MANAGEMENT MODEL OF VIRTUAL REALITY LABORATORY FOR ARCHITECTURAL & ENVIRONMENTAL DESIGN MAJORS IN UNIVERSITIES IN LIAONING PROVINCE

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ABSTRACT

The objectives of this research were: 1) to examine the components and indicators of management of Virtual Reality Laboratory for Architectural & Environmental Design majors; 2) to propose the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province and 3) to develop the implementation guideline used for Virtual Reality Laboratory management for Architectural & Environmental Design majors in universities in Liaoning Province.

The research was a mixed methodology, including qualitative and quantitative research. The population of the research consisted of administrators, VR laboratory leaders, teachers and students majoring in the Architectural & Environmental Design majors of 10 Arts and Design colleges and universities in Liaoning Province China, which have the Virtual Reality Laboratories, or are engaged in teaching and research activities related to Virtual Reality, 1057 people in total. A stratified sampling method was used to sample, totaling 290 persons. The instruments used for data collection were Document data record sheet, Semi-Structured Interview record, a five-level rating scale Questionnaire and record of Focus Group Discussion. The statistics used for data analysis were descriptive statistics and Confirmatory Factor Analysis.

The research findings revealed that: 1) there was total 5 components which consisted (1) Property and Environment , (2) Personnel, (3) Information, (4) Teaching, (5) Industry-

University-Research and 19 indicators of management of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province; 2) the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province found in this study was validated by CFA as valid and reasonable. The value of Relative Chi-square (χ2/df) = 1.301, Goodness of Fit Index (GFI) = 0.936, Adjusted goodness of fit index (AGFI) was 0.916, Tucker-Lewis Index (TLI) = 0.983, Root Mean Square Error of Approximation (RMSEA) =0.032, all in line with specified criteria. The standardized factor loading value of each item on its corresponding variable was above 0.6, and the P was less than 0.001, which were statistically significant, indicating that each indicator can well explain the variable it belongs to. In addition, the CR of the Models' Property and Environment, Personnel, Information, Teaching, and Industry-University-Research were greater than 0.7, and the AVE was greater than 0.5. Therefore, the variables have a good combination of reliability and convergent validity. Indicating that in this study, the Management Model of Virtual Reality Laboratory for Architectural & Environmental design majors was feasible; 3) the developed implementation guideline contained 19 items used for Virtual Reality Laboratory management of Architectural & Environmental Design majors in universities under Liaoning Province.

Keywords: Management Model, Virtual Reality Laboratory, Liaoning Province

1. Introduction

University innovation is one of the key tasks for university development. Many universities have had to innovate based on the use of new technologies to develop their courses. With the development of Virtual Reality technology, the use of Virtual Reality technology to realize the innovation and development of university education had received extensive attention and application in higher education. And Virtual Reality laboratory is the university's first frontier to develop and use this technology. Since 2013, the Chinese Ministry of Education has started to advocate the construction of virtual reality teaching and experimental institutions. In the past five years, many art and design colleges or universities in Liaoning province have established Virtual Reality laboratories. But since there still have no scientific management standard for these laboratories, the level of operational capabilities and efficiency was uneven.

There is no doubt that, competent leadership and management strategies are essential for an efficient laboratory. This research aims to examine the management components and

indicators of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities, to develop the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province and to develop implementation guideline for improving the administrative effectiveness of Architectural & Environmental Design majors' Virtual Reality laboratory.

Starting from the Laboratory Management, Virtual Reality Laboratory, Virtual Reality in Architecture & Environmental Design majors, this research examined components and indicators the laboratory management, to develop and propose the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province. And developed implementation guideline. It has extensive reference and influence on the development of Virtual Reality laboratories for higher education in art and design disciplines.

2. Research Questions

2.1 What are the components and indicators of Management of Virtual Reality Laboratory for Architectural & Environmental Design majors?

2.2 What should the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province be?

2.3 What is the implementation guideline to be practical used for Virtual Reality Laboratory management for Architectural & Environmental Design majors in universities in Liaoning Province?

3. Research Objectives

3.1 To examine the components and indicators of management of Virtual Reality Laboratory for Architectural & Environmental Design majors.

3.2 To propose the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province.

3.3 To develop the implementation guideline used for Virtual Reality Laboratory management for Architectural & Environmental Design majors in universities in Liaoning Province.

4. Research Methodology

4.1 Research Design

Used mixed methods, both qualitative and quantitative. First the qualitative to determine the components and indicators of the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors through content analysis from 32 documents and research related, including 9 key informants. And then used quantitative method, collected the data on the perceptions of the importance of laboratory management items from respondents through a questionnaire. Afterwards, used qualitative methods, develop implementation guideline through Focus Group Discussion.

4.2 Population and Sample

The population was composed of 1057 people who came from the Architectural & Environmental Design majors of 10 Arts and Design colleges and universities in Liaoning Province China, which have Virtual Reality Laboratories, or were engaged in teaching and research activities related to Virtual Reality. Among them: (1) Administrators and Managers of Architecture & Environmental Design majors generally refer to the leaders and managers of Architectural & Environmental Design majors, who are familiar with Teaching mode, Talent training purpose and Development methods of the majors; (2) Participating teachers of Virtual Reality Laboratories for Architecture & Environmental Design majors refer to teachers who regularly participate in or use Virtual Reality Laboratories for work, including use in teaching, research and practical projects; (3) Participating students refer to non-teaching staff who study, research, and practice in the laboratory, include doctoral students, master's students, senior undergraduates who often stay in the laboratory.

The sample group was 290 people which was calculated by using Taro Yamane (Yamane, 1973), and were sampled by stratified sampling.

4.3 Research Instruments

Used the Chinese website “WJX.cn” to create a five-point rating scale questionnaire for online data collection. It consists of three parts.

Part I: Demographic variables, general information of the respondents, totaling 8 items, such as gender, age, education level, position, working years, years of participating in the Virtual Reality Laboratories, etc.

Part II: Rating scale questionnaire, which asked about the items in management of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province, totaling 71 items.

Part III: Open Suggestions and additional comments.

All types of questionnaires will be Likert's rating scale by 5 choices (Likert, R. 1932 p. 1-55).

5 = Very Important

4 = Important

3 = Uncertain

2 = Slightly Important

1 = Unimportant

All of these develop are to use the Item-Object Congruence (IOC) and Cronbach's alpha coefficient to find the validity and reliability.

In the process of designing the questionnaire, there were totaling of 81 items after expert revision. And 71 items after the IOC conducted by 5 experts. After those got the reliability of the instrument by Cronbach's alpha coefficient. In this study, Cronbach's alpha coefficient above 0.70 was acceptable (Cronbach, L. 1990). As a result, the researcher found 71 items were statistically analyzed and the data were obtained. All items were higher than 0.80, indicating that the reliability of this questionnaire is very high.

4.4 Data Collection

1) The first phase of the research, the researcher has studied related literature about the concept, principles, and theories on Management of Laboratory, Virtual Reality Laboratory and Virtual Reality for Architectural & Environmental Design majors, as well as in-depth interview from 9 key informants who were all have at least 15 years of work experience in university education, including 4 University Administrators, 1 University Administrator also the Lab leader and 4 Lab leaders. Purposive sampling method was employed. A semi-structured interview recode form was used to collect the data.

2) In the second phase, the importance of each item in the management mode of the Virtual Reality laboratory for Architectural & Environmental design majors in universities in Liaoning Province was proposed through a questionnaire survey, as follows:

(1) Asked Bangkokthonburi University for permission and the letter of data collection was attached in the appendix.

(2) Asked permission from samples through contact. One thing to noticed was that some samples were not willing to do as for the reasons illustrated above thus under this circumstance, resampling was necessary.

(3) Meant of collecting data were chosen. Both online questionnaire methods and in person. The software were Wen Juan Xing and WeChat.

(4) Then, Bangkokthonburi University letter and questionnaire were sent to samples for the participation of collecting data.

3) The data collected in the third phase was composed of relevant professional experts from art design colleges and comprehensive universities in Liaoning Province, mainly heads of Architectural & Environmental design majors or leaders of Virtual Reality laboratories of related majors. The number of key informants was 7. The findings presented by the experts during the focus group discussions were recorded by the researcher.

4.5 Data Analysis

The researcher used SPSS and AMOS for analyze the categorical variables. Quantitative survey samples, manual sorting and auxiliary computer, computer input, and appropriate chart making were used here. Questionnaires in the survey process are influenced by many factors. Therefore, manual inspection is required before data analysis is admitted. The data of demographic variables were analysed by descriptive statistics; frequency, and percentage; the components and indicators of Management Model were analyzed by Confirmatory Factor Analysis (CFA).

The main purpose of confirmatory factor analysis (CFA) is to verify the validity, and at the same time, it can also analyze the Convergent (convergent) validity analysis: the purpose is to conduct convergent validity analysis, two indicators, AVE and CR, can be used for analysis. If the AVE value of each factor is greater than 0.5, and the CR value is greater than 0.7, it indicates good convergent validity. At the same time, it is generally required that the factor loading coefficient (factor loading) value corresponding to each measurement item is greater than 0.7. Sometimes it may also be combined with model fitting indicators and model MI value correction to achieve better conclusions.

5. Research Results

The research procedures consisted of three phases.

5.1 Research findings in phase 1

There were total of 5 components and 19 indicators of management of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province.

Component 1 was Property and Environment, contained 5 indicators: ERM (Environmental Resources and Management), FI (Funding Investment), FM (Finance Management), DRM (Device Resources and Management), SM (Safety Management);

Component 2 was Personnel, contained 3 indicators: P&E (Personnel & Evaluation), ST (Staff Training), TAD (Talent Development);

Component 3 was Information, contained 5 indicators: IAM (Information and Achievement Management), TTPM (Technical, Teaching resources and Platforms Management), MR (Management Regulations), OC (Organizational Culture);

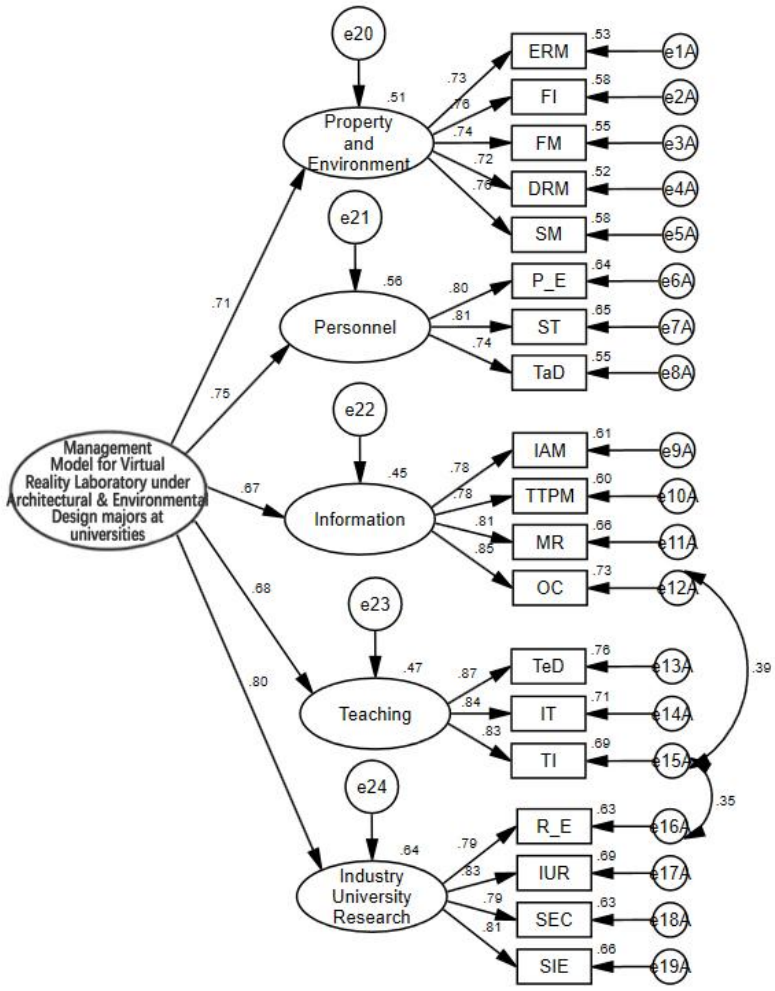
Component 4 was Teaching, contained 3 indicators: TED (Teaching Design), IT (Informatization Teaching), TI (Teaching Interaction);

Component 5 was Industry-University-Research, contained 4 indicators: R&E (Research and Experimentation), IUR (Industry-university-research), SEC (School-Enterprise-Cooperation), SIE (Students' Innovation and Entrepreneurship).

5.2 Research findings in phase 2

The researcher developed the research instruments. Through try out, it is found that the Cronbach's Alpha of Property and Environment, Personnel, Information, Teaching, and Industry-University-Research studied in this paper were 0.879, 0.800, 0.868, 0.872, and 0.837, respectively. It was generally believed that Cronbach's Alpha coefficient was more than 0.7 was more appropriate, so the variables had good reliability.

In this study, the standardized factor loading value of each item on its corresponding variable was above 0.6, and the P was less than 0.001, which were statistically significant, indicating that each indicator can well explain the variable it belongs to. In addition, the CR of Management Model of VR Labs' Property and Environment, Personnel, Information, Teaching, and Industry-University-Research were greater than 0.7, and the AVE was greater than 0.5. Therefore, the variables have good combination reliability and convergent validity, indicating that in this study, the Management Model of Virtual Reality Laboratory for Architectural & Environmental design majors was feasible.



Chi-square=188.609， df=145， P=0.309， GFI=0.936

AGFI=0.916， TLI=0.983， RMSEA=0.032

Figure 1 Show the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province that consistent with the empirical data

Table 2 Show Model fit of the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province

	χ^2	df	χ^2 /df	RMSEA	GFI	SRMR	NFI	IFI	TLI	CFI
Ideal Value			< 3	< 0.08	> 0.90	< 0.08	> 0.90	> 0.90	> 0.90	> 0.90
Model	188.609	145	1.301	0.032	0.936	0.037	0.941	0.986	0.983	0.986

Value										

Table 3 Show CR and AVE of each components in the Management Model

component			Estimate	S.E.	C.R.	P	Factor loading	CR	AVE
Property and Environment	<---	Management Model of VR Lab	1				0.713		
Personnel	<---	Management Model of VR Lab	1.066	0.138	7.701	***	0.745		
Information	<---	Management Model of VR Lab	0.963	0.13	7.412	***	0.668		
Teaching	<---	Management Model of VR Lab	1.084	0.138	7.842	***	0.682		
Industry-University-Research	<---	Management Model of VR Lab	1.047	0.132	7.941	***	0.799	0.845	0.523

Table 4 Show CR and AVE of each indicators in components in the Management Model

Indicator		Component	Estimate	S.E.	C.R.	P	Factor loading	CR	AVE
ERM	<---	Property and Environment	1				0.729		
FI	<---	Property and Environment	1.032	0.085	12.181	***	0.762		
FM	<---	Property and Environment	1.307	0.113	11.613	***	0.742	0.861	0.554

DRM	<---	Property and Environment	0.973	0.086	11.338	***	0.722		
SM	<---	Property and Environment	1.069	0.087	12.318	***	0.764		
P&E	<---	Personnel	1				0.8		
ST	<---	Personnel	1.459	0.111	13.189	***	0.806		
TD	<---	Personnel	0.924	0.077	11.979	***	0.739	0.825	0.612
IAM	<---	Information	1				0.78		
TTPM	<---	Information	1.141	0.084	13.632	***	0.776		
MR	<---	Information	1.118	0.077	14.516	***	0.811		
OC	<---	Information	1.438	0.094	15.294	***	0.853	0.881	0.649
TD	<---	Teaching	1				0.87		
IT	<---	Teaching	1.115	0.065	17.264	***	0.843		
TI	<---	Teaching	0.89	0.051	17.427	***	0.833	0.885	0.72
R&E	<---	Industry-University-Research	1				0.791		
IUR	<---	Industry-University-Research	1.002	0.066	15.126	***	0.828		
SEC	<---	Industry-University-Research	1.045	0.073	14.306	***	0.791	0.881	0.649

SIE	<---	Industry-University-Research	1.094	0.074	14.829	***	0.812		

From Figure and Table above, the results by CFA. With the AMOS, the following confirmation index values were obtained: It can be seen from the Figure and the tables that $\chi 2$ /df was 1.301, Degree of Freedom (df) = 145, Goodness of Fit Index (GFI) was 0.936, Adjusted goodness of fit index (AGFI) was 0.916, Tucker-Lewis Index (TLI) was 0.983, Root Mean Square Error of Approximation (RMSEA) was 0.032, NFI was 0.941, and CFI was 0.986. Met the statistical standard: Relative Chi-square (χ^2/df) < 2 (Schumacker, R. E. and Lomax, R. G.,2010), p > 0.05, GFI, TLI, CFI ≥ 0.95 and RMSEA ≤ 0.05 (Jöreskog and Sörbom,1993).

Therefore, the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province found in this study was validated by CFA as valid and reasonable.

At the end of the research objective 2, the researcher developed the graphical effect for the Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in the universities as in Figure2 and Figure 3. They were designed with computer software based on the model in Figure 1. They could clearly show the components and indicators and the model framework.

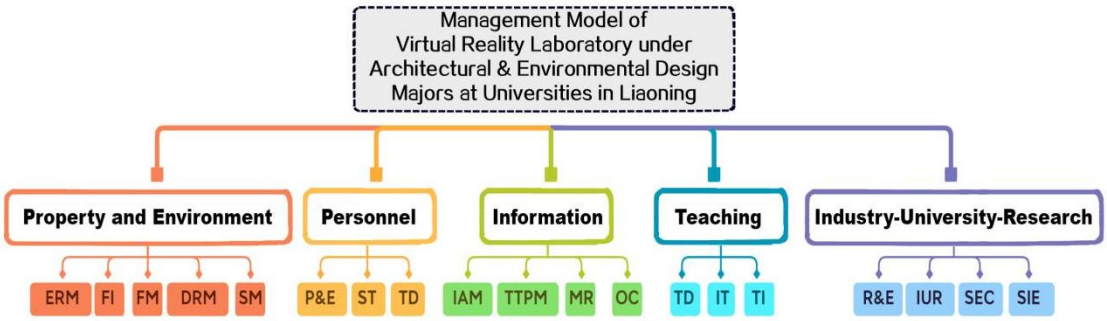


Figure 2 The graphical effect for Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province.

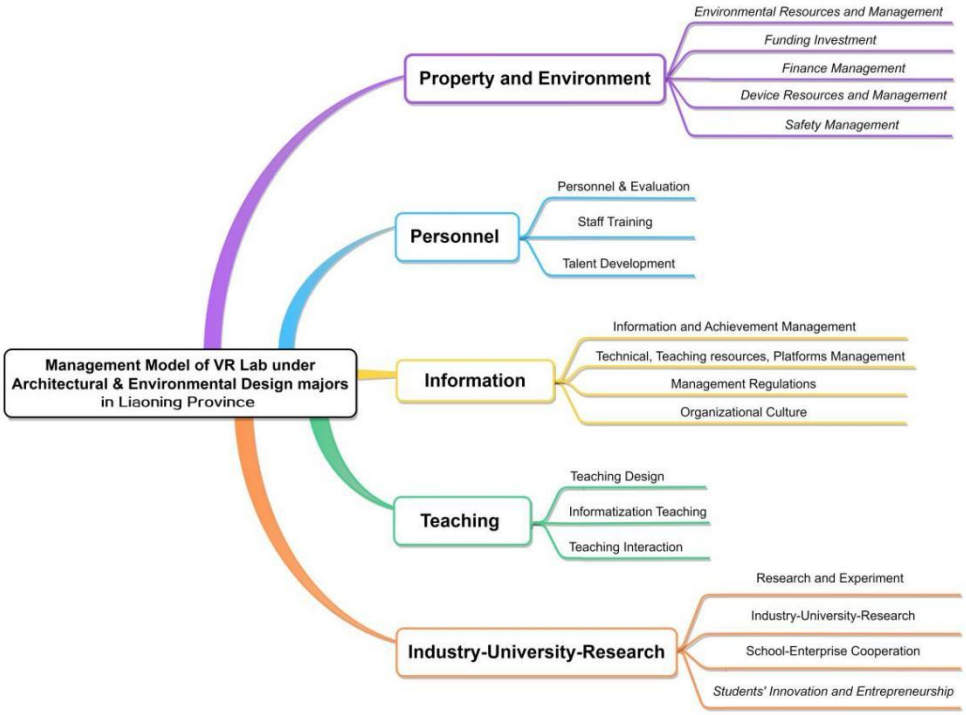


Figure 3 The graphical effect for Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in universities in Liaoning Province.

In addition, the Management Model could also serve as a reference for management research to Virtual Reality Laboratories for Architectural & Environmental Design majors in other universities or collages, so the researcher derived the visualize and simplify of the model as in Figure 4. It could provide more Virtual Reality Laboratories with a reference. And it could also make the management model clearer and be understood quickly.

Figure 4 The visualization for Management Model of Virtual Reality Laboratory for Architectural & Environmental Design majors in the universities.

5.3 Research findings in phase 3

5.3.1 Property and Environment of Virtual Reality Laboratory management for Architectural & Environmental Design majors in Liaoning Province.

The laboratory has an independent space with an area equal to or greater than the number of participants in square meters. When necessary, space can be shared with other types of laboratories in the major, but should not be occupied by other majors. The environment in the laboratory space is to be kept clean and tidy at all times. Personnel entering and exiting the laboratory must be registered for their entry and exit.

It is necessary to invest special funds for environmental decoration, equipment purchase and update equipment, highlight organizational culture, and pay salaries and rewards for participants. In the case of sufficient funds, it is necessary to purchase a software platform to manage the daily affairs of the laboratory, teaching, and experiments.

Financial entries and disbursements should be managed by the laboratory's managers. However, it is necessary to listen to the suggestions of laboratory participants in reporting funding applications and financial expenditure plans to superiors.

Full-time experimenters are required to manage the equipment as a whole, the participating teachers can participate in the management of the equipment, and the leader of the laboratory can issue powers to the participating teachers to participate in the management of the equipment.

The laboratory must have clear and specific safety management regulations, and the use of equipment must be recorded. Safety checks were required after each work, and special safety checks were conducted one to seven times a week depending on the size and usage of the laboratory. Make sure teacher participants are familiar with safety regulations and regularly conduct safety studies with student participants.

5.3.2 Personnel of Virtual Reality Laboratory management for Architectural & Environmental Design majors in Liaoning Province.

In terms of personnel arrangement, it can be managed by the leader as a whole, but because the teacher participants were the people to be managed, it is not recommended to be managed by professional teacher participants. The laboratory should set up an evaluation mechanism for the participants and regularly evaluate the performance of the participants.

And set up an evaluation reward mechanism, and reward or punish according to the evaluation results.

Laboratories should pay attention to personnel training. Enterprises and industry experts should be frequently invited to hold training sessions, seminars or lectures; organize personnel to learn from other institutions; organize internal technical exchanges and learning. Laboratories should attach importance to personnel training. It is necessary to focus on stimulating students' more diverse abilities. It is necessary to train students to obtain more thesis results, more scientific research project results and more award-winning results. To provide more internship opportunities for students.

5.3.3 Information of Virtual Reality Laboratory management for Architectural & Environmental Design majors in Liaoning Province.

The laboratory needs to set up electronic information databases for technical resources, teaching resources, software resources and other types of information, and can arrange professional teachers to manage the above information resources on a part-time basis. It is very necessary for a Virtual Reality laboratory to have a software platform for managing information such as teaching\research\experiments. However, managers and equipment managers do not have more time and energy, and do not necessarily understand teaching and scientific research content. Therefore, compared with professional teachers and participants, they were not suitable for managing laboratory information resources.

Laboratories need to record and manage teaching and research activities. Organize and publish the teaching and scientific research results developed by the laboratory and report the results, and arrange special personnel to be responsible for reporting and tracking the progress.

There must be special and detailed laboratory management regulations. These regulations can be developed jointly by administrators and teachers. And we need to constantly improve management regulations.

A laboratory should have its own organizational mission, vision, purpose, ethos and values. The above-mentioned organizational cultures of the laboratory should be highlighted in the internal environment of the laboratory and ensure that participants understand these organizational cultures. The laboratory should design and display its own LOGO, especially the name of the laboratory. The graphic of the LOGO is not necessarily important, but the name needs to have a sense of visual design.

5.3.4 Teaching of Virtual Reality Laboratory management for Architectural & Environmental Design majors in Liaoning Province.

The laboratory should pay attention to VR teaching, and should invest special funds for the design of VR teaching. The design of these VR teaching can be led by teacher participants, assisted by enterprises or industry companies. In order to make the teaching process smoother, laboratory experimenters (non-professional teachers) can assist VR teaching.

Both students and teachers need to master VR-related computer skills. VR teaching needs to be networked as much as possible.

VR teaching should pay attention to improving students' participation and learning interest, and also pay attention to students' group cooperation in the process. And it must be constantly innovated and adjusted according to the learning effect of students.

5.3.5 Industry-University-Research of Virtual Reality Laboratory management for Architectural & Environmental Design majors in Liaoning Province.

Laboratories should invest special funds for professional-related scientific research and experiments, and arrange special teachers for professional-related scientific research and experiments. In order to ensure the efficiency of scientific research work, this scientific research can be led by participating teachers, and enterprises or industry companies are invited to assist the laboratory. The laboratory should actively cooperate with other laboratories to improve the ability of scientific research and experiment and expand the scope of scientific research.

The most important core of the laboratory's production-learning-research is to enhance the professional ability of the participants, and at the same time, it can also be aimed at obtaining scientific research results. The laboratory needs to invite experts from enterprises and industries as mentors to improve the ability of the laboratory in practical work.

Laboratories should establish strong collaboration between universities, government, and industry, and establish mutual benefits between universities, government, and industry.

The laboratory should lead students to innovate and start a business, and organize more students to practice in enterprises. In order to make the various links of Industry-University-Research in the laboratory more successful and efficient: when students are the core of the laboratory workforce, they can be rewarded with wages or in other ways; when the enterprise is the core of the laboratory workforce, the laboratory can also pay out financial returns for the business.

6. Discussion

Based on the research objectives, this study also found that:

This finding has expanded and answered Wang Jijun (2018) 's research. And came to the same conclusion as Ji Xiaoyu (2017) which found Standardized management of the laboratory is a prerequisite for the smooth development of experimental teaching. Standardized management requires a corresponding management system as a guarantee. Improving the management capabilities of Virtual Reality Laboratories in colleges and universities may require the introduction of practical teaching and laboratory management platform systems to promote the information management of experimental teaching in colleges and universities, and realize the dynamics of teaching, personnel, and equipment in multiple laboratories between colleges and universities. manage. This was consistent with the conclusion obtained by Wang Yuping et al. (2018) in the laboratory of the School of Architecture, Inner Mongolia University of Technology.

Also, the findings were in the same direction as Chen Zhihui (2013) which also emphasized the importance of laboratory information management. This study also pays attention to the multi-dimensionality of virtual reality laboratories, and advocates the use of management platforms to coordinate the management of all aspects.

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The findings were in the same direction as Yue Qingying & Yang Qinghua (2021) who found that laboratory management was only reflected in the management of equipment Initially, and later the content was gradually enriched, covering many aspects such as experimental teaching, system construction, experimental teacher team construction, and experimental equipment management. Although Yue Qingying & Yang Qinghua (2021)'s study

was not as in-depth as this study, but after the verification of this study, it still proves that their conclusion was correct.

Moreover, the research of Wang Shuqiang et al. (2014) summarized four components of experimental teaching teacher team construction, management system construction, school-enterprise cooperation construction, and resource sharing construction in Virtual Reality Laboratory for Architectural Design Majors. Central management mechanism and sharing mechanism. This study believes that these four dimensions are not comprehensive and perfect, and found a management model composed of five components, which was the discussion and development of Wang Shuqiang et al. (2014) research.

7. Recommendations for Policy Formulation

7.1 Recommendation for Policies Formulation

There is much to be paid special attention to in formulating policy recommendations. The establishment of a Virtual Reality Laboratory resource access mechanism will effectively improve the overall level of the laboratory. In addition, strengthen the attention and management of the laboratory environment.

A sound system construction is of great significance to the long-term development of the laboratory. It is recommended to establish a series of normative management systems and assessment methods for laboratory technicians. Try to have a software platform for managing teaching\scientific research\experiments and other information to facilitate the information management of the entire laboratory.

Set up a safety management system to ensure the safety of various links such as experimental operation and management, emphasizing safety awareness, safety responsibility and emergency handling methods.

The Virtual Reality Laboratory regularly conducts assessments on relevant laboratory personnel. Encourage experimental managers and experimental teachers to actively participate in the work of experimental teaching reform, and take more encouraging measures. Actively create conditions to encourage experimental personnel to participate in various training exchanges to improve their own quality and professional level. Cultivate and exercise the laboratory team through various methods, such as participating in various trainings, teaching the experimental team internally, and cooperating to undertake various scientific research projects.

Laboratory construction project management should run through from project declaration and project management to relevant departments reviewing the construction project application plan according to the process, and includes whole-process tracking, project acceptance and project summary management, etc. Specific content. Through strict control of laboratory construction projects, the daily management of various projects in the laboratory is in order.

Highlight organizational culture, let the laboratory have its own name and LOGO image, strengthen organizational culture at the same time, and ensure that laboratory participants understand the mission, vision, purpose, spirit and values of the laboratory.

Put the virtual teaching design in the same important position as theoretical teaching, pay attention to the course design, break the boundaries of disciplines and professions, and integrate the design of the traditional experimental courses; in addition to the interaction between students and VR equipment, classroom interaction should be strengthened, including students' interaction with students and interaction between students and teachers. Highlight the cultivation of students' interest in participation, but also highlight the training of students' comprehensive expression ability and innovative thinking ability. Establish a student information feedback mechanism and actively listen to students' opinions and suggestions on the experimental course.

Further provide a platform for school-enterprise cooperation. Schools and enterprises can also develop high-quality teaching resources and realize the diversification of talent training by co-constructing virtual laboratories and virtual experimental courses. Efforts will be made to strengthen cooperation with enterprises in the aspects of project research, technical product development, incubation of scientific and technological achievements, and exchange of talents. Promote school-enterprise cooperation, and try to explore the mutually beneficial cooperation model of school-enterprise-government. Cultivate students' entrepreneurial thinking and stimulate students' innovative consciousness and entrepreneurial ability. Highlight the service function of the laboratory's "entrepreneurship incubation", establish and improve the cultivation of excellent innovative and entrepreneurial teams, and provide college students with free or low-cost entrepreneurial places, financial support, professional technical guidance and business docking services.

7.2 Recommendation for Further Research

1) Future research can make further questionnaire surveys on the basis of this research, expand the sample quantity and collect specific optimization opinions to improve the data quality.

2) In terms of research methods, regression analysis can be further used to study the influence of different independent variables on dependent variables to make the results more accurate and reliable, finding out more research findings.

3) To expand the population, so that the management model of virtual reality laboratory for Architectural and Environmental design majors under Liaoning Province formulated in this research, becomes the theoretical basis for the practical application management guidelines for VR laboratory of Architectural & Environmental design majors in colleges and universities across the country.

4) Practice the conclusions of this research, and after the management practice of the VR laboratory, test the management efficiency and results, and realize the test of the guidelines. Then provide the basis for revision for new theoretical research. Realizing the Deming Cycle.

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