The Assessment on the Use of Unreal Engine in 3D Animation Short Film Creation Course

Qinan Wang
Assumption University, Thailand
E-mail: 279900589@qq.com

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Abstract

Unreal Engine technology has greatly influenced the animation production process. However, its application in animation education is still in the exploratory stage. The research objectives of this study are as follows: firstly, to determine the different in student grades when use Unreal Engine technology and Traditional technology in the animation short film creation course; secondly, to determine the effect of Unreal Engine technology on student motivation in 3D animation short film creation course; thirdly, to determine the influence of Unreal Engine technology on student satisfaction in the 3D animation short film creation course. The population of the research were students majoring in Animation at Henan College of Science and Technology. Sampling target is Junior students majoring in Animation at Henan College of Science and Technology. Sampling size 57, dividing them into control groups (29) and experimental group (28), each undergoing pre-tests and post-tests. Performance test and open-ended questionnaire are utilized, as research instrument of this research. The data analysis was conducted based on the types of data obtained. Since the performance test obtained were quantitative data, Jamovi was used for analysis. For the qualitative data obtained from the open-ended questionnaires, Nvivo was used for analysis.

The results of the research findings were obtained through the analysis data of performance test and open-ended questionnaires. Firstly, the impact of Unreal Engine technology on the student performance in the 3D animation short film creation course was significant. Secondly, Unreal Engine's application in 3D animation short film creation courses had good perform on student motivation. Thirdly, Unreal Engine's application in 3D animation short film creation courses had good perform on student satisfaction.

Keywords: Unreal Engine technology; Animation education; 3D animation short film creation courses.; Game Engine

Introduction

3D Animation films production is a complex process involving different technical and artistic expertise (Li & Wang, 2021:13), The traditional animation production process is linear, divided into pre-production, production, and post-production phases. the production of 3D animation movies involves the efforts of hundreds of specialists, and their budgets often exceed hundreds of million dollars (Bąk & Wojciechowska, 2020:209). With the development of hardware and software, the emergence of game engines has changed this production process. As a cutting-edge tool in the animation industry, game engine technology continues to revolutionize the way animations are created, offering filmmakers and artists unprecedented creative freedom and efficiency (Tang, 2021:125). Unreal Engine, as a representative of this technology, has

* Received: March 21, 2024; Revised: April 18, 2024; Accepted: April 20, 2024

transformed animation production from linear to non-linear. Rendering has also become real-time hardware rendering, significantly enhancing the efficiency of animation film production (Wardhana et al., 2019:197). In education, Unreal Engine technology brought new possibilities for low-cost student 3D animation works. Breaking away from traditional linear animation workflows and applying Unreal Engine technology to animation education has become a consensus among animation educators (Sharif & Ameen, 2021:2). In the actual teaching process, the 3D animation short film creation course is a core course for enhancing students' professional skills. It is necessary to adapt to the changes of expression form and teaching mode as soon as possible, so as to cultivate more excellent animation professionals (Tao & Zhuo, 2020:125).

Based on the advantages of Unreal Engine and its urgency in the application of 3D animation education mentioned in the previous literature research. Therefore, this research attempts to experiment with the use of Unreal Engine technology in the animation short film creation course, in order to obtain final evaluation data on the application of this technology in the field of animation education.

Research Objective(s)

1.To determine the different in student grades when use Unreal Engine technology and Traditional technology in the animation short film creation course.

2.To determine students' learning motivation when Unreal Engine use in 3D animation short film creation course.

3.To determine students' satisfaction when Unreal Engine technology use in 3D animation short film creation course.

Research Methodology

This research is mixed-method research, consisting of a quasi-experimental part and a survey part. The experimental section utilizes performance tests as the instrument,

the performance test has good validity, because the standardized examination of performance test that come from the "National Standards for Teaching Quality of Animation and Digital Media Undergraduate Programs" formulated by the Ministry of Education's Steering Committee on the Teaching of Animation and Digital Arts in Higher Educational Institutions, which is the highest academic institution for animation majors in China. There are a total of 10 variables in the test, namely: (1) Completeness of the work (2) Structure of the work (3) Narrative rhythm of the work (4) Artistic style of the work (5) Visual effects of the work (6) Details of the work (7) Animation movements (8) Sound design (9) The level of Proficiency in techniques (10) Presentation. Through teaching practice, its validity has been confirmed to be satisfactory. The survey section employs an open-ended questionnaire survey as the instrument, open-ended questionnaire used CVI to ensure the validity of this method. The sampled case are Junior students majoring in Animation at Henan College of Science and Technology. Sampling was conducted on two animation major classes of the same grade, with Class 1 as the control group and Class 2 as the experimental group. First, the sample cases of the two classes were pre-tested, followed by an 8-week experiment. The post-test was conducted in the last week of the experiment. Ultimately,

pre-test and post-test scores were obtained for all sampled cases. Subsequently, an open-ended questionnaire survey was conducted to assess the learning motivation and satisfaction regarding Unreal Engine technology. The questionnaire was distributed to Class 2, and then collected the t open-ended questionnaire, Finally, data collection was finalized.

Research Scope

This study primarily focuses on evaluating the application of Unreal Engine technology in 3D animation short film creation course. Through comparative analysis with traditional 3D animation techniques within 3D animation short film creation course. Comparative analysis and interview-based data collection are employed to conduct experiments across three dimensions: learning outcome, learning motivation, and student satisfaction. Ultimately, the experimental data from both groups are compared to assess the application of Unreal Engine technology in 3D animation short film creation course, resulting in application-oriented data. The research scope involve:

1. The impact of using Unreal Engine technology on student grade in 3D animated short film creation courses.
2. Investigating students' attitudes towards the application of Unreal Engine technology in 3D animated short film creation courses.
3. Forming an evaluation of the application of Unreal Engine technology in 3D animated short film creation courses.
4. Generating teaching practice experience and data on the application of Unreal Engine technology in 3D animated short film creation courses.

The time of experimental data and open-ended questionnaire data collection is from September 2023 to January 2024.The population in this research are those enrolled in the animation specialization within the animation majors of Henan College of Science and Technology. Population Characteristics is those enrolled in the animation specialization within the animation majors of Henan College of Science and Technology, they should possess a foundational understanding of animation, including a grasp of the principles of 3D animation, animation motion laws, and creative techniques. The Sample is Junior students majoring in Animation at Henan College of Science and Technology. The experiment sampled two classes, one experimental group and one control group. The experimental group was Animation Class 2 (28 students), and the control group was Animation Class 1 (29 students), with a total sample size of 57. The open-ended questionnaire section was only conducted for the experimental group that had experience with Unreal Engine technology, the total of 28 sample cases.

Research Conceptual Framework

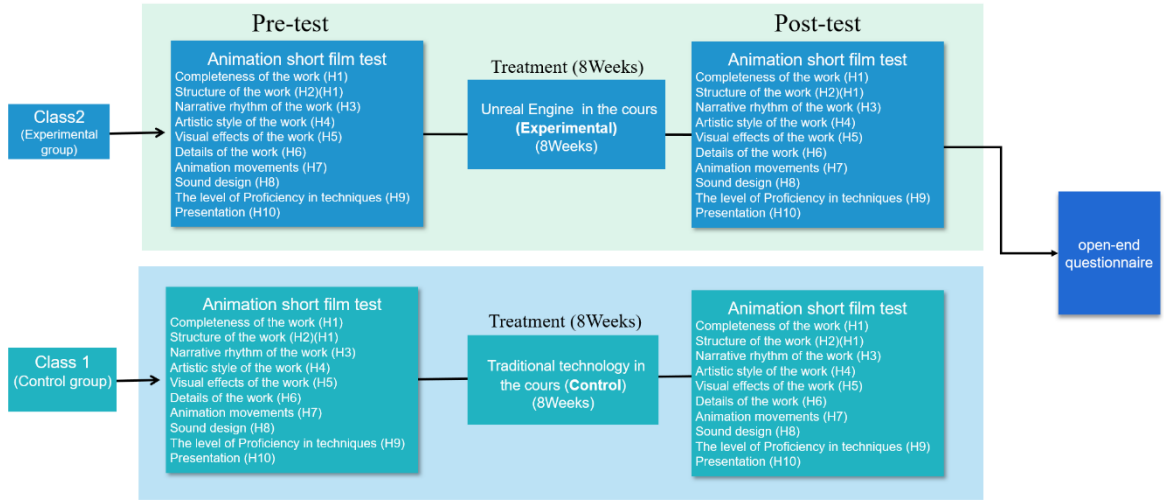

Figure 1 Research Conceptual Framework

Research Results

For the first research objective, which aimed to determine the grades differences brought to students by the application of Unreal Engine technology and traditional animation techniques in the 3D animation short film creation course, a comparison was made between the improvement scores of two groups: the experimental group using Unreal Engine technology and the control group using traditional animation techniques. The assessment was based on the "National Standards for Teaching Quality of Animation and Digital Media Undergraduate Programs" formulated by the Ministry of Education's Steering Committee on the Teaching of Animation and Digital Arts in Higher Educational Institutions.

Both pre-tests and post-tests for the two groups utilized the same professional performance evaluation criteria, consisting of 10 variables. Each variable had a total score of 100 points. The evaluation method was Collective Teacher Evaluation (At least 3 teachers). The entire process adopts a percentage-based system. The scoring process involved each teacher assigning a score for each item to the student. The scores given by each teacher for each item were summarized, and then divided by the number of grading teachers to obtain each variable average score. The follow table 1-2 are the data of experiment.

Table 1 The Descriptives grade improvement of group 1 (experimental group) and group 2 (control group)

Grade improvement of group 1 and group 2	Group	N	Mean	SD
Completeness of the work	1	28	7.07	3
	2	29	2.16	2.5
Structure of the work	1	28	10.35	2.33
	2	29	4.7	2.95
Narrative rhythm of the work	1	28	11.17	1.98
	2	29	5	3.27
Artistic style of the work	1	28	7.9	2.54
	2	29	2.64	3.46
Visual effects of the work	1	28	7.71	2.43
	2	29	3.13	2.82
Details of the work	1	28	7.51	2.37
	2	29	3.8	2.96
Animation movements	1	28	11.23	2.24
	2	29	5.31	3.28
Sound design	1	28	11.14	2.11
	2	29	5.49	4.27
The level of Proficiency in techniques	1	28	8.14	2.57
	2	29	3.28	3.3
Presentation	1	28	7.27	3.09
	2	29	2.15	2.38

NOTE: Improvement grade = post-test grade – pre-test grade

Table 2 T-test for 10 variables student Grade improvement

	Mean difference	df	p
Completeness of the work	4.91	55	< .001
Structure of the work	5.64	55	< .001
Narrative rhythm of the work	6.17	55	< .001
Artistic style of the work	5.26	55	< .001
Visual effects of the work	4.59	55	< .001
Details of the work	3.71	55	< .001
Animation movements	5.92	55	< .001
Sound design	5.65	55	< .001
The level of Proficiency in techniques	4.87	55	< .001
Presentation	5.12	55	< .001

From the data in Table 1, it can be observed that the Mean for each variable in the experimental group are higher than those in the control group. Data analysis showed that the improvement in scores of the experimental group was significantly better than that of the control group. From the data in Table 2, it can be observed that all variables, $P < 0.01$. Therefore, we reject the null hypothesis, indicating a significant difference between the experimental and control groups. Thus, the conclusion was drawn that the application of Unreal Engine technology in 3D animation short film creation course has a significant impact on student Grade improvement than traditional animation techniques.

For the second research objective, which aimed to determine students' learning motivation when Unreal Engine is used in the 3D animation short film creation course, three questions in the open-ended questionnaire were related to student learning motivation. Below are the qualitative analysis data results conducted used Nvivo.

Questions 1: The using the Unreal Engine has increased your interest in learning? Why?

Analysis data show there are 25 samples with a positive attitude towards Unreal Engine's technology enhances students' interest in learning, while only 1 sample holds a negative attitude, and the remaining 2 samples did not express a clear attitude. The reasons for the positive attitude are mentioned in 23 samples, mainly focusing on the following points: 1. Abundant digital resources (2 samples). 2. Rich learning resources (2 samples). 3. Realistic real-time rendering effects (4 samples). 4. High creative efficiency (6 samples). 5. New skills (6 samples). 6. Extremely high creative freedom (10 samples). 7. Powerful functionality (11 samples). There is 1 sample with a negative attitude, and the reasons for the negative attitude are mentioned in 1 sample, mainly focusing on three aspects: 1. Interest in 2D animation. 2. Not interest in 3D animation. 3. Not interest in game engines.

Questions 2: What is your interest in Unreal Engine technology? Why?

The main areas of student interest in Unreal Engine technology are Rendering, Interaction, Resource library, Level design, Lighting, Materials, Models, and Blueprints. Among these, Rendering is mentioned most frequently, with 14 sample cases, followed by Interaction with 11 sample cases, and the Resource library with 8 sample cases. Level design, Lighting, and Materials are each mentioned in 4 sample cases, while models and blueprints are mentioned in 2 sample cases each. Therefore, it can be observed that the greatest interest in Unreal Engine lies in Rendering, Interaction, and the Resource library.

Questions 3: Does Unreal Engine Technology Improve the Interaction between Teachers and You? Why?

The number of sample cases indicating enhanced teacher-student interaction by Unreal Engine technology is 25. Among these, 17 sample cases have indicated the reasons for enhancement, mainly citing the Complexity of Unreal Engine, Insufficient resources in online courses, Language barriers in software, and the Urgency of problem-solving. There is 1 sample case indicating that Unreal Engine technology has not enhanced teacher-student interaction. 2 samples did not state their attitude.

Based on the qualitative analysis data from the three questions above, we can conclude that the use of Unreal Engine technology in the 3D animation short film creation course demonstrates good learning motivation.

For the third research objective, which aimed to determine students' satisfaction when Unreal Engine technology used in 3D animation short film creation course. Three questions in the open-ended questionnaire were related to student learning motivation. Below are the qualitative analysis data results conducted used Nvivo.

Questions 1: Do you think your work has achieved your preset objectives? Why?

The data indicated 16 sample cases believe that their Unreal Engine course works have achieved the preset objectives, while 12 sample cases believe that their works did not achieve the preset objectives. Additionally, 15 sample cases explained why they were able to achieve the preset objectives for their works, and 11 sample cases provided reasons for their works not achieving the preset objectives. The reasons for achieving the preset objectives of the Unreal Engine course works as follows: 1. "good teamwork" with 6 sample cases, 2. "strong execution with clear goals" with 5 sample cases, 3."significant time and effort invested" with 5 sample cases, 4. "appropriate set goals" with 4 sample cases, and 5. "good technical mastery" with 3 sample cases. In the 11 cases where the preset objectives were not achieved, there were 6 sample cases citing "inadequate technical proficiency," 5 sample cases citing "overly ambitious preset goals," and 2 sample cases each citing "poor teamwork" and "limited time and energy."

Questions 2: Are you satisfied with this 3D animation software course? Why?

The data indicated 28 sample cases explicitly stated satisfaction with the Unreal Engine course. Among these, 26 sample cases elaborated on the reasons for their satisfaction. These reasons include "Learned new knowledge" with 11 sample cases, "Teaching content" with 10 sample cases, "Teaching attitude" with 7 sample cases, "Improved professional skills" with 5 sample cases, and "Expanded career opportunities" and "Teaching methods" with 2 sample cases each.

Questions 3: Will you continue **Questions 3**: Will you continue to use Unreal Engine technology for your future 3D design and creation? Why?

The analysis data indicates that 22 sample cases expressed their attitude towards using Unreal Engine for 3D animation creation in the future and stated the reasons. Among these, reasons for continuing to use Unreal Engine in the future, along with the sample cases, are as follows: "Efficient creative tool" with 15 sample cases, "Powerful functionality" with 12 sample cases, "Employment demand" with 6 sample cases, and "New technology for the future" with 5 sample cases. Four sample cases explicitly stated that they would not use Unreal Engine for future creations. Two sample cases did not express a clear attitude, and six sample cases discussed reasons for not using Unreal Engine in the future. Among these, five sample cases expressed interest in pursuing 2D animation in the future, three sample cases cited the high learning cost of Unreal Engine, and two sample cases expressed disinterest in both 3D animation and engines.

Based on the qualitative analysis data from the three questions above, we can conclude that the use of Unreal Engine technology in the 3 D animation short film creation course performs well in student satisfaction.

Additionally, according to the analysis of open-ended questionnaire data, 1 5 sample cases mentioned the difficulty of learning Unreal Engine. The reasons for the perceived difficulty, with 8 sample cases mentioning difficulty in software and system operation, 6 sample cases mentioning high learning costs, 3 sample cases mentioning high computer hardware requirements, and 2 sample cases mentioning English languagebarriers.

Discussion

Research by Caspersen et al (2017:1) supported grades are an important tool for measuring learning outcomes as they are relatively objective and accurate. From the data of this research, the impact of Unreal Engine technology on the student performance in the 3D animation short film creation course is significant than traditional animation technology. Firstly, from the quantitative experimental data, the improvement scores of the experimental group were significantly better than those of the control group. Research by Salli (2023:5) states that Unreal Engine can meet the needs of animation production very well. As Wardhana et al (2019: 196) stated Unreal Engine can lower costs and improve the quality of low-cost animation production and enhancing Machinima. Unreal Engine technology can better enhance the level of animation production (Mehta et al., 2015:2320). Obviously Unreal Engine technology in 3D animation short film creation effectively enhances students' creative performance. Secondly, from the open-ended questionnaire data, the application of Unreal Engine technology in the 3D animation short film creation course demonstrates excellent performance in students' learning motivation and satisfaction.

Additional findings Unreal Engine has narrowed the standard deviation of class scores, indicating its effectiveness in reducing the gap between individual student performance. Additionally, when implementing Unreal Engine technology in teaching, attention must be paid to addressing the difficulty of learning Unreal Engine technology for students. Future research on Unreal Engine could focus on its limitations in teaching applications, as well as curriculum arrangements, teaching formats, time constraints, teaching difficulties, and the challenges it poses for teachers in terms of knowledge updates

Recommendations

1. Theoretical Recommendation

More research on the application of Unreal Engine technology in animation education should be conducted, generating more instructional research data related to Unreal Engine technology and offering new perspectives for instructional reforms. Valuable data can be accumulated regarding the application of this technology in educational practices, providing numerical values and references for future research in educational technology.

2. Policy Recommendations

Firstly, in talent cultivation policies: promote the reform of animation education, revise talent cultivation plans, and swiftly integrate Unreal Engine technology into the classroom. Secondly, expedite the training of Unreal Engine technology instructors to enhance teachers' adaptability to new technologies. Lastly, introduce the school-enterprise cooperation policy on the application of Unreal Engine technology to bridge the gap between academia and industry.

3. Practical Recommendations

Firstly, develop teaching outlines that align with the requirements of Unreal Engine technology to enhance teaching effectiveness. Secondly, summarize the challenges and difficulties of integrating Unreal Engine technology into the teaching process to provide teachers with supplementary materials. Thirdly, delve into the potential of Unreal Engine technology for animation education and promote its integration with other animation courses. Furthermore, establish classrooms that comply with Unreal Engine technology standards, bridge the gap between industry and education. Lastly, introduce more new technologies in

animation education to enhance students' creative abilities, providing a talent pool and technological reservoir for the entire animation industry while improving students' professional skills and fostering their adaptability to the marke

References

Bąk, A., & Wojciechowska, M. (2020). Using the Game Engine in the Animation Production Process. *Intelligent Information and Database Systems: Recent Developments*. 209-220.

Li, F., & Wang, Z. (2021, 16-18 July 2021). The Value and Significance of Digital Media Interactive Technology in Animation Design. 2021 International Conference on Education, *Information Management and Service Science (EIMSS)*. 13-16.

Mehta, M. R., Bhatt, M. Y., Joshi, M. Y., & Vidhani, M. S. (2015). Animated movie making using a game engine. *Int. J. Emerg. Trends Sci. Technol*, *2*, 2320-2324.

Sharif, K. H., & Ameen, S. Y. (2021). Game Engines Evaluation for Serious Game Develop ment in Education. 2021 International Conference on Software, *Telecommunications and Computer Networks (SoftCOM)*. 1-6.

Tang, L. (2021, 2-4 Sept. 2021). Application of Engine Technology and in 3D Animation Production. *2021 Third International Conference on Inventive Research in Computing Applications (ICIRCA)*. 125-128.

Tao, J., & Zhuo, G. (2020, 18-22 Aug. 2020). Enlightenment of Digital Technology on Stop Motion Animation Teaching. *2020 15th International Conference on Computer Science & Education (ICCSE)*. 733-736