Lappeenranta–Lahti University of Technology
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# EVALUATION OF THE APPLICATION OF VIRTUAL REALITY FOR EMPLOYEE TRAINING AND PERFORMANCE IN NIGERIA

Master's Thesis

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## ABSTRACT

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The purpose of this study is to evaluate the application of virtual reality for employee training and performance in Nigeria. It was carried out with two aims in mind. The first is to evaluate the application of virtual reality training in improving employee training outcomes compared to traditional training methods. The second is to identify the benefits and limitations of using virtual reality in employee training and how it impacts on their job performance. Relying on the theoretical frameworks of the cognitive theory of multimedia learning and the Technology Acceptance Model (TAM), the study set out to achieve its aim by using a research instrument as source of primary data. Fifteen questionnaires were sent to participants of the study, which were three companies in Lagos, Nigeria that are into employee training and were accustomed to the use of VR. The study found that the application of VR in Nigeria is not as widely accepted as that of the conventional classroom training method, this is despite the fact that VR is more effective in improving employee training outcomes compared to the conventional training. The study also found that the use of VR has the benefits of training employee's soft skills, building employee confidence and has the capacity to train the employee in complex and dangerous procedures without exposure to hurt or danger. In all, the use of VR can improve employee performance on the job but is limited by major challenges in Nigeria, such as high cost of acquiring the technology, poor power supply and inability to adapt VR software for other uses. Despite this, the study opine that these challenges can be mitigated if there is more investment in the technology and if the government advances a policy that will grant incentives to those who are interested in importing and marketing the innovation in Nigeria.

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**Okwuejunti Esther Nwadinife**

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| | |
|---|---|
| 3D | Three Dimensional |
| VR | Virtual Reality |
| TAM | Technology Acceptance Model |
| TRA | Theory of Reasoned Action |

# 1. INTRODUCTION

## 1.1 BACKGROUND OF THE STUDY

There are many factors that influence employee performance in an organization but one of the most important is training. Almea (2020), note that training can enhance the capabilities of an employee because it increases his/her skills and competences. The author argued further that employees who have more on the job experience can perform better because of the level of training they have acquired over the years. Training has also been considered as a return on investment in the performance of an organization since employee performance will automatically translate to better organizational performance. This is because the human resources capital of an organization plays a crucial role in the growth of the organization (Abdeldayem et al. 2021).

According to Segura et al. (2020**)**, employees tend to put in their best in a situation where the work environment is conducive and where the management put a premium on manpower development. This position is based on the fact that the challenges that employees face in the workplace does not only arise as a result of low levels of education but also due to a mismatch between the skills that the employee possess, and the skills demanded in the industry. Hence rapid changes that come up in the industry require that the employees become skilled and knowledgeable for them to be flexible and adaptive to workplace requirements. Segura et al. (2020).

In line with this, Wang et al (2021) contend that over the years there has been remarkable changes in the work environment with substantial development in digital technologies. These developments have encouraged a shift in the way employees work, moving from the traditional work setting to "virtual work". The basic difference in these two work settings is that in virtual work, the employees are physically dispersed but they all communicate and work with the aid of digital technology. Aside from this distinction, virtual work environment exhibits a kind of employer-employee relationship that encourages independent working even though there is a physical separation from a command –and-control process.

Alongside a virtual work environment, there has been the need for virtual reality (VR) in the workplace to enhance training and manpower development. Bailenso (2020), argue that VR has the potential for use in work related situations due to its features and flexibility. For instance, a VR environment is classified as immersive and includes interactive 3D visualization

and graphical displays that comes via a head-mounted display and handhold positioned devices. The technology permits its users to experience and interact in a like-life environment that is safe and convenient whilst providing a degree of control over the simulation model.

In the opinion of Naranjo et al. **(**2020), the use of virtual reality (VR) technology has exploded in recent years, and it is now being used for a variety of purposes, including staff training. The manner that peoples are trained and given the abilities and information necessary to do their jobs well has the potential to be revolutionized by VR-based training. Due to its capacity to imitate real-world surroundings and offer immersive experiences, virtual reality (VR) has gained popularity in recent years and been used by a variety of businesses. According to Wang et al. (2018), it has demonstrated potential in recent years for enhancing employee training and work performance results. In furtherance to this, Zhao et al. (2020) opine that virtual learning plays an important role in education and training and it has become an essential part based on the reality and effectiveness that such trainings offer and the extent to which they reflect on how employees perform.

Abdulaimi et al. (2021) argue that the advent of the corona pandemic in 2020 brought about a new reality for many organizations globally on the need to adopt virtual reality trainings. By implementing virtual training programs remotely as it does not require the trainee to be in a training environment for this to occur. To this end VR has been effectively used in sports, medicine, psychology, and every aspect of life where manpower training is required.

Within the Nigerian context, Abdeldayen et al. (2021), suggested that despite the importance employee training and how it enhances the performance of the organization, training programs are not sufficiently supported by many organizations in the country. They opine that organizations in Nigeria often do not see the correlation between employee training and the performance of their firms. Rather they consider the money spent on training programs as a waste rather than an investment. Abdulaimi et al. (2021) hold the view that the organizations that conduct such trainings for their employees in Nigeria do so in an ad-hoc manner which results in unplanned and unsystematic training patterns that does not have much of an impact. This has also impacted negatively on the use of VR for employee training.

There are numerous empirical studies on the effect of training on employee performance (see Bailenson ,2020, Saunders et al. 2019) and even though organizations in Nigeria still do not consider training as key to their performance, research in this area in the country suggest that the use of VR in training in Nigeria is promising. (see Abdulahi ,2020 and Onojah et al. 2020).

It is therefore important to evaluate the extent to which VR technology has been applied in the workplace in Nigeria and how this has enhanced employee training for the purpose of improving their performance. This is the research gap the study intends to fill.

## 1.2 AIMS OF RESEARCH

The first aim of this research is to evaluate the application of virtual reality training in improving employee training outcomes compared to traditional training methods. This will be done by identifying the various ways that VR has been applied in training based on existing literature and studies. This will offer the study a background of how effective VR is and how extensive it can be applied.

The second aim is to identify the benefits and limitations of using virtual reality in employee training and how it impacts on their job performance. The benefits and limitations will come from existing literature and the responses from the research instrument. This will provide the thesis a comparative view between what is obtainable in general to what the situation is in Nigeria.

## 1.3 RESEARCH QUESTIONS

Based on the research gap identified, this study shall address the following research question:

1.How has virtual reality technology changed over time and what is its present condition in employee training?

2.In comparison to conventional training techniques, how successful is virtual reality in enhancing employee training outcomes?

3.What are the advantages and drawbacks of adopting virtual reality in employee training, and how do they affect the results of work performance?

4.What elements affect workers' engagement and motivation in virtual reality training programs? How do they react to them?

5.What implementation issues do businesses have when implementing virtual reality technology in employee training programs, and how may these issues be resolved?

These research questions will aid in filling the research gap of this study intends which is to evaluate the extent to which VR technology has been applied in the workplace in Nigeria and how this has enhanced employee training for the purpose of improving their performance.

## 1.4 THEORETICAL BACKGROUND

Training is an integral part of human resource development and is very crucial to both the employees and the organization, (Abdeldayem et al. 2021) consider training to be the practice of providing coaching, mentoring or other learning opportunities to employees in other to inspire, motivate and challenge them to have the right skill set to function in their official capacities within the standards set by the organization.

To Aldulaimi et al. (2021**)**, training is a planned process embarked upon to modify knowledge, attitude, behaviour or skill through various learning experiences to achieve performance in any given activity. Within the context of the work environment, Ahir et al. (2018), opine that the purpose of training is to develop the abilities of the employees to meet and come up to the expectation of the organization. This opinion suggests that training is linked with a planning process and an operation that is aimed at modifying skills through the application of education and experience.

In line with this position Aldulaimi et al. (2021**)**, hold the view that every good and effective training should have the following elements:

1.The training must be aligned with the mission goals of the organization to determine the skills, knowledge and attitudes needed for employees to perform optimally.

2. The ultimate purpose of the training is to improve the performance of the employee through learning and acting on what is learnt. So, when a performance gap is detected the typical and easiest way to fill the gap is through training.

3.It is necessary to choose the correct combination of the options available for the delivery of the training which includes taking into cognizance the target audience and choosing a training option that will give maximum impact.

4. If trainings are to improve the performance of the organization, it is essential that the effective training program must be capable of being duplicated so that issues can easily be identified by the organization. Aldulaimi et al. (2021**)**.

One of the training channels available is the use of virtual reality (VR). As regards this. Ahir et al. (2018) notes that even though training occurs with physical setups such as a classroom and laboratories, there are cases where trainees visit special facilities to receive proper training.

With VR technology it is possible to provide real-world training via virtual environments guarantees and effective and immersive experience for the trainee.

In comparison to real-world training, Blount (2021) argues that real-world training has some limitations which provide VR an edge. These limitations include: 1) real-time training can be time consuming as it requires a lot of effort to set it up the training site and handle the travelling logistics involved; 2) it could be expensive due to the cost of preparing the training materials and hiring human trainers;3)It can be unappealing due to the absence of visuals and animations; and 4) it cannot accommodate all forms of training especially emergency procedures that can only be safely trained using simulators.

Ahir and Kumar (2018) suggest that depending on the domain, the application of VR technology can drastically reduce the cost of training whilst having the potential of increasing the number of training scenarios. These scenarios are created using computer-generated 3D graphics which can be repeatedly applied to different people. VR training has not been proven to lower cost, but it has many advantages.

According to Ahir et al (2018), one of the advantages of VR is that it allows trainees to learn within the comfort of their personal and comfortable space. For instance, an employee can learn how to use a piece of safety equipment using VR at home VR training also affords the trainees privacy which is important in the event that the trainee is not comfortable in undergoing a training process in the presence of observers.

Aside from this, VR training provides a safe environment without exposing the trainee to actual danger. For instance, if the training is about fire control or explosions, an instructor can control a virtual fire rather than an actual one that will expose the trainee to firsthand danger. With VR, such a scenario can allow people to easily train in a safe environment with little exposure to real life challenges. (Ahir et al. 2018).

The theoretical framework that will be adopted for this study are the two most used ones that are related to the application of virtual reality in training. They are Mayer's Cognitive Theory of Multimedia Learning and the Technology Acceptance Model.

According to Almea (2020),the cognitive theory of multimedia learning as espoused by Mayer (1997) is hinged on many theories and concepts of cognitive psychology such as the working memory model proposed by Baddeley in 1992,the dual-coding theory by Paivio in1990,the generative theory by Wittrock in 1989,the selection –organization-integration (SOI) model of

multimedia learning proposed by Mayer in1995 and the cognitive load theory of Sweller et al. in 1990.

The theory holds the view that multimedia learning is the reception of educational material in different modes such as delivery media, presentation modes and sensory modes. In essence, almost all computer-based learning can be classified as multimedia learning, and this includes immersive virtual reality. In the application of VR, the learner is placed within a multimedia environment where he experiences not only picture and sound but also a lot of animated and interactive engagement.

in Mayer's theory, teractivity is considered a core concept in multimedia learning. The theory considers the learner to be a perceived knowledge constructor who selects and connects visual and verbal knowledge. Although this theory focuses more on the cognition of the learner rather than the experience, the instructional application of the concept has a strong impact on the learning of engagement of the learner and on how learning materials are processed.

According to Mayer and Moreno (1998), the theory of multimedia learning is based essentially on five principles:

1.The multiple representation principle which speaks of the multiple representation that a learner can apply to build multiple mental models, build connections between them and use the knowledge to improve learning.

2.The contiguity principle which applies to the presentation of pieces of information in a working memory so as to build connection between them to enhance learning.

3.The split principle which addresses the use of auditory and visual stimuli to engage the visual and verbal information processing systems.

4.The principle of individual difference is concerned with learners who have already have some mental models because of the high level of previous knowledge they have. To address this, the principle is that new models should be created for such learners to make learning easier for them.

5.The coherent principle which suggests that when using multiple learning modes, it's advisable to provide a coherent summary of what is learnt rather than having a long narration.

The technology acceptance model as proposed by Davis in 1989) tries to explain why people want and prefer to use a particular technological innovation instead of others. This understanding is based among others on the theory of reasoned action proposed by Fishbein

and Ajzen in1975 which predicts actual human behavior by using preexisting attitudes and behavioral intentions.

With the technology and acceptance model, the perceived use and perceived usefulness of the technology serve as predictors of the behavioral intentions of the learners. In this sense, perceived usefulness is described as the extent to which a learner believes that an application can him perform some tasks better. This is also in relation to perceived ease which speaks about how the learner can use the application effortlessly. The model holds the view that the higher the perceived usefulness and perceived ease of a technology, the greater the chances that learners will want to use it in the future.

## 1.5 RESEARCH METHODOLOGY

The research methodology shall be based on the consideration of all the various methods of research that exist in literature. Firstly, the study shall consider two research philosophies namely the interpretivist and positivist. The interpretivist approach seeks to understand the motive and the reason behind what people do in order to make sense of their intentions and actions. The philosophy is narrative and subjective in nature and is also centered on the use of qualitative data and is mostly applied when the method of gathering data relies on interviews, observations, and secondary information. (Bhome et al ,2013),

For the positivist philosophy, the approach is to deal with the reality of events by seeking the reason or cause why something happened or is happening thus giving room for a logical way of explaining the phenomena. To this end, this approach relies on quantitative data that can be analyzed to reach a conclusion. (Easterby-Smith et al. 2012).

In addition to this, the study shall examine various research approaches, the quantitative and qualitative paradigms. The former is focused is systematic in nature and involves the gathering of primary data which is then subjected to analysis. The paradigm relies on the use of numbers and statistics for the interpretation of a relationship that exists between the variables identified in a study. It is also the approach adopted when there is a need for the testing of a hypothesis. The qualitative approach is descriptive and subjective in nature and is not as rigorous as the quantitative approach. As it does not require primary data, the paradigm is ideal for studies that examine the opinions, attitudes, and behavior of people. This research methodology shall be provided in greater detail in chapter three of this study. (Saunder et al. 2011a).

The participants in the study will be employees from chosen companies who will be selected through their consent in participation. The data collection method will be via the research instrument designed for this study. The collected data will be analyzed using descriptive statistics. The study will be conducted in accordance with ethical guidelines for research. Participants will be informed of their rights and confidentiality and privacy will be maintained throughout the study.

## 1.6 STRUCTURE OF THE STUDY

The study shall be presented in five chapters: Chapter one, which is the introductory part shall cover areas such as background, research questions, brief literature review, theoretical framework, definitions and delimitations, research Methodology and structure of the study. This shall be followed by chapter two, which focuses mainly on the review of literature. Chapter three is the research design and methods, and it shall cover areas of the thesis that have to do with research context/case description, data collection methods, data analysis methods, reliability, and validity.

The fourth chapter shall present the findings of the study and chapter five shall cover the discussion and conclusion. It is in this chapter that the summary, theoretical contributions, practical implication, limitations, and future research directions will be presented.

## 2. LITERATURE REVIEW

### 2.1 VIRTUAL REALITY: MEANING AND APPLICATION

#### 2.1.1 Meaning of Virtual Reality

There is no doubt that organizations need to train their employees if they are maximizing work efficiency, reducing employee turnover, and reducing the risk of mistakes that come with untrained personnel. Many of these organizations are used to traditional training methods which take place in classroom, in the workplace or via seminars. As the world of technology evolved and more training solutions proved too effective, many organizations who had the means opted for virtual training as a replacement for traditional training. (Ekezie,2016).

Blount (2021) is of the opinion that in 2020 when the COVID-19 pandemic hit the world, the lockdowns and restrictions that followed as measures by governments to curb the spread of the virus, made traditional training almost impossible and consequently, organizations were forced to consider the possibility of training their personnel remotely and virtually. The COVID-19 pandemic made virtual training as relevant than it was before. Virtual training has many forms, but this study shall focus solely on virtual reality (VR).

So, what is Virtual Reality (VR)? The term has a plethora of definitions each one depending on how the organization or people using the technology understand it. According to Training Industry (2022), VR is a form of training carried out in a virtual environment and designed to simulate the settings and experience of a traditional classroom. Another definition as offered by Virtual Reality (2017), notes that the term refers to a computer-generated 3D-environment that allows the user to interact and explore using a virtual reality headset known as the head-mounted display (HDM). The headset covers the eyes of the user completely allowing him to get immersed completely into the virtual environment.

Cole (2021), suggest that VR training can come in these forms:

**1.Asynchronous Training:** A training form where the presence of the trainer and the trainee is not required to be at the same time and place, but it is done in such a way that will suit the requirements of both. The way it works is that both parties agree on the appropriate time and place and the learner receives training courses according to the predetermined program.

**2.Silmutaneous Training**: In this form of training the trainer and the trainee are required to attend at the same time. Training programs for such are offered through the internet and both parties are expected to exchange experiences and learn in real time.

**3.Target Group Training**: Such training is usually embarked upon by organizations to train their employees by relying on the broadcast of the training program.

Coifet and Burdea (2017), suggest that the technology is not new and in fact it has been around since the 1960's with the creation of the first head-mounted display by Ivan Sutherland; an American scientist. They further note that the headset was designed to use CRT-monitors and achieve graphical simulation which adjusted the images depending on the head movements of the user. Suffice to say it was not until the 1980's that the first commercial virtual reality headsets were produced. Nevertheless, the first sets of headsets were not without their defaults. Turi (2013), mentioned that the early headsets were heavy (weighed about 2kg), extremely expensive (about $11,000) and had blurry images which were due to image resolution. These initial challenges affected the acceptance of VR in the early years.

Robertson (2018), opine that what pushed virtual reality to the fore was the video game industry but later the potential for the use of that technology for training purpose was latched onto by organizations and companies and the successes that were recorded further pushed the boundaries of VR acceptability. For instance, in 2017 a VR simulation was created at the children's hospital in Los Angeles to train doctors in making life-saving decisions with infants. A similar feat was accomplished when a virtual reality platform was created by Osso to train doctors on how to use medical devices for highly complex procedures. Audi, the car manufacturing giant also created a VR showroom for cars that allows a potential buyer to sit in the car and inspect all aspects of the vehicle (Takahashi,2017).

As VR innovations continued what was available in the early days gave way to a large variety of virtual reality headsets that are now available in the market ranging from the phone-mounted displays to the more expensive high-end sets. With reference to its applicability to different training scenarios, new specifications and resolutions have altered users experience and different headsets can now offer different user preferences from fully stationery experience (where the user is stationary either sitting or standing) to a room scale experience that allows the user to move around in a limited area whilst his movements relayed to the virtual environment making it more immersive. These devices are also paired with motion tracked controllers which allows the user to interact with his virtual environment. (Mealy,2018).

Mealy (2018) also added that the devices come in various shapes with different number of control buttons which allows for seamless interaction. The controllers use haptic feedback to enhance the immersion of the user, meaning that the user can pick virtual items, rotate them, feel the objects, and generally have a feeling of interacting with the objects as if it were in real life.

### 2.1.2 Application and Effectiveness in Employee Training

Since the 60's when the technology was explored till the present time, virtual technology has been applied for training purpose by different organizations to the extent that the global market size of VR is estimated to reach $26.86 billion by the year 2027. (PR Newswire,2022). This growth is hinged largely on the benefits of using virtual reality in training and the many real-life scenarios that technology can be applied to. For instance, Linder et al (2019), mention that Walmart in the United States has successfully applied virtual reality to train over a million employees with recorded successes.

There are numerous cases in literature that have captured the application of VR from the military to medicine, to sports, football, fire service, transportation, and training in different spheres of life. To this end, Maese (2018) notes that technology has been adopted extensively for training purposes with great success. According to Deal (2018), prior to the winter Olympics of 2018 in South Korea, Mikaela Shiffrin trained with virtual reality to get used to the skiing course long before the competition commenced. This would not have been possible for her to do in real life as the game had not started and she never would have had access to the course. However, with a simulation of the course she was able to train and master the course using VR and she eventually won the gold medal at the Olympics.

In the same vein, in 2019, the UK government used the Virtual Reality in Land Training (VRLT) to train her soldiers using the Bohemian interactive simulation. The training was such that the soldiers interacted with custom avatars and real physical objects which had the facial features and body shapes of the soldiers which allowed them to recognize one another in the virtual environment. With VR, the army was able to analyze different combat scenarios and tactical responses that will save the lives of the soldiers in real combat situations. (GOV.UK,2019).

Furthermore, the effectiveness of VR for training purposes has been showcased in many literatures on the subject. A study on surgical training by Mao et al (2021) was conducted on medical trainees in 2021.The study found out that with the use of virtual reality training there was improvement in accuracy, task completion and the time of completing a procedure. Aside this, it was also found that the group that was trained using VR performed better than the control group by as much as 43% and there was improved cost –effectiveness with the use of VR.

In comparison with traditional training methods, Howard et al (2021) is of the opinion that VR training produces better outcomes. Bailenson (2020), note that one of the unique benefits of VR is that during training, a trainee can get immediate feedback from the program when a mistake is made. This in turn does not only make the training more efficient but also reduces the total training time considerably. In traditional training, the fear of making such mistakes might affect active participation.

Another example of the difference between VR training and traditional training was provided in a study conducted by PwC in 2020 where it was found that those that train with VR were four times trained faster than those who had similar training within the four walls of a classroom. This is because whilst it took those in the classroom to take the training for two hours, with VR the time was reduced to 29 minutes. The study further found that those who studied using VR were 245% more confident in discussing the outcome of what they learnt and were 275% more confident in going forward to apply the skills they have learnt in real life unlike those who had traditional training method. (PwC VR Soft Skills Training Efficacy Study,2020).

Examining the successes recorded with the application of VR from a different perspective, Saunders et al (2019), suggest that it appears the field where the VR technology is applied seems to determine how effective the training is. This position was based on the outcome of a study conducted for police officers. One set was trained using virtual reality and the other was trained in the usual traditional live exercises and it was found that there was no difference in their learning outcomes. This implies that in terms of outcomes, VR and traditional training can produce the same result depending on where both are applied. Regardless of this, the study proved that VR can be used to achieve similar results with traditional training methods, and this can be accomplished with the many other benefits that VR has that the traditional training does not.


Figure 1: VR adoption for different trainings. Sources as indicated.

Figure 2: VR adopted for driving training. Courtesy Lang et al (2018)

Figure 3: VR used for wheelchair training. Courtesy Li et al (2020)

### 2.1.3 VR benefits and challenges

There are many benefits attributable to the use of VR in training but one significant one is the ability of the technology to adapt to a variety of training purposes without necessarily changing the hardware. It then means that the technology offers the developers the chance to reuse existing hardware to suit different training purposes without the need to create a new one. This makes technology flexible to a large extent and from a business perspective, this can save cost in both the short and the long run (Baron,2021).

Aside from this Blount (2021) note that another immense benefit of VR technology is its ability to simulate dangerous and complex scenarios in a real-life way without putting or exposing the trainees to danger. For occupations in the fields of medicine, military, firefighting, and construction work that involve climbing great heights, VR be applied for such training without necessarily putting the trainees at the risk of real danger. In like manner, VR is capable of simulating scenarios that ordinarily will be very expensive to set up in a real-life environment using traditional training method. This makes VR a less costly alternative yet one that can provide the much-needed learning experience when the need arises.

In addition, Chang et al (2022) opine that VR can be used to train soft skills. The absence of a real-life situation reduces the pressure on the trainee thus allowing him to make mistakes during the simulation process without feeling shame whilst still learning. The trainee can learn from his mistake and make the necessary corrections in the process of taking the training. Thus, VR can be used to teach the trainee cognitive and interpersonal skills that are needed for real life situations. More so, the application of VR in training has been found to have other significant benefits such as improving the effectiveness and efficacy of training; helping with knowledge retention; building the confidence of the user in learning and in the application of what has been learnt. (Dieck et al. 2021)

Examining the benefits from a business perspective, Barnard (2019), is of the opinion that with the use of VR in training comes the benefits of cost reduction and the ability to reuse the assets of the technology to suit other training purposes. This is an attractive aspect to many organizations that want to invest in technology. With regards to work force training, the use of VR could help reduce the loss of productivity and resolve the lack of qualified training instructors. It could also help mitigate unemployment as it provides a variety of hands-on

experience and workplace simulations that can reskill the workforce (li et al. 2020; Brahim,2020).

Lacko (2020), is of the opinion that VR training adds value to the workforce because it reduces safety and health issues for high-risk occupations. The technology has the capacity to enhance hazard inspections skills and reduce the risks associated with emergencies and the movement of workers during work. Therefore, VR training can improve workers skill, improve the interpersonal skills of trainees, raising workers awareness at work and enables workers to properly assess work related risks and how to mitigate them. (Akdere et al. 2021a).

All these benefits do not mean that the VR technology is perfect or is without its own challenges. As a matter of fact one of the common challenges that comes with the use of a virtual reality headset is the motion sickness which comes with symptoms such as eye fatigue, nausea and disorientation.(Chang et al. 2020).According to Gordon (2021), the cause of the "VR sickness" as it is often referred to is due to the movement within the virtual environment when the physical body is actually still. This is what causes the disorientation of the user, and the body reacts to this in different ways in different people.

Cole (2021), note that to solve this challenge, game and App developers have come up with the process that will allow the VR user to teleport (instant change of location). This gives the body of the user a feeling of transitioning from one point to the other rather than standing or sitting still in one location in real life. The ability to teleport is a paradigm shift from the traditional system of using a controller to move from one location to another. Another challenge as cited by Ahir (2018) is that most of the controllers used in VR training come with consumer grade headsets that can track the human hand, but they still lack the ability to track fine hand and finger interactions which is an aspect that many jobs require.

Even with all these listed benefits, the upfront cost can deter many organizations from adapting the technology for training purposes. Aside this, the motion sickness that comes with the use of VR is a disadvantage for some trainees who do not like the feeling or those who have health conditions that might be aggravated by the "VR sickness". Nevertheless, the benefits and application of VR Technology far outweighs its challenges, and this should be a motivating factor for its adoption and use in training (Cook et al,2019).

## 2.2 THEORETICAL FRAMEWORK

The theoretical framework of this study is anchored on two relevant theories namely the cognitive theory of multimedia learning and the Technology Acceptance Model (TAM). These two theories were considered appropriate as they address the issues of cognitive development in training and the appeal that a technology has that would warrant people to use it. It has been established from literature that VR can develop the cognitive abilities of its user and its adaptation has also been proved to be based on user's acceptance of the technology. These are reasons why these two theories are applicable to this study.

### 2.2.1 The Cognitive Theory of multimedia learning

The theory is based on the work of Mayer (1997) but draws its basis from other theoretical paradigms such as dual coding theory (Paivio,1986; Clark and Paivo,1991), model of working memory (Baddeley,1992), cognitive load theory (Chandler, Tierney and Cooper,1990; Chandler and Sweller,1991) and SOI model of meaningful learning (Mayer,1996).

According to Wajdi et al. (2014), the Cognitive theory of multimedia learning hold the view that every learner possesses a visual system that processes verbal and non-verbal information such that all auditory and visual information goes into their respective system for processing. In multimedia learning Lacko (2020) states that the learner is engaged in three key cognitive processes:

1) Selecting: which is applied to any incoming verbal or visual information to yield a text or image base.

2)Organizing: which is applied to the text/image base model to create what the processing system is to explain and.

3) Integrating: which occurs when the learner establishes connections between the verbal and visual information that the system has organized.

Lang et al. (2018), note that in the application of the theory five major principles have been developed for multimedia learning. The five principles are:

**1.Multiple Representation Principle**: The principle is that it is better when an explanation is given to present them in words and pictures rather than in words only. In essence, a presentation made using two modes is better than using a single mode so that when a learner is not able to recollect one, he will recollect the other. This is called the multimedia effect.

**2. Contiguity Principle:** The principle is that when a multimedia explanation is presented, words and pictures should be presented contiguously and not separately. This is based on the premise that learners understand better when words and pictures are presented at the same time because it helps have a mental picture as well as a verbal understanding of what is explained.

**3. Split-Attention Principle**: This principle expects that words should be presented auditorily and not as visual screen text. This is because, visual and auditory information can overload the information processing system of the learner and to avoid this there is a need to split visual and auditory information and present them the way they ought to be presented for a better learning experience.

**4.Individual learner Principle**: According to this principle, every multimedia effect such as contiguity and split attention depends on individual differences in the learner. For instance, there are students with high prior knowledge who can generate mental pictures of what is been explained, so providing visual representations may not be needed. At the same time there are others who would require pictures of what is explained for a proper understanding. This is where the individual differences come in.

**5. Coherence Principle**: The principle is that students learn better when a coherent summary which highlights the salient points is presented rather than giving explanations with many extraneous pictures and words. In essence, a shorter presentation has the capacity to make the learner select relevant information and organize what is learnt productively.

Ekezie (2016), opine that even though all the highlighted principles are relevant and are subject to further testing, there is no doubt that the theory has demonstrated how it is possible for learning to be approached from the perspective of the learner. Cognitive theory is applied in VR training in the sense that the technology applies to both the visual and auditory modes of learning. Apart from this it is also centered on the learner because VR can be specifically constructed to suit the learner's learning objectives and the expected outcomes.

### 2.2.2 Technology Acceptance Model (TAM)

TAM is founded on the Theory of Reasoned Action (TRA) and the model emulates how the customer comes to accept and use an innovation or technology. Over the years the TAM model has been expanded and customized. This study shall present three such TAM models.

#### 1.TAM 1

The first model was created by Davis et al (1989) for computer technology acceptance and was applied to clarify the acceptable behavior of individuals. The model substitutes some of TRA's attitude factors with two variables of technology acceptance which are perceived ease and perceived usefulness. The model was based on the hypothesis that perceived ease and perceived usefulness act as a mediator for the impact of external factors.

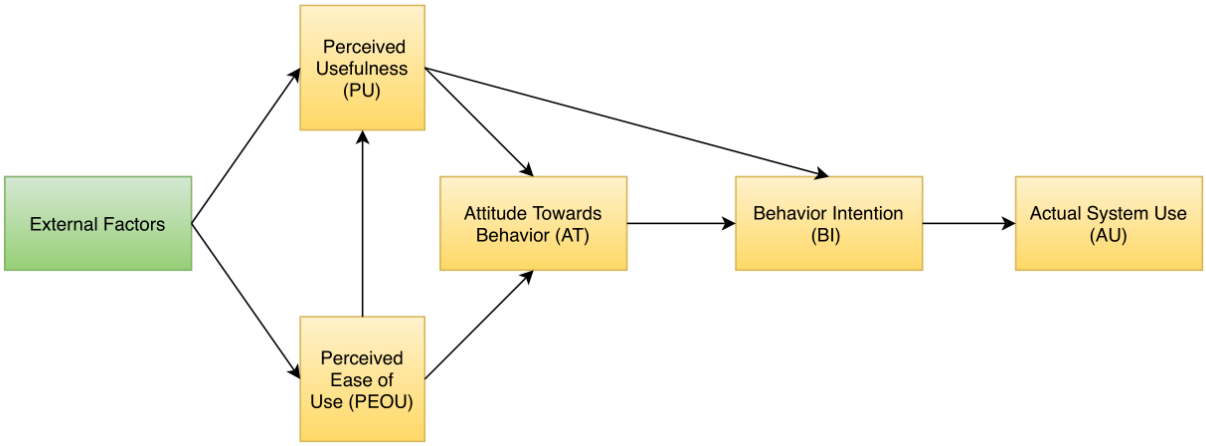
Table 1 provides the constructs of TAM for ease of reference. (Source: Samar et al. 2020)

| Construct | Definition |
|---|---|
| Behavioral Intention | An individual intends to act in a manner without guarantees to do so |
| Attitude towards behavior | The extent to which a person thinks that acting the behavior is positive or negative |
| Perceived usefulness | The extent to which an individual accepts that employing a certain application framework will raise his/her work performance in an organization |
| Perceived ease of use | Measures the level to which a person assumes that employing a system is effortless |

Table 1 indicates that TRA has four constructs. However, the actual use of the system is basically affected by behavioral intention which on its own is equally impacted by attitude towards behavior and perceived usefulness. In like manner attitude towards behavior is

impacted by perceived ease of use and perceived usefulness. The TAM model relies on perceived usefulness and perceived ease of use to examine the belief and attitude of an individual to the approval of computer technology. (Alambaigi, &Ahangari,2016).

Figure 4 provides the relationship between the TRA constructs (Source: Samar et al. 2020).




Fathema et al. (2015) argues that these models have two limitations. The first is the poor variance in investigative studies and the second is the inadequacy emphasis of external factors as variable factors facilitating conditions.

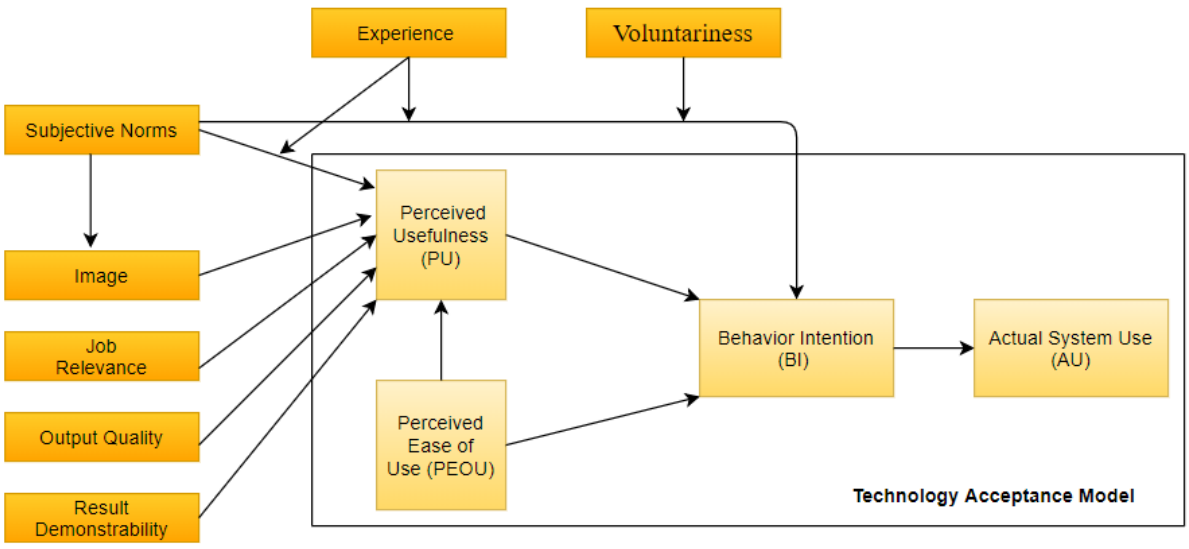
**2.TAM 2**

In the TAM 2 model Venkatesh and Davis (2000), expanded the model by clarifying the factors that determine perceived usefulness. The expansion included social influence variables such as image, subjective norms, and voluntariness; cognitive processing variables such as perceived ease of use, output quality, job relevance and result demonstrability. Table 2 captures the constructs of the TAM 2 model.

Table 2: The constructs of TAM 2 (Source: Samar et al. 2020)

| **Constructs of perceived usefulness** | **Definition** |
|---|---|
| Subjective norm | The extent to which an individual feels that people are supposed to carry out a behavior |
| Image | The degree to which the status of a person is viewed to be improved by the employment of innovation |
| Job relevance | The level of correlation between the innovation and the persons job |
| Result demonstrability | Visibility of results |
| Output quality | The extent to which novel technology executes work made by the user |

Figure 5 captures the relationships between the constructs of the TAM 2 model.




The major criticism of the TAM 2 model is that the model is not complete because it does not determine the factors that impact the perceived ease of use.

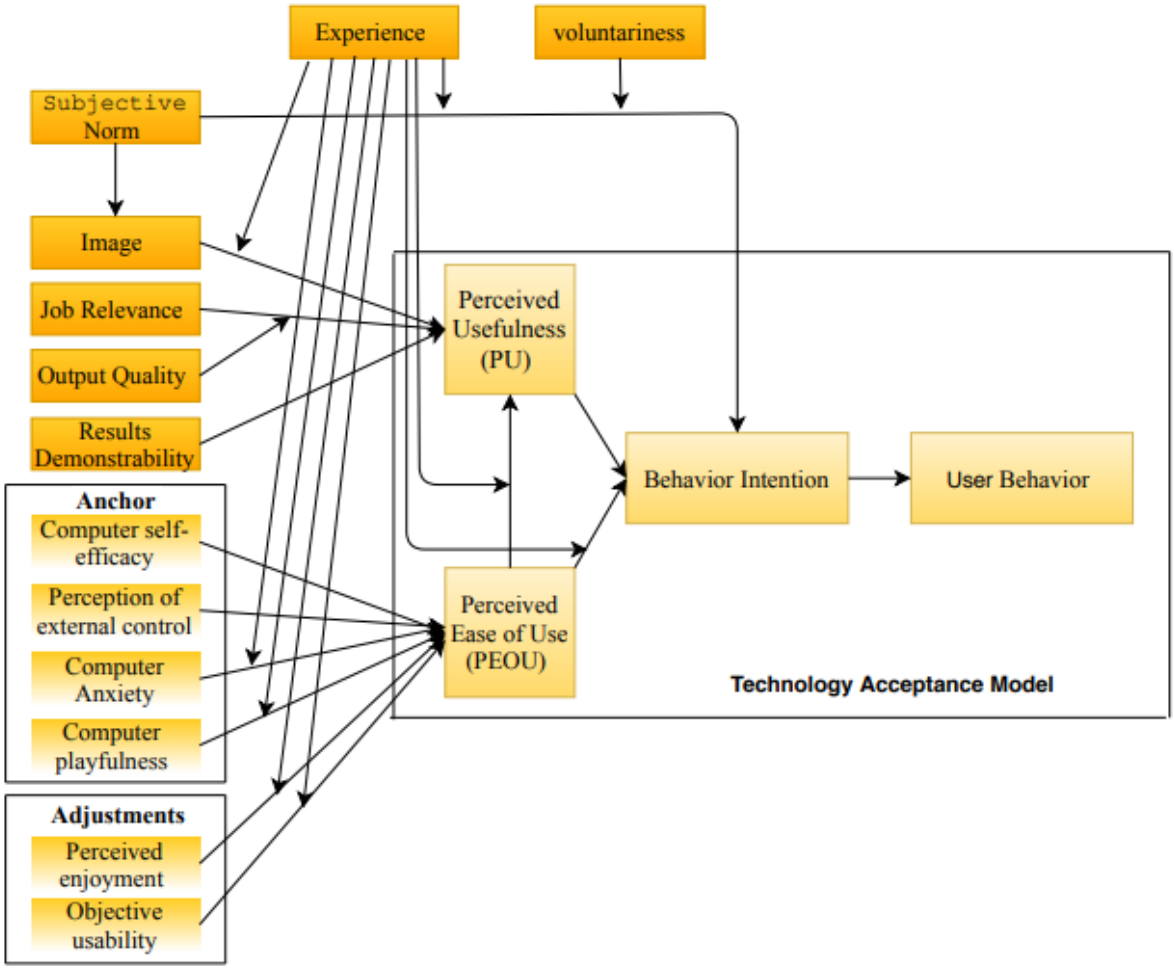
### 3. TAM 3

In the model identified as TAM 3, Venkatesh et al (2003), the key factors addressed were related to perceived ease of use. Developers of the model propose that experience is a mediator among perceived ease of use variables which are captured in the construct as presented in table 3.

Table 3: The constructs of TAM 3 (Source: Samar et al. 2020)

| **Constructs of perceived ease of use** | **Definition** |
|---|---|
| Computer anxiety | Concern of the potential of utilizing a computer |
| Perceived enjoyment | The level to which applying a particular framework is considered interesting on its own regardless of consequences. |
| Computer self-efficacy | The level of belief that using the computer can make one achieve a particular work |
| Computer playfulness | The fundamental inspiration to cooperate with the new framework |
| Objective usability | Comparison of the effort between the actual and the user perception of the technology to achieve specific tasks |
| Perception of external control | The level to which a person supposes that organizational assets are obtainable to ease the system use |

The relationship among these variables is captured in the figure 6 as cited by Samar et al. (2020)




The criticism of the TAM 3 model is that it is complex and that is a constraint on its applicability.

## 2.3 CHALLENGES AND OPPORTUNITIES OF VIRTUAL REALITY TRAINING IN NIGERIA

Personnel training in Nigeria aids in improving positive transfer of knowledge and skills however, in some circles and especially with newly recruited personnel, this can be a challenge. Training can come in different forms and according to Ekezie (2016), the secondary aim of every training might differ from one organization or the other but primarily training aims to 1) ensure job satisfaction 2) improve productivity, 3) increasing moral, 4) reducing employee turnover, 5) improving employee coordination and, 6) reducing the need for close supervision.

The application of Virtual Reality for training is not as pronounced as it is in the Western world, but this does not in any way suggest that the technology is not available. Even with the dearth

of literature on the various areas where the technology has been applied in Nigeria. Studies have shown that its application has been visible in areas such as education, training, the military and even in the medical profession. There are also many game centers where the technology is available for those who love VR entertainment. (Abdulahi,2020; Anaza,2017).

Adekomi (2014), opine that traditional forms of training have always been the go-to for many organizations when it comes with training but the advent of VR, the mode of training has changed to now accommodate more technological innovations. Despite all the advantages of applying VR in training as provided in this study, the application of the technology in Nigeria is faced with an array of challenges which are:

### 2.3.1 Challenges

**1. Cost:** The high cost of the VR technology is a major concern that impedes its level of application for training purposes in Nigeria. The price of VR systems that can offer complex and diverse functionalities are very expensive and not many organizations or training institutes can afford them. In addition to this challenge also comes that of the high and fluctuating exchange rate of the Naira to the USD which creates a financial burden on any organization discerning to adopt the technology. (Adekomi,2014).

**2.Health issues:** People who have used VR technology either for training or for sports have complained about the health implications as trainees have raised issues about having headaches because of eye strain brought about by the long use of the headset. There have also been reported cases of nausea and dizziness by some trainees. The only proffered solution to these health issues is that the trainee discontinues the use of the headset and rests for a while for the strain and stress to dissipate. Even as technology evolves and ways are being examined to reduce the identified health related issues, the health concerns have not gone away and it remains a fundamental limitation for VR technology (Omojah,2020 et al.).

**3.Low level of application:** Despite its many advantages, the level of applicability of the VR technology in Nigeria is still low in terms of interest and technical know-how amongst organizations. Aside from the high cost and low level of interest, the application of the VR technology will require that the trainer get familiar with training paradigm using the virtual simulation created before he can train others. This would be impossible in a situation where the trainer is not familiar or lacks the knowledge required to use the virtual interface.

**4.Power supply:** The poor and epileptic power supply in Nigeria is an impediment to the use of technological innovations for training .With many organizations relying on alternative sources of power to run their businesses in Nigeria, the cost of running the organization is increased in the long run and this makes the introduction of VR technology into training programs less desirable to the trainers and employers if the cost of acquiring the technology is factored in.

**5.Software development**: The development of VR software should be modeled to simulate the real environment and the situation that the trainer will be involved in for the training to be effective. If this is achieved, the trainer and the software developer need to work together to develop unique software for each aspect of simulation required. (Baenard,2019). The challenge with the Nigerian situation is that the level of computer knowledge is not at per with that of the developed countries hence the imported software technology can only be adapted to whatever scenario the trainer wants to use it for as there is no home-grown VR technology.

### 2.3.2Prospects

Notwithstanding these challenges Omojah et al (2020) is of the opinion that VR technology offers simulations, hands-on-training and concept visualization which offers both the trainer and the trainee limitless opportunities. The possibility of creating anything imaginable and the growth potential of VR in Nigeria, the opportunity in the country seems limitless.

Omojah et al (2020) identified the following prospects for the VR technology in Nigeria:

1. One of the major prospects of VR in Nigeria lies in the unique interactivity and immersive ambience it provides for the trainee. Apart from the ability to use it for individual training tasks, group training can also be undertaken. As more and more organizations come to appreciate what the innovation offers, the level of application will be on the rise and with this will come the increase in use VR training for diverse training programs which will cut across different spheres of human endeavor and workplace objectives.

2.Even though the cost of acquiring the VR technology is a major concern in Nigeria for now, advancement in technology will in the long run reduce the cost of VR software and hardware including the accessories that come with them. Even in a situation where the price drop does not come as at the time expected, the immense benefits that VR technology provides for the

training of personnel far outweighs the cost and with time, many organizations will take advantage and begin to apply the innovation in their training programs.

3.Since 1999, Nigeria has had a stable democratic system of governance and with this stability comes the boost to private sector and foreign direct investments into different sectors of the economy including technology. With the influx of foreign companies coming to establish their business in Nigeria will also come the transfer of technology and a new way of carrying out training for the work force. In trying to meet international standards for manpower training, Nigeria cannot afford to be left behind in applying technological innovations. This portrays hope for a greater level of adoption of VR in Nigeria.

## 3. **RESEARCH DESIGN AND METHODS**

### 3.1 The Research Philosophy

According to Saunders et al (2003), a research philosophy relates to both the nature of knowledge and the development of knowledge in the sense that it helps a researcher to acquire and develop knowledge on a particular field of study.

In line with this Collis and Hussey (2003) consider research philosophy to be the logic of inquiry governing each approach of research. Going by these explanations, the study shall consider two main research philosophies namely, the Interpretivist and the Positivist.

The Interpretivist approach, or paradigm as some schools of thought call it, seeks to make sense, and understand the motive behind the intentions and actions of individuals to understand why and how they do what they do. The paradigm also seeks to apply detailed information gathered from the participants of a study and to analyze events and interpret them in the real word context (Lee and Ling,2008).

According to Nueman (2007), the interpretivist approach involves an interaction between the researcher and the participants of the study. It relies on qualitative methods of research and the application of interviews and observations for the gathering of data which are subjected to analysis for interpretation.

Other attributes of the Interpretivist paradigm are that is it narrative in nature, it is also inductive and subjective because the approach provides the researcher the opportunity to show his intentions and opinions on the subject matter with the understanding that no two circumstances are the same. (Saunders et al. 2003).

The Positivist philosophy is different from the Interpretivist paradigm in so many ways. For one, in the positivist paradigm, the approach deals with the reality of things based on the explanation and description of how the reality is observed. The approach is underlined by the fact that the imperfection in humans make people liable to make mistakes and as such the paradigm holds the view that this must be put into consideration if the researcher is to make sense of the ideas and opinions of people before drawing up conclusions. This is why such information is subject to proof and verification. (Cohen and Crabtree, 2008).

Beech (2008), opine that the Positivist approach seeks to gather facts or find out the causes of an event without allowing the opinions or the state of mind of the participants of the study to influence the outcome. The approach therefore follows the pattern of logical reasoning in the way the research is carried out. According to Gray (2014), the positivist approach has these other attributes; it is deductive in nature, allows for the test of hypothesis, it employs quantitative data in the research process. And it can be replicated.

Saunders at al. (2003) gave the advantages and disadvantages of both approaches. As presented in table 4.

| Advantages | POSITIVIST | INTERPRETIVIST |
|---|---|---|
| | Ideal for the collection of large quantity of data | Ideal for studies that seeks to understand 'why' and 'how' |
| | Clear focus on the research is established from the beginning | The researcher is actively involved in the research process and the outcome. |
| | Allows the researcher to be in control of the research process. | The approach is ideal if the intention is to understanding social processes |
| | Easily comparable data | |
| Disadvantages | Highly structured process which leads to Inflexibility | Takes time to gather data |
| | Not ideal if the intention is to understand social processes | Data analysis is difficult |

### 3.2 Type of Research: Qualitative/Quantitative

The study shall consider two research types namely, the quantitative and the qualitative approaches.

#### 3.2.1The Quantitative Approach

The approach has the following attributes: it is systematic in nature, it requires the gathering of data in quantitative form, it depends largely on the use of numbers and statistics, its analysis relationships between established variables and its applicable when there is a need to test hypothesis. (Borrego et al. 2009).

In addition to this, Mohamad and Mohamad (2008) mentioned that this approach has other characteristics such as the research process can be controlled to provide clear and unambiguous answers, the process can be replicated, it enables in-depth analysis, and it is measurable and reliable.

Despite its advantages, Yin (2003) notes that this approach has been criticized because it is complex and might not be suitable in certain situations. It is also capable of leading to assumptions that the outcome of the study can be generally always applied to all people. Aside from this the process does not give room for the participants of the study to have their unique account and experiences interpreted to give them the meanings that suit what they experienced.

#### 3.2.2 The Qualitative Approach

In the opinion of Beech (2008),this approach has the following attributes; it is descriptive in nature and very subjective, it is ideal for studies that focus on assessing the behavior, opinions and attitudes of people, it is based on the interpretivism paradigm and it allows the researcher and the subject of the investigation to be linked in such a way that the outcome of the study is created by both of them.

Mayor and Blackmon (2005) identified the strength of this approach as follows:

1.Since the researcher is directly involved in the research process, he has the chance to gain insights into new forms of knowledge that might be gained from the process.

2.It is descriptive and narrative.

3.It is the best approach to adopt because it suggests all possible causes of the event that is studied.

The weaknesses of this approach according to Beech (2008) include 1) It is easy to replicate as there are differences in the context of events, 2) Since the approach is subjective, the reliability and validity of the approach is weak, 3) Data collection takes time.

### 3.3 DATA COLLECTION METHODS

The data collected for this research work were mainly derived from secondary and primary sources. These two shall be examined briefly:

**1.Secondary sources**

According to Mohamad and Mohamad (2008), this source of data refers to unprocessed data or complied data that have been somewhat selected or summarized. received some form of selection or summarizing. it, or it can also be data that have received some form of selection or summarization. It can also refer to data that is sourced from published or unpublished materials such as academic journals, scholarly articles, and materials from the print media. Secondary sources of data have the advantage of been easy and faster to gather and it is also less expensive. The materials are also readily available and can be adapted for the use of study easily. The disadvantages are that there could be a dearth of data on the area of research which could affect the outcome of the study. The data may be biased, may not be easily comparable and because it is not applied for the purpose for which it was originally collected, the result may be compromised by how the data was collected. For this study the secondary information was collected from scholarly articles and studies of virtual reality available online.

**2.Primary sources**

Lee and Lings (2008) are of the opinion that these sources of data refer to information firsthand and from the participants of the study using research instruments like structured interviews or a questionnaire. The advantage of primary data is that it is raw, unedited, and directly obtained by the researcher based on the responses provided by the participants. This offers the researcher the opportunity of directly applying the information obtained to the study without fear of such data been compromised by bias. On the contrary, primary data has the disadvantage of taking time to collect and it can be time consuming depending on the volume of research participants that will be engaged for the study. (Lee and Lings,2008).

For this study the primary data was obtained from the responses of the participants via the research instrument distributed to them via mail. The research instrument has two major

parts. Section one focused on the vital information on the participating company and its experience with VR and section two has questions that pertain to the research questions developed for this study. The research instrument was sent to three participating companies that into using VR for training purposes in Lagos State, Nigeria. Company A was established in 2021; company B in 2020 and company C in 2014. Each of them was established by trained and certified professionals who have been in the employee training industry for decades with vast experience in training and human capital development. All the companies that participated are based in Lagos, Nigeria.

## 3.4 DATA ANALYSIS METHODS

All the data gathered shall be analyzed using descriptive statistics. All the data shall be based on the information obtained via the research instrument. The data shall be presented using simple frequency tables which will include the responses of the respondents based on the options provided for them to select from. Charts will be used to provide a graphical representation of the tables. A simple analysis of each table shall be provided as inferred from the responses gathered.

## 3.5 RELIABILITY AND VALIDITY

### 3.5.1 Reliability

According to Mayor and Blackmon (2005), opined the reliability of a study has to do with whether if a particular technique is applied severally to the same object, produces the same result each time. The reliability of this study is based on the premise that careful and necessary steps to remove bias by gathering information from both primary and secondary sources. In addition, the contents of the research instrument were also vetted by the supervisor to ensure the research questions designed for the study were captured. It is also important to mention that the study was carried out in accordance with the rules of the university guiding the writing and presentation of a master thesis.

### 3.5.2 Validity

Unlike reliability, the Validity of a study describes the extent to which an empirical measure adequately captures and reflects the true meaning of the concept that is under consideration. Validity therefore has to do with the research truly measures what it was meant to measure

from the outset and how the results of the study reflect the true existence of what the study intended to capture. (Mayor and Blackmon ,2005),

The validity of this study is based on the fact that the study has been focused on the application of virtual reality and how its use has been essential for employee training and performance.

## 4. FINDINGS

The research instrument for this study was presented to three companies in Lagos Nigeria, that are into employee training, human resources, and human capital development. Each of them got five questionnaires making a total of 15. Of this number 13 were retrieved and the responses from them shall form the basis for the analysis presented in this chapter.

### 4.1 FIRM DEMOGRAPHY

Table 4.1.1,

| **Firm** | **No of years in practice** | **Number of employees** |
|---|---|---|
| A | 2 years | 7 |
| B | 3 years | 6 |
| C | 9 years | 10 |

Table 4.1.1 provides the year each of the companies sampled has been in practice and the number of employees they have. The study is of the opinion that these companies have been into training for a reasonable period, and they have a number of staff that can push the training objectives of the companies forward. It is also important to note that they ventured into VR training years after they were all established, an indication that there were factors that motivated each of them into venturing into VR training.

**Table 4.1.2: Qualification of employees**

| Educational Background | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| HND | 2 | 15.4 | 15.4 |
| B.A/B.Sc. | 6 | 46.2 | 61.6 |
| M.Sc. | 5 | 38.4 | 100.0 |
| Total | 13 | 100 | |

**Table 4.1.3: Work experience of lead instructors**

| Work experience | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| 1-5 Years | 3 | 23.1 | 23.1 |
| 5-15 Years | 5 | 38.4 | 61.5 |
| 20-25 Years | 3 | 23.1 | 84.6 |
| ABOVE 25 years | 2 | 15.4 | 100.0 |
| Total | 13 | 100 | |

**Table 4.1.4: Training Modalities**

| Work experience | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Designed to suit the needs of the trainees | 6 | 46.2 | 46.2 |
| Done in line with existing modules | 2 | 15.4 | 61.6 |
| Both | 5 | 38.4 | 100.0 |
| Total | 13 | 94.3 | |

In terms of academic qualification, an examination of the three companies indicate that they all have employees who are educated (see table 4.1.2) with 15 % having HND, 46% B.A/B.Sc. and 38% having M.Sc. This shows that all the employees are educated and would understand what the study is set to achieve. A look at the employee's job experience of the lead instructors from table 4.1.3 indicate that 23% of them have on the job experience ranging from 1-5 years and a cumulative of 77% have job experiences from 5 years and above. This shows that the employees have vast experience in human capacity training which includes training using VR technology. It also means that their responses can be relied on as coming from years of on-the-job experience in this field. From table 4.1.4 we found that the companies rely greatly on having training modules designed to suit the needs of the trainees (46%) and often combine this with the use of existing modules when the training needs demands it.

Despite the differences in the demographics of the firms as observed in table 4.1.1, the study found that they all have a lot in common in terms of the modalities of their operation, especially in the aspect of training. For one, all the firms have training programs that are designed to raise the efficiency if those who enroll in any training course to enable them to perform better at their respective jobs. These training programs come in stages and the first stage is the determination of training needs of the trainee. This stage involves knowing the quantities and qualities of the employees to be trained so that the new skill set they will acquire will be in line with what is required by the organization for the advancement of both personal and organizational growth.

After this comes the next stage which is designing the training program. It is at this stage that the solution to the training diagnosis in the first stage is offered. Activities in this stage include determining the objectives of the training program, knowing the sequence in which the training topics and materials will come for knowledge optimization, knowing how long each training will take and the best location to have the training, and setting the controls that must be met by the trainee during the trading program. Other considerations at this stage are determining the number of trainers required and setting the budget for the training.

The third stage is where plans are made on how best to manage and implement the training program. This stage involve knowing the right quantity of each topic that the trainee requires to reach the desired training program goals and making provision for the training requirements of each participant in the training, The fourth and final stage is the termination of the training

program and this include performing the following duties such as doing; a review of the program taking into cognizance the performance of the trainers and the trainees and reviewing how the training program was implemented and how it reflects on the work and the environment in accordance with the system followed. The review and evaluation help the training organization to determine if they were able to meet their set objectives.

## 4.2 APPLICATION OF VR IN EMPLOYEE TRAINING

Table 4.2.1: The type of clients that engage the training firms.

| Client | | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| | Private organizations | 7 | 53.8 | 53.8 |
| | Government agencies | 3 | 23.1. | 76.9 |
| | Both | 3 | 23.1 | 100.0 |
| | Total | 13 | 100.0 | |

From table 4.2.1, it was found that these companies have clients that vary from private organizations (irrespective of specialization) to agencies of the government even though the table indicates that 53.8% of their engagements come from the private sector. Despite this, it is obvious that VR training is appreciated by both the public and the private sectors in Nigeria and as such the potentials for growth and further application in these sectors is commendable.

Table 4.2.2: How do you get VR engagements

| VR engagements | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Referrals | 6 | 46.2 | 46.2 |
| Marketing | 3 | 23.1 | 69.3 |
| Both | 4 | 30.7 | 100.0 |
| Total | 13 | 100.0 | |

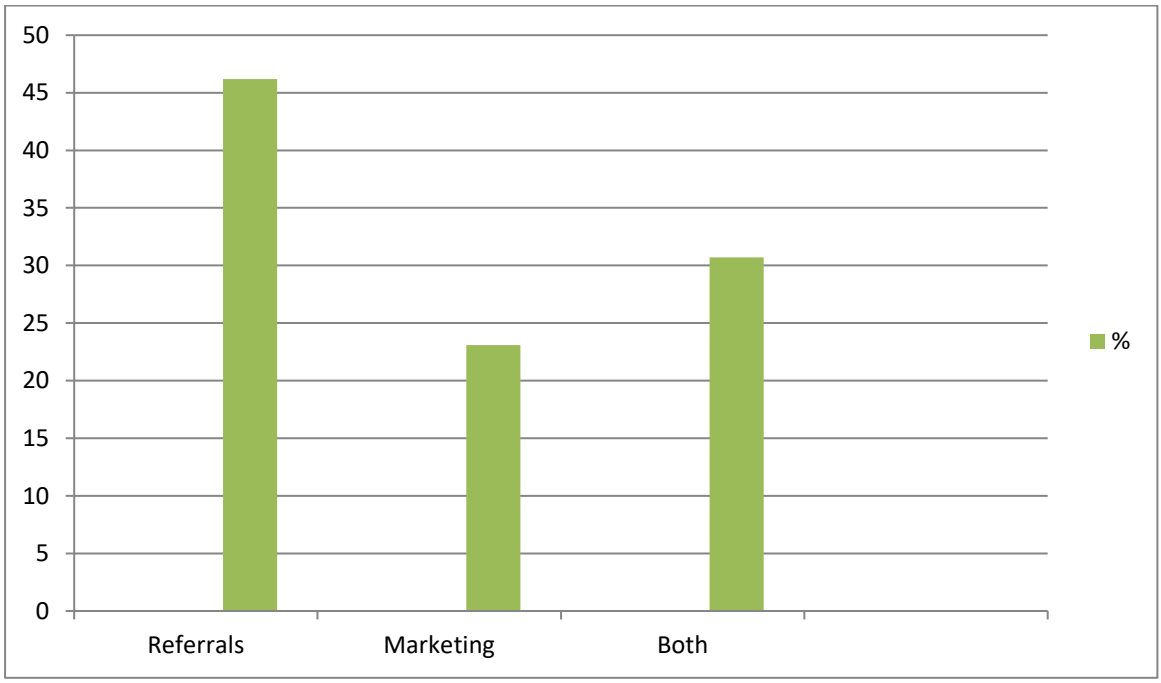



Figure 7 How the companies get their VR training engagement:

Even though VR is not new in Nigeria, its application in the areas of training is not as diffused as the long age traditional training methods. In essence, those who engage these sampled companies are organizations that are exposed to use of VR in staff training, and they want such benefits to be enjoyed by their organizations. As the sampled firms all began with using the

traditional training techniques for employee training before venturing into VR training, it is expected that their clients will be the first set of people to know of the innovation that they have added to their training approach. Expectedly and as indicated in table 4.2.2 46% of the respondents noted that their VR training engagements come mostly from referrals and only 23% come from marketing which is mostly done online.

Table 4.2.3: Changes in VR training and its present state in employee training

| Changes | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Little change | 2 | 15.4 | 15.4 |
| Average change | 2 | 15.4. | 30.8 |
| Significant changes | 9 | 69.2 | 100.0 |
| Total | 13 | 100.0 | |

According to table 4.2.3, 69.2% of the respondents indicated that VR training has witnessed significant changes over the years in terms of its application and in employee training in Nigeria. This indicates that as many organizations come to appreciate the use of VR in training and the advantages it has over the traditional training methods, the endless possibilities that the technology offers will continue to change the paradigm when it comes to employee training.

Table 4.2.4: Number of VR training done per year.

| Number of trainings | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| 10-20 | --- | ------ | ----- |
| 20-30 | 4 | 30.8 | 30.8 |
| 30-40 | 5 | 38.4 | 69.2 |
| 40 and above | 4 | 30.8 | 100.0 |
| Total | 13 | 94.3 | |

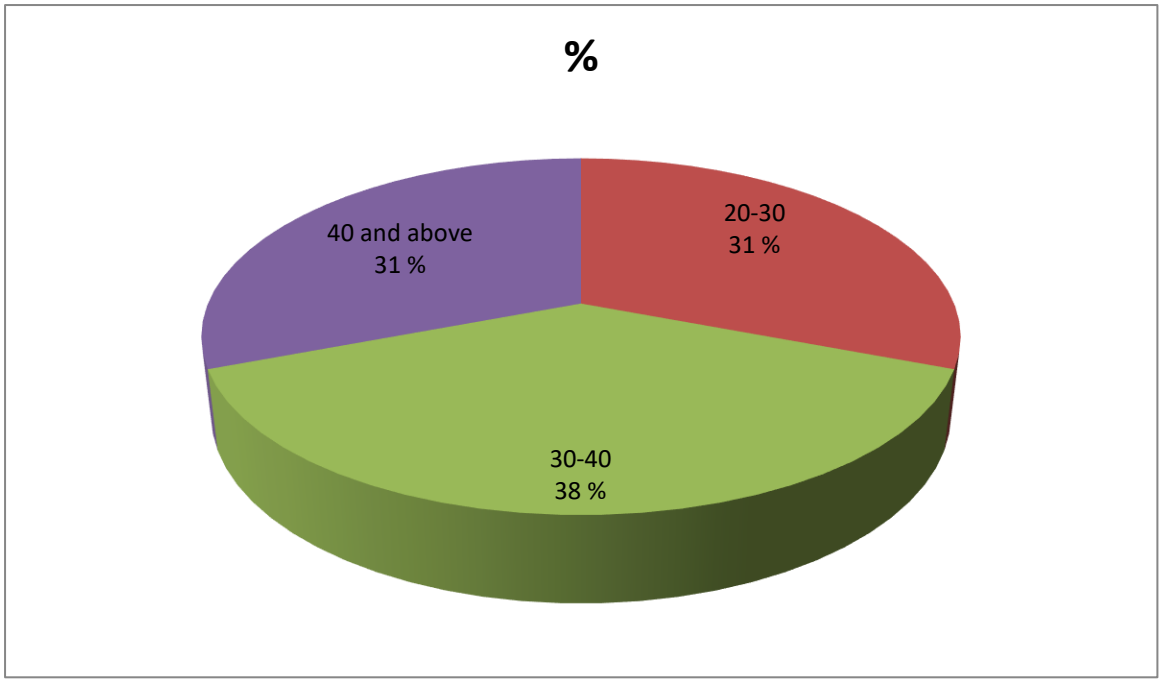



Figure 8 Number of VR training done by the companies per annum.

Table 4.2.4 indicate that there is a growing trend in the use of VR for training in Nigeria. Whilst this study is not privy to information about how many of such training were carried out in the immediate past, it is evident from the table that the sampled companies 30% of them handle between 20-30 of such training per annum and a cumulative of about 69% handle between 30 to more than 40 VR training per annum. That means that on average, they undertake 4-5 of such training per month.

Table 4.2.5: Preferred location for VR training

| Location | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Indoor training facility | 8 | 61.5 | 61.5 |
| Facility provided by client | 2 | 15.4 | 76.9 |
| Mutually agreed facility | 3 | 23.1 | 100.0 |
| Total | 13 | 100.0 | |

For companies that engage in employee training the training location is key and is carefully selected after it has been considered appropriate. In terms of preferred location for VR trainigs,61% of the respondents preferred to use their indoor training facility. This ensures that they are in control of the training dynamics, and it also affords them the opportunity of using the VR hardwires as already set up without the need to move and reset them all over again.

Where the clients prefer to use their own training facility, the companies will have to oblige even though only 15% prefer this option because of the possible loss of the advantage of control

of the training. In some cases, some clients will create room for such training within the office environment and by so doing disrupt the flow of proper training by virtue of unnecessary interruptions. For 23% of the respondents, they prefer to reach an agreement with the client on which of the options is preferable.

Table 4.2.6. Elements of VR training that motivates workers' engagement.

| Elements | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Interaction | 2 | 15.4 | 15.4 |
| Real life-like simulation | 6 | 46.2 | 61.6 |
| Vast learning possibilities | 5 | 38.4 | 100.0 |
| Total | 13 | 100.0 | |

Of the many elements that are attributed to the use of VR in training, 46% of the respondents suggest that the most engaging for trainees is the real life-like simulation it offers. For instance, there are some real-life situations that cannot easily be captured in training without exposing the trainees to danger and possible harm. This can be achieved with VR training.

This is followed by a 38% opinion that suggested that trainees get engaged in it because it offers a vast learning possibility covering many fields of human endeavor. There is hardly any training requirement that VR cannot be adapted to and simulated for training, and this is one of the elements that makes it an attractive training tool. 15% of the respondents suggest that it

is the interaction that gets some trainees engaged in VR. This is based on the premise that VR has the capacity of allowing the user to connect with the virtual environment in an interactive manner.

Table 4.2.7: VR training feedback mechanism

| | Method | Frequency | Percent | Cumulative Percent |
|---|---|---|---|---|
| | Feedback from client | 4 | 30.8 | 30.8 |
| | Appraisal of trainee before and after | 5 | 38.4 | 69.2 |
| | Both | 4 | 30.8 | 100.0 |
| | Total | 13 | 94.3 | |

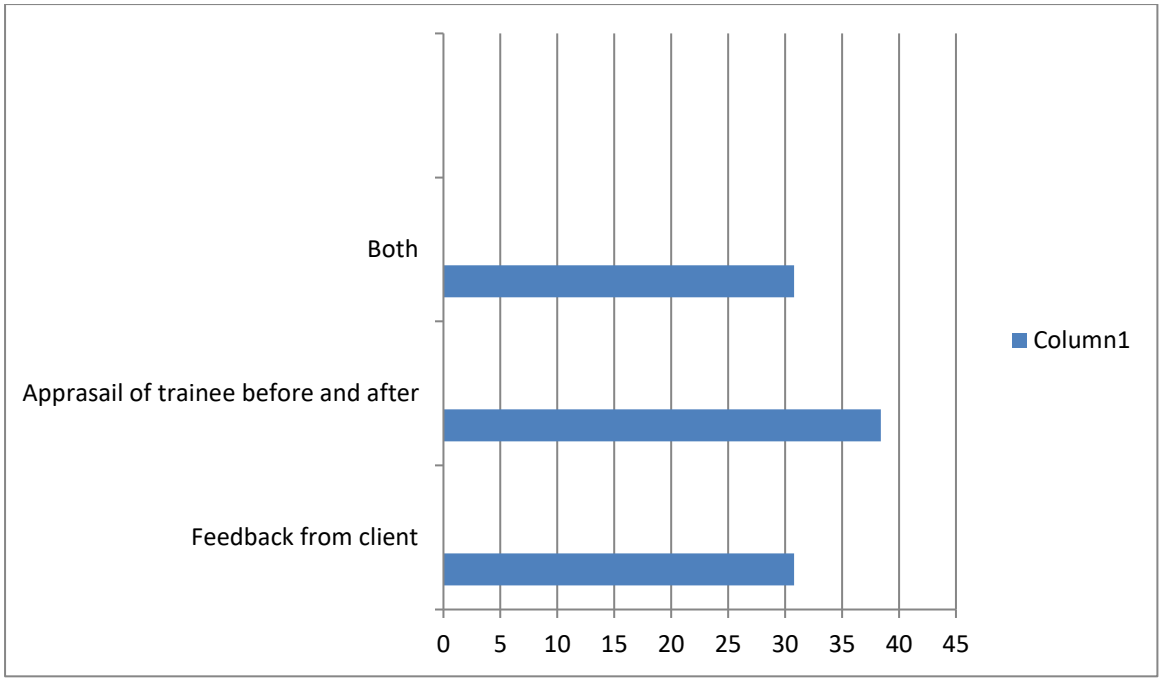



Figure 9 VR training feedback mechanism adopted by the companies.

As part of any training process, there is always a part for feedback which will indicate if the reasons for the training have been actualized. The companies have two feedback mechanisms, namely from the clients and from an appraisal of the trainee before and after the training. Knowing fully well that what happens within the organization of the client is outside the jurisdiction of the training compny,38% of the respondents noted that they prefer to rely on their in-house appraisal to determine how well the training went. 30% of them will not mind getting the feedback from the clients and 30% noted that both feedback mechanisms are applied in getting a robust and well-rounded opinion of how well the training went.

Table 4.2.8: Measurement of VR training effectiveness

| Measurement | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Based on set training objectives | 6 | 46.2 | 46.2 |
| Passing set tests | 7 | 53.8 | 100.0 |
| Others | ---- | ------ | |
| Total | 13 | 100.0 | |

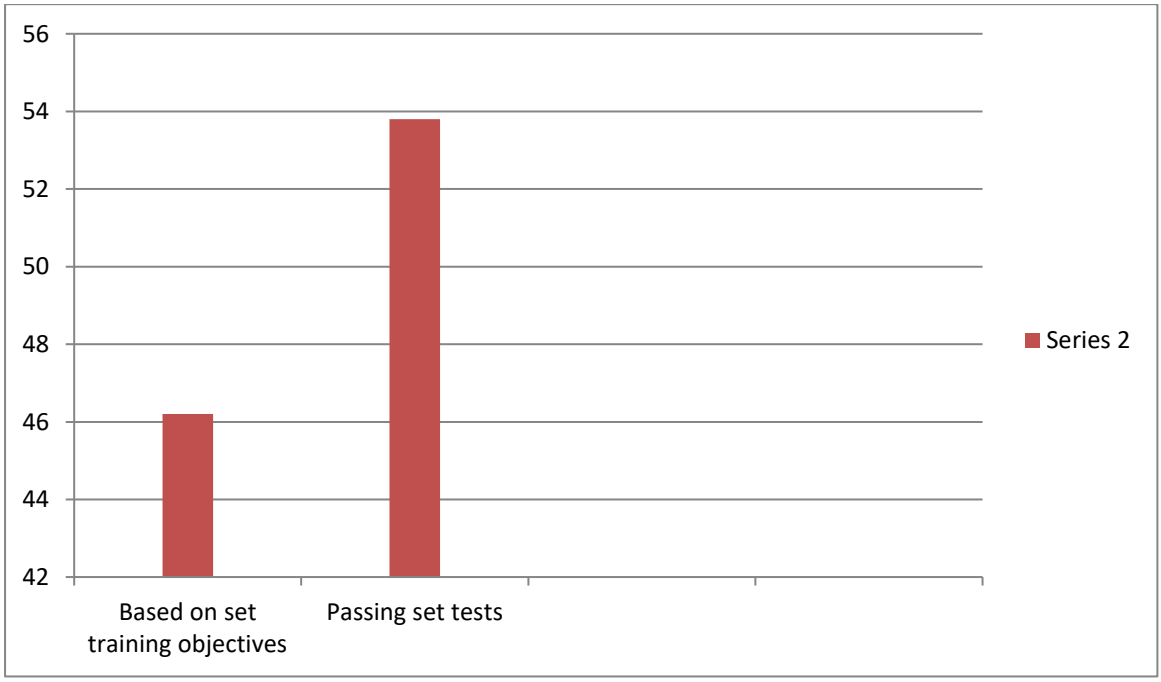



Figure:10. How the companies measure VR training effectiveness

The companies sampled also rely on two methods of determining how effective VR training is. The first is based on whether the training objectives as set by the client and the training needs of the trainees have been met. The second is determining how well the trainee has acquired the knowledge based on the trainee passing an internal self-evaluation test centered upon the training module.

Of these two methods 46% of the respondents indicated that they preferred measuring the effectiveness of the VR training based on if the objectives set for the training has been met.53% of them noted that the trainees will have to pass the test to show that they understood what was learnt and are able to recall the knowledge when the need arises

The study is of the opinion that both methods are appropriate. However, it is better if both methods are applied rather than applying one and ignoring the other.

Table 4.2.9: How trainee performance on the job is measured

| Measurement | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Feedback from the client | 9 | 69.2 | 69.2 |
| Feedback from trainee | 3 | 23.1 | 92.3 |
| Both | 1 | 7.7 | 100.0 |
| Total | 13 | 100.3 | |

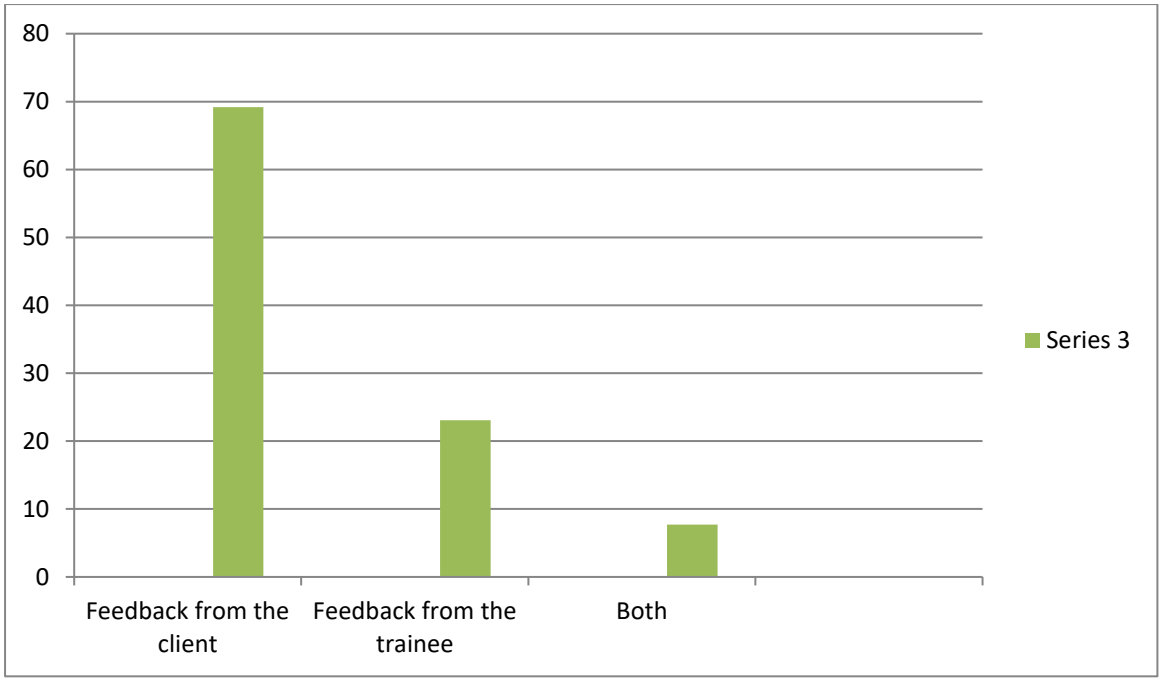



Figure 11: How the companies measure trainee performance:

The performance of an employee after a VR training can only be measured by the employers based on the job expectation expectations and work parameters. While it is not for the training organization to measure on the job performance of a trainee, the training organizations will rely on the feedback they get to ascertain if their training modules are effective or if their improvements that they need to effect. To this end and as captured in table 4.2.9, 69% of the respondents suggest that they rely on the clients for feedback on the performance of their employees after they have undergone VR training. 23% said they also get feedback from the trainees while 7% get it from both the clients and the trainees.

Table 4.2.10: In comparison to conventional training techniques, how successful is virtual reality in enhancing employee training outcomes?

| Success rate | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Averagely Successful | 2 | 15.4 | 15.4 |
| Very successful | 9 | 69.2 | 84.6 |
| Highly successful | 2 | 15.4 | 100.0 |
| Total | 13 | 100.0 | |

The success of both conventional and VR training depends on the expected outcomes. As this study has shown in the literature, there are some trainings where at the end of both the VR and the conventional training, the expected outcomes were the same even though it was faster to achieve that training using VR. However, VR has some advantages over the conventional training techniques which the literature in this study has captured especially in the areas of safety and efficiency in different workplace scenarios. To this end and in terms of enhancing employee training outcomes,69% rated the VR training as very successful and 15% rated it highly successful.

Table 4.2.11: Advantages of VR in employee training

| Advantage | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Practicality | 6 | 46.2 | 46.2 |
| Offers mixed modes of learning | 4 | 30.7 | 76.9 |
| Wide application for different job roles | 3 | 23.1 | 100.0 |
| Total | 13 | 100.0 | |

The respondents were presented with three advantages that are considered topmost among the advantages that VR training offers. Of these three 46% of the respondents suggest that its most important advantage is practicality.30% of them went for the mixed modes of learning that VR offers and 23% went for its wide application for different job roles. The study is of the opinion that the life-like practicality that VR offers is one of the most important features of technology. This explains its wide application in the fields of medicine and military combat where real and life-threatening scenarios can be simulated in such a way that the trainees will have a feel that they are having a real-life experience whilst learning.

Table 4.2.12: Disadvantages of virtual reality in employee training,

| Disadvantages | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Cost of the technology | 5 | 38.5 | 38.5 |
| Adapting one software for other uses | 2 | 15.4 | 53.9 |
| Poor power supply | 4 | 30.8 | 84.7 |
| Health issues | 2 | 15.3 | 100.000 |
| Total | 13 | 100.0 | |

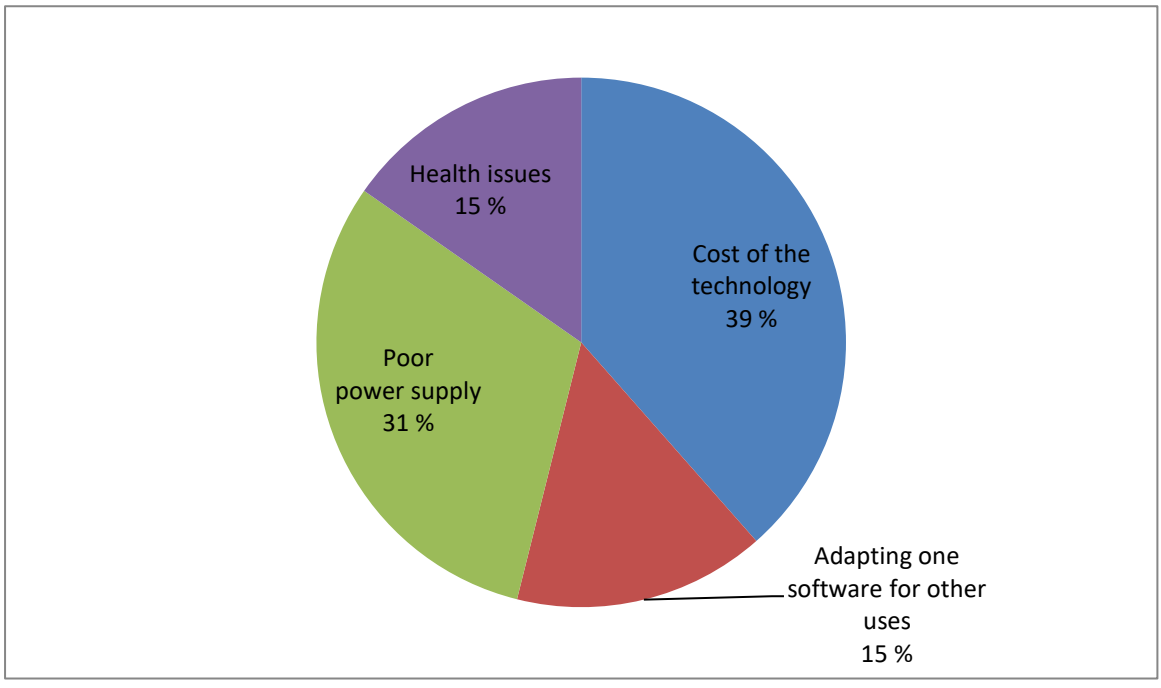



Figure 12 Disadvantages of VR training for employees training

The study presented the respondents with four disadvantages that come with VR training with reference to Nigeria. Of these disadvantages, 38% of the respondents suggested that the most challenging is the cost of acquiring the VR technology. This is understandable because both the soft and hard wares of VR used in Nigeria are imported and the cost fluctuates as a result of rising inflation and the exchange rate with the United States Dollar.

This is followed by 30% that suggested that the epileptic power supply in Nigeria is a major constraint. While this does not affect VR training only, conventional training can be conducted even when there is no power supply. This cannot be done with VR as the technology will need to be powered for it to be used. What the training organizations do is rely on alternative means of power supply which inadvertently adds to the cost of the training. 15% of them suggest that the major disadvantage is the absence of adaptability as they are unable to use one.

VR software for multiple trainings. Another 15% consider the health issues that come with using VR in training such as headaches and nausea as a big disadvantage, The study is of the opinion that health issues are not paramount as the dizzy feelings are temporal and moreover, there are first-aid provisions available to take care of trainees who might feel headaches and nausea.

Table 4.2.13: Implementation issues that come with virtual reality training.

| Issues | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| Designing specific training modules | 4 | 30.8 | 30.8 |
| Having training packages that suit different training needs | 8 | 61.5 | 92.3 |
| Others | 1 | 7.7 | 100.0 |
| Total | 13 | 100.0 | |

From table 4.2.13, the study found that 61% of the respondents suggest that the biggest implementing issues that the companies have when it comes to VR training is having training packages that can suit the different training needs of the trainees. This is because each training package is designed to suit a specific training requirement and though one package can serve other similar training purposes, it might not be adequate in meeting with the training objectives.

30% of them consider the need to design training modules to suit the specific needs of the client to be one issue they face in VR training. This becomes more difficult in a situation where the training companies must merge the training needs of the trainees with the training objectives as set by their employers. There are cases where the training organizations must make special plans for special trainees who require more attention due to some physical challenges.

Table 4.2.14: How the Implementation issues that come with virtual reality training are resolved

| Solution | Frequency | Percent | Cumulative Percent |
|---|---|---|---|
| More investment in VR tech | 9 | 69.2 | 69.2 |
| Replicating and upgrading training modules | 3 | 23.1 | 92.3 |
| Others | 1 | 7.7 | 100.0 |
| Total | 13 | 100.0 | |

According to 69.2% of the respondents, the best way of tackling the implementing issues that come VR training is to encourage more investment in technology. More of such investment can come when the government advances a policy that will grant incentives to those who are interested in importing and marketing the innovation in Nigeria. Such an incentive can also be extended to organizations that are willing to develop the technology locally.

With more investment in the innovation will come the possibility of having more of the hard and software packages available and with this will come a possible prove reduction and an array of different packages that can suit a variety of training needs.

## 5. DISCUSSION AND CONLUSIONS

### 5.1 SUMMARY

There is no doubt that training plays a significant role in human capital development and influences how an employee performs on the job. However, the concept of training itself is dynamic and continues to evolve to the extent that conventional classroom training approaches are giving way to new training innovations involving the application of technology. As this evolution occurs, organizations that want their employees to perform at the optimal level will also have to accept and inculcate new methods of training into their training process. The same can be said with organizations that offer such training.

Even at the workplace, there are changes that have come over the years that require the development of soft skills on the part of the employees. Aside from this, a lot of work is now carried out remotely and virtually as the case may be. Within the virtual workspace exist virtual reality training environments that have the potential for use in work related situations due to its features and flexibility.

There are limited studies in Nigeria on the application of virtual reality training and how it can be of immense benefits to employee training and performance. Hence in undertaking this study, the aim was two-fold. The first was to evaluate the application of virtual reality training in improving employee training outcomes compared to traditional training methods. The second was to identify the benefits and limitations of using virtual reality in employee training and how it impacts on their job performance.

In carrying out the study, three companies in Nigeria that are into employee training were sampled and fifteen research instruments designed for the study were administered to them. Thirteen of these questionnaires were returned. Based on the responses received from the participants, the study found that the prospect for VR training in Nigeria is commendable as the study has shown that both the private and public sector have come to appreciate and apply VR in the training of their staff and employees. However, this does not imply that its application is as widely accepted as that of the conventional classroom training method that has been the system for a long time. Despite this, it was found that VR training has witnessed a lot of positive changes in Nigeria over the years and in comparison, to the conventional training, VR has been found to be very successful when it comes to employee training and performance.,

Even though a lot of the companies that engage in VR training get a lot of their clients via referrals from satisfied clients, the study found that there is a growing trend in the number of trainings carried out in Nigeria using VR. With an average of 4-5 of such trainings per month and a possible 50 or more of such trainings carried about by a firm in one year, there is a big market in Nigeria for VR training, and it can only get bigger as the diffusion of the technology increases.

In terms of VR training effectiveness over conventional training techniques, the study found that the use of VR was more practical and more engaging in the sense that it can applied with real life-like simulations without exposing the trainees to any hurt or danger and it can also be applied for dangerous procedures that that are best practiced using simulations as real-life trials will have grave consequences. Furthermore, VR training is more effective that conventional training in the sense that the technology can be used to create practical training scenarios covering a vast area of human endeavors unlike the conventional training that relies more on theoretical.

Employee performance has to do with training outcomes and the meeting of set organizational job objectives. While studies have shown that in terms of training outcomes it is possible for both VR and conventional training to have the same result, the study found that those who are trained using VR are able to develop soft skills, learn faster, be more willing to put to practice what is learnt and be more willing to take on new job responsibilities. This is because unlike the conventional training, VR training allows the trainees to face their fears, make mistakes and correct them, build their levels of awareness and confidence, and expose them to challenging task scenarios that once mastered can enhance job performance.

In line with the benefits of using VR training as enumerated in the body of literature in this study, it was found that one of the key advantages the technology offers is practicability, the ability to offer mixed modes of learning and its wide application in different spheres of life. Thus, VR training gives the trainees the benefit of developing their cognitive skills by exposing them to audio and visual information during training. Nevertheless, the technology has some disadvantages which come with its use and application in training in Nigeria. The top among them is the cost of acquiring the technology. Nigeria is a country that is heavily reliant on importation and as there are no local substitutes for the VR hard and soft wares, all the ones currently in use in the country are imported. This importation is affected by many factors such as rising inflation in Nigeria coupled with the weak exchange rate of the Naira to the Dollar

and the many bureaucracies that is attached to importation in the country that makes the process cumbersome and more expensive.

The cost of acquiring VR for training purposes is high in Nigeria and to compound that is the fact that Nigeria experiences epileptic power supply and there are times when power can be off for days if not for months dues to a fault of the breakdown of the national power grid. Consequently, power supply from the public mains cannot be relied on and is hardly used when VR training is on-going. What the training organizations do is rely on alternative means of power supply which inadvertently adds to the cost of the training. Apart from the cost addition factor, relying on the use of generators places another burden of fueling them and there are times in the country when petrol or diesel will become scarce and expensive. These are business challenges that organizations must grapple with in Nigeria that have the capacity to hinder the application of VR training.

In addition to the disadvantages, the study found that there is the issue of the inability for one VR software to be adapted for other training uses. The goal of adapting the software is to cushion the cost effects of acquiring the technology and using alternative means to power the hardware during training. Adaptability from the business perspective will reduce these costs in the long run but where this is difficult to achieve, it means that software for other training modules will have to be procured.

Going by these identified challenges, the study concluded that one way of mitigating their impact is to encourage more investment in technology. To accomplish this the study suggested that the government should advances a policy that will grant incentives to those who are interested in importing and marketing the innovation in Nigeria. Such an incentive should also be extended to organizations that are willing to develop the technology locally. By taking this step, it is the hope of the study that it will encourage more investment in innovation and with that will come the possibility of having an array of different packages that can suit a variety of training needs and with this will come a possible price reduction.

## 5.2 THEORETICAL CONTRIBUTION

The theoretical framework of this study was centered on two relevant theories, namely the cognitive theory of multimedia learning as espoused by Mayer (1997) and the Technology Acceptance Model (TAM).by Davis et al. (1989).

The Cognitive Theory of multimedia learning focuses on what makes learning possible for the learner. Its emphasis is that for learning to take place, verbal and non-verbal information must be available along with auditory and visual information. It is the presence of these forms of information that builds the cognitive process of learning because it allows the learner to select, organize and integrate the information.

However, the application of this theory comes with the applications of certain principles in the learning process. So according to the theory the cognitive process of learning is best suited when an explanation is given in words and pictures rather than in words only; words and pictures are presented contiguously and not separately; words are presented auditorily and not as a visual screen text; individual learning difference in each learner is taken into consideration and the provision of a coherent summary which highlights the salient points is presented.

For the Technology Acceptance Model (TAM), the study presented three models. which are similar in principles both differ in terms of the variables of measurement. TAM 1 model used two variables to evaluate how a learner will accept a technology. The first is perceived ease and the second is perceived usefulness. In TAM 2 the acceptance of technology was based on variables such as subjective norm, image, job relevance, output quality and result demonstrability. For TAM 3 the variables are computer anxiety, perceived enjoyment, computer self-efficacy, computer playfulness, objective usability, and perception of external control.

In using these two theories, the study has contributed to both their advancement and validation. For one, not all theoretical perspectives are applicable in different climes due to differences in situations and the context within which they occur. Indeed, Nigeria is peculiar in the sense that our societal, social and value systems are unique to the extent that theories that are applicable in some societies may not be well adapted here. To this end, this study has shown that multimedia learning in Nigeria is also aligned with the application of both verbal and non-verbal information, the understanding of the needs of a learner.

It has also shown that the understanding of the cognitive process can change the way VR or conventional learning is conducted in Nigeria especially as regards the aspect of following the process and principles. In other words, for training to be effective the cognitive process should be observed, and the principles adhered to if the learning outcomes are achieved. This study has shown that this theory is workable and applicable in Nigeria.

The Technology Acceptance Models offers many constructs. Of key importance to this study are some constructs from the three models highlighted. From TAM 1 the key variables are perceived usefulness and perceived ease. The study has shown that both variables are presented in VR training and can be attributed to why the technology has been accepted. In Nigeria for instance where the development of such technology does not exist, accepting it and changing from the conventional norms of training has to do with the perception of the trainers and the trainees on how useful the innovation is and how easy it is to use.

From TAM2 they key variables that are application to the level of diffusion of VR training in Nigeria especially with reference to employee training are job relevance, output quality and result demonstrability. Is VR training relevant to the job of the trainee? Can VR improve the quality of job output? can the result of such a VR training be demonstrated? The study has shown that VR training can improve employee performance, the quality of job output and the training can be demonstrated in how well the job/task is handled. All these variables are valid including the fact that the soft skills that a trainee can acquire by virtue of using VR for training can prove valuable in the workplace and contribute to better performance on the job.

In TAM3, the model provided four variables that the study considers as reasons why VR training has been accepted in Nigeria. The four are perceived enjoyment, computer playfulness, objective usability, and perception of external control. VR training is perceived more like a game even though it is work related. This is more so as the training does not come with pressure and the trainee can easily get feedback on mistakes made and take steps to correct them without the fear of judgment. In essence and for the period of the training, the trainee using the VR technology is in control of his learning experience. Thus, in the perception of the trainee, VR training offers some form of enjoyment, playfulness, usability, and some form of control within the learning space. This explains why it has been accepted in Nigeria.

Relying on the existing theories adopted in this study, it is also important to mention that in the advancement of these theories or in the development of newer models, other factors and variables that are peculiar to developing nations such as Nigeria should be considered. For

instance, in cognitive theory, it will be proper to see how the learning environment, poverty and cultural norms affect learning. These three variables are prevalent in Nigeria and can be instrumental to how learning outcomes are affected.

In the same vein The TAM constructs should also consider variables such as cost of the technology, level of technology advancement and the role of government and how they affect the acceptance of a technology. In developed economies, governments have been known to encourage technological growth and the development of new innovations. This position advances the level of technology in such countries, and it has a direct impact on how affordable the innovation will be to the end users. The same cannot be said for Nigeria and other developing countries. Nigeria relies on borrowed technology and the government has not offered any policy direction on VR training. The impact of this on the acceptability of VR is negative in the sense that it has hindered its level of diffusion.

## 5.3 PRACTICAL IMPLICATIONS

There are several literatures that have identified the benefits of virtual reality training. Studies have shown that it is very effective, offers the trainee an immersive form of training, helps with learner engagement and learner retention. It has also been known to be safe, offers immediate feedback on the learning process, can be used to create different types of work-related scenarios and the training of soft skills.

Judging by the findings of the study, it is safe to assume that the prospects for the application of VR technology for employee training in Nigeria is good. This position is supported by the growing population of the country especially the youths and the young adults, the changing needs of the work place and the need for more employees to acquire soft skills required to succeed in the corporate world., In addition to this, the level of awareness on the use of VR in training among the corporate sector is quite commendable and it is expected that with more patronage and understanding of the benefits of the technology there will be a further boost to the chances of applying more of the technology in the nearest future.

Despite this, the challenges inherent in the system can erode the prospects and take a lot of the training organizations out of business. With the high cost of the technology coupled with poor exchange rate and the rising inflation in Nigeria, the diffusion of VR training in Nigeria is somewhat bleak except something is done about it. The poor power supply has been a perennial issue in Nigeria and with the efforts of successive governments in that sector, the result has not

been encouraging. Nigeria is also a country where fuel scarcity occurs often without warning meaning that that prospect of using alternative power is also threatened. It is therefore pertinent that the power situation be fixed if technology is enhanced by way of research and development. Without improvement in the power sector the cost of training using VR will be passed to the clients who will eventually either reduce the number of trainings they ought to provide for their staff or jettison VR training for the normal conventional training which does not come with much cost attached.

Of paramount importance is the need for the Nigerian government to take a position on how such technologies shall be advanced and developed locally. Aside from this the government should have a policy that will include the use of VR for the education of students in primary and secondary schools to expose them to benefits of VR and perhaps channel their career paths towards technology related studies.

By extension, using VR for learning should also be applied in universities as a way of advancing multimedia learning. If this is not done and the government does not encourage the use of VR in employee training, there is a likelihood that the level of application will be low and with time, there will be no business incentive for organizations to undertake VR training.

## 5.4 LIMITATIONS AND FUTURE RESEARCH DIRECTIONS

Even though there are not many studies in Nigeria on the use of VR in employee training and this study intends to contribute to the body of literature in this regard, there are some limitations that are worth mentioning. First the study was conducted using quantitative samples obtained from a small sample of organizations that are into VR training in Nigeria. Secondly, the study was limited to the companies operating in just one state in Nigeria which further narrows the scope of the study and has likely effect on the outcome of the study without invalidating the findings.

Further studies on this subject be done with larger samples of similar VR training organizations covering more state in Nigeria. Such studies should also incorporate the use of mixed methods methodology to offer the study of the opportunity of eliminating bias. Another limitation was that the study did not factor in the measurement of job performance for those who had used VR for employee training. This was because of two reasons. Firstly, the focus of the study was from the perspective of the trainers and how they apply VR. This is in line with the aim of the

study. The second reason is that due to time constraints and the dearth of information of VR training and employee performance in Nigeria, it would be difficult getting such information from selected private sector companies within the limited time frame available.

Future studies are encouraged to investigate VR performance related training using one or two case studies in Nigeria. Further research can also involve a longitudinal study that will explore and measure the performance as related to VR training over a period to determine if there is consistency in expected outcomes.

In the course of the study, it was mentioned under the cognitive theory that learning involves the understanding of the learning needs of the learner. In developed countries studies have been carried out on VR students with special needs such as those with autism. Such studies are not prevalent In Nigeria and further studies are encouraged in that direction.

Finally, there are other virtual related technologies such as extended reality training, mixed reality training and augmented reality training. This study was focused solely on virtual reality. Further studies can explore these other forms of virtual training and relate them to employee performance or employee productivity.

**REFERENCES**


Abdeldayem, M. M., Aldulaimi, S. H., & Kharabsheh, R. (2021). Development of Human Capital Resources to Increasing Economic Growth and Innovation in the GCC Countries. *International Journal of Green Management and Business Studies*, *1*(1), 62-79.

Abdullahi, Z. O. (2020). Determinants of Virtual Labs Adoption Among Physics Teachers in Ilorin-West Local Government Area. Dissertation, *Department of Educational Technology,* University *of Ilorin, Ilorin, Nigeria*.

Adekomi, U. Y. (2014). Improving Computer Science Education. 1st Edition., Routledge Chapman and Hall, London.

Ahir, K., Govani, K., Gajera, R., and Shah, M. (2019). Application on Virtual Reality for Enhanced Education Learning, Military Training and Sports. Augment. Hum. Res. 1 (5), 1–9. doi:10.1007/s41133-019-0025-2

Ahir, Kumar (2018). Challenges in using Virtual Reality for Training. *Medium*. [online]. <https://medium.datadriveninvestor.com/challenges-in-using-virtual-reality-for-training-fea4d986faa> [Accessed 24 February 2022].

Ahir, Kumar (2018). Challenges in using Virtual Reality for Training. *Medium*. [online]. https://medium.datadriveninvestor.com/challenges-in-using-virtual-reality-for-training-fea4d986faa [Accessed 14th January 2023].

Aimee, C. S. (2020). Relationship between Virtual Employee Engagement, Self-Efficacy, and Productivity. Minneapolis, MN, United States: Walden University.

Akdere, M., Acheson, K., and Jiang, Y. (2021a). An Examination of the Effectiveness of Virtual Reality Technology for Intercultural Competence Development. Int. J. Intercult. Relat. 82, 109–120. doi: 10.1016/j.ijintrel.2021.03.009

Alambaigi, A., &Ahangari, I. (2016). Technology Acceptance Model (TAM) As a Predictor Model for Explaining Agricultural Experts Behavior in Acceptance of ICT. *International Journal of Agricultural Management and Development (IJAMAD)*, *6*(1047-2017-1663), 235-247.

Aldulaimi, S. H., Abdeldayem, M. M., Mowafak, B. M., & Abdulaziz, M. M. (2021). Experimental Perspective of Artificial Intelligence Technology in Human Resources Management. In *Applications of Artificial Intelligence in Business, Education and Healthcare* (pp. 487-511). Springer, Cham.

Anaza, A. O. (2017). Assessment of lecturers' attitudes toward mobile technology usage for instruction in colleges of education in North Central, Nigeria. *conference proceedings Association for Innovative Technology in Education (AITIE2017)*, 67-74. Ilorin: Association for Innovative *Technology* in Education.

Baddeley, A. (1992). Working memory. Science, 255, 556-559.

Bailenson, Jeremy (2020). Is VR the Future of Corporate Training? *Harvard Business Review*, <https://hbr.org/2020/09/is-vr-the-future-of-corporate-training>. [Accessed 10th January 2023].

Barnard, Tom (2019). History of VR - Timeline of Events and Tech Development. *Virtual Speech*. <https://virtualspeech.com/blog/history-of-vr> [Accessed 21 December 2022].

Baron, Jessica (2021). Top 6 Biggest Challenges to Implementing AR Technology. *CGS* https://www.cgsinc.com/blog/top-6-biggest-challenges-implementing-ar-technology-2021 [Accessed 2 December. 2022].

Bailenson, Jeremy (2020). Is VR the Future of Corporate Training? *Harvard Business Review*, 18 September 2020 [online]. <https://hbr.org/2020/09/is-vr-the-future-of-corporate-training>. [Accessed 1 March 2022].

Beech N. (2008); Research Methods – Lecture Notes for MSc Corporate Governance Leeds Metropolitan University

Bhome.S,Jha.N,Chandwani.V,Iyer.S,Desai.S,Prabhudesail.A and Koshti.S (2013). Research Methodology.Himalaya Puvlishing House Pvt Ltd, Mumbai, India.

Blount, J. (2021). *Virtual Training the Art of Conducting Powerful Virtual Training that Engages Learners and Makes Knowledge Stick*. Hoboken: John Wiley & Sons Inc.

Borrego, M., Douglas, E.P., & Amelink, C.T. (2009). Quantitative, Qualitative, and Mixed Research Methods in Engineering Education. *Journal of Engineering Education*, 98(1): 53-66.

Brahim, Z. (2020). Nhmep Offers Virtual Training and Resources to Assist Manufacturers. New Hampshire Manufacturing Extension Partnership — NHMEP. Available at: https://www.nhmep.org/nhmep- offers-virtual-training-and resources- to-assist-manufacturers/ (Accessed February 23, 2023).

Chang, Eunhee, Kim, Hyun Taek & Yoo, Byounghyun, 2020. Virtual Reality Sickness: A Review of Causes and Measurements. *International Journal of Human–Computer Interaction.* 36(17), 1658–1682. DOI: https://doi.org/10.1080/10447318.2020.1778351.

Chiang, Feng-Kuang, Shang, Xiaojing & Qiao, Lu, 2022. Augmented reality in vocational training: A systematic review of research and applications. *Computers in Human Behavior*. 129, 107125. DOI: https://doi.org/10.1016/j.chb.2021.107125.

Chandler, P. & Sweller, J. (1991). Cognitive load theory and the format of instruction. Cognition and Instruction, 8, 293-332.

Clark, J. M. & Paivio, A. (1991). Dual coding theory and education. Educational Psychology Review, 3, 149-210.

Cohen D. and Crabtree B. (2006); Qualitative Research Guidelines Project Robert Wood Johnson Foundation Princeton NJ.

Coiffet, P. & Burdea, G. C., (2017). *Virtual Reality Technology*. 2. Hoboken: John Wiley & Sons Ltd.

Coles, Jason, (2021). What causes motion sickness in VR, and how can you avoid it? *Space.com*. [online]. <https://www.space.com/motion-sickness-in-vr> [Accessed 24 February 2023].

Collis, J. and Hussey, R. (2003) Business Research: A Practical Guide for undergraduates and Postgraduate Studies, 2nd edn London: Palgrave Macmillan

Cook, Allan V., Mariani, Joe & Kishnani, Pankaj Kamleshkumar, (2019). How to begin regulating a digital reality world. *Deloitte Insights*. [online]. <https://www2.deloitte.com/content/www/us/en/insights/industry/public-sector/regulating- digital-reality-augmented-spaces.html> [Accessed 2 February 2023].

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: a comparison of two theoretical models. Management science, 35(8), 982-1003.

Deal, David 2018. Virtual Reality Helps U.S. Athletes Train to Win Olympic Gold. Medium. <https://davidjdeal.medium.com/virtual-reality-helps-u-s-athletes-train-to-win-olympic-gold- bb8c8876449c> (accessed 23.2.2023).

Dieck, C. M., Jung, T. H. & Loureiro, S. M., (2021). Augmented Reality and Virtual Reality: New Trends in Immersive Technology. Cham: Springer International Publishing.

Ekezie, Obinna, (2016). Council Post: Your Success Starts with More Frequent Employee Training. *Forbes*. [online] <https://www.forbes.com/sites/theyec/2016/04/14/your-success-starts-with- more-frequent-employee-training/> [Accessed 4 January 2023].

Fathema, N., Shannon, D., & Ross, M. (2015). Expanding the Technology Acceptance Model (TAM) to examine faculty use of Learning Management Systems (LMSs) in higher education institutions. Journal of Online Learning & Teaching, *11*(2).

Gray, D. (2014) Doing Research in the Real World. *Sage*. 3rd Edition.

GOV.UK (2019). British Army tests innovative virtual reality training. *GOV.UK*. [online]. https://www.gov.uk/government/news/british-army-tests-innovative-virtual-reality-training [Accessed 14th January 2023].

Easterby-Smith, M., Thorpe, R., & Jackson, P. (2012). Management research: Sage Publications.

K., Onojah, A. O., Aderogba, A. J., Obielodan, O. O., Ganiyu, O. S., & Fakomogbon, M. A. (2020). Computer teachers' awareness of virtual reality for instructional purposes in Kwara State. Indonesian Journal of Learning and Instruction, *3*(1), 1-10. doi:10.25134/ijli. v3i1.3002.

Lacko, J. (2020). "Health Safety Training for Industry in Virtual Reality", in 2020 Cybernetics & Informatics (K&I), Velke Karlovice, Czech Republic, Jan 29, 2020 (New York, NY: IEEE), 1–5. doi:10.1109/ki48306.2020.9039854

Lang, Y., Wei, L., Xu, F., Zhao, Y., and Yu, L. (2018). "Synthesizing Personalized Training Programs for Improving Driving Habits via Virtual Reality", in IEEE Conference on Virtual Reality and 3D User Interfaces, 297–304.

Lee, N. and Lings, I. (2008) Doing Business Research: A Guide to theory and Practice. London: Sage

Lindner, Philip, Miloff, Alexander, Fagernäs, Simon, Andersen, Joel, Sigeman, Martin, Andersson, Gerhard, Furmark, Tomas & Carlbring, Per (2019). Therapist-led and self-led one-session virtual reality exposure therapy for public speaking anxiety with consumer hardware and software: A randomized controlled trial. *Journal of Anxiety Disorders*.61, 45–54. DOI: https://doi.org/10.1016/j.janxdis.2018.07.003.

Li, W., Talavera, J., Samayoa, A. G., Lien, J.-M., and Yu, L.-F. (2020). "Automatic Synthesis of Virtual Wheelchair Training Scenarios", in IEEE Conference on Virtual Reality and 3D User Interfaces. 539–547.

Maese, Rick (2018). Virtual reality helps U.S. Olympic ski team prepare for PyeongChang's great unknown.*WashingtonPost*.[online]. <https://www.washingtonpost.com/sports/olympics/virtual- reality-helps-us-olympic-ski-team-prepare-for-pyeongchangs-great-unknown/2018/01/23/45085e20-ff73-11e7-bb03-722769454f82_story.html>. [Accessed 15 March 2022].

Mao, Randi Q., Lan, Lucy, Kay, Jeffrey, Lohre, Ryan, Ayeni, Olufemi R., Goel, Danny P. & Sa, Darren de (2021). Immersive Virtual Reality for Surgical Training: A Systematic Review. *Journal of Surgical Research*. 268, 40–58. DOI: https://doi.org/10.1016/j.jss.2021.06.045.

Mealy, Paul (2018). The History of Virtual and Augmented Reality. *dummies*. [online]. <https://www.dummies.com/article/technology/programming-web-design/general-programming-web-design/the-history-of-virtual-and-augmented-reality-256104> [Accessed 1 March 2023].

Muhammad, B., Muhammad, T.A., & Muhammad, A. (2008). Reliability and Validity of Qualitative and Operational Research Paradigm, *Pak.j.stat.oper.res. 4(1): 35-45.*

Mayer, R. E. (1996). Learning strategies for making sense out of expository text: The SOI model for guiding three cognitive processes in knowledge construction. Educational Psychology Review, 8, 357- 371.

Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions. Educational Psychologist, 32, 1-19.

Maylor, H. & Blackmon, K. (2005) Researching Business and Management. Hampshire: Palgrave MacMillian.

Neuman, W.C. (2007). Social Research Methods: Qualitative and Quantitative Approaches, third edition. Needham Heights. Allyn and Bacon.

Paivio, A. (1986). Mental representations: A dual coding approach. Oxford, England: Oxford University Press.

PR Newswire (2022). Virtual Reality (VR) Market Size is Projected to Reach USD 26860 Million By 2027 At A CAGR of 19.0% - Valuates Reports. *PR Newswire*. [online]. <https://www.prnewswire.com/in/news-releases/virtual-reality-vr-market-size-is-projected-to-reach-usd-26860-million-by-2027-at-a-cagr-of-19-0-valuates-reports-820202440.html> [Accessed 23 February 2022].

PwC (2020). How virtual reality is redefining soft skills training. *PwC*. [online]. <https://www.pwc.com/us/en/tech-effect/emerging-tech/virtual-reality-study.html> [Accessed 19 March 2023].

Samar Zaineldeen1, *, Li Hongbo1, Aka Lucien Koffi1, Bilal Mohammed Abdallah Hassan (2020) Technology Acceptance Model' Concepts, Contribution, Limitation, and Adoption in Education Universal Journal of Educational Research 8(11): 5061-5071, 2020 http://www.hrpub.org DOI: 10.13189/ujer.2020.081106

Saunders, M., Lewis, P. and Thornhill, A. (2003) Research Methods for Business Students, 3rd edn Essex: Prentice Hall

Saunders, M. N. K., Saunders, M., Lewis, P., & Thornhill, A. (2011a). Research Methods For Business Students, 5/e: Pearson Education India. Available at www.arabianjbmr.com/IPDS_indexphp

Segura, Á.; Diez, H.V.; Barandiaran, I.; Arbelaiz, A.; Álvarez, H.; Simões, B. Posada, J.; García-Alonso, A.; Ugarte, R. (2020): Visual computing technologies to support Operator 4.0. *Comput. Ind. Eng. 139*, 105550. [Google Scholar]

Takahashi, Dean (2017). How VR training prepares surgeons to save infants' lives. *VentureBeat*. 22.7.2017. [online]. <https://venturebeat.com/2017/07/22/how-vr-training-prepares-surgeons-to-save-infants-lives/>.

Turi, Jon (2013). Time Machines: NASA goes virtual at CES. *Engadget*. [online]. <https://www.engadget.com/2013-12-15-time-machines.html> [Accessed 21 February 2023].

Naranjo, J. E., Sanchez, D. G., Robalino-Lopez, A., Robalino-Lopez, P., Alarcon-Ortiz, A., & Garcia, M. V. (2020). A scoping review on virtual reality-based industrial training. *Applied Sciences*, *10*(22), 8224.

Wajdi Milhem∗; Khalil Abushamsieh and Maria Nieves Pérez Aróstegui (2014) Training Strategies, Theories and Types Journal of Accounting –Business & Management vol. 21 no. 1 (2014) 12-26 Available at https://www.researchgate.net/publication/269165999

Wang, P., Wu, P., Wang, J., Chi, H. L., & Wang, X. (2018). A critical review of the use of virtual reality in construction engineering education and training. International journal of environmental research and public health, 15(6), 1204.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS quarterly*, 425-478.

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management science, *46*(2), 186-204.

Virtual Reality Society 2017. What is Virtual Reality? *Virtual Reality Society*. [online.] <https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html>[Accessed20 February 2023].

Yin, R. K. (2003). *Case study research: Design and methods* (3rd ed.). Thousand Oaks, CA: Sage.

**THE QUESTIONNAIRE**

**ON**

**EVALUATION OF THE APPLICATION OF VIRTUAL REALITY FOR EMPLOYEE TRANING AND PERFORMANCE IN NIGERIA**

My name is Okwuejunti Esther Nwadinife, a student at Lappeenranta University of Technology, Lappeenranta, Finland. currently studying International Business and Entrepreneurship. I am writing my thesis on the captioned subject and would appreciate your assistance. This research aim is to evaluate the application of virtual reality for employee training and performance in Nigeria.

All responses are confidential, and no personal data will be made public. Data collected will be used solely for the purposes of this research.

Thank you.

Section One. Demography

1.Name of Firm…….

2.Position of respondent: ----------

3.Job role: ----------

4.Number of employees in the firm. a) 1-3 [ ] (b) 3-5 [ ] (c) 5-10 [ ] (d) Above 10 [ ]

5.Gender: Male [ ] Female [ ]

6.Highest academic qualification: a) /HND [ ] (b) BS.c/ [ ] (c) MS.c [ ]

7.Years of experience. Of lead instructors a) 1-5 [ ] (b) 5-15[ ] (c) 20-25[ ] (d) Above 25 [ ]

8 Training modalities adopted a). Design to suit client need [ ] (b) [ ] Use of existing modalities (c) Both[ ]

9. Offer brief explanation on how you do your training modalities……

Section Two Application of VR in training

Please tick the most appropriate response among the options provided.

1. Type of clients engaged in VR training

a). Private organizations [ ] (b) Government agencies [ ] (c) Both[ ]

2.How you get VR training engagements

a). Referral [ ] (b) Marketing [ ] (c) Both[ ]

3. Changes in VR training and its present state in employee training

a). Little change [ ] (b) Average change [ ] (c) Significant [ ]

4. Number of VR trainings done per year

a). 10-20 [ ] (b) 20-30 [ ] (c) 30-40 [ ] (c) Above 40 [ ]

5. Preferred location for VR training

a). Indoor training facility [ ] (b) Facility provided by client [ ]

(c) Mutually agreed facility [ ]

6. Elements of VR training that motivates workers' engagement

a). Interaction [ ] (b) Real life-like simulation [ ](c)Vast learning possibilities[ ]

7. VR training feedback mechanism

a). Feedback from client [ ] (b) Appraisal of trainee before and after [ ] (c) Both [ ]

8. Measurement VR training effectiveness

a). Based on set training objectives [ ] (b) Passing set tests [ ] (c) Others [ ]

9. How trainee performance on the job is measured

a). Feedback from the client [ ] (b) Feedback from trainee [ ] (c) Both [ ]

10 In comparison to conventional training techniques, how successful is virtual reality in enhancing employee training outcomes?

a) Averagely Successful. [ ] (b) Very successful [ ] (c) [Highly successful l ]

11. In comparison to conventional training techniques, how successful is virtual reality in enhancing employee training outcomes?

a) Averagely Successful. [ ] (b) Very successful [ ] (c) [Highly successful [ ]

12. Advantages of VR in employee training

a) Practicality [ ] (b) Offers mixed modes of learning [ ] (c)Wide application[ ]

13. Disadvantages of VR in employee training

a) Cost of the technology [ ] (b) Adapting one software for other uses [ ]

(c) Poor power supply [ ] d) Health issues [ ]

14 Implementation issues that come with virtual reality training.

a) Designing specific training modules [ ] (b) Having training packages that suit different training needs [ ] (c) Other (explain)……

15 How the Implementation issues that come with virtual reality training are resolved.

a) More investment in VR tech [ ] (b) Replicating and upgrading training modules [ ]

(c) Others (explain)…….