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Stakeholders' Perceptions on the use of an ICT-Enabled Onboard Diagnostic System Tool for the Teaching of Motor Vehicle Mechanics at Port Harcourt Technical College, Nigeria

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Abstract
This research study seeks to explore the experiences of the use of an ICT-enabled On-Board Diagnostic (OBD) system scanning tool in the teaching and learning of Motor Vehicle Mechanics (MVM) in the Government Technical College, Port Harcourt, Rivers State, Nigeria. The study is guided by the question: *How do we improve teaching and learning in MVM using the OBD system?* A qualitative exploratory case study involving a community-based participatory action research (CBPAR) approach was used to engage in individual and focus group interviews with purposefully sampled technical college teachers and students, alongside industry employers in the Motor Vehicle Mechanics Trade. The study is framed within the Triple Helix theory which calls for improved and increased relationship amongst academia-industry-government institutions in an industrial economy to stimulate innovation. This framework opens creative ways for tracing the role of ICTs in improving teaching and learning in MVM trades. Our findings reveal that the use of ICTs helps in the development of technical college students' new knowledge and problem-solving skills; willingness to learn; and experiential learning, amongst others.

Key words: Computerised On-Board Diagnostic System; Motor Vehicle Mechanics; Triple Helix Theory

Introduction

The Federal Government of Nigeria, in recognition of the importance and role of Information and Communication Technologies (ICTs) in the modern world, has integrated ICTs into their last revised education policy in Nigeria, dated 2004, which is known as the Federal Republic of Nigeria (FRN) National Policy on Education (NPE) (2013). In addition, the NPE (FRN, 2013) states that the government will make ICT facilities available in all schools. Despite this promise, the country still lacks in the use of ICT in achieving educational aims. The reality of the possibility of great achievement proffered by ICT remains a mirage in most Nigerian schools, particularly technical colleges (TCs) (Adeyemo et al., 2015). The purpose of this study was to explore the use of the ICT-enabled On-board Diagnostic (OBD) system scanning tool in the teaching and learning of the Motor Vehicle Mechanics (MVM) trade programme. More specifically, the study was designed for the Government Technical College (GTC), Port Harcourt, Rivers State, Nigeria. Therefore, using a qualitative case study design, the experiences of three stakeholder groups were elicited, namely: a MVM Trade Technical College teacher, students, and a member of the industry. Producing employable MVM trade graduates that will meet industry employers' demands adequately qualified technical manpower and all the available resources to accomplish this. Majumar (2011) argues that the challenges of the 21st century present a radical and different economy, which is likely to impact Technical and Vocational Education and Training (TVET). One of these challenges is the globalisation of knowledge in society and the ICT revolution (Majumar, 2008). The maintenance of the numerous subsystems of modern automobiles has become highly challenging and expertise demanding (Ogbuanya & David, 2020). For example, today's cars are rolling computers, with 30 to 100 microprocessors controlling various systems (Ogbuanya & David, 2020). These systems require routine diagnosis, maintenance, and service (AutoMech, 2012). As Mertl (2016, para. 12) argues, "[T]he level of sophistication is likely to rise as self-driving vehicles move closer to mass production".

It is disheartening to note that in this age of technology explosion, the teaching and learning in most Nigerian TVETs still follows the old traditional and manual approach, which is classroom-based. The TVET system is "characterised by a significant lack of practical relevance and responsiveness to labour market needs, insufficient infrastructure and equipment" (Lolwana, 2017, p. 11). The effectiveness of a TVET teacher would depend on his/her ability to navigate the above-mentioned challenges and leverage all the available ICT resources that industry and other sectors have to offer. Furthermore, the training of a 21st century MVM trade graduate would have to inculcate the requisite knowledge, competence and employability skills, coupled with the application of modern technology and other facilities that would give them a competitive advantage.

Conversely, one of the major challenges facing TVET programmes in Nigerian TCs is a lack of adequately trained teachers. As in other parts of the region, workplace exposure or industry training is not yet a structured part of TVET teacher training (Papier, 2017). Teachers are trained in mere academic universities based on upgrading their qualification, not their skills. Very few TVET programmes, if even any, combine pedagogical competencies with technical qualifications and industry experience (Lulwana, 2017). This implies absolute dependence on a paper-based qualification rather than being trained with the necessary practical skills. This impacts negatively on the type of graduates produced in the country's TCs.

In the next section of the paper, we present a review of the TC programme, the emergence of the OBD diagnostic system, the need for training and retraining teachers, and strengthening technical teacher education. Furthermore, included in this presentation is the methodology, theoretical framework, findings, and conclusion of the research.

Technical College Programmes in Nigeria

TCs are educational institutions established with the aim of training and producing technicians for industry who will become self-reliant and contribute to the economic growth and development of their nations (Okolie et al., 2019). TCs are principal TVET institutions in Nigeria given the mandate to deliver full vocational education and training to equip graduates as well as prepare them for gainful employment in public and private industry (FRN, 2013). These TCs are categories of secondary or high schools in Nigeria where students acquire training and skills in various trades (Legg-Jack, 2014).

According to the FRN (2013) and Federal Ministry of Education (2005), TVET was prescribed by policymakers as a practical education choice for redirecting the nation towards sustainable development, poverty mitigation, responsible citizenship, industrial progress and economic advancement. Considering the experiences of the Koreans and Asian Tigers whose economies were changed from regressive states to frontline nations, Dangote (2013) endorsed TVET as a necessary paradigm for Nigeria's industrial advancement. According to Caleb and Udofia (2013), if TVET in Nigeria is to be a tool for technological development, then it must equip its recipients with both technical and soft skills that allow for flexibility and the ability to work across a wide range of fields and occupations. They argue that TVET in Nigeria needs to prepare its graduates with skills that go beyond taking up immediate employment, but with skills that enhance the employability of its graduates so they can adapt to different jobs throughout their lifetime. However, there is a great question as to how relevant the school curriculum is to meet these requirements outlined by industry (Caleb & Udofia, 2013).

Graduates of TCs are expected to possess skills in the MVM trade, among others (FRN, 2013). The MVM trade is one of the TVET programmes that involves the acquisition of scientific skills in the design, selection of materials, construction, operation, and maintenance of motor vehicles (Audu et al., 2014). According to the National Board for Technical Education (NBTE), the MVM programme is designed to provide craftsmen and master craftsmen with the skill to carry out preventive maintenance, general repair, and overhauling of various automobile units and components (NBTE, 2017). The MVM trade at TC level consists of three components, namely: service station mechanics work; engine maintenance and refurbishing; and auto electricity. The philosophical foundations for the establishment of the MVM programme, as stipulated by the NBTE (2017), is to produce experienced automobile craftsmen for Nigeria's technological and industrial development as well as conduct examinations leading to the award of the National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) for automobile craftsmen and master craftsmen, respectively. Unfortunately, several studies (Idris et al., 2020; Ogbuanya & David, 2020) have reported that graduates of MVM lack the requisite competence to be either employed or self-reliant due to teacher and facilities-related issues, among others, that are associated with their training. Consequently, there is a need to properly equip teachers within the MVM trade with adequate and appropriate skills, which guarantees them the knowledge to impart the same to their students in order for these students to acquire the right skills and be gainfully employed.

According to the NBTE (2001), the aim of the MVM trade is to enable its graduates to test, diagnose, service and repair any fault relating to conventional motor vehicle main assembly units and system to the manufacturer's specification. Specifically, for Vocation 1 (Senior Secondary 1/Grade 10), their course content covers: service station mechanics work, e.g., engine repairs; engine maintenance and refurbishing, e.g., fault-finding analysis and diagnosis; and auto electricity, e.g., all electrical wiring. Thus, MVM trade students are expected to possess the following attributes, namely: good problem-solving skills; the ability to hear, smell, see clearly, and communicate effectively; manual competencies and mechanical aptitude; an interest in mechanical/electronic systems in motor vehicles; the ability to drive a range of vehicles; the ability to read technical diagrams and illustrations; physical fitness; safety consciousness and a responsible work attitude; and keeping pace with technology (Manitoba Advance Education and Training [MAET], 2005). Therefore, meeting these attributes depends on the quality of the teachers that are employed to implement the programme. Ogbonna et al. (2021) argue that teachers of the MVM trade are to equip students with the necessary theoretical knowledge and practical skills that will enable the graduates of Motor Vehicle Mechanic Work to set up their own workshops, be self-employed, and even employ others. Accordingly, skilled teachers are considered the driving force behind effective teaching and learning (Ismail et al., 2017). Likewise, the quality of TVET graduates equipped with technical knowledge and skills to fulfil the job market is dependent on a competent and skilled teacher (Ismail et al., 2018), especially with skills related to the manipulation of the OBD technology to avoid potential errors in diagnosing car trouble codes and making appropriate repairs (Malone, 2006).

The Emergence of the OBD System

Fault-finding in vehicles is carried out to improve their efficiency. According to Surasinghe (2014), a breakthrough in automobile efficiency came into existence in the form of On-board computers, otherwise known as the OBD system, in the early 1980s. The OBD system is one of the computer systems fitted in cars to discover and diagnose problems that occur in vehicle's systems and subsystems with the data reported by the Electronic Control Units (ECUs) (Sawant & Mane, 2018).

There are basically two types of OBD systems: the OBD I and OBD II. The OBD I is found in cars manufactured from 1991 to 1995, whilst the OBD II is found in cars manufactured from 1996 to the present. Some reasons for the modification to OBD II, which are lacking in OBD I, include the consistency in communication and interface while allowing different interpretations among vehicle manufacturers' software-based systems (Ezeora & Ehimen, 2021); support in a range of protocols; provision of healthy information about the use of a vehicle; delivery of relevant and fast data for tracking; and rectification of trouble codes (Caffrey, 2016). The emission control system of the OBD II is high compared to the OBD I, as the latter made it difficult for drivers to pass the emission test (Surasinghe, 2014). Another reason is that there is an engine light on the dashboard with which the OBD II communicates a fault, which is not found in the OBD I. The OBD system functions with other units in the car such as the ECU and the Transmission Control Unit (TCU). The ECU functions with the sensors placed in the various parts of the car, mainly the engine area. When the ECU detects a fault, it communicates with the OBD, which stores it as a code known as the Diagnostic Trouble Code (DTC). It is at this point that a technician or mechanic connects a tool called the OBD system scanning tool to read the code to provide the necessary information for repairs. Therefore, manipulating this tool requires skilled personnel since it is ICT-based. ICT has been globally identified as an effective tool that brings about rapid transformation (Audu et al., 2014). Therefore, it is significantly important to improve on the academic training of technical instructors, especially vocational teachers, since they are saddled with the responsibility of equipping students with different vocational competencies and the knowledge necessary for them to establish and survive in their occupational trades, and to also contribute to the development of their immediate community and society at large (Adeyemo et al., 2015).

Training and the Retraining of MVM Trade Teachers

Keeping pace with the latest technology has created competition globally, hence the need to train and retrain teachers. The training and retraining of a TVET teacher, as defined by Mohamad et al. (2009), is the preparation for a job, and the improvement of performance and knowledge of a current job. Training can also be considered the acquisition of knowledge, competencies, attitudes, and experiences that enable an individual to make an effective contribution to the combined effort of a team in service delivery (Audu et al., 2014). Retraining is the upgrading of existing skills or the acquisition of a new one (Audu et al., 2014). Ahmad and Essien (2021) define TVET teacher training as the process of developing knowledge and skills that will be useful in the immediate or near future, while retraining is the process of attaining or advancing a particular skill, and this can be achieved by accelerating the learning process or by joining other training centres. Audu et al. (2014) stress that a training and retraining programme should expose the MVM trade teacher to the necessary facilities that they have to work with in their fields. Accordingly, technical institutions are expected to be equipped with gadgets, resources, and materials essential for use in the classroom and workshops (Audu et al., 2014). Goro (2000) notes that teachers must be provided with these, and should have access to the necessary technological equipment, training, and resources that will result in enriched student learning. Moreover, TVET teachers who are highly experienced and skilful are catalysts in the development of high-quality graduates (Ridzwan et al., 2017). Since TVET is capital intensive, providing teachers with access to technological equipment depends on the college's partnership with the industry.

Strengthening Technical Teacher Education

In producing graduates with the requisite skills, the industry sector is considered an essential component in ensuring the effectiveness of TVET institutions in generating qualified and skilled workers. Consequently, forming partnerships with the industry empowers TVET teacher training and retraining through the acquisition of practical skills, positive attitudes, and the gradual development of teachers' understanding of working within the industry (Bukit, 2012). Dependence on the industry as a means of accessing the latest technology and practices, as well as indicating the level and types of skills currently required, ensures that the TVET curricula and teaching methods are relevant and up to date (Bukit, 2012). According to Bukit (2012), close partnership with the industry avails the teacher an opportunity to access information concerning the latest technology in use in the industry, which can form the basis of a suitable teaching module. Evidently, most sophisticated forms of technology are used in industries, and considering the rapid technological explosion and competing with other graduates from the automobile industries in other parts of the world, there is a need to get used to the latest technology within the automobile industry. For example, to strengthen TVET teacher education, specialised training was conducted in automotive diagnostics for some new TVET teachers participating in Handwerkskammer (HWK) Erfurt Germany and nine TVET colleges in the Eastern Cape Region of South Africa (Findley, 2021). The essence of the programme was to enable teachers to provide training that will assist motor mechanics to diagnose problems quickly and precisely.

Theoretical framework

This study was guided by the Triple Helix theory of academia, industry, and government relations (Etzkowitz & Leydesdorff, 1997). According to these authors, this theory is a model that encourages a trilateral network amongst academia, industry, and government to stimulate innovation. The theory proposes an enhanced role for academia in innovation in a knowledge-based society. The implication is that academia, in partnership with the industry and government, has an equal role to play in stimulating innovation in a knowledge dependent economy (Leydesdorff, 2000). The Triple Helix model constitutes three basic elements: A more *prominent role for academia* in innovation on par with that of industry and government; a *trilateral collaborative relationship* between institutional spheres in which the outcome of a given policy is the product of the three institutions rather than coming from one of the institutions solely; and an *assumption of each other's role* in conjunction with fulfilling their traditional roles.

Deductions from the principles of the Triple Helix model hinge on stimulating innovation through collaboration amongst the three institutions. Hence, the involvement of the automobile industry in this intervention to improve the teaching and learning in the MVM trade via the use of a computer device, otherwise called the OBD II scanning tool. This promotes the production of graduates equipped with the necessary skills to deal with the modern technology used in the industry.

Methodology

To address the research question, a qualitative (Teherani et al., 2015) case study design (Merriam, 2009), involving a community-based participatory action research (CBPAR) approach (Banks et al., 2013), was employed. "Qualitative research is the systematic inquiry into social phenomena in natural settings" (Teherani et al., 2015, p. 669). These phenomena may cut across, but are not limited to, individuals' lived experiences, how people and/or groups behave, how organisations function, and how relations are shaped through various interactions (Teherani et al., 2015). On the other hand, case study, as was employed in this study, entails "an in-depth description and analysis of a bounded system" (Merriam, 2009, p. 40). Whilst CBPAR is considered research that entails some level of active involvement of a range of community stakeholders, it generally operates from a value base that is derived from a commitment to sharing power and resources, and working for the beneficial outcomes of all involved (Banks et al., 2013).

Consequently, the study focuses on having an in-depth description and analysis of stakeholders' views involved in the use of an ICT-enabled OBD system tool for the teaching of MVMs at Port Harcourt Technical College.

Thus, the sample of this study, which was purposively selected (Ames et al., 2019), consisted of eight stakeholders, namely: one TC teacher, six Vocation One students, and one industry employer from the automobile trade. The students were selected based on their availability and willingness to participate in the study as determined by class attendance.

The data were generated through individual interviews as well as focus groups discussions (Cohen et al., 2011). These methods were considered appropriate as they allowed credibility of the data to be achieved through triangulation of sources as well as the sample (Creswell & Miller, 2000).

Thematic analysis was used to analyse the data (Hesse-Biber & Leavy, 2011) which took place according to the following five stages: transcription of the recorded focus group discussions and semistructured interviews; reading and familiarisation; coding of data; searching for themes; and review of the themes that emerged before reporting.

The intervention study was carried out in stages. Firstly, a programme was planned based on the topic of fault-finding using the OBD II scanning tool. Secondly, the students were taught theoretically in the classroom by the industry employer on the different types of the OBDs that have emerged over the years. Thirdly, they were taken to the workshop where a faulty Toyota Sienna car was parked. Fourthly, they were taught where to find the year of manufacture of a car so as to know the type of scanning tool to be used; thereafter, the guest lecturer asked them about the tool, and they all echoed that it was the OBD II. Fifthly, they diagnosed the car, and, in a few minutes, they found two things that were problematic: misfiring in the 3rd cylinder, and the Antilock Braking System (ABS).

Results

The results of the study show how the introduction to OBDs influenced the students' approach to their own learning, as the following themes came to the fore: the potential to enhance problem-solving skills; develop eagerness/willingness to learn; and develop relevant new specialist knowledge and competence. Moreover, it highlighted the enhancement of knowledge through experiential learning; the inadequacy of teacher knowledge; and the inadequacy of curriculum coverage on the use of OBD.

In the next section, we present the findings of the participating students' experience, followed by that of the teacher, and finally, the employer.

The Students' Experience

The findings from the analysis of the focus group interviews revealed the following three ways in which the MVM students experienced the introduction of the OBD II scanning tool in their instruction:

- As having the potential to enhance problem-solving skills;
- As developing an eagerness/willingness to learn; and
- As aiding in the development of relevant new specialist knowledge and competency.

Potential to enhance problem-solving skills

This category refers to the perceived potential offered by the OBD II scanning tool in improving students' fault-finding and diagnosis problem-solving skills. The students were used to the old and manual method of trial and error in fault-finding and diagnosis, but with the introduction of the OBD II scanning tool, there was the potential for their fault-finding and diagnosis skills to be improved. This is evident in their comments below:

> *It has brought a* ***lot of change*** *..., when you go to a motor* [car] *instead of us, as in eeh .... reasoning another thing in the car when someone brings a car, we will just go directly to it, using our system to find out the fault of the car, and go directly to the source, and do the work, and give the person the car. It has done a lot of things that, you cannot be touching anywhere**, doing guesswork** than using the computer to find out the fault* ... (MVM student 1).

As can be seen from the above excerpt, the potential afforded by the OBD II scanning tool is the removal of 'guesswork' in the process of fault-finding and diagnosis. Similarly, other students commented and raised the point that the OBD II scanning tool not only eliminates guesswork, but allows for faster and efficient processing of fault-finding and diagnosis. This is evident in the excerpts below:

> *…When the man from industry brought the diagnostic machine, when he taught us, I realised that we are living in a computerised world, whereby everything* ***goes easier for us****, whereby if somebody brings a car, and says, "I don't understand this in my car, saying the engine is doing like this or like that"…* [there is] ***no need for you to guess*** *… just use the diagnostic tool; just plug it* [in]*, it will just show you what you are going to do, just go straight to the point, don't go and touch here,* [and] *touch there because of one fault and destroy another* (MVM student 2).

> *... he taught us many things about* [the] *car, how you can use the diagnosing tool ...to find a fault easily in a car, not like if a fault is in a car, in the gearbox, you start scattering the engine, the diagnosing tool just **go**[es] **straight to the point*** (MVM student 4).

> *What the man taught us last week, it gave me more knowledge to know how to find fault in vehicle and to know how to solve them **without wasting time** finding where the fault is, just go straight to the diagnostic system under the steering and you plug your wireless or wired tool i[n], to make sure you find the fault and you solve the problem, to make work easier* (MVM student 3).

As illustrated in the excerpts above, the OBD II scanning tool has the potential to enhance the problem-solving skills of MVM students in that it eliminates guesswork from fault-finding and diagnosis, moving to the use of faster and more efficient ways of achieving the latter.

Willingness to learn

This category refers to the ability to stimulate the students' intrinsic desire to learn. This implies the inculcation of the desire, interest, and readiness of an individual to learn new things. The use of the OBD II scanning tool aroused the students' interest to learn and, as a result, they were willing to explore new ideas of how to use the scanning tool. This willingness is expressed in various ways in the excerpts provided below.

> *... even in our class, when they rang the bell to indicate school was over for the day, the industry man was still there teaching, we were there to learn; I wish that he could come every day. I was even very happy ….* (MVM student 2).

Student 1 concurs with the above statement:

> *This technical practical that this industry man has come to do now, it helped us to enhance our knowledge and helped us to be motivated in some things and make us to be energetic ... the motivation, like now, is high, this exposure will help us to go further* (MVM student 1).

The inculcation of the intrinsic value to learn is seen in the students' willingness to remain in class long after the bell had rung. Furthermore, one of the students affirmed their awareness of the potential that this exposure has for their development, which they viewed as promising.

Development of relevant new specialist knowledge and competency

This category refers to the ability to acquire and develop new and specialist knowledge or competency that is relevant to the learners through innovation, like Voice Command Technology (VCT). The introduction of the OBD II scanning tool afforded the students the opportunity to learn about the programming of Voice Command Devices (VCDs). As can be seen from the comment below, the OBD scanning tool introduced the students to the skill of personalised security systems in cars through programming.

> *I benefitted that day when we were taught that in modern cars, there are censors inside the key, so you programme your key to your car, that even if a particular key like that should come, it cannot open the car apart from your key. He told us, because we asked him about the master key ...* (MVM student 5).

> *He said that if you don't want your car to be stolen, you should diagnose it with your voice, like when you speak the car will open, or when you touch the car with your body, the car will open* (MVM student 3).

From the excerpt above, the use of the OBD scanning tool affords one the ability to develop skills for using VCTs to either trigger the ignition or open or close a car's door. Likewise, on developing programming skills using voice commands, another student remarked that

> *…. you can use the diagnosing tool to set a code on a car, when you talk, the car can open …* (MVM student 4).

Conclusively, the last student that commented asserted that through the use of the OBD scanning tool, one can develop a new competency in:

> *… how to manufacture* [a] *key,* [and] *how to give commands to* [a] *car with your voice and it will open …* (MVM student 6).

From all four excerpts above, it can be seen from the students' experiences that the use of the OBD scanning tool has exposed them to the development of highly technical and unfamiliar knowledge and competency in programming that is applicable to daily life experience. There were variations in their experiences of the skills developed. Participant 5's experience was that the use of OBDs affords one the ability to programme a car key so that it cannot be stolen, whilst for Participant 6, the affordances of the OBDs include car key manufacture and voice code programming. Alternatively, for Participants 3 and 4, the use of the OBD scanning tool has developed in them the ability to programme a car with a voice code so that it cannot be stolen, as well as how to open a car through a programme voice code. From these findings regarding the students' experience with the use of the OBD scanning tool, one can easily conclude that the introduction of the computerised device has exposed the students to new knowledge and ideas that were totally different from what they were used to, but very relevant to the MVM trade.

Teacher's Experience

The findings from the analysis of the personal and focus group interviews revealed the following two ways in which the MVM teacher experienced the introduction of OBD II in the instruction of the students:

- As the development of students' readiness/willingness to learn; and
- As the development of enhanced knowledge through experiential learning.

Development of students' readiness/willingness to learn

This category refers to the level of preparedness and zeal shown by the MVM trade students to learn as a result of the introduction of the OBD II scanning tool for instruction.

> *… like I said earlier, so many of them after that lesson that day came asking me, Sir, when do we have this lesson again…we didn't know such a thing, such a tool will be used to detect a fault, and the thing reads immediately …* (MVM Trade Teacher).

As can be seen from the teacher's comment above, there is readiness in the students to gain more knowledge due to the introduction of the OBD II scanning tool. The excerpt not only highlights their level of excitement, but also shows their inquisitiveness and eagerness to learn. Suffice it to say that the availability of the device stirred their interest and curiosity to acquire more knowledge in fault-finding and diagnosis using the scanning tool.

Development of enhanced knowledge through experiential learning

This category refers to the ability to develop and improve students' knowledge through performance. This is illustrated in the teacher's comment below:

> *... as it was said that 'seeing is believing' ... Yes, I for one experienced a change ...* (MVM Trade Teacher).

The teacher's comment above signifies the development of enhanced knowledge since he admitted that he "*experienced a change"*. The implication is that there was a change in knowledge through the practical use of the OBD scanning tool.

Employer Experience

The findings from the analysis of the personal and focus group interviews revealed the following three ways in which the participating employer experienced the introduction of OBD II in his instruction:

- As the development of eagerness in the students to learn;
- As inadequate teacher knowledge of OBDs; and
- As inadequate curriculum coverage of OBDs.

Eagerness in the students to learn

This category refers to the observable change in the students' behaviour regarding their own learning. It refers to the intense eagerness and joy demonstrated by the students to learn. The enthusiasm of the students to learn fault-finding and diagnosis increased because of the use of the OBD II scanning tool, which is justified by the employer's comment:

> *There is a very big change because most of the students didn't want to go, I exhausted my time, exhausted the time given to me, and even the students' own time ... they were supposed to go ... but they were prepared to stay till 5pm that day. So, that alone, I feel there is a very big great change ...* (Employer).

From the employer's comment above, it can be clearly seen that the students' eagerness to learn was evident in their refusal to leave the class, even when the employer had closed the lecture period, and used the extra time given to him.

Inadequate teacher knowledge of OBDs

This category refers to the absence of adequate technical knowledge possessed by the teacher. The implication is that the MVM trade teacher(s) is not adequately trained in the use of the OBD II scanning tool.

> *…. government should create room for teachers to go and learn this, they must sponsor the training because this section wasn't covered when they were learning on campus. There should be experts that work with the teachers, or that government send[s] the existing teachers for in-service training, give[s] them more training on using these tools, because they know how to teach about fault-finding, but fault-finding using these tools ...* (Employer).

The excerpt above justifies the employer's perception that the average MVM trade teacher lacks experience in the use of the OBD scanning tool. Thus, he recommends that government should intervene by organising in-service teacher training to address the gap in the use of the facility.

Inadequate curriculum coverage of OBDs

This category refers to the limited nature of the curriculum content in treating topics related to the use of OBD scanning tools for instruction on fault-finding and diagnosis in the MVM trade. The excerpt below validates this.

> *I found is lacking in their curriculum, it's not in their curriculum, this fault-finding using the computer is a new innovation coming in now, so I believe if it is not in the syllabus, government should put it in the syllabus* (Employer).

The excerpt above shows that at the time of this research, the college was using an outdated curriculum in the teaching and learning of the MVM trade. This is highlighted in his comment regarding the absence of the use of a computerised device in the teaching of fault-finding and diagnosis. He therefore suggests that the government embarks on a curriculum review to include the use of fault-finding using a computerised scanning tool.

Discussion

The findings above highlight the innovative and improved ways of using a computerised OBD II scanning tool in the teaching and learning of fault-finding in the MVM trade. In terms of the students, it stimulated their curiosity, enhanced their problem-solving skills, aided the development of new knowledge relevant to their trade, as well as developed their eagerness/willingness to learn. These findings support Adelabu and Adu (2014) who specify that the use of ICT-aided facilities in teaching can make the teaching process more effective, as well as enhance the students' ability to understand basic concepts. In addition, the integration of ICT, especially for skills-oriented trade, also prepares students for self-learning, critical thinking, digital capabilities, and also increases their problem-solving ability (Davies, 2019; Aberšek & Flogie, 2017; Puncreobutr, 2016). This would therefore prepare them for the competition ahead in their various trades.

For the teacher, the intervention was an eye-opener, as highlighted in the findings. The study exposed the teacher to new knowledge, which related to the existence and use of a computer device in finding faults in vehicles. This result corroborates the finding that teachers lack the competencies required in the use of OBDs, and that when trained, they would impart the right knowledge to their students, who in turn would use it to maintain vehicles that use the OBD system (Igwe et al., 2017). This finding concurs with that of Bukit (2012) who posits that close partnership with the industry avails the teacher with an opportunity to access information concerning the latest technology in use in the industry, which can form the basis of a suitable teaching module. Corroborating this, Legg-Jack (2018) in his study revealed that partnership between TVET institutions and the industry enables teachers to be trained in the industry for them to possess the needed technical knowledge in modern facilities that will facilitate the proper execution of their job. According to Findley (2021), TVET institution-business partnerships, as well as the participation of industry specialists, is key to achieving the upskilling of TVET teachers' training in the use of automobile diagnostic tools. As reported, the application of such technological mechanisms by teachers and leaders in TVET institutions enhances knowledge integration because ICT is considered a powerful force that can revolutionise teaching and learning processes (Ismail et al., 2017).

From the employer's perspective, the findings revealed a lack of experience in the use of the scanning tool by the MVM trade teacher, and the absence of fault-finding using a computer scanning tool in their curriculum. This finding corroborates with that of Idialu (2007) who remarks that the effect of new social needs, equipment, and technology needed to meet the growing industrial requirements and new education equipment used to impart skills, calls for a TVET institution-industry partnership. It would seem that the present-day TVET teacher cannot keep up with these challenges, hence the need to retrain the vocational teacher in the accomplishment of a modern TVET programme. This finding is also in agreement with Legg-Jack (2014) who contends that the curriculum in use in TCs in Nigeria is outdated and cannot meet the needs of the employer. Similarly, the result of this study supports the work of Msibi (2021) in South Africa where it was reported that some programmes offered at TVET colleges have little or nothing to do with industry demand due to a misaligned or obsolete curriculum. Generally, the use of a computer facilitated device, as revealed in this study, has impacted teaching and learning in the MVM trade. This confirms the findings of Audu et al. (2014), who explain that ICT has been identified globally as a tool that brings about rapid transformation. Digital learning, according to Hamilton et al. (2019), catalyses and promotes transformative learning which enables critical reflection, reflective discourses, and action. In a study, it was recommended that TVET teachers should be trained in the use of OBDs through a partnership arrangement between various leaderships of the mechanic cluster groups and the relevant government agency for capacity building and training (Ezeora & Ehimen, 2021).

From the theoretical framework, it is indicative that collaboration amongst the three institutions – colleges, industry, and government – could stimulate innovation, as proposed by the Triple Helix model. The innovative teaching and learning that resulted from the findings of this study were made possible because of the intervention carried out, which involved the three stakeholders required to stimulate innovation. Therefore, producing graduates with the desired employability skills in the automobile trade demands a collaboration between these three stakeholders in the provision of the needed resources and technology.

Conclusion

This study explored how to improve teaching and learning using a computerised OBD II scanning system tool. The findings of this study support the conclusion that the global trend in the use of ICT-aided facilities brings about change in the traditional mode of teaching and learning in all spheres of human life. Therefore, the use of ICT-aided facilities in teaching and learning in the MVM trade and other trades in TCs at this time of increased knowledge and technology use has the potential to enhance students' problem-solving skills and develop their willingness to learn. Also, this allows them to develop enhanced knowledge through experiential learning, as well as relevant new specialist knowledge and competencies. However, from the findings of the study, the use of these facilities is impaired due to the lack of its provision in TCs, inadequate teacher knowledge, and a lack of curriculum coverage on the use of OBDs. This, therefore, signposts a lack of TVET college-industry partnerships. In light of this, there is a need to encourage the use of these innovative gadgets for teaching and learning due to the enormous benefits their use promises in the teaching and learning of technical subjects in TCs. Moreover, this calls for the need to establish partnerships with the relevant stakeholders to ensure that TC programmes align with the requirement of the industry.

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