

Studies on Developing Virtual Simulation Experiments for College and University Instruction

Dr. Siddharth Dnyaneshwar Sarkate

Head and Associate Professor, Department of Mathematics, Millind College of Science, Nagsenvan, Aurangabad-431004, Maharashtra India

Corresponding author- sdsarkate@gmail.com

Abstract- Building virtual simulation experiments is a crucial component of developing subjective majors and has emerged as the primary focus of experimental education reform for these majors. A new challenge for experimental teaching in higher education is the virtual simulation experiment course. In order to provide useful references for virtual simulation experiment teaching to the establishment of virtual simulation experimental teaching centres, this paper first summarises the need for and contents of virtual simulation experiment teaching in colleges and universities and then it offers countermeasures and recommendations. This study offers recommendations for enhancing the functionality of the subjective majors virtual simulation experimental centre and offers resources for other majors hands-on instruction and skill development.

Keywords- Virtual simulation, Teaching, Subjective majors, Universities

Introduction-

It has been suggested in recent years that universities and colleges' educational, scientific and technical departments work together to support the creation of new liberal literature. In light of the fourth industrial revolution and the ongoing advancements in science and technology, we must prioritise the holistic development of interdisciplinary skills, fully account for the ways in which these factors have affected people's methods of production, particularly the ways in which education and teaching have changed, and encourage the creation and growth of disciplines (Zhang, 2021).

With global competition becoming more intense, innovation is now the main engine propelling progress. The superior advancement of human society, the economy, and science and technology can only be really enhanced by inventive development. High-level, high-quality talents with inventive potential are necessary for innovation, which raises the bar for our educational system's ability to develop such skills. Pure theoretical education can develop talents with systematic knowledge, but it lacks the practicality to develop exceptional talents with innovative ideas, innovative consciousness, and innovative ability, according to this paper, which is based on research from a higher education experiment project on virtual simulation experiment teaching tourism management against the backdrop of new liberal literature construction (Wang, 2019).

In contrast to theoretical education, experiential teaching is essential for developing students creative and practical skills. But in the past, professors and students could only do certain experiments due to constraints on time, location, equipment, and other factors. Experiments with high hazards or severe circumstances, irreversible operation, high expense and large consumption were challenging to do (Su, 2018), which significantly limited the development of students' practice and innovative skills. The new arts are compared to the traditional arts; they are the global new revolution of science and technology, economic development and socialism with Indian characteristics into a new era as the backdrop; they break the traditional liberal arts thinking mode, inheritance and innovation; they promote multidisciplinary cross and depth fusion; they promote the traditional arts of updates; they move from subject-oriented to demand-oriented; they move from professional segmentation to cross-integration; and they move from

adaptive service to support and guidance. Colleges and universities now have a deeper and more comprehensive grasp of teaching virtual simulation experiments because to the recent fast advancements in computer communication and virtual reality technologies. In particular, the advancement of virtual simulation experiment technology not only overcomes temporal and spatial constraints but also offers more suitable circumstances for conducting hands-on experiments with educational purposes (Zhang, 2021).

Virtual simulation technology has grown in importance as a teaching tool in higher education due to the quick advancement of technology. Virtual simulation technology may replicate a variety of real-world situations and settings, provide students authentic and thorough hands-on experience, and significantly enhance both the quality of instruction and students' practical skills. Virtual simulation technology is a kind of computer-generated virtual environment that may build a fictional world outside of reality and replicate real-world physical phenomena, ambient conditions, item states, etc. It creates an immersive experience that draws people in by fusing technology from many domains, including computer graphics, human-computer interaction, and physical simulation (Wang, 2022).

Present state of experimental virtual simulation instruction: Virtual simulation technology has the following features:

- (1) **Extremely flexible:** virtual simulation technology allows for experimentation and simulation at any time and from any location. Additionally, the virtual environment and experimental circumstances may be altered at any moment to provide more varied and adaptable experimental outcomes.
- (2) **High realism:** By simulating different characteristics and features in the real world, virtual simulation technology may provide an extremely realistic virtual environment.
- (3) **High interactivity:** To improve the feeling of involvement and immersion, virtual simulation technology may enable users to interact with the virtual world and with virtual objects in a variety of ways, including touching, moving, and rotating.
- (4) **Extremely cost-effective:** Through simulation prediction, virtual simulation technology may optimise the experimental plan and cut down on pointless tests while also saving a significant amount of money and time.
- (5) **High reliability:** Through data analysis and simulation prediction, virtual simulation technology may enhance the accuracy and dependability of experiments while avoiding the risks and hazards that might arise in conventional experiments.

Virtual simulation experimental teaching is necessary in higher education, Currently, virtual simulation technology is used in higher education courses for the following kinds of application scenarios:

- (1) **Scientific research:** To provide data and support for scientific study, virtual simulation technologies may replicate social and natural events. For instance, the field plant survey and observation virtual simulation experiment course can virtually replicate the essential components of plants, including morphological structure, ecological function, and community species composition, using drone aerial photography, panoramic photography and other technologies. In addition to learning about the primary plant species and their ecological roles, students can also comprehend survey and measurement techniques like water content, groundwater level, peat sedimentation dating, etc. and summarise the evolution and geographic distribution of hidden plants as well as discussion strategies.
- (2) **Skills training:** Virtual simulation technology may assist students learn practical skills by simulating the real working world in vocational education and skill development. The special education virtual simulation experiment, for instance, is useful for training the professional quality of special children's education. Students can rapidly learn the fundamentals of the comprehensive practice of special children's

education through online virtual simulation teaching, giving them the ability to deliver high-quality professional services for special children's education.

(3) Experimental simulation: Experiments are a key tool for enhancing students' practical skills and knowledge of innovation in the domains of engineering and medicine. However, many experiments cannot be conducted in the classroom because of the costly equipment and risky operation. Through the use of computers, virtual simulation technology may replicate the experimental setting, conduct experiments, and increase the security and effectiveness of tests. In order for students to become proficient in the examination, diagnosis, treatment plan formulation and operation technology of surgery under the premise of non-invasive, risk-free, low-cost and reproducible procedures, the surgical virtual simulation experiment course, for instance, can visualise and virtualise the irreversible treatment process of surgery. This allows students to effectively receive thorough training in this skill.

(4) Distance education: Students may study remotely over the Internet at home or at another location by using virtual simulation technologies. For instance, students both within and outside of the school may watch professors demonstrate their expertise online and learn about relevant technologies remotely via virtual classrooms thanks to virtual simulation laboratories.

Encouragement of the development of virtual simulation teaching resources: A virtual simulation platform requires a stable network environment. A virtual simulation laboratory is a system that uses a computer network as its central component and links virtual instruments across the network to enable remote operation, data collection, and analysis.

(1) New challenges in teaching reform: The virtual simulation experiment course must implement a thorough reform of traditional experimental teaching, redesigning the experimental scheme, teaching materials and teaching methods etc. This raises the bar for teachers' curriculum design and teaching skills. Teachers must adopt a new educational and teaching philosophy, include students in more active learning, and use experiments to improve their capacity for both independent and collaborative learning. Additionally, teachers must be flexible in their employment of various teaching techniques and procedures in order to meet the needs of various experiments as well as the characteristics of their pupils. Teaching obstacles in the development of virtual simulation experiment courses also involve ensuring the efficacy and authenticity of virtual simulation experiments, assessing the learning impacts on students, and resolving technological issues.

(2) There aren't many experts: Building virtual simulation experiment courses calls for a wide range of technological tools, as well as a significant amount of labour, funding and technical assistance. According to the study, enterprise workers must participate in the course development process since no university staff can finish it on their own. Because most schools lack the capacity to develop independently and because colleges and universities lack a sufficient number of professionals capable of independently completing virtual simulation experiment courses, the majority of the current virtual simulation experiment courses are co-developed by universities and businesses.

More sophisticated virtual simulation experiments and varied experimental material, requiring interdisciplinary content understanding, may now be realised using the virtual simulation platform. A great and high-quality virtual simulation experiment course necessitates not only familiarity with the course material but also knowledge of program development and content production. This includes instructional design, technical support, content production, testing and evaluation, optimisation and improvement, etc. For the development of courses on the virtual simulation platform, some teachers have not yet mastered the intelligent technical means, such as artificial intelligence, human-computer interaction, virtual reality and augmented reality, and lack program development ability and experience. However, at the level of the course's basic content, teachers already possess a thorough understanding of professional knowledge. Teachers must possess the technical skills necessary for the optimisation, improvement, and follow-up development processes.

(3) The co-construction and sharing mechanism is inadequate: A lot of educational resources are needed to build a virtual simulation experiment course, but they are not distributed evenly, making it challenging for schools to create and implement virtual simulation experiment courses because of a shortage of educational resources in some areas. Furthermore, several courses on the virtual simulation experiment platform are restricted to on-campus usage, meaning that non-university students are unable to enrol in them. A waste of educational resources results from the duplication of certain courses. Consequently, instructional materials will be pooled and integrated, resulting in resource conservation and increased utilisation efficiency. In order to support the balanced growth of educational resources, sharing will allow high-quality materials to be distributed to a greater number of schools and regions via the network and other channels. To raise the standard of education generally, more schools and students may benefit from advanced virtual simulation experiment courses.

(4) The assessment criteria are not consistent: Virtual simulation education has been developed extensively in higher education institutions, and virtual simulation experiment instruction is gaining popularity in these institutions. However, it is challenging to create a single grading system because of the vast array of virtual simulation experiment courses that span many topic areas. Each course has its own distinct goals and features. Furthermore, the assessment system must be updated and improved on a regular basis, since the use of virtual simulation technology in teaching and education is still relatively new. The evaluation process for the virtual simulation experiment course must consider the authenticity and operability of the virtual environment, which is more complicated and challenging than the traditional experimental course. The course involves computer simulation, virtual reality, and other technologies. As a result, there is currently no unified evaluation index system for virtual simulation experiment courses that is appropriate for the times and technological advancements. This was lack of scientific guidance for the creation of virtual simulation experiment courses results in the phenomenon of prioritising quantity over quality, which limits the long-term growth of virtual simulation experiment instruction in colleges and universities.

Building an experimental multi-dimensional virtual simulation teaching system: The centre was should follow the ability-oriented talent training program and come up with an innovative way to build an experimental multi-dimensional virtual simulation teaching system for management and economics majors. The framework was needed to focus on "promoting the reform of experimental teaching methods such as autonomous learning, inquiry learning, collaborative learning and entrepreneurial learning under the information condition". Building a virtual simulation experiment teaching project can help advance the informatisation of experimental practice instruction in colleges and universities, increase the scope and depth of experimental teaching content, increase the amount of time and space available for experimental instruction and raise the standard of experimental education and experimental teaching quality. The training standards of experimental practice teaching talents in colleges and universities, various disciplines and professional expertise, the most recent scientific research accomplishments in related fields and the talent training objectives should all be incorporated into the content of the virtual simulation experiment teaching project.

The goal of the project's research and development is to fulfil the teaching requirements and content; the principle is correct; the content is concise; the duration is reasonable; the difficulty is appropriate; there are comprehensive instructions for the experimental operation; the experiment should be divided into basic, comprehensive and innovative experiments, among other types; students of different grades can choose from a variety of levels and through experimental training, they can comprehend, master and integrate the pertinent fields of knowledge. The physical physics experiment and the virtual simulation experiment are naturally integrated and deep learning is guided from shallow to deep. The teacher is knowledgeable about the experimental procedure and operation, the virtual experiment is taught before the course and the teacher prepares thinking questions in advance to help students identify and consider issues in the virtual experiment. After that, ask questions, use class discussions, speeches and other

formats to carry out learning and combine them with the teacher's lectures. Conduct related practical operation experiments to develop your ability to perform practical operations and your intuitive comprehension of experimental phenomena. In order to create the fusion of virtual and real, as well as virtual to practical, virtual experiments are utilised to support physical investigations. The project's construction should start with a course, then refine a portion of the experimental content, explain the experiment's purpose and principle, design the experimental procedure, specify the system for evaluating the experimental results etc., and finish the production by combining the Internet and 3D technology. The creation of a human-computer interaction interface should be expressive and visually attractive throughout the manufacturing process. The project's ultimate presentation effect should be achieved by using standard software and secondary function development.

Recommendations for bolstering the development of the experimental virtual simulation teaching centre for subjective majors: The virtual simulation platform requires strong network environment support. A virtual simulation laboratory is a system that uses a computer network as its central component and links virtual instruments across the network to enable remote operation, data collection, and analysis.

(1) Encourage the reform of experimental teaching: One of the key elements in encouraging the reform of experimental teaching and virtual simulation course teaching is the change in the way instructors think about teaching. It is crucial to provide relevant training and assistance to encourage the reform of experimental teaching in order to encourage the transformation of teaching conceptions. Departments and schools may set up pertinent training sessions, invite professionals and seasoned educators to share their expertise and provide the required technological assistance. Second, schools may create a community of educators who instruct in virtual simulation laboratories and promote idea and experience sharing among educators. Schools may simultaneously implement an incentive system to encourage educators to experiment and be creative while delivering virtual simulation experiment courses. In order to teach virtual simulation laboratories, learn about the newest technologies and applications and incorporate this experience and knowledge into their own instruction, educators are urged to form alliances with other organisations.

(2) Develop and train professional skills: To help the professional instructors with the development and execution of the virtual simulation experiment course, the school may develop skills to help them overcome the technological hurdles. Professional instructors need to get training in addition to the introduction of human resources. To conduct regular training on the creation of virtual simulation experiment courses, enhance professional teachers' capacity to create virtual simulation experiment courses on their own, assist teachers in comprehending the creation of virtual simulation experiments, software structure design, VR teaching systems and other information and encourage the growth of professional teachers into instructors who integrate theory and practice, collaboration with professional institutions is required.

(3) Create a sharing mechanism: In order to provide instructors and students access to a variety of high-quality educational materials, it is first required to create a platform for exchanging educational resources. A variety of academic areas should be covered by the platform, such as online courses, instructional videos, teaching materials and virtual simulation experiment courses. To help users locate and choose the best resources, the platform must also provide matching search and assessment features. Second, we should make the idea of sharing educational materials more widely known and promoted via training and publicity. A fair resource sharing system should be implemented, and institutions and people of all types should be encouraged to actively contribute their own educational materials while also respecting the intellectual property rights of resource providers. To further encourage the exchange and development of educational materials, a structure for cooperation between universities, businesses, and research institutes should be developed. The quality and quantity of educational materials may be jointly enhanced and complementary gains can be realised by collaboratively building sharing platforms, resource exchanges and sharing, research and development etc. All stakeholders must work together to create a united force

in order to construct a sharing mechanism and develop educational resources in a balanced manner. We can only fully use educational resources, optimise their allocation, and advance educational equality and growth by promoting them in a variety of methods.

(4) Strengthen curriculum management: By enhancing the evaluation system, it will be possible to standardise the creation of virtual simulation experiment courses, create and develop courses with a high academic value, as well as courses that contain scientific and technological content and encourage the creation of high-quality virtual simulation experiment courses. The ideal evaluation system can help educators and learners in higher education select and utilise top-notch resources for virtual simulation experiment courses, encourage the normalisation and advanced development of virtual simulation experiment courses in higher education, establish effective classrooms that integrate online and offline learning and realise the effectiveness and quality of college instruction. The school must set up a reliable system for managing and assessing the curriculum, monitor and assess the virtual simulation experiment course on a regular basis, identify any issues or shortcomings quickly and take appropriate action to fix them.

Clear learning goals and assessment standards must be established early in the curriculum design process. Learning goals must be precise, quantifiable and applicable to everyday situations. To guarantee that students learning results are evaluated thoroughly and impartially, assessment criteria have to be customised for every learning purpose. Feedback and learning recommendations from students are also a significant component of course assessment. In order to improve, teachers should promptly gather student comments and ideas. To increase the calibre and efficacy of the curriculum, instructors should simultaneously make adjustments to its design in light of the evaluation's findings. Furthermore, the secret to the efficient creation and administration of virtual simulation experiment courses is course management. To guarantee the curriculum's orderly growth and the achievement of positive outcomes, a strong management system must be established, including curriculum design, resource management, teacher training, student management etc. In addition to improving the curriculum's quality and efficacy, these actions may also boost students' motivation and learning outcomes and encourage an increase in their overall quality.

Conclusions

The creation of virtual simulation experiment courses is a crucial component of the high-quality advancement of higher education, according to the current study's findings. With the quick development of networks and computer technology, virtual simulation has emerged as a key tool for hands-on instruction in management and economics. High-risk and irreversible procedures may be carried out in a virtual environment using virtual simulation technology, which can also significantly reduce experimental expenses. One significant strategy to raise educational standards and foster creative genius in India is via the use of virtual simulation experiments. Experimental instruction now has a new avenue to develop creative creativity thanks to the integration of virtual simulation technologies. The core of teaching virtual simulation experiments is the virtual simulation experiment teaching centre. In order to support the sustainable development of virtual simulation experiment courses, all universities and colleges can focus on superior resources to create high-quality virtual simulation experiment courses, innovate and create high-quality virtual simulation courses to meet various needs, encourage students to actively participate in virtual simulation experiment teaching, and support the diverse development of teaching methods. The centers building impact has a significant impact on how well the virtual simulation experiment teaches. One significant aspect of the current educational reform for management and economics majors is the reform of virtual simulation experiments.

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