Effectiveness of an Online Pedagogy in Trainees' Acquisition of Practical Skills: A Case of Selected TVET Institutions in Uganda

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Abstract

Globally, as emphasised by the Education 2030 Framework for Action, ICTs are being utilised to boost education systems so as to increase knowledge diffusion, broaden access to information, and enhance learning quality and effectiveness. Nationally, the government has committed, through Vision 2040, to mainstreaming ICTs in education so that it can benefit from ICT-enabled learning. The purpose of this study, therefore, was to compare the results of online and face-to-face pedagogies so as to determine the effectiveness of an online pedagogy in trainees' acquisition of TVET practical skills. The study used a quasi-experimental design in which a comparison group (face-to-face pedagogy) provided the baseline data that was compared with outcomes of the experimental group (online pedagogy). The population sample (N) consisted of trainees (n = 69). Observation checklists and questionnaires were the instruments used for data collection. Descriptive statistics were used to define and explain the characteristics of the data and then inferential statistics (independent-samples Mann-Whitney U test) was used to examine the significance of the identified difference(s). The findings of the study demonstrated that there was no statistically significant difference in the acquisition of practical skills between those trained in the skills face-to-face and those trained online. Based on the findings, the study concluded that the processes of delivering practical skills training online is as effective as delivery of the same face-to-face. The study then recommends the development of an online training framework and investment in online pedagogy enablers.

Keywords: *TVET; Pedagogy; Online training; Practical skills; Skills acquisition.*

Introduction

Globally, practical skills are at the centre of all TVET systems and strategies. As hallmarks of TVET, practical skills and how they can be acquired effectively are the two subjects that dominate most discussions on TVET today. Uganda's strategic plan entitled "Skilling Uganda" denotes a paradigm shift for skills development in Uganda through the creation of employable skills and competencies relevant in the labour market instead of educational certificates (Uganda Ministry of Education and Sports [MoES], 2012). Considering that practical skills have until now been predominantly acquired through face-to-face training at the training institutional workshop or the workplace, the idea of teaching them remotely (such as online training) poses numerous concerns. Most of these apprehensions arise from the lack of tangible evidence on how the separation in space and time affects the core facets of practical skills such as competency in the manipulation of equipment; effective selection and use of materials; adherence to health and safety practices; and time taken to perfect a particular skill.

Under the fundamental premise that learning is primarily a social phenomenon, current technologies can accelerate the acquisition of practical skills, even though hands-on practical training cannot be substituted by the technologies (UNESCO, 2017). The core tenet of Education 2030 is to expand upon fundamental education and launch a thorough reexamination of the educational industry in order to create a society that values lifelong learning. The ensuing framework for action emphasises the need for ICTs to "be utilised to boost education systems" and to help increase knowledge diffusion, broaden access to information, enhance learning quality and effectiveness, and provide more effective services (UNESCO, 2015). The ICTs of today have the ability not only to enlighten and entertain but also, as noted by UNESCO (2023), to impact student learning when integrated into the curriculum.

Purpose of the Study

The purpose of this quasi-experimental study was to compare an online pedagogy to a face-to-face pedagogy so as to determine the effectiveness of an online pedagogy in trainees' acquisition of TVET practical skills. By analysing and comparing data from the work sessions of trainees that had trained in the skill delivered online (experimental group) to that of trainees that had trained in the same skill delivered face-to-face (control group), this quasi-experimental study determined the effectiveness of an online pedagogy in terms of trainees' acquisition of practical skills.

Literature Review

To determine the efficacy of a particular pedagogy in delivering practical skills to TVET trainees, the indicators that will identify what has to take place need to first be determined. A search for existing literature on the different skills domains, the different types of skills, and then the pillars that support an effective skills training and practice brought to light the common grounds in any form of effective skills acquisition that forms the basis for a reliable means for measuring trainees' learning and acquisition of practical skills is key in determining the efficacy of a particular pedagogy. Kettunen (2013) notes that two interrelated, but fundamentally diverse, processes make up learning. Learning might come about as a consequence of the learner's interactions with his or her social, cultural or physical surroundings, or it can come about as a result of an internal psychological acquisition process and elaboration in which fresh impulses are linked to the outcomes of previous learning (Kettunen, 2013). Frymier and Houser (1999) based themselves on the idea that students engage in particular behaviours or activities when they are immersed in learning to select nine student actions as learning indicators for a measure to solve the issue. Their findings showed that empowerment, motivation, emotional learning and relevance were all positively correlated with students' performance on learning markers (Frymier & Houser, 1999). Within a digital learning platform, the end of cycle learning outcomes, have been found to be greatly affected by the student's onset performances and desire to seek feedback (Ober et al., 2023).

In their research on the "factors and indicators for measuring students' sustainable engagement in e-learning" as indicators of student engagement in face-to-face learning environments, Lee et al.

(2019) emphasise the following seven behavious: 1) Making an effort to learn, which includes habits that students pick up on their own, such as finishing their homework, getting ready for class and studying after school; 2) Involvement in class activities, which includes showing up, presenting, asking questions and expressing oneself; 3) Interaction, which involves the exchange of information regarding the learning materials between the instructor and the student, which might include queries or requests for learning assistance; 4) Cognitive task solving, or the internal cognitive processes of a learner, such as information acquisition, comprehension, application and memory; 5) Learning satisfaction, a psychological condition that involves learning interest, learning expectations and learning enjoyment; 6) The feeling of being a part of the learning community, which is the degree of ties to friends and classmates; and 7) Learning enthusiasm, which is having an active mentality during learning and may show itself as mental energy and a readiness to take on difficulties, and having a passion for learning (Lee et al., 2019). Johnson and Proctor (2017) note that "skills may have large perceptual (e.g. reading a medical image), cognitive (e.g. reading or remembering large amounts of information) or motor (e.g. typing or skiing) components". This observation opens up a whole new dimension in the quest to understand and thus be able to determine the effectiveness of any pedagogy (face-to-face or online) on practical skills acquisition. Two questions arise here: 1) What is common about skills in the perceptual, cognitive, and motor domains? and 2) Is it possible to use such a commonality to demonstrate an objective, measurable and quantifiable efficacy of a pedagogy on the acquisition of practical skills? The answers to these two questions would offer a solid foundation for designing a calibrated benchmark of indicators upon which to measure the extent of practical skills being acquired by the trainees. Whereas some researchers emphasise commonalities across the different domains, and others, such as Johnson (2013), point to differences, almost all skills, however, require coordinated processes of perception, cognition and action. In acquiring a skill, we learn to select relevant information and link it to actions in a smooth, integrated fashion (Johnson & Proctor, 2017). Practical work involves four skills that are closely related, and these include procedural skills (ability to do something, e.g. cut a timber joint), conceptual skills (to understand complex scenarios and develop creative solutions), process skills (to manage and modify actions, e.g. selecting the right tools) and practical skills (competence in operating a certain piece of machinery or equipment). Abrahams and Reiss (2015) use the following example of a teacher teaching an electricity lesson to illustrate how these abilities connect in the setting of scientific practical practice:

> The instructor of an electrical class wants to utilize a hands-on activity to illustrate how current remains constant inside a parallel circuit. In this case, procedural comprehension would require knowing how, in theory, to construct a workable parallel circuit and how to use and interpret an ammeter with reasonable accuracy in order to obtain the necessary readings as required by the instructor. Knowing that the data obtained from the ammeter readings can be understood in terms of the scientific principle that the flow of electric charge is preserved in a parallel circuit would be the conceptual understanding. The process skills comprise adhering to the instructor's instructions and understanding the fundamental issues that arise with things like fair tests and measurement inaccuracies. Lastly, the practical skills would refer to the student's capability to use the components and tools that are at their disposal in this example to set up a functioning electrical circuit. (Abrahams & Reiss, 2015)

Lamprianou and Athanasou (2009) propose three phases (not necessarily distinct but overlapping in a continuous fashion) for the learning of a complex skill: 1) an early cognitive phase, where initial performance depends more on mental factors, including the ability to understand the task instructions, to concentrate one's attention on the task and to perceive important task details; 2) a practice fixation stage, where correct behaviour patterns are practiced until the chance of making incorrect responses is reduced to zero; and 3) an autonomous stage, where performance is usually locked in as a response pattern and as such characterised by increasing speed of performance in which errors are unlikely to occur (Lamprianou & Athanasou , 2009). The fifth element of Bloom's taxonomy as , cited in Picciano (2017) is: Understanding: Making sense of oral, written, and visual communications by interpreting, exemplifying, categorising, sumarising, inferring, contrasting, and clarifying.

Effective teaching and learning frameworks are derived from psychological, cognitive, social and educational research findings. According to the United States of America (USA) National Research Council (2000), students learn most effectively when: 1) their pre-existing knowledge and

"preconceptions" are acknowledged and engaged; 2) they are given practice and time to construct "conceptual frameworks" on the basis of foundational knowledge through active, experiential and contextually varied learning; and 3) they are given practice and time to "take ownership of the learning" through metacognitive reflective thinking (National Research Council, 2000). Müller et al. (2023) concluded that, when implementing blended learning programmes, the focus should be mainly on simulating interaction, course structure, timely feedback on the learning outcomes and presence of trainers. Skill acquisition, Kaufman (2013) points out, requires practicing the skill in question for significant periods of sustained, focused concentration. It requires creativity, flexibility and the freedom to set your own standard of success (Kaufman, 2013). City and Guilds (2013) guide that during the performance observation and product evaluation, the training facility should use the competence checklist to plan a series of activities that will allow the candidate to demonstrate competence in the necessary practical skills, which frequently involve using equipment in a workshop. City and Guilds also mandate that the training facility use the competence checklist to plan such workshop activities (City & Guilds, 2013).

Study Design and Methodology

A quasi-experimental design served as the study's compass that enabled comparison of outcomes (acquisition of practical skills) of the experimental group (those trained online) with the control group (those trained face-to-face), to determine the efficacy of the online pedagogy, while controlling for any other factors that could affect that result (Creswell, 2014). The study was conducted at St Joseph's Technical Institute, Kisubi and Nakawa Vocational Training College located in Wakiso and Kampala districts of Uganda, respectively. First-year trainees offering the National Certificate in Building Construction (NCBC) programme and the National Certificate in Woodwork Technology (NCWT) programme were selected for the study. For each programme, two practical task trainings were delivered through both face-to-face and online pedagogy.

To promote homogeneity between study groups and ensure equipment and tools are enough for trainees to work on the practical tasks, only trainees that would be comfortably accommodated in the respective institution workshop were selected to participate in the study. Thus, following the administration of the pre-test questionnaire, stratified sampling (gender, academic background, ICT competency and online experience strata) was used to select the 69 trainees who participated in the study. The methods (and respective instrument) of data collection for this study were observation (trainees' work process observation checklist) and survey (pre-test questionnaires). To ensure validity and reliability of the data collected by the instruments, the instruments focused on collecting data that accurately addresses the objectives of the study; the observations were made by instructors who were well versed in the practical tasks being performed; and the Linkert scale observation checklist was piloted by the third-year (finalist) Bachelor of Vocational Studies students (instructor trainees) of Kyambogo University on trainees at Nakawa Vocational Training Institute that were not taking part in the study. A Cronbach's alpha test (SPSS) result of 0.726 showed that the checklist was reliable. Also, the control and experimental groups were in separate institutions for the same practical task, whereas both training sessions (face-to-face and online) of the same practical task took place simultaneously and for uniformity of extent and difficulty of content, the practical task taught in the face-to-face (control) group was the one recorded and digitally enhanced with the use of ICTs, and livestreamed for the online (experimental) training.

A quantitative research approach was used to collect, analyze and interpret data. A group of twenty (20) instructors observed trainees as they worked on the assigned practical tasks after undergoing training of a particular practical task. The observations of each trainee working on the assigned tasks were made for the group that had trained for the practical task face-to-face and the group that had trained for the task online. The observations were made for the work sessions of the two practical tasks in the NCBC programme (Steel Bending and Broken Bond), and another two practical tasks in NCWT programme (Beam Formwork and Equilateral arch centre). Since the work sessions

for the group that had trained face-to-face and that of the group that had trained online took place simultaneously, then the instructors were split into two groups of ten (10) each to observe and score both groups (face-to-face trained group and online trained group). With the number of instructors (10 per session) being smaller than the trainees being watched (15, 19 or 20 per group for each work session), some instructors followed and thus scored two trainees during a single work session. Each observer (instructor) scored their respective trainee (s) for a particular work session (face-to-face trained group or online trained group) using the trainees' work session observation checklist shown in **Appendix II**. For each practical task being worked on, the instructors scored trainees along eight parameters as shown in **Table 1** .

Table 1: Parameters observed during practical work sessions of each practical task

	Observed Parameter
Parameter 1	Trainee demonstrates ability to read and interpret working drawings.
Parameter 2	Trainee consistently demonstrates procedural skills (ability to do something, e.g. cut a steel bar).
Parameter 3	Trainee demonstrates competence in the handling of tools and equipment.
Parameter 4	Trainee demonstrates conceptual skills (understands complex scenarios and develops creative solutions).
Parameter 5	Trainee observes and focuses on the skill being taught.
Parameter 6	Trainee shows interest and is motivated as he/she works on the practical task.
Parameter 7	Trainee demonstrates process skills (to manage and modify actions, e.g. selecting the right tools).
Parameter 8	Trainee demonstrates a sense of belonging and connection with colleagues in the learning community.

Source: Author (2023)

The scoring of each observed parameter was made along a five-point ranked Likert scale that ranged from 'Strongly disagree', 'Disagree', 'Neutral' and 'Agree' to 'Strongly agree'. To simplify the presentation of the findings, the rankings were condensed to just three points that included 'Disagree' (merging 'Strongly disagree' and 'Disagree'), 'Agree' (merging 'Strongly agree' and 'Agree') and 'Neutral'. Descriptive statistics were used to define and explain the characteristics of the data by providing brief summaries (mean) of the data obtained from the Likert scales and then inferential statistics were used to examine the significance of the identified difference(s) between the means. The nonparametric test, the independent-samples Mann-Whitney U test, was used to test the hypothesis of the study.

Findings of the Study

Demographically, the sample population of trainees (n = 69) varied in the institution of study, programme of study, gender, academic background, competency in the use of ICT and experience in online learning. Whereas 56.5% of trainees in the study were from programme A, 43.5% were from programme B. Also, 26.1% of the trainees were female and 73.9% male. Furthermore, 24.6% had Uganda Advanced Certificate of Education (UACE), 71% had Uganda Certificate of Education (UCE) and 4.3% were from Community Polytechnic/Technical Schools. Those trainees who were competent in the use of ICTs stood at 79.7%, while 20.3% were not competent in the use of ICTs. Whereas 26.1% had prior experience of online training, 73.9% had no prior experience of online training.

A total of 138 observations of trainees' practical work sessions were made. Seventy observations were made at St Joseph's Technical Institute, Kisubi. These included 40 observations for the NCBC

programme (20 trainees observed per session x 2 work sessions [one face-to-face trained and one online trained]) and 30 observations for the NCWT programme (15 trainees observed per session x 2 work sessions [one face-to-face trained and one online trained]). Then, 68 observations were made at Nakawa Vocational Training College. These included 38 observations made for the NCBC programme (19 trainees observed per session x 2 work sessions [one face-to-face trained and one online trained]) and 30 observations made for the NCWT programme (15 trainees observed per session x 2 work sessions [one face-to-face trained and one online trained]). The mean scores of the observations made were computed and are presented in **Table 2**.

Table 2: Mean of trainees' work session scores across the eight observed parameters for the face-to-face trained and online trained groups

Observed parameter	Number of observations	Face-to-face mean	Online mean
Parameter 1	138	4.77	4.70
Parameter 2	138	4.39	4.51
Parameter 3	138	4.52	4.30
Parameter 4	138	4.39	4.19
Parameter 5	138	4.43	4.48
Parameter 6	138	4.39	4.42
Parameter 7	138	4.35	4.38
Parameter 8	138	4.14	4.12

The results in the table show that the mean scores of all parameters are above the 4.0 rank ("Agree") across both pedagogies (online and face-to-face). To graphically present the slight differences in mean scores of the parameters, the mean scores of observed responses for the online and face-to-face training sessions across the eight observed parameters were plotted on a line chart. Slightly smaller differences between the line chart plots of the face-to-face and online mean scores exist at parameters 2, 3 and 4, as shown in **Figure 1** below.

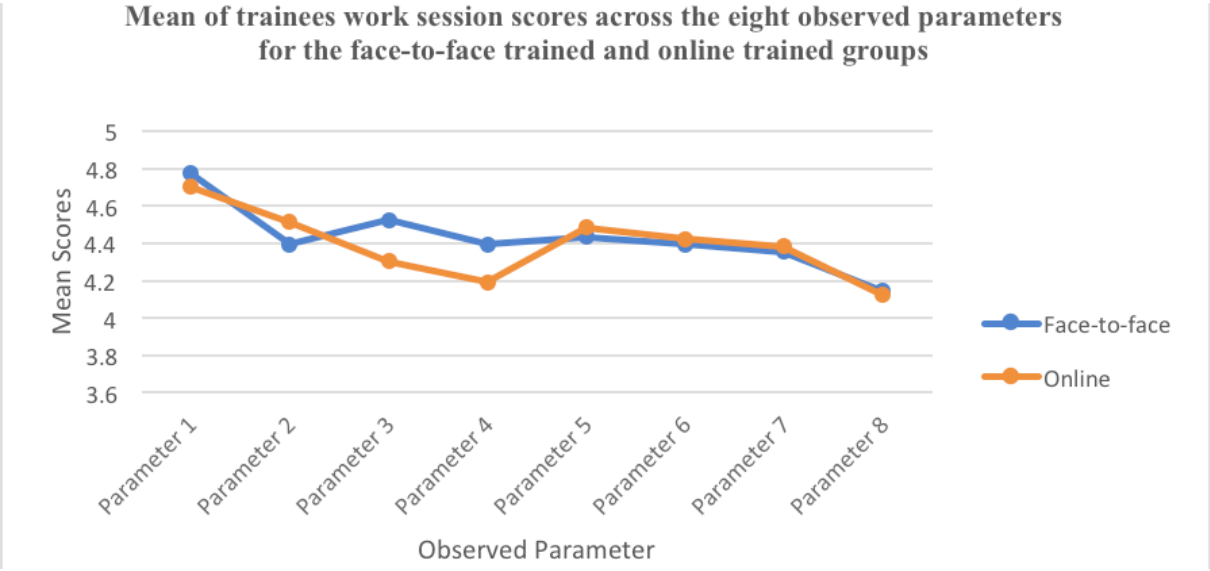

Figure 1: Mean of trainees' work session scores across the eight observed parameters for the face-to-face trained and online trained groups

The hypothesis for the study stated that "*There is no significant difference in the TVET practical skills acquisition of trainees trained face-to-face and those trained online.*" To test the hypothesis, the normality of

the scores was first determined before deciding on which inferential statistical test to run on the data set. The normality of the mean scores was run in SPSS and, owing to the number of samples in the study, the Shapiro-Wilk test of normality was used to test the normality of the mean scores of trainees' practical skills acquisition, as shown by the results in **Table 3**.

Table 3: Normality test for the amalgamated observation means of all the work sessions

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Mean	.126	138	.000	.971	138	.005

Table 3 shows a significant value 0.005 for the amalgamated means. The value was less than the study alpha confidence level of 0.05, which indicated that the amalgamated means were not normally distributed. This is confirmed by the detrended normal Q-Q plot of the amalgamated means (**Figure 2**) in which a sizable number of means are far below the horizontal line, which represents how much lower they are than what would be expected if the data were normally distributed.

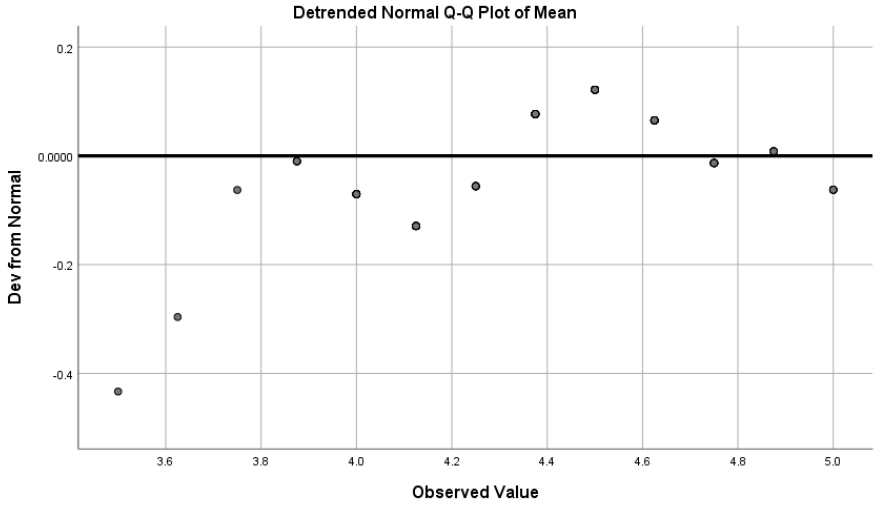

Figure 2: Detrended normal Q-Q plot for the amalgamated observation means of all the work sessions

Considering that the amalgamated observation means of all the work sessions that were to be used in the analysis are not normally distributed as shown above, then a nonparametric test, the independent-samples Mann-Whitney U test, was used to test the means. The results of the test are summarised in **Table 4** and **Figure 3**.

Table 4: The independent-samples Mann-Whitney U test summary

Total N	**138**
Mann-Whitney U	2208.500
Wilcoxon W	4623.500
Test statistic	2208.500
Standard error	232.973
Standardized test statistic	-.738
Asymptotic sig. (2-sided test)	.460

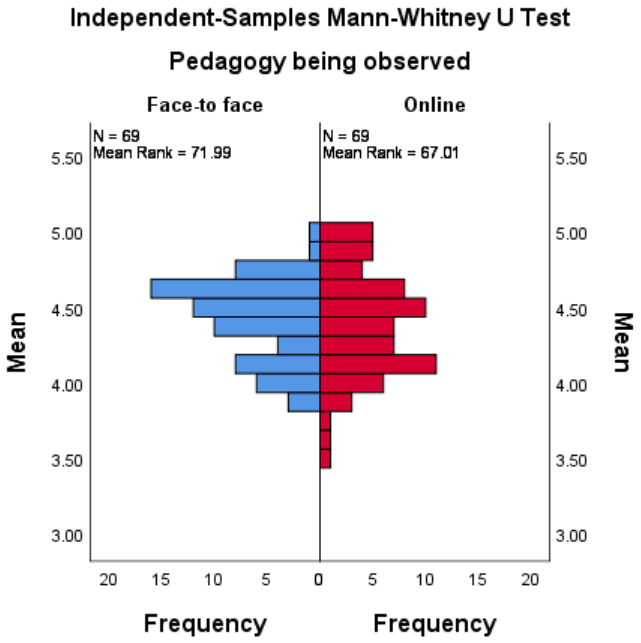

Figure 3: The independent-samples Mann-Whitney U test comparison of means

As summarised in the hypothesis test summary in **Table 5**. Since the significant value p = 0.460 is greater than the study significance level α = 0.05, then the null hypothesis is retained, and the conclusion made that the distribution of trainees' average performances is the same across the face-to-face and online categories of pedagogy being observed in the study. Based on the results, there was no statistically significant difference in the acquisition of practical skills by trainees who trained in the skills face-to-face and those that were trained online.

Table 5: Hypothesis test summary

Null hypothesis	Test	Sig	Decision
The distribution of mean is the same across categories of pedagogy being observed	Independent-samples Mann-Whitney U test	.460	Retain the null hypothesis

Discussion of Findings

The results of the study showed that the distribution of the mean scores was the same across both categories (face-to-face and online pedagogies) being observed and thus the null hypothesis was retained. The findings of the study demonstrated that training in a practical skill online (experimental group) was as effective in eliciting desired outcomes with regard to trainees' practical skills acquisition as the process of training in the same practical skills face-to-face (control group).

The results of the study confirmed that students learn most effectively when, among other aspects, they are given practice and time to "take ownership of the learning" through metacognitive reflective thinking (National Research Council, 2000). The study findings showed that both trainees trained face-to-face (control group) and those trained online (experimental group) in the respective practical tasks clearly demonstrated the ability to read and interpret working drawings; the ability to observe and focus on the skill being taught; interest and were motivated as they worked on the practical task; process skills (managed and modified actions such as selecting the right tools); and a sense of belonging and connection with colleagues in the learning community. These findings are consistent with conclusions of a range of literature that was reviewed for the study. The results are in tandem with the fifth element of Bloom's taxonomy as cited in Picciano (2017), in which he concluded that for understanding to be deemed to have happened, the trainee should be able to make sense of

oral, written and visual communications by interpreting, exemplifying, categorising, summarising, inferring, contrasting and clarifying what has been learnt or delivered.

There is consistency between the findings of the study and Abrahams and Reiss' (2015) categorisation of process skills as comprising adherence to the instructor's instructions and understanding the fundamental issues that arise with things like fair tests and measurement inaccuracies. It also corroborates Kaufman's (2013) writings on skills acquisition where he asserts that it requires significant periods of sustained, focused concentration as well as creativity, flexibility and the freedom to set one's own standard of success. Kaufman captures this assertion in his book entitled *The First Twenty Hours: How to Learn Anything Fast*. The results were in conformity with three of the seven behaviours emphasised by Lee et al. (2019) as indicators of student engagement in a learning environment. The study results of trainees trained face-to-face (control group) and those trained online (experimental group) both showed strong outcomes on learning satisfaction, as a psychological condition that involves learning interest, learning expectations, and learning enjoyment; a feeling of being a part of the learning community, which is the degree of ties to friends and classmates; and learning enthusiasm, as trainees under both pedagogies exhibited an active mentality during the work sessions and many showed positive mental energy, a readiness to take on difficulties, and a passion for learning (Lee et al., 2019). Although there was no significant statistical difference in TVET practical skills acquisition of trainees trained face-to-face and those trained online, a few means of the two pedagogies (face-to-face and online) slightly differed in some of the parameters. The results showed that the mean score of trainees that had trained in a practical skill online was slightly higher for demonstrated procedural skills (ability to do something such as cut a steel bar), which was consistent with Abrahams and Reiss' (2015) works on procedural skills; whereas the mean score for those who had trained in a practical skill face-to-face was higher for demonstrated competence in the handling of tools and equipment. These findings were concurrent with City and Guilds' requirement that the demonstration of competence in the necessary practical skills should frequently involve using equipment in a workshop (City & Guilds, 2013) and the description of practical skills as those that unmistakably reveal a person's competence in using a particular tool, machinery or equipment (Abrahams & Reiss, 2015). However, as noted earlier, the observed differences were very small and, thus, did not in any way signify a strength or weakness of the respective pedagogy. The findings corroborated Kettunen's (2013) view on two interrelated but fundamentally diverse processes that make up learning, and Johnson and Proctor's (2017) observation that all skills require coordinated processes of perception, cognition and action. The mean scores showed that trainees that had trained for the task under both pedagogies demonstrated a sense of belonging and connection with colleagues in the learning community and, at the same time, consistently exhibited good procedural, conceptual and process skills. Also, in agreement with the findings of Frymier et al., cited in Frymier and Houser (1999), that empowerment, motivation, emotional learning and relevance were all positively correlated with students' performance on learning markers, the findings showed that trainees under both pedagogies showed interest and were motivated as they worked on the practical tasks. However, whereas the findings were in tandem with two of Lamprianou and Athanasou's (2009) three phases of the learning of a complex skill (early cognitive phase and the practice fixation stage), the limited duration of the experiment meant that the results were not conclusive on the third phase (autonomous stage, where performance is usually locked in as a response pattern and as such characterised by increasing speed of performance in which errors are unlikely to occur).

Trainees that trained for the tasks online demonstrated that they, too, had, after training, consciously developed intellectual facets of the task for which they had been trained, such as thinking and reasoning. Cognitive presence was further evidenced by the high scores that were recorded for the practical skill acquisition of the online trained group in the three parameters of: (1)ability to read and interpret working drawings; (2) demonstration of conceptual skills (understands complex scenarios and develops creative solutions); and (3) demonstration of process skills (to manage and modify actions, e.g. selecting the right tools). However, because of the limitations of the available technology, the presence of social interaction for the online group gave mixed results. On one hand, because the online sessions were conducted in the same location, the results showed that trainees

demonstrated a sense of belonging and connection with colleagues in the online learning community. On the other hand, the results showed that the training and assessment processes of practical skills failed to provide feedback to trainees about their work.

There was mixed and inconclusive evidence relating to Lee et al.'s (2019) emphasis on the feeling of being a part of the learning community requiring trainees to exhibit a degree of ties to friends and classmates. Whereas the results suggested that during the work sessions trainees that had trained for a practical task online consistently demonstrated a sense of belonging and connection with colleagues in the learning community, this result may only have been possible because the trainees accessed the online training from the same location during the study. As such, this result cannot be generalised, and this calls for more investigations to establish with certainty whether online training in practical skills can elicit trainees' sense of belonging with colleagues in the learning community.

Conclusion

By comparing, assessing and drawing conclusions on both face-to-face and online pedagogies, this quasi-experimental study has revealed insights into the effectiveness of an online pedagogy as a method for TVET practical skills training. The findings provide statistical support and evidence that the delivery of practical skills online is just as effective as face-to-face delivery of the same in terms of trainees' acquisition of practical skills. Besides providing trainees with the option of playing back the training session over and over again to reinforce their learning as they practice, the results have also provided evidence that the online pedagogy can engage trainees to participate in the training session activities (such as full attendance). Parents, trainees and employers can now have confidence that practical skills acquired online are as effective as those acquired in the face-to-face pedagogy. This will greatly ease access to skills as those who may have difficulty or challenges in acquiring skills at the training institutions will still be able to access the same practical skills at home, or at the workplace, via the online pedagogy in the same way the theoretical content has been accessed to date.

Recommendations

1. TVET providers and institutions should be equipped with enablers of online training and assessment that may include internet connectivity with good speeds; a stable electricity source that also has a back-up system in case of an outage; and ICT equipment (digital video cameras, video editing equipment, sound equipment, projectors, computers and Wi-Fi routers, among others).
2. TVET providers should develop and accumulate practical skills training content to be used in the online pedagogy, starting with recording their face-to-face training sessions that may then be edited and enhanced for online delivery later.

Limitations of the Study

The need for trainees to work on practical tasks meant that the study had to take place in the workshops. This dictated that the sample population had to be in numbers that could be accommodated comfortably in the respective workshops. The resulting small sample size and the fact that only two programmes were selected for the study constituted a limitation to the study that may possibly affect generalisability of the findings to the larger national or regional population. Also, because of the limited number of female trainees in the TVET programmes selected for the study, the study sample did not represent the gender population size.

Suggestions for Further Research

A replication of this study should be done with an expanded scope of study to include several other formal and non-formal TVET institutions (both public and private) across the country to see if there are any changes in the results of this study.

Declarations

Availability of data and materials

The authors confirm that the sources of data supporting the findings of this review are available within the article.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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