-field learning metaverse teaching model constructed in this paper is significant, with a 67.3% increase in the mean number of formative assessment scores in the eighth week of class compared to the first week, and a shift in the learners' mastery of the course from half-knowledge to proficient application. The mean standard deviation was controlled at 14.5, the curve was relatively smooth, the

Table 2. In-class formative assessment score data

Variable Name	Median	Average	Standard Deviation	Skewness	Kurtosis
1.1	53.125	52.439	10.882	-0.636	0.602
1.2	59.091	58.537	12.226	-0.295	-0.097
2.1	61.346	60.759	17.333	-0.787	1.421
2.2	64.286	63.393	19.955	-0.305	-0.267
3.1	68.75	70.395	15.433	-0.209	-0.757
3.2	72.222	69.509	15.247	-0.76	-0.331
4.1	74.615	73.502	11.708	-0.484	-0.674
4.2	69.444	70.867	11.371	-0.501	-0.63
5.1	73.056	68.389	21.442	-0.835	-0.384
5.2	75	74.808	9.534	-1.816	4.253
6.1	77.778	75.9	14.969	-1.404	2.767
6.2	84.615	86.207	9.726	-0.418	-0.775
7.1	91.667	89.693	14.905	-2.88	9.938
7.2	90.909	85.682	16.064	-1.113	0.88
8.1	90.909	85.682	16.064	-1.113	0.88
8.2	91.667	87.069	15.079	-1.615	2.462

difference between the highest and lowest scores in the classroom was small, the balance between what was learned and the unit tests was relatively high, and most learners in the classroom were highly focused on the learning objectives.

Skewness refers to the degree and direction of asymmetry of the data distribution, such as skewness > 0 means that the right tail of the data is left-skewed, and the learning effect is unsatisfactory; skewness $= 0$ means that the data is normal, and the learning effect is average; skewness < 0 means that the left tail of the data is right-skewed, and the learning effect is good.

Kurtosis characterizes the characteristic number of the peak height of the probability density distribution curve at the mean, such as kurtosis > 0 means the shape of the peak

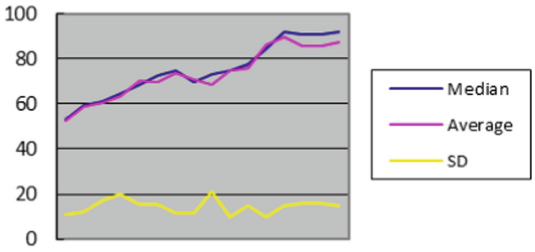

Fig. 3. Median, mean and Standard Deviation charts

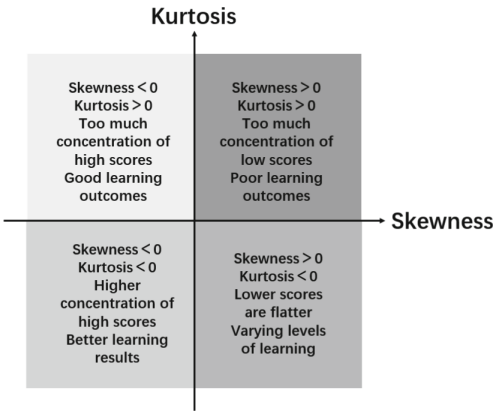

Fig. 4. Bi-dimensional learning effect analysis of skewness and kurtosis

is steep and sharp, and the learners' performance is in the concentration of high score distribution; kurtosis = 0 means the shape of the peak is normal, and the learners' performance is more average; kurtosis < 0 means the shape of the peak is gentle and smooth, and the learners' performance is in the concentration of low score distribution [7]. The learning effects were analyzed by combining the two dimensions of skewness and kurtosis using Fig. 4 as the criterion, corresponding to the four learning effects.

The skewness and kurtosis trend graphs derived from the data in the table (see Fig. 5) show that the weekly course effect of the all-time, new-field learning metaverse classroom is significant, and there is no data situation where both skewness and kurtosis are > 0 indicating poor learning effect. 8 out of 16 formative evaluations have skewness and kurtosis < 0 indicating good learning effect, and 8 times have skewness < 0 and kurtosis > 0 indicating good learning effect.

The difference between the average formative assessment score of the first class of each week and the corresponding average formative assessment score of the second class was calculated, resulting in a graph of the difference in formative assessment scores as in Fig. 6, to visually reflect how the immersion effect of the all-time, new-field learning metaverse classroom changed.

From the data, it can be seen that the immersion effect of the all-time and new-field learning metaverse classroom was significant in the second session of the first week,

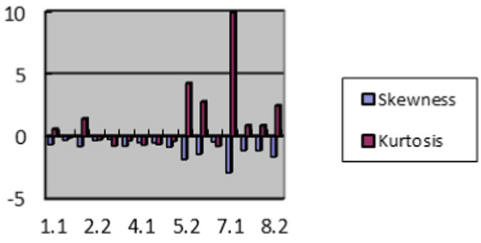

Fig. 5. Skewness and Kurtosis trend

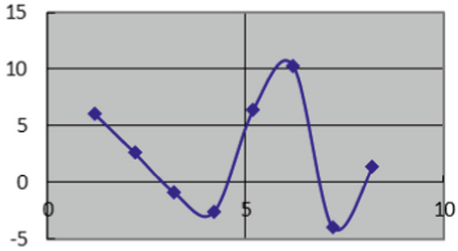

Fig. 6. Formative evaluation grade difference trend

and remained until the second session of the second week, then showed a small decrease from the second session of the third week to the second session of the fourth week, rose in the second session of the fifth week, and was similar to the immersion effect of the second session of the first week, peaked in the second session of the sixth week, dropped and settled in the second session of the seventh week, and then became smooth in the eighth week. The immersion effect was smooth and fluid in week 8.

It can be seen that the mean scores of learners' formative assessment in week 1, lesson 2, week 5, and week 6, lesson 2, have improved significantly and the classroom immersion effect is the best; the mean scores of learners' formative assessment in week 7, lesson 2, have dropped back the highest and the immersion effect has much room for improvement; the mean scores of formative assessment in week 3, lesson 2, and week 4, lesson 2, have dropped back slightly and belong to the settling period of classroom immersion effect. In the subsequent application of the all-time and new-field learning metaverse teaching model, we can pay close attention to the course sessions where the immersion effect falls back and find the main factors affecting the immersion effect to improve the classroom immersion experience.

5 Conclusions

Based on immersion theory, this research identifies three characteristics of the learning metaverse: high immersion, enhanced engagement, and interactive experience, focuses on the immersion core of the learning metaverse, constructs all-time, new-field learning metaverse teaching model, explores the impact of the teaching model on learners' engagement in learning and formative assessment scores in traditional classrooms, and explores its mechanism of action through teaching practice. It enriches the original immersion theory applied to teaching level research and provides further exploration of the learning metaverse to empower traditional classrooms.

The research shows that the overall effect of the all-time, new-field learning metaverse classroom constructed in this paper is significant, and there is a positive correlation between learners' engagement in the all-time, new-field learning metaverse classroom and their immersion experience, and the immersion experience generated in the classroom can be well transferred outside the classroom, which has a positive effect on the exercise of learners' thinking and the cultivation of innovation ability.

In future research, it is possible to take the perspective of two different identities of teachers and learners. When teachers conduct all-time, new-field learning metaverse

classroom, they can customize diverse and personalized classroom interactive experiences based on learners' interest level and learning needs in the subject matter, and shape balanced skills and challenges with learners in mind to enhance the immersion experience. When experiencing all-time, new-field learning metaverse classroom, learners can take a certain subject knowledge as a point of interest to spread out, conduct certain investigation and understanding in the learning process, promote their own immersion experience, and better integrate into the all-time, new-field learning metaverse classroom.

References

1. Zheng Z. and Yutan L., (2022) Connotation Interpretation and Cultural Logic of the Concept of Immersion, Nanjing Journal of Social Sciences, 02:165-172.
2. Wenchao Z., Lei Y., RuonanY., Hang Y., (2022) Gamification Learning to Learning Metaverse: New Framework and Practical Essentials for Immersive Learning, Journal of Distance Education, 40.04:3-13.
3. Csikszentmihalyi, M. and Csikszentmihalyi I., (1988) Optimal Experience: Psychological studies offlow in consciousness, Cambridge: Cambridge UniversityPress.
4. Lu Y. and Chaofei Z.,(2012) On the Model and Practice of Immersion Teaching in China's Higher Education, Henan Social Sciences, 20.06:78-80.
5. Feng X.,(2019) Application and research of immersive classroomteaching based on virtual reality technology in 5G networks, Computer Engineering & Science, 41.S1:14-17.
6. Yinfeng M. and Zhihua S.,(2010) Research on the immersion design strategy of educational games based on Flow theory——Research on the dynamic regulation of difficulty of educational game activities, e-Education Research, 03:54–57+62.
7. Stan Brown. (2008) Measures of Shape: Skewness and Kurtosis. https://brownmath.com/stat/shape.htm.