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Research Article

Development Of An Online Learning Model By Using A Virtual Environment With Scaffolding Strategies To Improve Learning Achievements For Undergraduate Students In China

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ABSTRACT

The development of a learning model by using a virtual environment with scaffolding strategies could improve students' learning achievements in moot court teaching. The purpose of the research were 1) to develop a learning model by using a virtual environment with scaffolding strategies to improve students' learning achievements in moot court teaching; and 2) to study the result of using a learning model developed by using a virtual environment with scaffolding strategies to improve learning achievements in moot court teaching. There were two phases of research. The sample was 40 third year law students. The research instruments were 1) a learning model developed by using a virtual environment with scaffolding strategies; 2) lesson plans; 3) learning achievement test; and 4) student satisfaction questionnaires. The learning model developed by using a virtual environment with scaffolding strategies, the lesson plans and the student satisfaction questionnaires were analyzed. Data were analyzed by using mean, S.D., and t-test. From the results, it was found that the learning model developed by using a virtual environment with scaffolding strategies had seven components and eight processes, and after implementation, it was found that there was a significant difference in the learning achievement between the pretest (mean = 53.65, S.D = 3.16) and post-test (mean = 95.30, S.D = 2.84) with statistical significance ($p<0.05$).

Keywords—an online learning model, virtual environment, scaffolding strategy, learning achievement, virtual moot court

I. INTRODUCTION

The development of modern technology has had a profound impact on the transformation of teaching methods. The blended teaching method of online and offline learning has become increasingly popular. Online teaching is not limited by time and space, and the location of online teaching is not limited to the classroom. Learning time is no longer limited to classroom teaching. Online teaching resources are abundant and teaching modes are novel. Teachers have actively utilized learning platforms to carry out online teaching through multiple channels, such as blended learning and Zoom. Through comprehensive management techniques such as task guidance before class, multi-channel teaching during class, and feedback evaluation after class, teachers have achieved three-dimensional online teaching and effectively improved the quality of online teaching. The use of the Internet for online teaching has achieved resource sharing and expanded the coverage of high-quality educational resources. Therefore, online teaching has been warmly welcomed by a wide range of learners and teachers.

An online learning model using a virtual environment with scaffolding strategies was mainly developed to conduct moot court teaching in a virtual moot court environment. Through virtual reality technology, court

trial scenes could be recreated, including the court appearance procedure of the judges, the seating arrangement of the litigation participants, and the main scenes of the court trial, giving the participating students a sense of reality. Using scaffolding was important, too. Scaffolding is a process through which more knowledgeable others (teachers, peers, or tools) provide cognitive and social support designed to augment student problem solving [1], [2]. The scaffolding strategy of this study was reflected in the moot court virtual learning system, which helped students complete tasks that they could not independently complete by setting up theoretical knowledge Q&A, knowledge point prompts, and after-school knowledge expansion. The teacher encouraged students to adopt a group discussion approach, allowing learning members to act as support and help each other, learning from each other's strengths and weaknesses in order to achieve common improvement. The moot court teaching involved different tasks, and they were a form of assessment which combined both knowledge of substantive law and procedural law [3]. Therefore, the learning achievements of the moot court teaching included the remembering, understanding and applying levels of Bloom's Taxonomy [4] with regard to substantive law knowledge and procedural law knowledge, as well as student satisfaction with the learning model developed by using a virtual environment with scaffolding strategies. Through prompting, students were guided to analyze cases and select evidence, and the whole process of litigation was simulated so as to help students review theoretical knowledge and consolidate and apply theoretical knowledge.

Law courses, as important courses in the field of social sciences, are courses that teach legal norms and legal systems, and cultivate legal talents. They are crucial for both individuals and society. The moot court course is an essential part of law courses and has significant implications for legal education. However, before this research, an online learning model had not yet been used in a moot court course. "Moot court" originated in medieval England before programs of legal study within English colleges were established, according to several scholars [5]. A moot court was defined as a court where hypothetical cases were tried for the training of law students [6]. Li Huiying summarized the dilemma of the practice teaching of moot court and proposed that the training of moot court should be close to judicial practice and avoid inclusion of role-playing [7]. Zhai Yehu comprehensively analyzed the existing problems in moot court teaching in colleges and universities in China and put forward suggestions for improvement [8]. Tian Honggu proposed the improvement of the content design of a moot court course [9]. The review results show that up until now, scholars have mainly studied the value and organizational form of moot court in colleges and universities and have paid less attention to the application of virtual reality technology in moot court teaching, and there have been some problems with moot court teaching. Therefore, it was necessary to use an online learning model to make up for the disadvantages of current moot court teaching and improve learning achievement.

In summary, whether the application of an online learning model developed by using a virtual environment with scaffolding strategies could improve learning achievements in a virtual moot court for undergraduate students had not been tested. As a result, this study attempted to solve the existing gaps in this field. This research aimed to develop an online learning model by using a virtual environment with scaffolding strategies to improve learning achievements in a virtual moot court for undergraduate students.

II. LITERATURE REVIEW

A. Online Learning Model

In this study,"online learning model" refers to the learning model developed by using a virtual environment with scaffolding strategies. "Online learning model" has been used to refer to virtual learning, or net-based learning [10]. Additionally, it has taken the form of complete courses with access to content for "just-in-time" learning access [11]. Kong Yan proposed that the online learning model was a new learning style carried out through the Internet [12], meaning an Internet platform was established in the field of education, and learners learned in an electronic environment composed of communication technology, microcomputer technology, computer technology, artificial intelligence, network technology and multimedia technology, which was technology-based learning. Online learning environments have included a diverse range of pedagogical practices and have often been characterized by active learning and student-centered pedagogical techniques [13],[14]. The online learning model has embraced a wide set of technology applications and learning processes, including computer-based learning, web-based learning, virtual classrooms, and digital collaborations [10]. As far as law learning is concerned, Chinese universities have also started to use an online learning model. Li Huiying analyzed the advantages of applying an online learning model to legal education [15]. Online learning has been helpful in improving teaching and learning efficiency. If students have doubts about the knowledge points explained in class, teachers can use Internet technology to re-tutor students on the relevant content in class through online communication. Based on the knowledge attributes of law itself, the traditional teaching mode has often been used to teach legal knowledge, which has made students feel bored and has weakened their enthusiasm for learning to a certain extent. Therefore, online learning combined technology with learning and could improve learning enthusiasm through realistic case teaching. The online learning model developed by using a virtual environment with scaffolding strategies could provide a sense of a three-dimensional environment and user immersion.

B. Virtual Environment

In most cases, virtual environments are powerful learning tools and have been used in many engineering fields successfully [16]. The virtual environment referred to in this study was mainly built by virtual reality technology. Virtual reality is a very powerful and compelling computer application by which humans can interface and interact with computer-generated environments in a way that imitates real life and engages all the senses [17]. Virtual reality is commonly defined as an experience in which a user remains physically within their real world while entering a virtual world (comprising three-dimensional objects) using a headset with a computer or a mobile device [18].

The moot court virtual reality system used in this study was a desktop virtual reality system. The system was designed as an experimental project, and students only needed to operate it according to the steps. The virtual simulation system could reproduce scenes, bring new experiences to students, stimulate learning motivation and improve learning achievements.

C. Scaffolding

Wood et al. coined the term scaffolding and defined it as assistance from experts that enabled children to achieve what was beyond their ability to accomplish independently. Originally, Wood et al.'s conceptualization of scaffolding was consistent with Vygotsky's model of instruction and emphasized the teacher's role as a more knowledgeable learner who could help learners to solve problem-oriented tasks within their zones of proximal development [19]. This concept of scaffolding was based on the notion of the zone of proximal development (ZPD), which Vygotsky defined as the gap between what a learner accomplished independently and what could be accomplished with the assistance of a more capable other [19]. This process of supporting the learner through the ZPD was identified as 'scaffolding', which could be manifested as a teacher's measured and appropriate intervention through verbal prompts, the provision of carefully selected materials, the opportunity to interact with peers or even a well-chosen computer program [20]. The metaphor of scaffolding has been widely used in recent years to argue that, just as builders provide essential but temporary support, teachers need to provide temporary supporting structures to help learners to develop new understandings, new concepts, and new abilities. As the learner acquires these skills, teachers need to withdraw that support, only to provide further support for extended or new tasks, understandings and concepts.

III. MATERIALS AND METHODS

This research, which was based on research and development methodology, was divided into two phases. An experiment was conducted in this study. Before the experiment, the researcher conducted a pretest on the participants' learning achievements in the moot court course; after training the participants with the online learning model developed by using a virtual environment with scaffolding strategies, the researcher conducted a post-test on the participants' learning achievements in the moot court course. The independent variable was an online learning model developed by using a virtual environment with scaffolding strategies, while the dependent variables were learning achievements.

A. Participants

Phase I: The sample was five model experts composed of three content experts and two technology experts who were proficient in virtual reality technology and selected by using a specific random sampling method.

Phase II: The sample was a total of 40 third year undergraduate law students from the Faculty of Law who registered in 2023 and were selected from the third year students according to a convenience sampling procedure with a random chance of being selected.

B. Research Procedure

The research procedure was divided into two phases:

Phase 1: Development of a learning model by using a virtual environment with scaffolding strategies to improve students' learning achievements in moot court teaching

In the first phase, researchers studied, analyzed, and synthesized the documents and relevant research, and created two instrument tools; the first tool was needs questionnaires about the traditional moot court teaching, and the second tool was a learning model developed by using a virtual environment with scaffolding strategies and lesson plans. The research tools were approved by IOC experts and then used to collect data. After receiving the results of the needs questionnaires about the traditional moot court teaching, the researcher created a draft model, and then the model was assessed by five model experts who approved the components and processes of the model.

Phase 2: A study of the results of using the learning model developed by using a virtual environment with scaffolding strategies to improve learning achievements in moot court teaching

In the second phase, there were two research instruments used; the first tool was student satisfaction questionnaires, and the second tool was the learning achievement test. The research tools were approved by IOC experts before being given to the students, and then the learning model developed by using a virtual environment with scaffolding strategies was implemented with the students for 8 weeks.

C. Data Collection

In phase I, the researcher collected data by using needs questionnaires about the traditional moot court teaching to survey 40 students and used an interview form to interview five model experts. The learning model developed by using a virtual environment with scaffolding strategies and lesson plans was analyzed by the five model experts and data were collected. After modification according to the experts' suggestions, a graphic model was produced, as shown in Figure 1.

There were seven components of the model:

1)Teacher and students: This component specifically included the teacher of the virtual moot court and undergraduate law students. The teacher's role was to check the relevant knowledge students had gained from the preview through questioning and other methods, explain key and difficult knowledge, guide students to log into the learning system, help students complete simulated exercises in the learning system through questioning and teacher-student discussions, and evaluate students' practice. The students role was to preview relevant knowledge, enter the litigation process and analyze cases under system prompts, select evidence, clarify litigation requests, and simulate the entire process of civil litigation, including prosecution, filing, first instance trial, appeal, and second instance trial. When encountering learning difficulties, students discussed issues with teachers or classmates.

2) Learning platform: This component included five specific aspects:

Equipment: computer; smart phone; mobile tablet; and wired network, mobile network or Wi-Fi. Students opened the URL with a browser and entered the virtual learning system; Content: operation video, case video, and standard answer library; Exercises: online exercises combined with platform cases and scaffolding strategies; Simulation: a simulated judge, lawyer, plaintiff and defendant; System reports: system analysis and summary.

3) Multimedia: This component specifically included projector and screen, text, animation, courseware, video, audio and pictures.

4) Lesson plans with learning activities: This component specifically included the preview check, key and difficult knowledge explanation, system login, group discussion, operation drill in the learning system, completing the system assessment, writing experiment reports and experiment evaluation. All learning activities were provided to students via online and onsite channels.

5) Scaffolding: This component specifically included theoretical knowledge Q&A, instructional guidance, knowledge point prompts and knowledge expansion. All scaffolding was done online.

6) Communication: These specifically included online teacher-student and student-student discussion; and onsite teacher-student and student-student discussion. Online teacher-student and student-student discussions were conducted using QQ and WeChat.

7)Evaluation: This component specifically included material and spiritual rewards, achievement, credit, rating level and student satisfaction evaluation on the learning model developed by using a virtual environment with scaffolding strategies.

There were eight processes of the model:

Process 1: Preview check (onsite): Students previewed the relevant knowledge points of the moot court in advance, and the teacher checked the relevant knowledge they had gained from the preview through questioning and other methods.

Process 2: Key and difficult knowledge explanation (onsite): Based on results of the review check, the teacher explained the key and difficult knowledge required by the students.

Process 3: Online moot court activity (online): The teacher guided students to log into the learning system. Students logged into the learning system and became familiar with the operating procedures.

Process 4: Group discussion (online and onsite): When students encountered problems due to lack of understanding while practicing in the learning system, they solved them through student-student discussion and teacher-student discussion.

Process 5: Operation drill in the learning system (online): Students entered the litigation process, analyzed cases, selected evidence, clarified litigation requests, and simulated the entire process of civil litigation, including prosecution, filing, first instance trial, appeal, and second instance trial.

Process 6: Assessment (online): The teacher guided students to complete the system assessment.

Process 7: Writing experiment reports (online): Students wrote experiment reports in the learning system.

Process 8: Experiment evaluation (onsite): The teacher evaluated the students' operational performance, and the students performed a satisfaction evaluation of the learning model developed by using a virtual environment with scaffolding strategies.

The learning processes are shown in Figure 1 for reference.

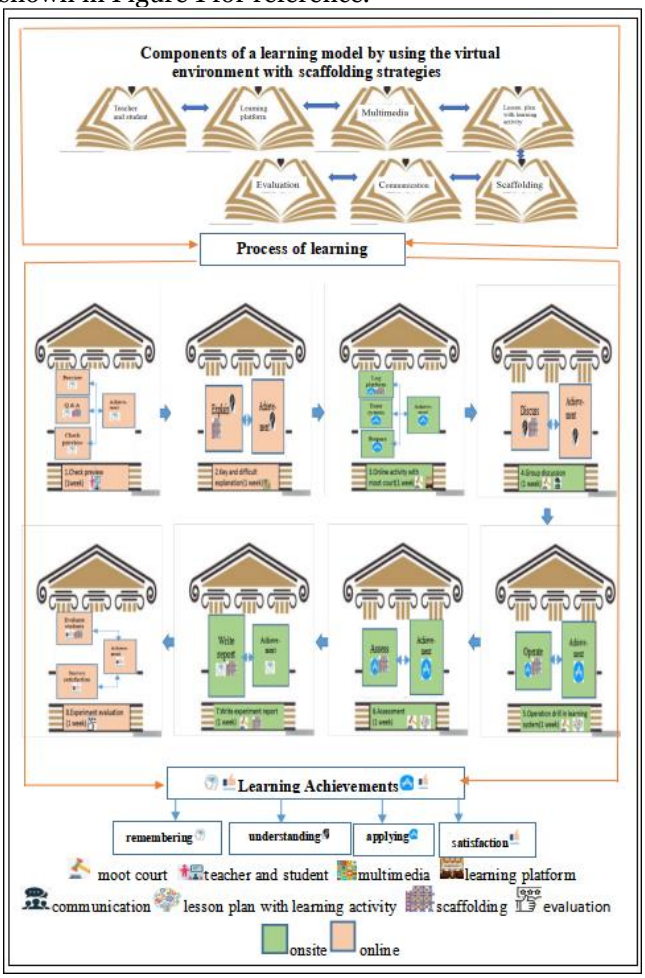

Fig.1. A graphic model of the learning model developed by using a virtual environment with scaffolding strategies.

In phase II, the researcher collected data by using the learning model developed by using a virtual environment with scaffolding strategies and lesson plans, then collected the results of the learning achievement test (pretest and post-test) and student satisfaction questionnaires.

D. Data Analysis

The data collected on the learning model developed by using a virtual environment with scaffolding strategies and lesson plans from the five model experts was analyzed using mean and S.D. The learning achievement test was analyzed using t-test, and the data collected from the student satisfaction questionnaires were analyzed using mean and S.D.

IV. RESULTS AND DISCUSSION

A. Results

Phase 1: Development of a learning model by using a virtual environment with scaffolding strategies to improve students' learning achievements in moot court teaching

1) The results of the learning model developed by using a virtual environment with scaffolding strategies from five model experts

Table 1. The details and results of the learning model developed by using a virtual environment with scaffolding strategies from five model experts

Components	Details		M	S.D.	Meaning
Teacher and students	1	Teacher of the virtual moot court	5.00	0.00	Strongly Agree
	2	Undergraduate law students	4.50	0.58	Strongly Agree
Average			4.75	0.29	Strongly Agree
Learning	1	Equipment, including	4.50	0.58	Strongly

Components	Details		M	S.D.	Meaning
platform		1) computer, 2) smart phone, 3) mobile tablet, 4) wired network, mobile network or Wi-Fi; students opened the URL with with a browser and entered the virtual learning system.			Agree
	2	Content, including 1) operation video, 2) case video, 3) standard answer library	4.75	0.50	Strongly Agree
	3	Exercises: Online exercises combined with platform cases and scaffolding strategies	4.75	0.50	Strongly Agree
	4	Simulation: Simulated judge, lawyer, plaintiff and defendant	4.75	0.50	Strongly Agree
	5	System reports, analysis and summary	4.75	0.50	Strongly Agree
Average			4.70	0.52	Strongly Agree
Multimedia	1	Projector and screen	5.00	0.00	Strongly Agree
	2	Text	4.75	0.50	Strongly Agree
	3	Animation	4.75	0.50	Strongly Agree
	4	Courseware	4.75	0.50	Strongly Agree
	5	Video	4.75	0.50	Strongly Agree
	6	Audio	4.50	0.58	Strongly Agree
	7	Pictures	5.00	0.00	Strongly Agree
Average			4.79	0.37	Strongly Agree
Lesson plans with learning activities	1	Preview check	4.75	0.50	Strongly Agree
	2	Key and difficult knowledge explanation	5.00	0.00	Strongly Agree
	3	System login	4.75	0.50	Strongly Agree
	4	Group discussion	4.75	0.50	Strongly Agree
	5	Operation drill in the learning system	5.00	0.00	Strongly Agree
	6	Complete system assessment	4.75	0.50	Strongly Agree
	7	Writing experiment reports	4.75	0.50	Strongly Agree
	8	Experiment evaluation	4.75	0.50	Strongly Agree
Average			4.81	0.38	Strongly Agree
Scaffolding	1	Theoretical knowledge Q&A	4.75	0.50	Strongly Agree
	2	Instructional guidance	4.50	0.58	Strongly Agree
	3	Knowledge point prompts	5.00	0.00	Strongly Agree
	4	Knowledge expansion	4.75	0.50	Strongly Agree
Average			4.75	0.40	Strongly Agree
Communication	1	Online teacher-student discussion	4.75	0.50	Strongly Agree
	2	Onsite teacher-student discussion	5.00	0.00	Strongly Agree
	3	Online student-student discussion	4.75	0.50	Strongly Agree
	4	Onsite student-student discussion	4.75	0.50	Strongly Agree
Average			4.81	0.38	Strongly Agree

Components	Details		M	S.D.	Meaning
Evaluation	1	Material and spiritual rewards	4.75	0.50	Strongly Agree
	2	Achievement	5.00	0.00	Strongly Agree
	3	Credit	4.75	0.50	Strongly Agree
	4	Rating level	4.75	0.50	Strongly Agree
Average			4.81	0.38	Strongly Agree
Overall average			4.78	0.39	Strongly Agree

Table 1 shows the overall average score of the learning model developed by using a virtual environment with scaffolding strategies from the five model experts, of which the meaning was "strongly agree" (mean = 4.78, S.D = 0.39). In addition, the top ranking items with the meaning 'strongly agree', in descending order, were: 1) "Lesson plans with learning activities", "Communication" and "Evaluation" (mean = 4.81, S.D = 0.38), 2) "Multimedia" (mean = 4.79, S.D = 0.37), and 3) "Scaffolding" (mean = 4.75, S.D = 0.40).

2) The results of the lesson plans

The opinions of five model experts on the 8 weeks of activities were sought, and the results are shown below:

Table 2. The results of the lesson plans based on the opinions of five model experts

Item	M	S.D.	Meaning
Week 1: Stage 1 Preview check	5.00	0.00	Strongly Agree
Week 2: Stage 2 Key and difficult knowledge explanation	4.75	0.50	Strongly Agree
Week 3: Stage 3 Online moot court activity	4.50	0.58	Strongly Agree
Week 4: Stage 4 Group discussion	5.00	0.00	Strongly Agree
Week 5: Stage 5 Operation drill in the learning system	5.00	0.00	Strongly Agree
Week 6: Stage 6 Assessment	4.75	0.50	Strongly Agree
Week 7: Stage 7 Writing experiment reports	5.00	0.00	Strongly Agree
Week 8: Stage 8 Experiment evaluation	5.00	0.00	Strongly Agree
Overall average	4.88	0.20	Strongly Agree

Table 2 shows the overall average score of the lesson plans, of which the meaning was "strongly agree" (mean=4.88, S.D =0.20), and the average scores of all activities, of which the meanings were "strongly agree", too.

Phase II: A study of the results of using the learning model developed by using a virtual environment with scaffolding strategies to improve learning achievements in moot court teaching

1) The results of the learning achievement test

The total population of this study was 40 third year undergraduate students. The results were as follows:

Table 3. Results of the learning achievement test

*p<0.05

Table 1 shows that the mean score of the post-test (mean= 95.30, S.D= 2.84) was higher than that of the pretest (mean = 53.65, S.D = 3.16) with statistical significance at p<0.05.

	Mean	S.D	Mean difference	S.D difference	t	p
Pretest	53.65	3.16	41.65	-0.32	-62.758	.000*
Post-test	95.30	2.84				

2) The results of the student satisfaction questionnaires

The total population of this study was 40 third year undergraduate students majoring in law in the Faculty of Law. The results were as follows:

Table 4. Results of the Student Satisfaction Questionnaires

Item	M	S.D	Rank	Meaning
Using the learning model in my learning would increase my productivity.	4.45	0.50	11	Satisfied
My interaction with the learning model would be clear and understandable.	4.48	0.55	10	Satisfied
Learning to operate the learning model would be easy for me.	4.53	0.55	9	Strongly Satisfied
I would find the learning model flexible in terms of interaction with it.	4.55	0.55	8	Strongly Satisfied
I would find it easy to use the learning model to do what I want to do.	4.55	0.50	8	Strongly Satisfied
Using the learning model in my learning would enable me to accomplish tasks more quickly.	4.58	0.50	7	Strongly Satisfied
Overall, I found the learning model useful for my learning	4.60	0.50	6	Strongly Satisfied
It would be easy for me to become skillful at using the learning model.	4.65	0.53	5	Strongly Satisfied
Using the learning model would make it easier for my learning.	4.68	0.47	4	Strongly Satisfied
Using the learning model would improve my learning performance.	4.70	0.46	3	Strongly Satisfied
Overall, I found the learning model easy to use	4.75	0.49	2	Strongly Satisfied
Using the learning model would enhance my effectiveness in learning.	4.83	0.38	1	Strongly Satisfied
Overall average	4.61	0.50		Strongly Satisfied

Table 4 shows the overall average score of the student satisfaction questionnaires, of which the meaning was strongly satisfied (mean = 4.61, S.D = 0.50). From maximum mean to minimum mean, the top three ranked items were 1) "Using the learning model would enhance my effectiveness in learning" (mean = 4.83, S.D = 0.38); 2) "Overall, I found the learning model easy to use" (mean = 4.75, S.D = 0.49); and 3) "Using the learning model would improve my learning performance" (mean = 4.70, S.D = 0.46).

B. Discussion

In this part, the researchers discuss the results according to the following research objectives below:

Objective 1: To develop a learning model by using a virtual environment with scaffolding strategies to improve students' learning achievements in moot court teaching

Regarding objective 1, it was found that the learning model developed by using a virtual environment with scaffolding strategies contained seven components: 1) teacher and students, 2) learning platform, 3) multimedia, 4) lesson plans with learning activities, 5) scaffolding, 6) communication, and 7) evaluation. There were eight processes: 1) preview check (onsite), 2) key and difficult knowledge explanation (onsite), 3) online moot court activities (online), 4) group discussion (online and onsite), 5) operation drill in the learning system (online), 6) assessment (online), 7) writing experiment reports (online), and 8) experiment evaluation (onsite). Five model experts all agreed with the learning model developed by using a virtual environment with scaffolding strategies. For this finding, the following discussion focuses on the highlights of each process:

Process 1: Preview check (onsite), which included the component of teacher and students: Teachers checked the relevant knowledge that students had gained from the preview and were able to grasp the learning situation, which helped teachers adjust lesson plans and content in a timely manner. Students could preview the content before practicing, which allowed them to consolidate the basic knowledge needed for

practice. This finding was consistent with that of ER Schotter and M Leinenger [21], who found that that a preview could help students discover weak links in the old knowledge structure and quickly supplement this knowledge before class, clearing obstacles for listening. The checking of the knowledge gained was also performed to urge students to better complete the preview.

Process 2: Key and difficult knowledge explanation (onsite), which included the components of multimedia and communication: Explaining key and difficult knowledge could help students clearly understand and master the parts which needed to be focused on for understanding and mastery. This could avoid wasting time in the classroom and improve classroom efficiency. By focusing on explaining key and difficult knowledge through teaching, students could gain a deeper understanding of the knowledge points, thus achieving true mastery. This finding was consistent with that of J Rose [22], who found that key and difficult knowledge explanation was an important method of knowledge dissemination and communication. Through key and difficult knowledge explanation, people could improve their thinking and analytical abilities.

Process 3: Online moot court activities (online), which included the component of learning platform: By using online activities on a learning platform, there was no need to worry about changes in time and spatial location. Learning could be done anytime and anywhere. The learning time was controllable and could be adjusted freely. The learning location was also more flexible and convenient, with no software or hardware requirements for students. This finding was consistent with that of Fatimah Mulya Sari and Lulud Oktaviani [23], who found that only a computer and network were needed to operate online activities on a learning platform, making it very convenient.

Process 4: Group discussion (online and onsite), which included the component of communication: Group discussions could stimulate students' enthusiasm for learning, enabling them to participate more actively in learning and thus improved their learning achievements. Through the communication method of group discussions, students could better understand and solve problems encountered in learning. This finding was consistent with that of Lokanath Mishra [24], who found that through group discussions, students could gain a deeper understanding of the course content and also gain inspiration from the speeches of other classmates.

Process 5: Operation drill in the learning system (online), which included the component of lesson plans with learning activities and scaffolding: During the process of the operation drill in the learning system, students knew how to apply the knowledge they had learned to solve practical problems. Therefore, the process improved the application of learning achievements. The finding was consistent with that of N Sukmaningthias [25], who found that lessons plans based on realistic mathematical approach had been valid, and achievement was improved after using the lesson plans.

Process 6: Assessment (online), which included the component of scaffolding: During the process of assessment, students completed system tasks with the help of scaffolding strategies. Therefore, the process improved the application of learning achievements. This finding was consistent with that of Marianne Perie and Scott Marion [26], who found that the assessment system had strong practicality. Before students prepared to take the assessment, they could familiarize themselves with the entire process, rules, and environment of the assessment by using the assessment system. The assessment system could provide a standardized assessment environment for a large group of students, and it could also quickly collect a large amount of data.

Process 7: Writing experiment reports (online), which included the component of lesson plans with learning activities: During the process of writing the experiment report, reviewing the entire operational process helped students consolidate basic their knowledge. The knowledge points were covered again to increase the retention of knowledge. Therefore, the process improved the remembering of learning achievements. This finding was consistent with that of Mulyani Mulyani and Teti Sobari [27], who found that that writing experiment reports helped students consolidate new knowledge and make up for deficiencies in a timely manner. A Samad and J Mustafa [28] found a positive association between lesson plan implementation and student achievement. Zühal YÜKSEL and Nadir ÇELİKÖZ [29] found that the implementation of lesson plans improved student achievement.

Process 8: Experiment evaluation (onsite), which included the component of evaluation: From the process of experiment evaluation, through a questionnaire survey on student satisfaction, it was concluded that students were satisfied with the learning model developed by using a virtual environment with scaffolding strategies. Therefore, the process improved the satisfaction with learning achievements. This finding was consistent with that of WF Tichy and P Lukowicz [30], who found that through experiment evaluation, teachers could understand whether their teaching had achieved the expected goals and make corresponding adjustments and improvements by evaluating student performance. Teachers evaluated and provided feedback to students through experiment evaluation, allowing them to understand their learning progress

and shortcomings, thereby encouraging them to work harder and improve.

Objective 2: To study the results of using the learning model developed by using a virtual environment with scaffolding strategies to improve learning achievements in moot court teaching

Regarding objective 2, it was found that the post-test scores were significantly higher than those of the pretest. Researchers used the learning achievement test to test 40 third year undergraduate law students in the Faculty of Law to find out whether learning achievements had improved in terms of remembering, understanding, applying and satisfaction with the online learning model developed by using a virtual environment with scaffolding strategies. In conclusion, the post-test scores were significantly higher than those of the pretest. Therefore, it could be concluded that learning achievements in terms of remembering, understanding, applying and satisfaction had significantly improved.

From the results of data analysis, it could be seen that the improvement of learning achievements in terms of remembering was mainly due to the use of theoretical knowledge Q&A and knowledge point prompts in scaffolding strategies. By using theoretical knowledge Q&A and knowledge point prompts, teachers could present theoretical knowledge to students in the form of a series of questions. When students solved problems, teachers could use knowledge point prompts to provide appropriate support to help students concentrate and improve their learning achievements. This finding was consistent with that of Amanda J. Barnier [31], who found that a scaffolding strategy guided learners to answer questions step by step, built a complete knowledge system, and improved learning achievements in terms of remembering.

From the results of the data analysis, it could be seen that the improvement of learning achievements in terms of understanding was mainly due to the learning model developed by using a virtual environment with scaffolding strategies and the strict implementation of lesson plans. Through the learning model developed by using a virtual environment with scaffolding strategies, students could have an immersive experience of the court proceedings in a virtual environment and experience the litigation process in a scene similar to the real environment, which helped to improve learning achievements in terms of understanding. This finding was consistent with that of Kunyi Jian and Peng Nai [32], who found that through the construction of virtual learning models and man-machine interaction, students could improve their ability to handle cases, develop their thinking, and improve their learning achievements in terms of understanding. This finding was also consistent with that of W. Banyen, C. Viriyavejakul and T. Ratanaolarn [33], who found that an online learning model could let students understand the content better and enhance learning achievement in terms of understanding.

From the results of the data analysis, it could be seen that the improvement of learning achievements in terms of applying was mainly due to the use of instructional guidance in scaffolding strategies. Through instructional guidance and simulation exercises, students could systematically review the knowledge they had learned and improve learning achievements in terms of applying. This finding was consistent with that of Ching-Yi Chang and Patcharin Panjaburee [34], who found that online scaffolding strategies could significantly improve the students' learning achievements in terms of applying in university online courses.

From the results of the data analysis, the improvement of learning achievements in terms of satisfaction was mainly due to the use of knowledge expansion in scaffolding strategies. Scaffolding helped students acquire new experiences and skills, expand their knowledge, and improve learning satisfaction. This finding was consistent with that of DK Gormley and C Colella [35], who found that knowledge expansion in scaffolding strategies was very beneficial for learning, and when students used scaffolding strategies to achieve success, their satisfaction increased.

V. CONCLUSION

Based on the research findings, it was concluded that there were numerous elements that influenced the learning achievements in moot court teaching. The learning achievements of the moot court teaching included the remembering, understanding and applying levels of Bloom's Taxonomy with regard to substantive law knowledge and procedural law knowledge, as well as student satisfaction with the learning model developed by using a virtual environment with scaffolding strategies.

The learning model developed by using a virtual environment with scaffolding strategies contained seven components: 1) teacher and students, 2) learning platform, 3) multimedia, 4) lesson plans with learning activities, 5) scaffolding, 6) communication, and 7) evaluation. There were eight processes: 1) preview check (onsite), 2) key and difficult knowledge explanation (onsite), 3) online moot court activities (online), 4) group discussion (online and onsite), 5) operation drill in the learning system (online), 6) assessment (online), 7) writing experiment reports (online), 8) experiment evaluation (onsite). Five model experts all agreed with the learning model developed by using a virtual environment with scaffolding strategies.

The findings showed that the learning model, lesson plans, scaffolding and technology all had an impact on students' learning achievements. The learning model had an impact on the remembering aspect of learning achievements. Scaffolding had an impact on the understanding aspect of learning achievements. Technology had an impact on the applying aspect of learning achievements. Lesson plans had an impact on student satisfaction, while satisfaction had an impact on the utilization of the learning model developed by using a

virtual environment with scaffolding strategies.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

AUTHOR CONTRIBUTIONS

Xiaofang Chen conducted the research; Jaemjan Sriarunrasmee conducted the research and composed the article; and Khwanying Sriprasertpap conducted the research and analyzed the data.

REFERENCES

[1] Vygotsky, L. S, "Mind in society: The development of higher psychological processes," *M. Cole et al. (Eds.)*, vol. 11,no. 2,pp. 61-70,1979.
[2] Wood, D., Bruner, J., and Ross, G, "The role of tutoring in problem solving," *Journal of Child Psychology and Psychiatry and Allied Disciplines,* vol 17,no. 2, pp. 89-100, 1976.
[3] Lynch, A., "Why do we Moot?Exploring the Role of Mooting in Legal Education," *Legal Education Review,*vol. 7,no. 1,pp. 67-78,http://www.austlii.edu.au/au/journals/LegEdRev/1996/3.html,1996.
[4] Anderson, L. W. and Krathwohl(Eds.). "A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives," *New York: Longman*, vol 7, no. 1,pp. 103-115, 2003.
[5] Knerr, Charles R. and Sommerman, Andrew B, "Undergraduate Moot Court in American Colleges and Universities," *The Annual Meeting of the National Communication Association*,vol. 26,no. 2, pp. 359–366, 2001.
[6] Rachid and Mohamed, "Brief History of Moot Court: Britain and U. S," *The Annual Meeting of the Southwestern Political Science Association,* vol. 22,no. 3,pp. 135–149, 2000.
[7] Li Huiying, "Research on the practical teaching mechanism of real combat moot court," *Heilongjiang Education Higher Education Research and Appraisal*,vol. 27,no. 3, pp. 12-14, 2020.
[8] Zhai Yehu, "Thoughts on standardizing the teaching of simulated court in Colleges and universities in China," *Higher education research*, vol. 24,no. 1,pp. 71-74, 2015.
[9] Tian Honggu, "Course content design of simulated court teaching," *China University teaching*, vol. 15,no. 2,pp. 67-70, 2014.
[10] Urdan, T. A. and Weggen, C. C, "Corporate e-learning: Exploring a new frontier," *WR Hambrecht Co*,vol. 24,no. 2,pp. 117-125,2000.
[11] Hall, B, "New study seeks to benchmark enterprises with world-class eLearning in place," *Elearning*, vol 1, no. 1, pp. 18-29, 2000.
[12] Kong Yan, "Research on the Development of K12 Online Learning in the United States," *Qufu Normal*,vol. 18,no. 2,pp. 57-68,2010.
[13] Baker,A, "Faculty development for teaching online: Educational and technological issues," *The Journal of Continuing Education in Nursing*, vol 34, no. 6, pp. 273-278, 2003.
[14] Browne, E, "Structural and pedagogic change in further and higher education:A case study approach," *Journal of Further and Higher Education*,vol 29, no. 1, pp. 49-59, 2005.
[15] Li Huiying, "Research on the practical teaching mechanism of real combat moot court," *Heilongjiang Education Higher Education Research and Appraisal,*vol 1,no. 1, pp. 12-14, 2020.
[16] Mokhtar,A. and Khan, M, "Education – oriented visualization model for buildings cross ventilation," *Proceedings of the 2nd international conference on Computer graphics and interactive techniques in Australasia and South East Asia, Singapore*.vol. 22, no. 3, pp. 71-73, 2004.
[17] Philippe Coiffet and Grigore C. Burdea, "Virtual Reality Technology," *Wiley-interscience*, vol. 27,no. 1,pp. 127-139, 2003.
[18] G. Cooper,H. Park,Z. Nasr, L. P. Thong, and R. Johnson, "Using virtual reality in the classroom: preservice teachers perceptions of its use as a teaching and learning tool," *Educational Media International*,vol 56, no. 1,pp. 1-13, 2019.
[19] Vygotsky, L. S, "Mind in society: The development of higher psychological processes," *M. Cole et al. (Eds.)*, vol. 11,no. 2,pp. 61-70,1979.
[20] Pritchard, A. and Woollard, J, "Psychology for the classroom: Constructivism and social learning," *London: Taylor and Francis*,vol. 15,no. 3,pp.167-188, 2010.
[21] ER Schotter. and M Leinenger,"Reversed preview benefit effects: Forced fixations emphasize the importance of parafoveal vision for efficient reading,"*Journal of Experimental Psychology: Human Perception and Performance,*vol. 25,no. 2,pp.21-42,2016.
[22] J Rose,"Interpreting difficult knowledge,"*Technical Leaflet*,vol. 24,no. 2,pp.112-132,2011.
[23] Fatimah Mulya Sari. and Lulud Oktaviani,"Undergraduate Students' Views on the Use of Online Learning Platform during COVID-19 Pandemic,"*Teknosastik,*vol. 19,no. 1,pp.41-47,2021.

[24] Lokanath Mishra,"Focus group discussion in qualitative research,"*TechnoLearn: An International Journal of Educational*,vol. 40,no. 2,pp.78-89,2016.
[25] N Sukmaningthias, "Developing lesson plan and student worksheet on realistic mathematics approach oriented to achievement and interest in mathematics," *Journal of Physics: Conference Series*, vol. 17,no. 3, pp. 108-116, 2020.
[26] Marianne Perie. and Scott Marion, "Moving toward a comprehensive assessment system: A framework for considering interim assessments,"*Educational measurement,*vol. 28,no. 3,pp.5-13,2009.
[27] Mulyani. and Teti Sobari, "Learning to Write Experiment Report Text using Project-Based Learning Method,"*Journal of Language Education Research,*vol. 6,no. 3,pp.184-192,2023.
[28] A Samad and J Mustafa, "A Study on the Association between Lesson Plan Implementation in the Classroom and Students' Achievement,"*Al-Qirtas*,vol. 2,no. 3, pp. 98-106, 2023.
[29] Zühal YÜKSEL and Nadir ÇELİKÖZ, "The Effect of Lesson Plans Based on IB Education Philosophy and UbD Model on Student Achievement," *International Journal of Educational Research Review*,vol. 20,no. 3,pp. 671-691,2023.
[30] WF Tichy. and P Lukowicz, "Experimental evaluation in computer science: A quantitative study,"*Journal of Systems and Software*,vol. 32,no. 2,pp. 76-87,1995.
[31] Amanda J. Barnier, "Memories, memory studies and my iPhone: Editorial,"*Memory Studies*,vol. 3,no. 4,pp. 293-297,2010.
[32] Kunyi Jian and Peng Nai, "Simulation application of virtual reality technology in legal education," *Journal of Physics: Conference Series*,vol. 12,no. 3, pp. 149-160, 2019.
[33] W. Banyen, C. Viriyavejakul, and T. Ratanaolarn, "A Blended Learning Model for Learning Achievement Enhancement of Thai Undergraduate Students," *IJET*,vol. 11, no. 3, pp. 48-55, 2016.
[34] Ching-Yi Chang and Patcharin Panjaburee, "Effects of online strategies on students' learning performance, self-efficacy, self-regulation and critical thinking in university online courses," *Education Tech Research Dev,*vol. 22,no. 2, pp. 185-204, 2022.
[35] DK Gormley. and C Colella, "Motivating online learners using attention, relevance, confidence, satisfaction motivational theory and distributed scaffolding,"*Nurse Educator,*vol.21,no.3, pp.59-68,2012.