

# COVID-19 Virtual Teaching and Learning Impact on TVET Students' Academic Success

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**Abstract:** The COVID-19 pandemic necessitated many essential modifications across all sectors of the economy, including the education sector. Before the COVID-19 pandemic, the Technical and Vocational Education and Training lecturers were offered via a blended mode. The COVID-19 pandemic commanded entire Virtual Teaching and Learning for these students and lecturers. The article looks at the impact of student academic success due to only Virtual Teaching and Learning during the COVID-19 pandemic in the Department of Technical and Vocational Education and Training (TVET) at the Namibia University of Science and Technology (NUST), Windhoek, Namibia. This study employed a quantitative approach to collect data from the TVET Department students of 2020 cohorts. For this purpose, an online survey was developed and deployed via Qualtrics to 240 students. The article's main findings revealed that Virtual Teaching and Learning contributed to students' academic success, as proven by the 75 % graduation number of these participants. However, the participants stated that technical problems and reduced motivation are the two most significant challenges most participants encountered during the COVID-19 Virtual Teaching and Learning. Furthermore, Virtual Teaching and Learning is an alternative mode of study to avoid the costs associated with frequent traveling to attend face-to-face classes. The article further emphasizes the need to integrate digital inclusion within Technical and Vocational Education and Training. Finally, continuous infrastructure and support systems improvement must be implemented to promote equitable access to technical and vocational education training.

**Keywords:** Virtual teaching and learning; Technical and vocational education and training; Academic success of students; COVID-19

## 1. Introduction

In December 2019, Wuhan, China, reported the initial case of COVID-19. The disease soon spread throughout China before reaching other countries. On 30 January 2020, the World Health Organization (WHO) deemed the outbreak a Public Health Emergency of International Concern (PHEIC). By 11 March 2020, the WHO announced that the disease had become a pandemic (Cucinotta and Vanelli, 2020; WHO, 2020). Numerous effects of the COVID-19 pandemic have been and are still observed globally, impacting economic, social, political, environmental, health, and education. One of the worst effects was the restriction on movement of people during the spread of the disease.

The COVID-19 pandemic disruption resulted in global adjustments to traditional business practices to embrace and implement Virtual Learning (VL) strategies through VL Environment

(VLE) platforms (UNESCO-UNEVOC, 2020). The VLE has raised increased interest as a delivery platform in the success of students' programs for pedagogy at higher institutions in Namibia and the world at large.

Technical and Vocational Education Training (TVET) enhances students' pedagogical skills and the outcomes of educational experiences to improve the quality and effectiveness of TVET education. These students already have practical skills and knowledge from Vocational Training Centres in Namibia in their trades, such as plumbing and pipe fitting, motor mechanics, and electrical fields (NUST, 2023).

The Namibia University of Science and Technology (NUST) is one of Namibia's two public institutions of higher learning. NUST, the former Polytechnic of Namibia (PoN), received accreditation from the National Training Authority (NTA) in 2011 to provide teacher training programs at levels 4, 5, and 6 following the Namibia Qualifications Authority guidelines for certificates, higher certificates, and diplomas. These programs are offered in the Department of TVET in the School of Human Sciences and Technical and Vocational Education Training, Faculty of Commerce, Human Sciences and Education (NUST, 2023). These programs gave in-service and pre-vocational teachers the necessary teaching skills to possess the characteristics of national-level vocational lecturers. The NTA produced unit standard-based credentials for trainers, which formed the foundation of the level 4 and level 5 programs, while level 6 included provisions for improving management abilities. Programs were designed to provide pre-service and in-service training with the instructional knowledge, skills, and attitudes necessary for the TVET setting. Diploma for TVET: Trainer and Diploma for TVET: Management were the new program titles in 2020 (NUST, 2020). The justification was maintaining Namibia's Vision 2030 objective of having an industrialized, knowledge-based economy by 2030 (Office of the President, 2024).

Before COVID-19, the TVET lecturers had the choice of hybrid or face-to-face teaching and learning. The COVID-19 pandemic hit Namibia in March 2020, and organizations, including the TVET Department, were forced to opt for Virtual Teaching and Learning. The article aims to address the following questions. Firstly, what was the impact of VTL during the COVID-19 pandemic on student success in the Department of Technical and Vocational Education Training at the Namibia University of Science and Technology? Secondly, which mitigation strategies can enhance VTL to promote student success in the Department of Technical and Vocational Education and Training at the Namibia University of Science and Technology?

## **2. Literature Review**

### **2.1 Virtual Teaching and Learning**

Technological advancements, like the internet, have profoundly impacted global education delivery and student outcomes, meeting the needs of today's job markets. Virtual Learning (VL) is expanding significantly, as shown in the data from the Sloan Foundation's Annual Report titled "Going the Distance: Virtual Learning Education in the United States 2011." According to the report in 2010, 6.5 million students were enrolled in at least one VL course, with 31% of post-secondary students taking at least one VL course (Allen and Seaman, 2011).

Despite the increasing use of VL, it is still considered an innovative approach to Teaching and Learning at higher education institutions. The change to VTL and creative approaches has impacted both students and lecturers. Implementing VL can positively and negatively impact students' online experiences, ultimately affecting their academic success. Several studies by Irfan and Iman (2020), Awal et al. (2020), and Basar et al. (2021) explore the effectiveness of online learning and the challenges thereof on students' success in higher education.

Awal et al. (2020) argue that VTL can be helpful if students can undertake empirical research and contribute to the body of knowledge across various academic disciplines. Furthermore, lecturers can use the flexibility of digital applications to effortlessly share materials with students, enhancing their understanding of online learning. The education landscape has been and continues to be transformed by technological improvements, ushering in an era of VTL. Awal et al. (2020) further state that further studies are needed to comprehensively

understand the global impact of VTL. In addition to traditional face-to-face classroom teaching avenues like television and radio, many educational institutions have adopted VTL as a complementary approach (Puma, 2022). Halili (2018) states that implementing technological advancements in the academic space may enhance the teaching and learning experience. Consequently, these technological advancement methods may strengthen student encounter and active participation. Previous studies have proven the positive impact of technology on student learning outcomes (Halili et al., 2018; Dakhi et al., 2020; Puma, 2022).

The VLE allows students with an internet connection to access their learning resources and take online assessments, enhancing effective learning, teaching, and assessment (Saykili, 2019). Moreover, students and lecturers can work together on VL (Barco, 2018). Lecturers must be equipped with technological skills to capitalize on eLearning platforms' full benefits effectively. Students can attend classes from home or participate in remote classroom setups. The entire degree program, including coursework, assessments, and graduation requirements, can be completed online, eliminating the need for physical attendance. This instructional approach incorporates tools such as web-based course materials, video modules, and Mobile Learning. "Web-based" means students can access materials using any internet-enabled device whenever necessary. Communication with lecturers and administering assessments occurs through the web-based platform (Barco, 2018). In addition, lecturers can prepare video clips of lectures in advance. These pre-recorded video lectures are usually delivered via the web or through Applications.

Furthermore, some video modules require online quizzes to ensure students have mastered the learning outcomes. Mobile Learning (m-learning) facilitates learning and teaching through portable electronic devices, such as smartphones, tablets, or laptops, to support VL and virtual Teaching and Learning (VTL). M-learning ensures that lecturing content and resources are offered via mobile technology, enabling students to access, interact, and engage in learning activities in remote mode of studies (Johnson et al., 2016).

VL allows active communication between lecturers and students, which may enhance support and interaction. Mathew and Iloanya (2016) argue that interaction in VL can improve student motivation and learning outcomes. VL is not limited to student interaction but involves participation that enhances knowledge transfer and learning. VL platforms promote digital access to course materials, the exchange of knowledge, and enhanced learning effectiveness through increased interaction between lecturers and students via online forums and platforms. Alghizzawi et al. (2019) stress the justification of these various platforms in supporting learning by offering features such as creating online courses and tracking student and lecturer activities. A study conducted by Al Rawashdeh et al. (2021) reveals that students use VL to improve communication and interaction with their peers and lecturers.

Furthermore, written communication can be done through student email or online chat. The students can access study groups, message boards, social media groups, or chat rooms (Martin et al., 2023; Hernández-García, 2015). Course materials are uploaded exclusively online; students may be encouraged to purchase physical course materials if needed. Purchasing physical course materials such as textbooks is becoming less common (Ayu, 2020).

A significant advantage of the VL experience is how students can manage their time and create flexible studying schedules that fit with other aspects of their lives. While attending online classes, students can create a balance between their academic life and their social life and be able to participate in every lecture. According to a study conducted by Rawashdeh et al. (2021), the findings support existing empirical evidence that most lecturers considered time flexibility an advantage of online teaching (Zalat et al., 2021). Rawashdeh et al. (2021) state that VL offers students flexibility and the opportunity to participate in classes in a virtual setting.

VL tools are the latest modes of delivering education. These tools include but are not limited to live instruction conducted remotely, allowing lecturers and students to interact in real time. The newest mode promotes dynamic discussions, clarification of concepts, and the ability to adapt lesson plans to meet the student's individual learning needs. VTL includes Zoom or Microsoft Teams to conduct classes compared to the face-to-face courses of traditional teaching and Learning (Ariffin et al., 2022; Basar, 2021; Mansor et al., 2021; Nik-Ahmad-Zuky et al., 2020; Samat et al., 2020).

Educational institutions frequently adopt VTL to offer various modules and programs. VTL platforms such as Google Classroom, Moodle, and e-learning are essential to provide students with an interactional and conducive learning environment. Some institutions offer entirely virtual instruction, while others opt for the hybrid model that combines VTL with traditional in-person classes. This hybrid approach aims to maximize flexibility and accessibility for students (Grubišić et al., 2020).

## **2.2 Adverse Effects of Virtual Teaching and Learning**

The challenges for TVET training providers stemmed from using the graduates' expertise to meet the job market demands. Although VL environments like Moodle were a component of the teaching and learning process at NUST, their suitability for VL instruction and testing remained under debate (Chitema, 2021). The Moodle platform at NUST is called the MyMust eLearning platform and is the primary Learning Management System (LMS). Although the VLE is a Teaching and Learning (TL) component, its updated suitability for these purposes was in doubt (Kampinga, 2020). The arguments are supported by integrating VL tools, delivery strategies, assessments, and resource accessibility (Baihaqi, 2024).

Despite all the advantages that VL provides, there are undoubtedly adverse side effects to this learning experience. These can be problems that lecturers and students face during online classes and the factors contributing to or hindering success in TVET study programs. A study by Mumtaz 2022 finds that internet access problems, a lack of interaction between teachers and students, and a lack of technological facilities challenge the efficacy of Online Learning. A drawback of VL is that it creates a sense of seclusion for both the lecturer and the students. Students can work independently, while other students must be on campus full-time to ensure access to the lecturers and fellow students.

According to a study conducted by Hazwani et al. (2016), an institution's infrastructure plays a significant role in ensuring that online learning operates successfully. Inadequate infrastructure, such as limited internet connectivity and unworkable electronic devices, can hinder student access. These challenges are not part of traditional teaching and learning because no internet or gadgets are needed.

Screen time spent by the student is one of the most adverse effects of VL. The era of time, enhanced by the COVID-19 of today, exposed people to screen time for extended periods. Poor posture and headaches are only two physical issues people experience due to excessive screen time. According to Mseleku (2020), online learning during COVID-19 provides a limited learning experience that balances time and technology development.

According to Rosian (2023), students keep pace with social change by adapting to the availability of new technologies. This adaptation is crucial, as modern life is rooted in technology. Once students have attained these skills, they can adapt regardless of their circumstances and respond to the emergence of new or familiar problems. That means that students are required to have greater self-discipline to improve accountability. Students who believe they have not received sufficient guidance may lack the self-discipline to continue engaging with their lessons.

The traditional disadvantages of online learning revolve around technical issues. Nothing ruins a synchronous lesson like audio, video, or connection problems. In the past, students were frequently required to download and install time-consuming apps or technology that produced inconsistent results. Dube (2020) found related results, where participants also reported limited internet connectivity and workable devices as a hindrance to online teaching and learning. These results revealed that limited internet access and high data costs affect students' learning. Some respondents noted that they did not have stable internet access and could not participate in class without disruptions. Rahiem (2020) and Samat et al. (2020) claim that these factors do not motivate students in their learning. Furthermore, Adnan (2020) and Hazwani et al. (2020) argue that online learning is still new and unfavorable among students. Other than inadequate facilities at home, the unfamiliar learning environment, such as 'different' learning activities and tasks that were new to the students, might have affected their motivation to learn.

### **2.3 Mitigation to Enhance Virtual Teaching and Learning to Promote Student Success**

The COVID-19 pandemic contributes to the everyday use of VTL and the development of online courses. The shift to VL comes with its challenges for students and lecturers. More so, it is believed that the availability and use of Information Communication Technology (ICT) resources play a significant role in enhancing the effectiveness of TVET education in a rapidly changing world. In this regard, VL can help students acquire practical 21st-century skills needed for their employability (Aina and Ogebo, 2022). Several mitigations can be implemented to enhance VTL and promote student success at higher institutions. These include difficulty staying motivated and engaged, lack of access to technology, and difficulty forming relationships with students and lecturers.

#### **2.3.1 Technology**

In the current digital era, high-tech technological infrastructure is a requirement for VTL. The latest technological tools in educational settings should be embraced to enhance students' proficiency in digital literacy. Furthermore, this practice can undoubtedly impact students' academic success (Gómez and Mediavilla, 2021). Technical and vocational education has materialized as a critical tool to contribute to lifelong learning among students. The availability and use of open educational resources (OER) represent significant components of ICT integration, which may return beneficial effects on TVET. The defense for this lies in the presence of accessible resources that can significantly support the professional growth of educators by facilitating the implementation of innovative and flexible methodological approaches. These methods may enhance students' educational and vocational competencies in TVET (Ghavifekr and Yulin, 2021).

#### **2.3.2 Knowledge and Skills**

Continuous technological improvements have transformed the educational scene from face-to-face methodology to VTL (Lase, 2019). The COVID-19 pandemic speeds up the transformation from face-to-face to VTL. Laily and Riadani (2018) argue that the influence of technology may play a huge role in various components of academia, such as program development, lecturer expertise and qualifications, and the learning process. Considering the universal transformations and developments it necessitates the improved standard of human resources to participate in global competition, with a particular emphasis on the business sector (Lase, 2019). TVET is an educational approach that emphasizes supporting academic courses with the ever-changing needs of the industry it serves. (Singh and Tolessa, 2019). Therefore, TVET lecturers must exhaustively understand and grasp new expertise to ensure that graduates meet the industry's current requirements (Marzuki et al., 2022). In contemporary technological advancements, lecturers must facilitate knowledge transmission, foster cognitive values, and promote spiritual growth to maintain a harmonious equilibrium between academic progress and holistic personal development (Lase, 2019). Therefore, TVET lecturers must enhance their capacity to adapt to technological advancements and address global challenges.

Mbanga and Mtembu (2020) argue that before VTL can be effectively incorporated into TVET institutions, resources must be available, and there must be some level of readiness and willingness for lecturers and students. Even though most participants in this study recognize the significance of VL and are aware of the need for change, problems in the adoption process continue to emerge, indicating a critical gap in teaching and Learning (Aina and Ogegbo, 2022; Parlakkiliç, 2019). Therefore, creating a positive learning environment is vital from the lecturers' side. In this positive learning environment, the students should feel comfortable asking questions and welcomed and supported by lecturers and the peer group.

Contextual factors such as a lack of learning facilities, access to data and connectivity, home climate, and inadequate training and support for TVET educators and students strongly mediate adapting VL in TVET institutions (Denhere and Moloi, 2021). Technology can be a powerful tool for enhancing VTL if sufficient training, knowledge, digital skills, positive acceptance, and motivation are integrated into the technology (Mpungose, 2020). Moreover, not all students learn in the same way, so it is essential to personalize instruction to meet the needs of all students.

There is a need for the TVET lecturers and students to develop skills for economic growth in job markets and the ability to manage the change process, which would enhance their performance during teaching and learning engagements (Salleh and Sulaiman, 2020). Such integration of ICT is based on the belief that it can improve the productivity of the TVET sector. ICT application in TVET transcends technology usage for instructional delivery to its integration into advanced tools in factories and industries, where workers can use advanced machines to enhance productivity (Ghavifekr and Yulin, 2021). Aina and Ogegbo (2022) also assert that integrating ICT in TVET colleges can help students acquire practical 21st-century skills needed for their employability. Thus, the need for mitigation strategies for VTL in TVET is inevitable.

### **3. Research Methodology**

The study opted for a quantitative research approach. The target group was the 2020 TVET student in the Department of TVET, Faculty of Commerce, Human Sciences and Education at NUST. An online survey, administered through Qualtrics, was employed to collect quantitative data to answer the study questions, including 5-point Likert scale items with some open-ended questions. According to Chua (2022), a questionnaire helps provide direct information from the respondents on their encounters, experiences, and perceptions of an issue.

Section A of the questionnaire requested the participants to provide their biographical data. In addition, the questionnaire sought to analyze the impact of VTL on student success in the TVET Department. The following section addressed success factors during the COVID-19 pandemic. Finally, the last section of the questionnaire opted for recommendations for VTL to improve student success in the TVET Department at NUST.

<b>Program: Year 2:2020</b>	<b>Male</b>	<b>Female</b>	<b>Total Respondents</b>
Diploma in TVET Management	30	27	57
Diploma in TVET Trainer	100	83	183
<b>Total</b>	<b>130</b>	<b>110</b>	<b>240</b>

**Table 1:** Population for the Study

**Source:** Department: Corporate Strategy, Namibia University of Science and Technology. (2023)

The study opted for the 2020 first and final-year student cohorts for the following reasons. Firstly, the COVID-19 pandemic only started to disrupt Namibia by the end of April 2020. Secondly, students could not register if COVID-19 disrupted Namibia in January at the start of the academic year. The study excluded lecturers of the TVET Department at NUST from this study. The reason for the exclusion is to maintain the article's focus on how the VTL impacts students' success. In addition, including lecturers at TVET and management of NUST may introduce confounding variable(s) that may result in unreliable findings.

The article opted to sample the entire population of 240 Diploma TVET Trainers and Diploma TVET. A total of 185 participated in the Qualtrics online survey. The actual response rate was 77.1% of the entire population. The graduates are 74. 8% of the respondents.

<b>Program: Year 2:2020</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>	<b>Graduates</b>
Diploma in TVET Management	24	18	42	39
Diploma in TVET Trainer	100	43	143	106
<b>Total</b>	<b>124</b>	<b>61</b>	<b>185</b>	<b>145</b>

**Table 2:** Sampling for the Study

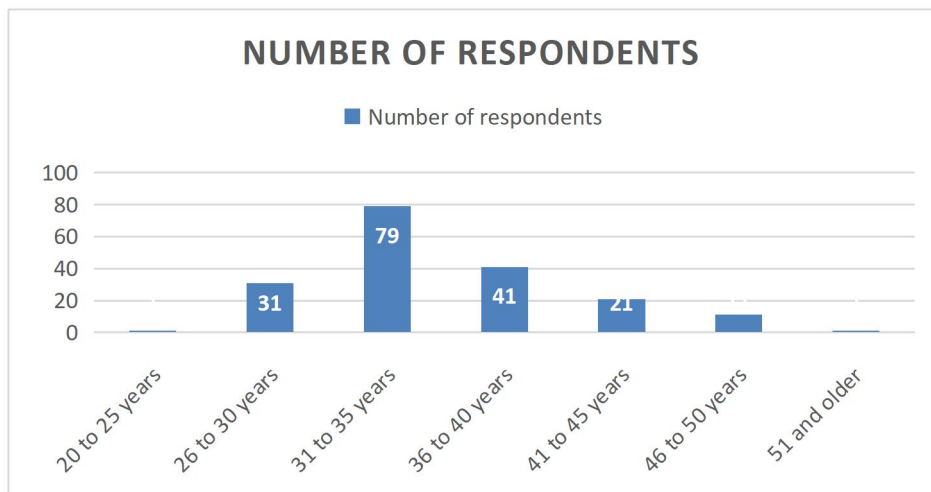
The researchers uphold the reliability of the online survey by using standardized questions from similar research as a guide when compiling the online survey questions for the data collected for the article. Furthermore, a pilot test was conducted with a representative sample to validate the questions' reliability and validity. Moreover, a Cronbach's alpha test run reflects a 0.81, which positively reflects the reliability of the online survey questions.

## **4. Data Analysis and Interpretation**

The NUST-TVET students participated in an online survey administered by Qualtrics to grasp their evaluation of the VLE after completing their studies in 2020. NUST issued an ethical clearance for this research to proceed with the selected students' participation. The researchers contacted these students for informed consent to participate in the study. All the responses are kept private. The ethical principles observed were the right to privacy, voluntary involvement, declining to answer specific questions, and informed and uncoerced consent. A code was allocated to prevent the disclosure of personal information throughout the study's analysis and writing-up stages. Five years after the research is published, the completed Qualtrics survey responses will be deleted as per NUST rules and guidelines stipulated in the ethical clearance letter.

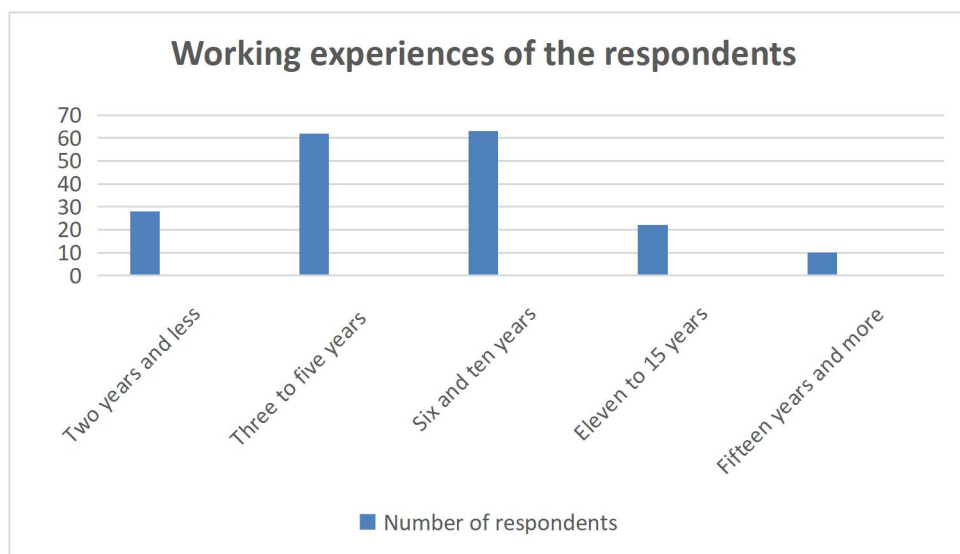
### **4.1 Data Analysis**

The online survey managed via Qualtrics consists of three sections; the questions in the first section addressed the demographic profile of the 185 respondents. The response to the second question reveals that 35 students enrolled in full-time study, 46 for part-time study, and 104 for distance study. NUST TVET department offered two programs to the TVET students: 150 registered for the Diploma in TVET Trainer program and 35 for the Diploma in TVET Management program. The data reflected that 102 students were female students, and 83 students were male students. 145 of the 185 who responded to the online survey graduated.



**Figure 1:** The Age Composition of Respondents

Furthermore, the data showed that nine Grade 10 and 18 respondents had a senior school leaving certificate. In contrast, 72 respondents have post-secondary certificates, 75 obtained diplomas, seven have undergraduate degrees, and six have post-undergraduate qualifications.



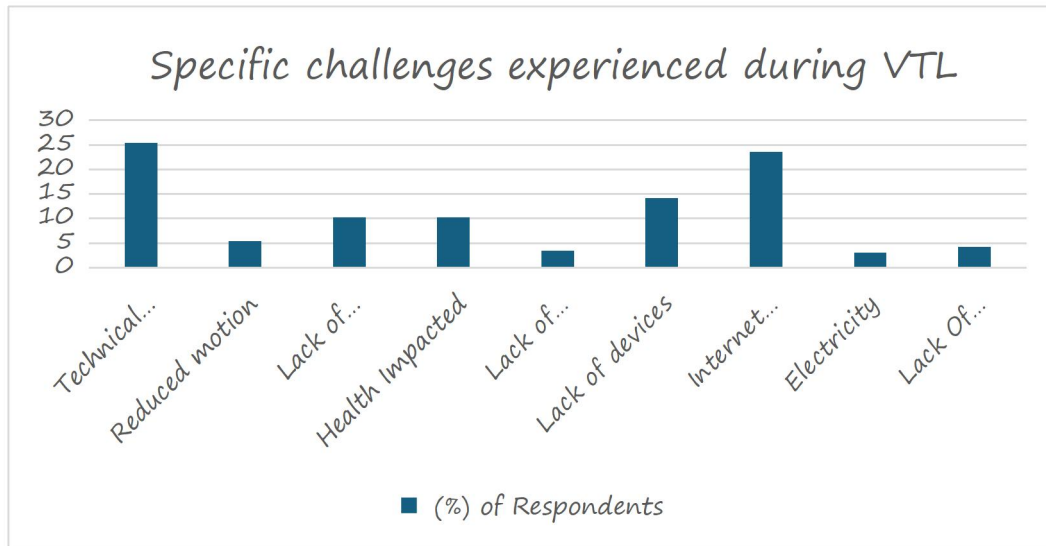
**Figure 2:** Working Experience of Respondents

The second section of the survey addressed the impact of VTL due to COVID-19 on the success of TVET students. The following reflected the results: Very Satisfied (22.7%), Satisfied (51.9%), Neutral (20.5%), Dissatisfied (3.7%), and 1.2 % indicated that they were very dissatisfied. The second set of questions in the section opted to get the respondents' views regarding teaching and learning and their success during VTL during the COVID-19 pandemic. The data revealed that 51.4% of the respondents benefited from VTL. In contrast, 15.1% indicated that VTL somewhat contributes to their success. Furthermore, 25.4% are neutral, while only 6.5% of the respondents stated that they did not benefit, and 1.6% did not benefit from VTL.

The closed-ended question regarding the general impact of VTL shows the following results. Only 25.9% of respondents stated that VTL during the COVID-19 pandemic was convenient. In comparison, 42.3% of the respondents state the flexibility of teaching and learning. In addition, 7.0% rated more focused attention from the lecturers.

The open-ended question in the online survey asked the respondents to describe the challenges they experienced during the COVID-19 VTL. These responses to the open-ended question were grouped under the following themes: technical problems, impact on motivation, impact on health, lack of engagement with fellow students, and support from lecturers. The respondents' responses fell under various themes. The following figure reflects the reactions to these themes.

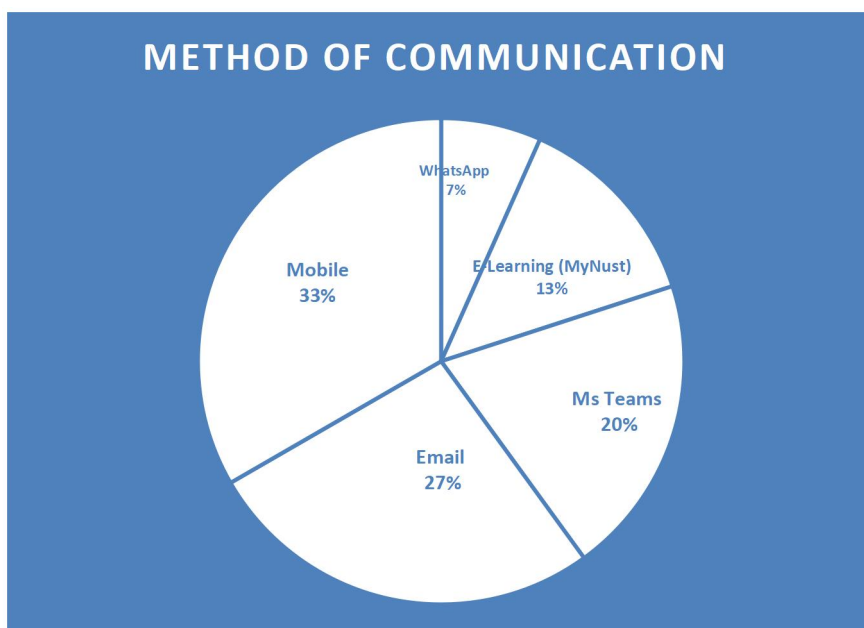




**Figure 3:** Specific Challenges Experienced During Virtual Teaching and Learning

The following question opted to get the opinion of respondents on communication with the lecturers and classmates during VTL during the COVID-19 pandemic. A total of 122 respondents indicated they regularly communicated with their lecturers. A divergence of 20 respondents stated that they did not have access to regular communication with their lecturers. While 42 had occasional contact with their lecturers. Only one respondent indicated that there was no communication.

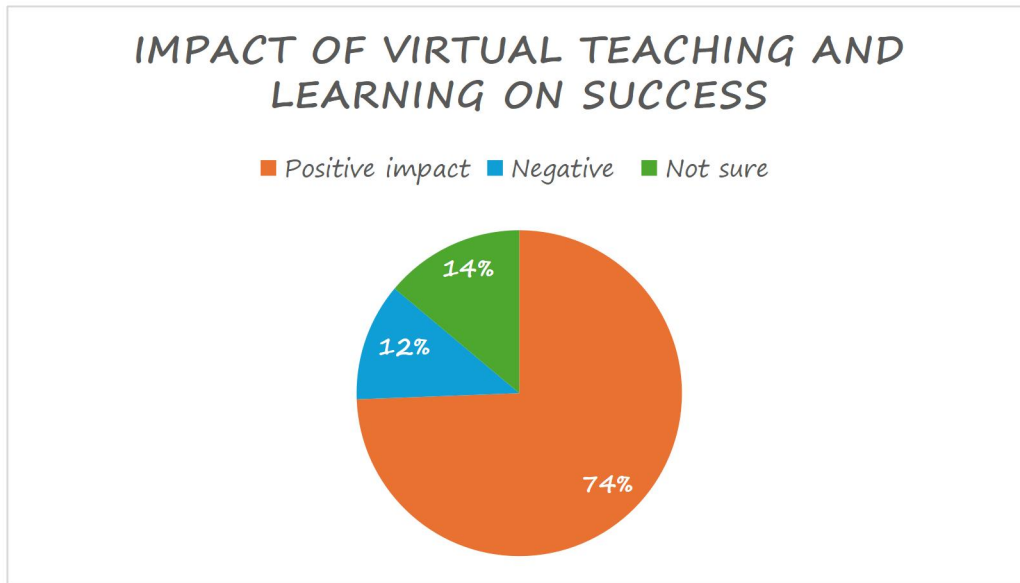
Figure 5 reflects the respondents' rates of the most preferred method of communication with lecturers and fellow students.



**Figure 4:** Method of Communication

The respondents' communication methods during the COVID-10 VTL are mobile, email, and Microsoft (MS) Teams, and WhatsApp for virtual courses. Furthermore, the respondents' response regarding their preferences on instruction post-COVID-19 reflects that 10.9% opted for virtual instruction, while 34% preferred face-to-face instruction. Hybrid teaching was opted for by 45.4% of the respondents. Furthermore, 9.7% opted for face-to-face with a minimum of virtual instruction.

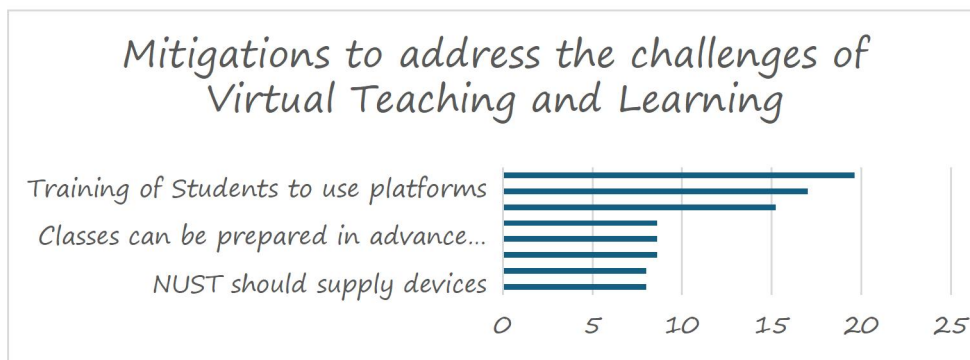
The next section of the questions sought respondents' opinions on how much VTL relates to their academic success. The responses reflect the respondents' overall perception regarding VTL toward academic success.



**Figure 5:** Impact of Virtual Teaching and Learning on Success

74.4% of the respondents indicated a positive impact of VTL instruction. In contrast, only 11.7% gave a negative response to VTL. Meanwhile, 13.9% of the respondents were neutral regarding the impact of VTL.

The following figure reflects the respondents' reflections on mitigations to address the challenges of VTL.



**Figure 6:** Mitigations to Address the Challenges Experienced During Virtual Teaching and Learning Amid the COVID-19 Pandemic

## **4.2 Data Interpretation**

An interesting observation is reflected in Figure 1, which shows that 79 of the respondents are in the age group of 31 to 35 years and have work experience between three and ten years (Figure 2), 72 respondents have post-secondary certificates, 75 obtained diplomas, seven have undergraduate degrees, and six have post-undergraduate qualifications. The researchers concluded a positive relationship between age, work experience, post-secondary qualification, and academic success, as reflected in 145 of the 185 respondents who graduated.

The first section aims to obtain the biographical information of the respondents. The second section of the online offers survey addressed the impact of VTL due to COVID-19 on the academic success of TVET students. The following reflected the results: Very Satisfied (22.7%), Satisfied (51.9%), Neutral (20.5%), Dissatisfied (3.7%), and 1.2 % indicated that they were very dissatisfied. The second set of questions in the section opted to get the respondents' views regarding VTL and their success during the COVID-19 pandemic. The data revealed that 51.4% of the respondents benefited from VTL. The aforementioned is evident in more than 70% of the graduation rate of that intake.

In contrast, 15.1% indicated that VTL somewhat contributes to their success. Furthermore, 25.4% are neutral, while only 6.5% of the respondents stated that they did not benefit, and 1.6% did not benefit from VTL. The challenges that some of these respondents encountered due to VTL may be the reason why these respondents are pessimistic, did not benefit from VTL, or did not graduate.

The closed-ended question regarding the general impact of VTL shows that 25.8% of the respondents indicated that VTL was convenient. In comparison, 42.3% of the respondents state the flexibility of teaching and learning. In addition, 7.0% rated more focused attention from the lecturers. The flexibility option for the most significant percentage of the respondents reflects one of the advantages of VTL. These responses indicate the following themes as challenges: The first challenge is technical problems. Mumtaz (2022) supports the technical challenge and states that internet access problems, a lack of interaction between lecturers and students, and a lack of technological facilities challenge the efficacy of Online Learning. Dube (2020) found related results, where participants also reported limited internet connectivity and workable devices as a hindrance to VTL. These results revealed that limited internet access and high data costs affect students' learning.

The second challenge identified by the respondents is the impact on students' motivation. Rahiem (2020) and Samat et al. (2020) claim that these factors do not motivate students in their learning. Other than inadequate facilities at home, the unfamiliar learning environment, such as 'different' learning activities and tasks that were new to the students, might have affected their motivation to learn. The third challenge is the impact on health and lack of interaction due to VTL. Hazwani et al. (2017) support the challenge raised by the respondents and state that poor posture and headaches are only two physical issues people experience due to excessive screen time. According to Rosian (2023), students keep pace with social change by adapting to the availability of new technologies. This adaptation is crucial, as modern society faces ever-changing technological improvements. Furthermore, Mseleku (2020) argues that students without sufficient guidance may lack the self-discipline to continue engaging with their learning. Mathew and Iloanya (2016) support and state that interaction in VL can boost student motivation and, therefore, improve their mental health and learning outcomes.

A total of 122 respondents indicated they regularly communicated with their lecturers. A divergence of 20 respondents stated that they did not have access to regular communication with their lecturers. While 42 had occasional contact with their lecturers. A study conducted by Al Rawashdeh et al. (2021) reveals that students use VL to enhance communication and interaction with their peers and lecturers. Regular communication with lecturers may create opportunities for motivation and engagement, which may contribute to mental fitness.

Figure 5 reflects the respondents' rates of the most preferred method of communication with lecturers and fellow students. The respondents' communication methods during the COVID-19 VTL are mobile, email, and Microsoft (MS.) Teams and WhatsApp for virtual courses. Furthermore, the respondents' response regarding their preferences on instruction post-COVID-19 reflects that 10.9% opted for virtual instruction, while 34% preferred face-to-face

instruction. Hybrid teaching was opted for by 45.4% of the respondents. Furthermore, 9.7% opted for face-to-face with a minimum of virtual instruction. The responses align with Martin et al. (2023) and Hernández-García (2015), arguing that students can access study groups, message boards, social media groups, or chat rooms.

74.4% of the respondents indicated a positive impact of virtual instruction. In contrast, only 11.7% gave a negative response to virtual instruction. Meanwhile, 13.9% of the respondents were neutral regarding the impact of virtual instruction. Furthermore, the flexibility of digital applications enables lecturers to effortlessly share materials with students, enhancing their understanding of online learning. Halili (2018) states that integrating technological advancements in educational space may improve the teaching and learning experience. The overall positive response towards VTL may indicate that the respondents realized the importance of VTL and the subsequent benefits.

Consequently, these technological advancement methods may enhance student engagement and active participation. Previous studies have shown the positive impact of technology on student learning outcomes (Halili et al., 2018; Dakhi et al., 2020; Puma, 2022). VL mode promotes dynamic discussions, clarification of concepts, and the ability to adapt lesson plans to meet the student's individual learning needs. VTL includes Zoom or Microsoft Teams to conduct classes compared to the face-to-face courses of traditional teaching and Learning (Ariffin et al., 2022; Basar, 2021; Mansor et al., 2021; Nik-Ahmad-Zuky et al., 2020; Samat et al., 2020). While attending online classes, students can create a balance between their academic life and their social life and be able to participate in every lecture.

The respondents got the opportunity to make recommendations based on their challenges experienced with VTL during the COVID-19 pandemic. The respondents recommend the following mitigations to mitigate the challenges they experienced during the COVID-19 VTL.

Classes can be prepared and shared by lecturers in advance- Johnson et al. (2016) state that lecturers may prepare video lectures in advance. These are usually delivered via the web or through Applications. Some video modules require online quizzes to ensure students have absorbed the information. Students may listen and reflect on this work before class and can become active participants in VL.

Internet service providers should offer more reliable Internet services. Mbanga and Mtembu (2020) agree that resources must be available before online learning can be used effectively in TVET institutions. Institutions and resources must be available. Denhere and Moloji (2020) argue that a lack of learning facilities, access to data and connectivity, home climate, and inadequate training and support for TVET educators and students strongly mediate adapting VL in TVET institutions (Denhere and Moloji, 2020).

Regular upgrades- gadgets, systems, and apps are recommended. According to a study conducted by Hazwani et al. (2017), an institution's infrastructure plays a significant role in ensuring that online learning operates effectively and efficiently to contribute to active learning. The continuous betterment and advancement of technology requires institutions, including higher learning institutions, to stay abreast of the latest technology to remain relevant and competitive.

Training of Students to use platforms - The selective utilization of technological tools in educational settings can enhance students' proficiency in digital literacy. Simultaneously, this practice has positively impacted students' academic achievements (Gómez and Mediavilla, 2021). The TVET Department should prepare their students for conditions, like the COVID-19 pandemic, that may require VTL.

The following section addresses the mitigations offered by the participants. There is a need for social services and support for students. Recognizing the significance of VL and the need for change, problems in the adoption process continue to emerge, indicating a critical gap in teaching and Learning (Aina and Ogegbo, 2022; Parlakkiliç, 2019). Therefore, creating a positive learning environment is vital from the lecturers' side. In this positive learning environment, the students should feel comfortable asking questions and welcomed and supported by lecturers and the peer group. The second mitigation strategy is that ICT should

be part of all qualifications offered at NUST. According to Laily and Riadani (2018), integrating technology could significantly influence various academic aspects, such as program development, lecturer expertise and qualifications, and the learning process. TVET is an educational approach that emphasizes aligning academic programs with various industries' specific needs and demands (Singh and Tolessa, 2019). In contemporary technological advancements, lecturers must facilitate knowledge transmission, foster cognitive values, and promote spiritual growth to maintain a harmonious equilibrium between academic progress and holistic personal development (Lase, 2019). The recommendation that ICT should be part of all programs means that students will be more at ease in reaping the benefits of VTL. In addition, it will prepare the students for the industry's ever-changing technological landscape.

Thirdly, NUST should supply devices. The presence of accessible resources can significantly support the professional growth of educators by enabling the implementation of innovative and adaptable instructional methods. These approaches can potentially enhance students' educational and vocational competencies in TVET (Ghavifekr and Yulin, 2021). According to respondents, the last strategy is to prepare for future disruptions. As with the COVID-19 pandemic, many organizations, including higher learning institutions, were unprepared to move instantly to engage VTL fully. In the current era of technological advancements, the educational landscape has transformed from traditional instructional methods to VTL (Lase, 2019). Institutions, including the TVET Department at NUST, should prepare for the unexpected that may require VTL or hybrid Learning.

Only the TVET department students at NUST participated in the study. As a result, this study's results cannot be generalized to the entire student population at NUST. Furthermore, the respondents' responses can reflect personal biases. Additionally, the study did not get the opinion of the lecturers at the TVET Department and Management of NUST.

NUST faculties and departments and other institutions of higher learning may apply the lessons learned from this study. Furthermore, the management of NUST can study the recommendations offered to ensure that all interested Namibians and a larger audience of students globally can benefit from effective virtual instruction to ensure efficient mastering of the content of the programs offered.

There is a need for future research on virtual education, considering the turbulent landscape of the environment, which is impacted by social changes, economic downturns, and political uncertainty that may affect education, as proven by the recent COVID-19 pandemic. The article only looks at the students' perspectives regarding their success due to VTL. Further studies are needed to capture the lecturers' perspectives, the community, industry, and the Namibian Government. Furthermore, the article only looks at the views of the students. A comparative study with other TVET institutions and studies that reflect the view of the lecturers of TVET, Management of NUST, future employers, and ICT service providers may have distinctive findings that may add value to the body of knowledge.

## **5. Conclusion and Recommendations**

### **5.1 Recommendations**

The findings of the study have several important implications for future practice. Virtual education potentially reaches a larger audience and gets over geographical limitations. However, it also makes already existing challenges worse. The research finding also points to the need for effective participation in virtual instruction, which is difficult for students living in rural areas and those with limited access to technology and stable Internet connectivity. It is worth noting that ICT infrastructure should be continuously upgraded as technology improves regularly. Furthermore, support systems are to be upgraded to ensure high-quality TVET education.

A second broad recommendation is that despite the difficulties brought on by the pandemic, the research identifies several chances to improve TVET programs through VL education. The key policy priority should be to plan for the long-term care of reliable internet connection in consultation with various stakeholders, like internet providers, institutions of higher education,

industry, and the Ministry of Higher Education. Secondly, with VL technology, students can participate in practical tasks electronically, allowing them to put their knowledge to use. The move to VL instruction has also created new and innovative assessments coupled with the latest educational technology tools. These prospects highlight the value of incorporating VLE and digital literacy into TVET programs to prepare students for the ever-changing technological demands of the employment market.

Unless the Namibian government adopts technology and facilitation and handles concerns with cost, software, and network access, clear regulations, and procedures for VL in TVET programs become a critical factor to consider. Furthermore, achieving this necessitates a coordinated effort to improve institutional and human capabilities regarding digital competencies and infrastructure. As institutions move forward, the findings from this survey may guide the design of sustainable and effective educational strategies, balancing the demands of remote learning with the benefits of face-to-face interactions.

The difficulties and possibilities outlined in this study underline the demand for a comprehensive, long-term strategy that incorporates efficient teaching techniques, technology integration, policy assistance, and capacity building. TVET programs can use the potential of VL to deliver high-quality instructions that equip students for the demands of a dynamic, technologically advanced world by considering these factors. The TVET programs should continuously align with the ever-changing needs of the job market for the vocational sector.

## 5.2 Conclusion

The benefits of virtual instruction identified by respondents align closely with the advantages often associated with VL. Convenience, flexibility, and focused attention are positive aspects of the VLE. The challenges outlined, such as technical difficulties and reduced motivation, highlighted areas requiring further attention. These challenges have also been recognized in the existing literature and serve as focal points for improvement. Although many respondents appreciate the benefits, such as adaptability and concentrated attention, the difficulties of technological difficulties and decreased engagement highlight the need for continual improvement. The preference for hybrid training and acknowledging the value of VTL in promoting job readiness provide insights into the future of TVET programs as education advances. This topic adds to the larger conversation on the future of TVET education by highlighting the adaptability of students and lecturers in adjusting to virtual environments.

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