Research Article

Study on the Design and Optimization of Learning Environment Based on Artificial Intelligence and Virtual Reality Technology

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1. Introduction

A number of educational institutions and colleges are currently engaged in research and development of a new generation of virtual reality information technology. Educational researchers will benefit from studies on the potential educational benefits of virtual reality classrooms as well as creative educational initiatives that combine artificial intelligence and virtual reality [1]. In order to reap the benefits of this new direction, current management structures must first be strengthened. As a result of their lack of prior experience with virtual reality technology, conventional management practises are useless when it comes to dealing with virtual reality course challenges. Professors use an artificial intelligence-based virtual reality course management system to analyse and improve the work of students in virtual reality [2]. A virtual reality curriculum management system powered by artificial intelligence has piqued the curiosity of a large number of academics in the United States and throughout the world. Jang RY has created a mobile virtual reality platform that students can use to share content with one another [3]. With the help of a virtual reality learning environment, the author has designed a learning environment for autistic children, which allows them to experiment and take risks by engaging with people on a daily basis. In addition, once the research is completed, the virtual intelligent course administration system based on artificial intelligence can be put to use [4]. When kids frequently study, learn, and are reminded of important topics, they can lay the groundwork for a strong educational foundation. The use of virtual reality course management can replace traditional ways of learning that are only available through the Internet. A wide range of industries can benefit from the technique, which can be used to assist people in advancing in their professions [5]. The course administration systems investigated in this research have the potential to assist distance learning at universities as well as the development of professional skills in the workplace. As a result, it is intended to pique children’s interests while also improving their academic performance [6].

As a result, new technologies, such as virtual reality (VR), have gained popularity as teaching tools as a result of
advancements in low-cost computer graphics technology. Immersive virtual worlds are made possible by virtual reality (VR), which provides tools for situating oneself in a virtual world. Immersive virtual worlds are made possible by virtual reality (VR) [7]. A computer monitor serves as the primary display, with a keyboard and mouse serving as the primary input devices for engaging with computer-generated images. Desktop virtual reality (also known as non-immersive virtual reality) is used to interact with computer-generated images. As technology improves, desktop virtual reality (VR) is becoming more and more popular among users [8].

A range of methodologies are being applied in educational settings to conduct research on the relationship between virtual reality and students’ cognitive capacities. This method, which is the most often used for evaluating virtual reality-based learning environments, takes into consideration factors such as user interface design and cognitive load. The impact of virtual reality on pupils’ emotional states is still unknown [9]. In response to the advent of constructivist instructional methodologies, instructional designers are starting to detect a connection between cognitive development and social and emotional development. Psychologists and educators agree that emotional well-being is related to higher levels of achievement in academic subjects. The researcher came to the conclusion that emotions have an immediate impact on learning and achievement and that this influence is mediated by attention, self-regulation, and motivation [10]. An individual engages in self-regulated learning when they are guided toward or away from certain learning objectives. In earlier studies, it has been demonstrated that students’ emotions have an impact on their performance and achievement when they are using computer-supported learning. When it comes to virtual reality-based learning environments, Kansei Engineering methodologies are used to handle the emotional aspects of the learning process in desktop virtual reality [11]. Based on the empirical findings of this study, Kansei Engineering can be used in the evaluation of virtual reality-based learning environments. When virtual reality first appeared on the scene, no one had any idea what they were talking about. The first step in the development of virtual reality technology, senсорama, was developed by an American named Morton Heilig to assist him in his professional endeavours. Senсорama was a cutting-edge multimodal simulation system that used 3D stereographic vision, sound, and aroma to create an immersive experience [12]. Since then, virtual reality has grown into a multibillion-dollar business. The next year, the Massachusetts Institute of Technology investigated helmet-mounted displays. The nickname “Sword of Damocles” was given to it because it had two CRT monitors that could display more images, mechanical links, and ultrasonic sensors that could be handled by a handheld terminal when Ivan finally completed the project after years of hard effort [13]. Virtual reality can be controlled with the use of a handheld device. The Sword of Damocles has been referred to as a prototype because of its importance in the creation of virtual reality technologies in the past. The number of virtual reality applications accessible on the market is increasing. Virtual reality was first used in education in Europe and the United States roughly 22 years ago, and it is still being used today [14]. For a long time, the Electrical Engineering Department at MIT has been at the forefront of virtual reality education research and development. After over a year since its introduction, virtual reality (VR) technology has finally made its way into the classroom. The online physics lab was developed in collaboration with the NASA Institute of Space Physics and the Department of Physics at Houston University. A well-known university researcher created a Java-based web-based virtual physics lab that is accessible via the Internet. An important focus point can be found in either of these two locations [15]. Start with virtual experimentation and hardware development to get a feel for the process. Second, studies examining how groups of individuals learn are being conducted.

During this time period, the initial steps toward virtual reality technology were taken. The following year, a whole new type of virtual reality, known as the Virtual Interactive Environment Workstation (VIEW), was introduced. Before the VPL Eye Phone, there were no other consumer virtual reality devices available on the market. VPL was the person who coined the phrase “Virtual Reality” in the first place [16]. Despite its numerous applications, virtual reality (VR) still has some limitations in the educational setting. The design and implementation of vocational schools is more difficult for nationally recognised undergraduate universities than it is for other institution. It is challenging to meet the demand for large, expensive, and difficult-to-maintain virtual reality equipment. It is now necessary to move on to a logical design platform for VR technology in domestic and international educational institutions in order to determine the benefits and drawbacks of existing VR technology in education, as well as the hardware and software requirements or performance parameters for VR technology in educational institutions [17]. In order to make high-quality visuals and films for preschool training, researchers used virtual reality technology, which included real-time 3D computer graphics and network transmission. Dmax and the unidirectional 3D engine were used to create interactive educational settings [18]. It is possible for educators and students to create an interactive teaching platform that tackles difficulties such as out-of-date technology, stale course content, and the inability to connect in real time by utilising low-cost virtual reality headsets, smartphones, and online learning APPs. As a final step, a questionnaire survey of “tour guide practitioners” was conducted in order to gain feedback on the platform’s advantages and disadvantages [19]. This study focused on evaluating the role of AI and virtual reality in design of learning environment.

2. Motivation for the Study

The aim of the study was to investigate the design and testing of an interactive learning system using technologies such as virtual reality (VR) methods. Twenty people qualified and were divided into two teams of five boys and five girls each. The first intervention class takes place in the real operational environment, while the second takes place in a VR virtual
teardown experiment conducted. Statistical analysis was performed on task procedure errors, expert series of questions scores, and user subjective satisfaction. The significance probability $P$ of the nature of the questionnaire in the test was 0.888, larger than 0.06, and thus the variance was uniform, and thus the finalised $P$ of an independent samples $t$-test has been susceptible to “presumed different equivalent.” The possibility of significance was 0.718, which was greater than 0.06, and the questionnaire results revealed no significant difference between the two groups, indicating that VR virtual worlds could indeed facilitate learning in a real-world situation. The number of errors inside a VR system and its environment is significantly smaller than the number of mistakes inside a real-world situation. The VR virtual world could indeed achieve the learning of the actual environment, and the VR virtual world could indeed achieve so much interplay for effective interaction. The goal of this project is to look into the design and testing of an interactive learning system employing technologies like virtual reality (VR). Twenty persons qualified, and they were split into two teams, each with five males and five girls. The first intervention lesson takes place in a real-world setting, while the second takes place in a virtual reality disassembly exercise. Task process errors, expert series of question scores, and user subjective satisfaction were all subjected to statistical analysis.

3. Materials and Methods

Our primary focus on the learning platform is two people involved in the learning process. The first person is the student, and the second person to care about is the teacher. As the essential starting collection of data is the first mandatory thing for both Artificial Intelligence and Virtual Reality, it is impossible to work on and learn such concepts without a single piece of data. After collecting data, a separate database would store all such information and details that need to be accessed sooner rather than later. Through the access of the cloud platform, the entire operation can be done using a browser connection, which runs with the support of models and servers. The login and correction modules are being managed as the first things to be addressed—other homework modules like the tweet managing module, display accessing module, etc. While the module is behind, there are several sections in it. For example, Login Statistics, maintaining the database system, interfacing analyzing, managing the resources, relaying that supports little data, and finally, the data pushing module. According to further options, the designs are created with a separate algorithm. That means that the first login module is one of the attender sections, as it monitors the student’s presence and time management. Through this set of data collection, it automates the report that holds the history of each student login. Secondly, the database managing module would manage the registration process, which gets both the student and parent login and facilitates the subsequent verification process. Once the module’s technical-based work has been completed, the other process is divided into three sections: logical interfacing, data managing, and finally, the representation layer. It is a systematic process with a relationship with the other layers. Hence, the relationship between different layers is one of the abstractions served by the system. Creating a separate platform for education systems is the only thing they have in common, but the actual usage would be significant. Regular optimization is a set of operations where choosing a particular input is done according to the output. In the case of deciding in such an effective manner, the allocation occurs while producing the actual model with matched characteristics. Maximizing and minimizing are the commonly used words under the level of optimizing. There might be some limitations or constraints within the resources. If there is a possibility of getting restrictions in boundaries, creating a different environment for the learning or teaching platform should be helpful for the students when they study their concepts. One of the most remarkable things about the online session is that notifications are the most distracting thing for those students who used to attend their classes using mobile phones.

While in the management modes, according to the user, there would be different permissions when they used to get into the learning platform for the first time. There would be a connection between each student and the head administrator here. The head administrator can delete the user’s list when the students focus on any set of malformed practices or any other misbehavior during the class. Figure 1 analyses the module format of a learning platform designed for a student and a teaching faculty.

These abilities are the significant quality fundamental basis for interactive AI learning system to participate in the development and optimization of learning environments based on artificial intelligence and virtual reality technology $x$ resource allocation. $M$ stands for methodology, and VR stands for virtual reality. There are many components in Artificial Intelligence (AI) and Virtual Reality (VR) Methods, such as location and transformation as the following equation:

$$M = \int \sum_{i=1}^{n} \sum_{j=1}^{x} g_{ij} (n_i - \bar{n})(n_j - \bar{n}) + \{M1, M2, \ldots, mx\}. \tag{1}$$

instantaneous transition but also time change. Space time transformations, including the previous $MX$, take a few time to, Transition $n_i - \bar{n}$ is divided into two categories shown in the following equation:

$$MX = \sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij} (n_i - \bar{n})(n_j - \bar{n}) \frac{\sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij} (n_i - \bar{n})^2}{\sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij} (n_i - \bar{n})^2}. \tag{2}$$

The transceiver and $g_{ij}$ the receiver have to be distinct from other two, and also the operator must be undeniably connected to a required device by the following

$$MX = x \sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij} (n_i - \bar{n})(n_j - \bar{n}). \tag{3}$$

The transition time is represented by
\[
M_X = \frac{x \sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij}(n_i - \bar{n})(n_j - \bar{n})}{D^2 \sum_{i=1}^{x} \sum_{j=1}^{x} g_{ij}}.
\]

After which, the following equation calculates the amounts of data to exchanges regarding the time sequential manner:

\[
VR = \frac{j \sum_{d=1}^{d} \sum_{i=1}^{d} \sum_{n=1}^{x} s_{ij} - s_{dij}}{2x^2 t}.
\]

There are various kinds of according the ones that follow; an amount of data-related statements could be represented by places or transitions and is represented in the following equation:

\[
VR = \sum_{j=1}^{q} \sum_{d=1}^{d} \sum_{i=1}^{x} \sum_{n=1}^{x} s_{ij} - s_{dij}.
\]

In addition to \( s_{ij} - s_{dij} \) with the amount of data being \( t_j + t_d \), described by focused weights is given in (7). The following is a brief description of the AI and virtual reality (VR) methods.

\[
RE_{jd} = \frac{\sum_{j=1}^{d} \sum_{i=1}^{x} s_{ji} - s_{dij}}{x \times d \times (t_j + t_d)}
\]

The article summarizes the AI and virtual reality (VR) techniques code behaviour procedure. The direction \( \theta \) of the action scene in AI and Virtual reality (VR) Methods is provided by equation (8). \( B_1 \) symbolises the very same type of transition as in the correlation between both the various object classes in a statement given, and the weight of the oriented action sequence reflects the enormous variety of data products in a declaration.

\[
M_{sm} = 1 - \sum \left( \frac{2q n_{s_{q}} + B_1}{2r_{n_{q}} + B_2} \right) \left( \frac{2r_{n_{q}} + B_2}{2q n_{s_{q}} + B_1} \right)
\]

A \( L \) Techniques virtual reality (VR) and AI modelling technique for code influence on \( h_i \) performance and the \( v_q \) correlating correlation between many \( q \) Virtual Reality (VR) Methods are represented by the equation (9) and AI techniques elements and also code elements is crafted as shown in the following equation:

\[
L \left( h_i, g_{ij} \right) = L \left( h_i \right) L \left( \frac{g_{ij}}{h_i} \right).
\]

\[
L \left( \frac{g_{ij}}{h_i} \right) = \sum_{q=1}^{q} L \left( \frac{g_{ij}}{v_q} \right) L \left( \frac{v_q}{h_i} \right).
\]

\[
I_q = \frac{2q}{q + 1} + \left[ \frac{1}{2} + \frac{1}{2q} \right] \left( \frac{b_2 - b_1}{3} \right)^2 + \frac{2(b_2 - b_1)}{3}.
\]

To achieve the \( b_2 - b_1 \) evolution from regulations to Virtual Reality (VR) Methods and AI techniques, its static analyzer method is used to analyse but also process its executable, as shown in following equation:
From the (12) for such process, an \( s - n \) single programme report gives an affiliated operation \( hE_j \) an input data object set which has been digested, but a \( B_{j, d} \) digital signal object that has been produced at the end.

\[
B_{j, d} = \int_0^\infty hE_j(s) \int_0^s (s - n)hE_d(n).
\]

The technicians in (13) are depicted by \( M_{iu} \), the same \( a + \beta \) set of audio frequency data items is represented by \( \theta \), and also the series of digital signal objects is symbolised by \( Z_n \). Hence, \( \alpha \) seems to be the declaration granted for the input object \( I \) complies to a procedure \( Y \) information and data object, and also the statement is extended even as data item \( \alpha \) equates to a procedure \( \sum n=1^\infty \) output data object, even with highest priority, according to the source materials of the following:

\[
\ln \left( \frac{M_{iu}}{M_{iu} - 1} \right) = \alpha + \beta \ln M_{iu} - 1. \tag{12}
\]

\[
\sum n=1^\infty Z_n^* I = \sum n=1^\infty \left( \frac{(G + Y_i/\sum G_i)/(B + Y_i*B)}{\beta + \alpha \ln M_{iu} + (L/B)} \right). \tag{13}
\]

Variable has been considered as the greatest output item so because original statement’s \( r_0 + r_1 \) activity should be \( h^*hu \) depicted in the ultimate result of the schoolwork operation. As shown in equation, the \( \epsilon_i \) method of altering the amount and forms of information goods could be quickly encapsulated as in (15) and (16).

\[
\ln \text{petri}_{iu} = r_0 + r_1^* h^* hu + \sum i=1^X c_jN_i + \epsilon_i, \tag{14}
\]

\[
\int (r) = \sum \frac{1}{Xd} \sum i=1^X q\left( \frac{N_i - n}{d} \right). \tag{15}
\]

\[
\sum (1/Xd) \sum i=1^X q\left( (N_i - n)/d \right) \text{ portrays the transition of the} \int (r) \text{ process from knowledge data element to manufacturing item in a Virtual Reality (VR) Methods and AI techniques. The direction but also weights of declaration transformation’s input/output action scene are depicted by} \sum i=1^X q\left( (N_i - n)/d \right), \text{ which reflects the process of transition from knowledge data item represented by} \int (r) = \sum \frac{1}{Xd} \sum i=1^X q\left( \frac{N_i - n}{d} \right). \tag{16}
\]

\[
\sum (1/Xd) \sum i=1^X q\left( \frac{N_i - n}{d} \right) + \sum \frac{1}{Xd} \sum i=1^X q\left( \frac{N_i - n}{d} \right). \tag{17}
\]

Methods for investigating the design and testing of an interactive learning system, such as Virtual Reality (VR) and AI techniques. Twenty people qualified and were divided into two teams of five boys and five girls each. The first intervention class takes place in a real-time operating environment, whereas the second takes place in a VR virtual teardown experimental setting. A statistical analysis of task procedure errors, expertise series of questions scores, and user subjective satisfaction was performed.

### 4. Results and Discussion

Twenty eligible subjects have been selected and split into two groups for analysis (refer Figure 2). The male-to-female ratio for each group usually tends to be the same, with five males but also five females from each. The first experimental group worked in such real-time operating surroundings, while the second worked in an AI and virtual reality reassembly and arrangement environment. The experimental assignment would have been to complete its disassembly but also the assembly duties of the suppressant assembly framework using the team’s data and technology.

After the experiment, complete its knowledge inquiry and test based on the knowledge gained during the disassembly but also the assembly learning process. Table 1 shows that, in addition to different environments, other circumstances appear to be consistent between both the two experimental groups; that is, there seems to be an equal understanding among experimental able to operate objects, experimental hardware, as well as experimental textual information.

Users’ Subjective Satisfaction: Figure 3 shows the mean rating since trying to sort and analyse the points scored data of such a user interpretive rating scale from the two groups of experimental tests. Figure 3 depicts the particular data description for the independent t-test on user qualitative satisfaction field analysis. It is clear there are substantial differences in the evaluation metrics of customer satisfaction between the two operational conditions. Among them, it is AI and VR online learning that has a considerably higher user satisfaction rating than that of the actual operating environment. The AI and VR online educational environment’s satisfaction is substantially lower than that of the real-time operating climate, refer to Table 2. The multitude of errors that occurred during the aspect of this approach to the experimental AI and VR number of 10 users provided the result on average, and the AI and VR environment provided the same 10 users with the multitude of errors that occurred during the aspect of the approach.

Scores on the knowledge questionnaire task failures are primarily defined within the procedure of experimental (shown in Figure 4) tasks as one of the three following circumstances: each mistake, each record. In particular, during the disassembly procedure, its parts must be positioned inside the designated parts tray, and any errors in placement are recorded as task errors. The different forms are managed to be grabbed for assembly during the assembly process, which is documented as an assignment error. The assembly positions as well as the direction of parts are incorrect, resulting in a task error. As shown in Table 3, the percentage of mistakes made in the AI and VR virtual environment while completing tasks was significantly lower than it is in the real environment. It is easy to make a mistake during the physical assembly operation, particularly during the assembly of stiffing part groups 1 and 2. The most common error is the incorrect assembly role of parts. The
primary reason for consumer error in an AI and VR virtual operational context is that there are more than load-carrying and adaptation rings inside a shafting part collective of the scores on the knowledge questionnaire (refer Table 3). However, the matching of a system’s constructed parts would be one to another, such that the bearing on the left side of a shaft should be gathered on the left side first before the scheme can recognise the assembly as effective.

F represents the questionnaire score and Sig. as the significant probability of F in Figure 5. The user of a reducer among various parts of an assembly position of knowledge, true or false, understands that a consumer understands such a number of components, but also examines the participant’s learning extent of a converter attempting to draw in addition to having the big questions depicted in Figure 5. In AI and VR headsets, the illustration technique of portion attached form is attributed to the dominance of the headset equipment’s resolving. There is a significant difference in the error rates in the arrangement drawing scores between the two groups. Making use of various components because the AI and VR online reality contains diversified but also sensorimotor information, the questionnaire results were tested using an independent sample $T$-test. The users’ learning effects upon those operating principles of the drivetrain model are superior to those in the real world. Inside the three-dimensional changing situation, users can quickly grasp and improve their cognition of this expertise point.

Table 4 demonstrates that the average expertise questionnaire scoring system within the VR virtual world ($M = 86$) was marginally lower than the real-time operating environment ($M = 86:6$). As seen in Table 4, the two pairs of questionnaires measureable are independent samples $t$-test;

Table 1: Result analysis for each factor’s corresponding relationship in the 2 groups of experimental tests.

| Performance properties | Physical disassembly group (%) | AI and VR disassembling group (%) |
|------------------------|-------------------------------|----------------------------------|
| Experimentation setting | 92.34                         | 93.56                            |
| The experimentation task| 94.67                         | 95.78                            |
| Laboratory apparatus   | 96.87                         | 98.90                            |
| The topics             | 98.90                         | 92.98                            |
| Data from test         | 99.34                         | 98.76                            |
Figure 3: Graph of average rating the consumer subjective eventually realizes scoring data from the two groups of experiment have been sorted and analysed, and also the mean chart of a score has been obtained.

Table 2: The multitude of errors that occurred during the aspect of this approach.

| Experimental VR number of users result | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Average |
|---------------------------------------|---|---|---|---|---|---|---|---|---|----|---------|
| 1. Real environment                   | 6 | 4 | 8 | 6 | 9 | 3 | 5 | 6 | 8 | 6  | 5.7     |
| 2. VR environment                     | 3 | 2 | 5 | 2 | 6 | 1 | 3 | 2 | 4 | 5  | 3.2     |

Figure 4: Performance analysis of the scores of knowledge questionnaire in real and VR environment.
the results of the analysis show that the two types of learning environmental expertise questionnaires measureable in the test through significant likelihood $P$ values are 0.888, which is greater than the critical value of 0.05, relatively homogeneous variance, and in the independent samples $t$-test, the last $P$ values would be subordinate to presume equal variance. The $t$-$F$ test’s value of importance likelihood is 0.264, which would be larger than 0.06. Table 5 shows the performance analysis using the existing method. The results proved that the proposed model works well than the existing algorithms. The proposed algorithm has obtained accuracy of 98.67.

Table 3: Result analysis for scores on the knowledge questionnaire.

| Experimental result | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | Average |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|---------|
| 1. Real environment | 85  | 78  | 96  | 87  | 92  | 86  | 87  | 79  | 91  | 81  | 84.23   |
| 2. VR environmental | 89  | 93  | 73  | 79  | 78  | 89  | 77  | 87  | 84  | 96  | 83.12   |

Table 4: Result analysis questionnaire scores tested using an independent of the sample $t$-test.

| Equation variability $t$-test | Conditional mean equation $t$-test |
|-------------------------------|-----------------------------------|
| Variance of equation assumed  | $F$ | Sig. | T value | DL (degrees of liberty) | Sig. (two tail) |
| 0.0934                        | 0.888 | 0.616 | 20 | 0.264 |

Table 5: Comparison result analysis with the existing method.

| Algorithm                  | $F$  | Sig. | Training/testing | Speed (s) | Accuracy |
|----------------------------|------|------|------------------|-----------|----------|
| Virtual reality (VR) methods | 0.0934 | 0.888 | 0.616            | 0.39      | 98.67    |
| Existing method:            |      |      |                  |           |          |
| Real environment            | 0.0754 | 0.666 | 0.421            | 0.58      | 92.45    |

Figure 5: Performance analysis for the user various parts questionnaire scores tested using an independent of the sample $t$-test.
5. Conclusions

Virtual reality (VR) methods will be used to investigate the design and testing of an interactive learning system. It is important to learn in a virtual environment, and it is possible to have as much interplay as possible for effective interaction. As a result of being transported to an alternate reality where they can see things that are otherwise unimaginable, even students will be more attentive when using virtual reality technology. When this system is implemented in as many universities and colleges as possible, students’ eagerness to learn will naturally rise. For the past few years, nearly 40% of students have been working on virtual reality projects in their colleges. The Virtual Reality Driving Simulator Dataset is used in the study. Comparing these results to the real world, it is discovered that the proposed model has an accuracy rate of only 96.67%.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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