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The Existing Scenario of Automotive Major In Vocational Education and Training under The Background of Artificial Intelligence

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Abstract:- Many vocational education and training system in the world are reforming to integrate emerging technologies aiming to transfer and adapt in vocational school training. Vocational education and training systems are urged to stride with the development of artificial intelligence to mitigate the impact. This paper described the existing scenario of automotive major of vocational education and training under the background of AI as well as curriculum structure characteristics and implementation factors which influence AI integrated curricula. Therefore, literature review is combined with interview results from different experts in Ethiopia have been analyzed. Qualitative analysis with help of MAXQDA 2020 has been employed. The result of the reseach showed that as there is no courses of recent technologies or AI in the curriculum. Teaching AI in vocational education and taining of developing country like Ethiopia would not come into effect in the near future due to influencing factors. Level of school-Enterprise cooperation, Teacher's professional and teaching ability, instructional method, student, infrastructure, instructional method and curriculum are the main factors.

Keywords: AI, curriculum, vocational education

1. INTRODUCTION

Ethiopian vocational education has created national level coordinated training system. This decision has been made to share uniform resources and training anticipating good quality graduate that would assist the development of the nation. The other main aim of vocational training program other than developing work pace based human power is to increase the self-employed individuals who otherwise be jobless since they are high school dropout. This can also decrease the pressure on government created due to joblessness. In general terms, the end goal of Ethiopian VET is to achieve measurable work-based skill pool and improve employment among individual VET graduate. However, training is not providing the desired goals as result of inflexible training curriculum which does not underpin the current labor market.

Countries global economic competition requires to compete on good service and qualities, which requires technical and professional skill alongside with high level skills from higher education. [35] Till, L. *et al.* (2023) showedthat tasks automation in company by year 2027 is expected to be 35% - 65%. Technologies do not only change the way of work but also changed content of job and skills. [36] Ra, S. *et al.* (2019), the industrial 4.0 revolution brought changes in occupation that demand greater knowledge, skills and development of workforce at all levels. Most of new technologies are more likely demand high level of cognitive skills.

In education, implementation and organization sets begins from the classroom/laboratory work state micro level to school, state and national level. There are institutes, agencies and organizations that strongly affect the effective education to be carried out, however, they have different degrees of influence.

2. LITERATURE REVIEW

2.1 Challenges and opportunities of TVET on the background of AI

Due to the rapid development of AI application, VET has faced incredibly strong challenges. On the other hand, it has brought opportunities such as creating new jobs, save time and energy from being wasted. The challenges of AI on VET include professional construction, forms of VET education, transformation and designing teaching contents. The continuous change of occupation as result of technology advancement drag VET/TVET in another challenge to implement reform effectively L. Geleto [24]. On the other

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hand, M. Munir et al [22] stated that the concept of work, work structure and competence needed have been changed in this era. The change has brought changes in ways of teaching and concept of teaching itself, one of which is vocational education. Workplace requirement that is dynamic always has an impact on frequent vocational curriculum changes. D. Zeng et al [15] claimed industries have put new requirements and competence level of practitioners as result of high quality development. Therefore, vocational education reform to cultivate complex technical and skilled labor force is required to support high-quality human resource needs. I. Koricanac[66] posited that high level of competitiveness among automotive industries facilitated the implementation of AI in the system such as driverless features among many

2.2 Threats of increase use artificial intelligence on vocational education and training

Some form of jobs will be eliminated as a result of modern technologies due to automation, consequently, unemployment will be exacerbated M. Munir et al [22]. Similarly, J. Shi and X. Ran [19] depicted, AI impact VET jobs, shake the base and pose threat to the existence of vocational education. On the other hand, when the time goes on many traditional business and crafts men B. Ziblim et al [16]. On the contrary, P.V Ajitha and Ankita Nagra [14] have referred the report of Boston consulting group (BCG) and direct mobility lab 2019 that the increased use of electric and self-driving vehicles would produce more than 100,000 US mobility jobs within 10 years bound.

2.3 Vocational education and training transformation challenges

Adopting trending situations and actively encountering different internal and external challenges should be the way to transform and sustain the development of vocational education and training. [33] M. Toepper et al. cited Fraunhofer MOEZ, 2012 and Haering et al., 2014 that one of the key challenges in the transfer of vocational education training is the low social standing in the community. Furthermore, the root cause of transfer barrier is communication difficulties; lack of English language skill on the training and trainers have aggregative effect on the transfer process. Vet has been neglected [2] OECD, it has got less attention compared to other education system and often considered lower status.

2.4 Successful ways of VET transfer

W. Shi [25] actively resisting various problems from the community and the college itself as well as adopting the new situations are the main requirements for sustainable development of vocational education. [33] M. Toepper et al. according to his reference in Bliem et al., 2014; Fraunhofer MOEZ, 2012; Peters, 2019a, 2019b; Pfaffe, 2019 works the successful implementation of VET needs knowledge of conditions and adaptation of trending situations to the target country. Besides, the stakeholders involved should work closely and cooperate in the transfer process. On the other hand, the competence of teachers, other decision-makers and the role of individuals are influencing factors. He added, especially at the beginning of transfer process, participation of highly trained staffs and expatriate trainers as well as company's involvement in training activities are important

others resulting the demand for highly skilled personnel on the field. F. Hui [37] depicted that the emergence of artificial intelligence made the requirement of employee quality stricter and graduates with comprehensive quality would be selected. Hence vocational education colleges should understand the trends of artificial intelligence, influences and the role on the development of education to reform vocational education as counter measures to cultivate high quality talents J. Ma [34] suggested the way of transform was by adding large data and artificial intelligence courses and contents to the existing professional curriculum system of vocational education, as well as reconstructing resources, library and establishing a hierarchical and modular training system

for controlled transfer. According to [2] OECD, reform career guidance, right mix of skills, well-prepared teachers with industry experience, workplace learning and stakeholder involvement are the main policy directions for the transfer.

2.5 Factors influencing implementation of AI integration with automotive major in vocational education and training school

Vocational education implementation shortcomings can be categorized into system and school or individual factors. System factors such as funding, the need for cooperation between sectors, work placement requirements, teacher availability and human resource issues are the major ones. System factors are the prominent limiting factor for vocational education change. The existing assessment patterns, school structure, schedule, subject- specific curricula, textbooks, instructional periods, teachers (as they are trained in the subject-specific curriculum), and lack of school-enterprise collaboration are all significant barriers to the implementation and continuation of curriculum integration. In this rapidly changing world of work only well-designed curriculum with respect to the industry would play pertinent role in cultivating the right skill for the labor market. Due to rapid technological change [2] OECD, many skills required are volatile while it demands higher level of technical skills.

2.5.1 Level of school-Enterprise cooperation

Providing quality training is difficult in training centers. The practice of students in enterprises is crucial part of enhancing technical skills. Vocational education teachers engagement in enterprise practice is also an effective method to improve the level of profession and practical skill. skills incurred by trainers from the enterprise working culture include production process, technological applications, development trends, job responsibilities, skill requirements, employment standards, management and new equipment. Munir et al [22] posited that vocational teaching curriculum must be prepared in accordance of the condition of the actual work. Matching skill with the requirements of job can create value for vocational educational graduates. Employers prefer graduates with skills and abilities in accordance of jobs so that training cost spent reduces. Enterprise can provide a real work environment in which comprehensive skills are applied as result trainees would combine theoretical knowledge and practical skills to analyze problems, improve innovation

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ability and raise practical skill heights as theoretical knowledge heights.

The aim of vocational education is to cultivate personnel with advanced technology applications who can work directly in important technical jobs after graduation. To achieve this goal, vocational schools need to allow students to fully exercise enterprise's operating mode and recognized technical requirements. Therefore, as of the current method, school-enterprise cooperation is the best way for implementation. School-enterprise cooperation is only based on mutual communication between school and enterprises and helps vocational students to combine theoretical knowledge they have learned in class with enterprises' actual production in practice in order to realize comprehensive study.

One of the main industrial development driver is AI and a major factor in fostering the integration of trending technologies such as, cloud computing, internet of things, block-chain, big data, graphic processing unit, and industry 4.0 [9]. A. Räisänen and M. Räkköläinen [28] described that to solve the collective problems of VET, higher degree of public commitment in financial support and great involvement of firms in training are required. J. Li et al [11] indicated, there is leapfrog development of intelligent manufacturing technology of automobile and many other giant industries as well as emerging companies which displayed latest automobile technologies such as Tesla and google, and I. Koricanac [13] Mercedes Benz and Renault. In addition, traditional automobile manufacturers are also advancing technologies such as smart and connected manufacturing system. A. Manimuthu et al [12]described that AI is being incorporated in business to offer smart services and solutions. Industry sectors are adopting industry 4.0 and industrial internet-ofthings) (IoT) where production, control and process are getting boosted.

Based on the assessment there should be strong cooperation with industry to fulfill the infrastructure and technology transfer. Vocational education needs to establishing practical and theoretical classes based on the concept of recent technologies. To bring this in to effect, vocational school and industry should maintain a close cooperative relationship and share teaching resources among themselves. In this regard, industry must participate in updating laboratory equipment of vocational schools to mitigate the gap between graduate competence and practical competence required in industries.

2.5.2 Students

Students come to the vocational school with different prior knowledge, beliefs, attitudes and skills which influence how they are going to conceive and organize in-coming knowledge. This will in turn affect how they apply, think, remember and create new knowledge. Since new knowledge and skill is dependent on pre-existing knowledge and skill. High achievers are characterized in high general cognitive capabilities and prior knowledge or past academic achievement. They can also contribute more often on higher levels of conceptual complexity during group discussion and in response to teachers. Jossberger, H. et al. [18] the major/program provided for the student is dependent on students' prior knowledge about a certain domain. Student need to have good soft skill which refers to interpersonal skill that enable work and communicate with others Isdawati Ismail [21]. [31] X. Wang *et al* stressed that learning is closely associated with formal school, however, it should happen at home and at work place. Conversely, learners assume once they are done with school, they are also done with learning.

2.5.3 Teacher's professional and teaching ability

Teachers are substantial element in the dissemination of knowledge and skills. Thus, they should be professionals and experienced in the instruction of particular vocational major. These days, teaching a vocational skill is one of the most complicated jobs due to technological advancement which modernize peoples' life and affects many sectors including vocational education. The application and content integration of technology in vocational educational process increases that shift conventional teaching-leaning towards more technology-based teaching. Therefore, vocational education teachers should enhance their qualities to present vocational training that can cultivate talented human capital who can adapt new technologies and deter challenges in this artificial intelligence era. It demands mastery of broad knowledge of subject matter, competence in instructional planning, mastery technology applications in AI era, attitude, enthusiasm, curriculum standards, classroom management techniques and desire to make a difference in the lives of young people. With all these qualities required, trainers are required to be far more prepared. Their skills need to be updated constantly and they need to be supported on all necessary areas required of them. Vocational schools do not have many teachers who have both industrial experience and theoretical knowledge. Besides, vocational teachers need to have innovative ability, creativity, outcome oriented, open minded, written communication skill and all-round viewer. vocational education colleges value the linkage of school and industry to create research mindset. However, most vocational education teachers are less involved in enterprise horizontal scientific research projects and are unable to promote teaching with scientific research results. Vocational specialized teaching staffs and teaching environment shortage are the prominent problem. Counting the numbers of graduates every year without considering the qualities will be counted as a slow suicide for VET. Teacher's lack of appropriate theoretical framework of curriculum integration is one reason for incapability to implement curriculum integration.

Furthermore, vocational schools need to create good opportunity for technology adaptability, lifelong learning and set of learning outcomes which can go along with the rapid change of industry requirements. Jossberger, H. et al [18] described that teachers should be activators of learning not facilitators. The characteristics of activator are feedback, direct instruction and teaching cognitive analysis. P. Andersson and K. Muhrman [23] described that teachers are not expected not only to be competent on up-to-date knowledge but also interpersonal competence like communication and close relationship with students. They stressed sustaining continuous career development and openness to critique attitude are vital for teachers. M. Munir

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et al [22] teachers need to enhance teaching abilities in both theory and practical knowledge. Every trainer in vocational education level needs to have up-to-date competence with the change technologies. They also need to improve technological application skills in classroom. According to S. Antera [32], teachers not only be competent in up-to-date vocational competence but also interpersonal competence which will help to maintain close relationship with students. Sustain continuous development attitude and being open minded are the basic elements for teachers. In the regime of vocational competence, teachers are required to have teaching and occupational abilities. He added, important competence of teachers are not developed during teacher training rather it is developed in informal and previous studies. Therefore, the recruitment process is the key, the requirement must involve teaching competence not only vocational. Besides, S. Yang and H. Bai [6] suggested that teachers shall thrive to apply AI technologies in their teaching activities to make learning special and attractive thereby teaching quality can be improved.

2.5.4 Infrastructure

Vocational school is responsible for preparing students to enter the workforce and developing a professional attitude. To achieve this, vocational high school organizes certain competency education and training, so that graduates can have qualified competencies and have a professional attitude. Thus, vocational high school graduates will find it easier to find jobs and this will reduce the number of unemployed, which is due to the presence of unskilled human resources. To address skills deficiencies and increase employability, there is a need to focus on industry relevant education and vocational curriculum embedded with continuous learning which leads up-skilling the existing knowledge. To be able to achieve this, school infrastructure has to accompany physical and digital infrastructure, relevant curriculum and finance. Infrastructure is an important component to support the learning operational in vocational schools. This is a challenge for vocational schools to manage their infrastructure so that they can keep up with the developments of technology and information. Infrastructure and facilities at vocational education is very difficult to follow the technological advances responsively, because technology is developing very quickly. Identify the training equipment, simulation software and other resources is required to support effective program delivery. Students will emerge from the program trained on the tools and equipment needed to get the job done. Therefore, managing infrastructure and development plays an important role to reinforce the skill and knowledge that students would have at the end of their study. Failure to invest in the infrastructure of vocational education institutions results lower number of students that are equipped with the necessary knowledge and skill.

Table 1 the recommended ratio of item to student distribution (Ethiopian Ministry of Labor and Skill, 2022)

EIS AUM1 M01 0322		Applying 5S Procedures		
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A.	***Learning Materials***			
1.	TTLM	Prepared by ministry of labor and skill	25 Pcs	1:1
2.	Reference Books			
2.1	Kaizen book	Suzanna Lee	5 Pcs	1:5
B.	***Learning Facilities & Infrastructure***			
1.	Class room	31.5 m^2	1 Pcs	1:25
2.	Whiteboard/Blackboard	240 x 120 cm	1 Pcs	1:25
3.	Arm Chair	55 X 100 x 70	25 Pcs	1:1
4.	Workshop	100 m^2	1 Pcs	1:25
5.	LCD	Used to display	1 Pcs	1:25
6.	Laptop or Computer	32-bit OS; 3 GB RAM; Intel core i5 (Processor)	1 Pcs	1:25

Table 2 reference book distribution among students (Ethiopian Ministry of Labor and Skill, 2022)

EIS AUM1 M04 0322		Performing Bench Work		
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
A.	***Learning Materials***			
1.	TTLM	Prepared by Ministry of labor and skill	25 Pcs	1:1
2	**Reference Books**			
2.1	Metal work	5th Edition Herbert Maryon	5 Pcs	1:5
2.2	Welding fundamental	5th Edition William A. Bowditch	5 Pcs	1:5
2.3	Metal work	G,H Thomas	5 Pcs	1:5

Table 3 the available laboratory equipment (Ethiopian Ministry of Labor and Skill, 2022)

Classroom and laboratory

A large part of vocational training cost is taken by physical infrastructure of training centers. Federal government and state control large chunks of buildings and land. However, all these leases must be structured based on training outcomes. Physical infrastructure for automotive major exit competencies of practical facilities are automotive engine, electricity, chassis and power train systems. The ratio of available computer to student was 1:25 which means a class of students do share one computer if there is any training computer related works.

EIS AUM1 M05 0322		Applying Automotive Mechanical System Fundamentals		
Item No.	Category/Item	Description/ Specifications	Quantity	Recommended Ratio (Item: Trainee)
D.	***Tools and Equipment***			
1	Wrenches	Set	One	1:25
2	Pliers	Set	One	1:25
3	Screw drivers	Set	One	1:25
4	Sockets and accessories	Set	One	1:25
5	Diesel Engine	Four strokes on stand operated	One	1:25
6	Gasoline Engine	Four strokes on stand operated	One	1:25

Modern textbook which has artificial intelligence related knowledge in automotive application needs to be organized. L. Rageth and U. Renold [30] referred Billet 2011 that factors of curriculum application are resources such as equipment and trainers, the availability of such resources affects how trainers apply the curriculum. Vocational education curriculum under the background of AI requires the construction of smart classroom and formulation of personalized learning plan J. Shi and X. Ran [19].

Appropraite Curriculum

With current pace of workplace and labor market changes, vocational teaching curriculum is being outdated much even before students completes their education. In addition, industry looks at soft skills, the domain skills, team building ability, values and attitude of an individual to be recruited for the job. As result, upgrading curriculum to keep up with the changes is required of the vocational institutes and also

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curriculum needs to be made in collaboration with the industry.

Financing

Finance is one of the key items used to create competition, conduct teaching process and gather information about outcomes. It would have been good if more industries participate in financing the workforce teaching-learning process. Employer need to establish association to perform important reform and grant to co-finance vocational education and training. G. Brunello and P. Wruuck [27] posited that financing skill development required by employers shall include job seekers, schools and employers.

2.5.5 Instructional method

In Ethiopia, training and instructional method used in vocational school for automotive major are lecture, demonstration, group discussion, individual assignment and tutorial or exercise for none impaired learners. Task which is going to be performed under each training methods are clearly indicated in training module. These trainings methods are for all unit of competence for a particular curriculum. There is also training resource indicated for learners with disabilities like deaf, hard of hearing and physical impairment. H. Luan et al [7] and L. Chen and Ping ping Chen [8] showed that the solution to the mode of instruction for vocational education in AI era is use of adaptive educational tools and flexible learning systems accommodating individual learning needs. L. Man [17] claimed AI is being used to address the traditional problems of teaching with the help of technologies with or without the instructor. N. Herbert et al. [10] the new integrated curriculum needs to be supported with research and industry guest speakers throughout all course units to corelate each unit to work tasks. N. H. Jabarullah and H. Iqbal Hussain [26] described that students in higher technical and vocational and training responded better with problem-based teaching method. TVET students using hands-on approach tend to obtain more benefits in student-centered approach. In the era of digitalization more practice than theory in vocational curriculum is crucial M. Munnsiir et al [22]. Vocational education colleges shall have smart classroom with different teaching method such as mixed teaching, flipped classroom and muti-screen teaching J. Shi and X. Ran [19]. According to A. Haleem et al [20] information technology has become driving force to the reform of education system such as MOOC (massive open online courses), virtual laboratories, online exams and dynamic visualization technologies which assist learning. X. Wang *et al* [31] referred that training method shall be reflective learning with active learning on materials covered in training. [36] Ra, S. *et al.* (2019) widening learning opportunities like formal, informal, physical and virtual learning spaces are the best ways to address countries with resource constraints to deliver education.

2.5.6 Evaluation method

Vocational education assessment methodology used to assess professional competence/ outcome has to be good quality and suitable for both students and teachers. Ethiopian federal labor and skill ministry has promulgated two evaluation methods for vocational student learning in vocational institutes. Formative and summative evaluation method are being used to assess what has been achieved by each student. Formative evaluation provides the trainee with feedback regarding success or failure in attaining training outcomes. It identifies the specific training errors that need to be corrected, and provides reinforcement for successful performance as well. Techniques used to obtain information about trainees' achievement include oral or written test, demonstration and on-site observation. Whereas, summative evaluation is given when all the modules in the program have been accomplished. It determines the extent to which competence have been achieved and it will be expressed in is the other form of evaluation is given when all the modules in the program have been accomplished. It determines the extent to which competence have been achieved. The specific assessment method for each module is provided so as to help instructors to follow. However, most of the module assessment method is done by interviews, assignment, written test and demonstration. [19] J. Shi and X. Ran expressed that intelligent evaluation is performed through developmental evaluation of learning process that is collected based on learning data of learners. Martha et al [29], assessment refers to the process of grading student's course assignments and tests to standardized as well as to collect information about their success of the program. This assessment can be done within short period or over extended period. Assessing student over the course of semester is one of the most effective methods to get feedback of student progress throughout the semester.

2.5.7 Government policy

Government support in facilitating vocational education and training is crucial. By mobilizing funding and resources the government can deliver maximum support to training process. In addition, rigorous assessment of quality and accreditation must be the main concern of the government.

The responsible bodies in developing knowledge and skills required by employers include job seekers, schools and employers particularly in financing skill development G. Brunello and P. Wruuck[27]. [25] W. Shi suggested that it is important to strengthen the investment/budget in VET specially in teachers capacity building that includes the practical training, deepening VET teaching reform, implement talent development model and encouraging co-operation between schools and enterprises.

3. METHODOLOGY

Expert interview was conducted to assess the integration of automotive major with AI in VET from educational institutions and companies based on their professional experience. On the other hand, literatures related to vocational education and training systems development and success transfer factors under the background of artificial intelligence have been selected to support the research findings. As there are shortage of studies focusing on contemporary technology integration in VET, studies from other countries were considered and combined. It been used to assess the curriculum reform methods, identify implementation factors, the challenges of vocational

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education in AI era, applications of AI in Automotive industry and to study the development of AI.

3.1 Interview

Each interview begun with the brief explanation of AI application in vehicle systems which otherwise known as smart systems. The participants are recorded with their consent during the interview period to transcribe what has been discussed. It was conducted in Amharic language which later transcribed into text. Interview questions were delivered to participants through telegram before interview. The interview duration was between 10 and 56 minutes and conducted from December 2022 to March 2023.

3.2 Sample

The criterion for selection as interviewee was the experience and profession on the field. The participants were contacted face-to-face at their working sites and through virtual medias. A total of 14 experts have been interviewed. Sample size determination, [1] Oeben, M. and Klumpp, M. (2021) used 19 experts and the duration of interview was 10:05 to 65:33 minutes. Taking interview from labor and skill ministry official was not successful twice due to tight schedules of office works and unavailability.

3.3 Analysis

For analysis of expert interview and literature review, the qualitative thematic analysis method was applied. Qualitative method provides descriptions from the data as well as insight that goes beyond numbers and "thematic analysis is a data analysis method strategy commonly used across all qualitative designs" [3] Castleberry, Ashley, and Amanda Nolen. Thematic analysis is an independent qualitative descriptive method for analyzing, identifying and reporting patterns(themes) within data [4] Vaismoradi, M and [5] Sundler, A.J. *et al.* (2019). This analysis procedure has two steps.

Qualitative data collected from interview and literature has been analyzed with the help of MAXQDA 2020 which is known as computer aided qualitative data analysis software. This allows to transcribe audio and video files with synchronous playback options. [1] Oeben, M. and Klumpp, M. (2021) used MAXQDA 18.1.1 for the evaluation of expert interviews. Qualitative data analysis softwares are useful in developing visual data in three-dimensional code map which able to see relationships among constructs [3] Castleberry, Ashley, and Amanda Nolen. Besides, all the interviewed information used to draw conclusion are kept anonymized.

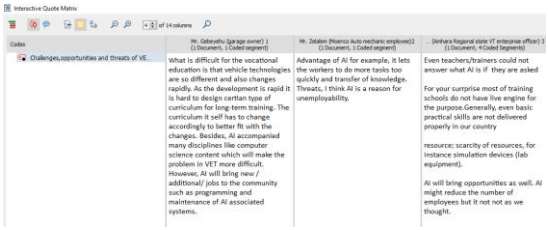
4. RESULT AND DISCUSSION

Twenty open ended interview questions were prepared and delivered to a total of 14 individuals. Respondent were from different locations and from different stakeholders. Audio of respondents were recorded carefully for later transcription purpose which spans from 10 up to 56 minutes. Among the interviewees, about 50% of them were students and employees intended to collect the actual data that are pertinent to answer the research questions. All of the employees interviewed were VET/TVET graduates, three of them have their own garage. Those employees work experience range from two half – 25 years. Teachers, directors of vocational educations, labor and skill, and technical education ministry interviewees were all master degree holder. Teachers have more than 10 years of experience in teaching while directors and officers have the minimum of two years and 20 years maximum working experience. The interviewees were from Bahir Dar city (Regional state of Amhara) and Addis Ababa city (a capital city of Ethiopia).

4.1 Challenges and opportunities of automotive technology in vocational education due to advancement of artificial intelligence application in automotive industry

As artificial intelligence application in vehicle systems increased maintenance works for old school automotive technicians has become more difficult. There are also many more challenges that automotive major in vocational education going to face because of the rapid development of AI application in vehicles.

Table. 4 responses of interviewees on challenges and opportunities of VET on the background of AI



In this section, interviewees are asked the noticeable challenges and opportunities VET will encounter as AI application in automotive increases. Accordingly, the major challenge mentioned by respondent 3, 4 and 6 are the lack of vocational teachers who adapted the basic elements of AI. Respondent 3 stressed that most of the trainers could not even know the word AI and its application in vehicles if they are asked. Most of the respondent claimed that fulfilling AI related training laboratory materials in vocational school would be the most challenging one of all. Most of the available laboratory resources in VET are outdated which will not emulate work place requirements.

What is difficult for the vocational education is that, vehicle technologies are so different from company to company and also changes rapidly. As the development is rapid it is hard to design certain type of curriculum for long-term training. The curriculum itself has to change accordingly to better fit with the changes. Besides, AI accompanied many disciplines like computer science content which will make the problem in VET more difficult (Interviewee 1).

Therefore, unless the curriculum changes as the technology changes there will always be skill and knowledge gab between the industry requirement and Automotive technology /technician/ graduate of VET. This results less interest on the choice of students to vocational training respondent 9 and 13. Another challenge which VET will face is an increase of unemployment rate of graduates (interviewee 6 and 14). Employer companies usually provide short-term training for the recruited graduates on particular

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job which indicate school training is much more far behind the actual job on the market.

As developing country, purchasing latest laboratory equipment and simulation technologies are the other challenging issue because these materials are not only expensive but also unavailable on the market.Furthermore, respondent 7 has indicated that mostly students who join VET are twelve grade complete. These students would have no capacity to take classes of cutting-edge technologies like AI systems in the vehicle so admitting good quality student is imperative challenge. However, one of a respondent (respondent 4) has arguably described that AI will not bring some sort of opportunity to automotive technology graduates of vocational education and training. Whereas interviewee 2,13 and 14 thought that AI will take people's jobs which impedes unemployment of auto-technicians.

4.2 Factor affecting automotive curriculum implementation on the era of artificial intelligence

The curriculum is the guide for teaching and learning process which clearly define the duration of study, types of courses, number of courses, assessment, out-come, and semesters. Therefore, the quality of curriculum determines the out-come of the training. Effective implementation of curriculum will help to achieve the intended out-come of the training. However, implementing the curriculum on the ground is not easy task as it is associated with many limiting factors. The main challenges for effective implementation of curriculum as per the respondents are teaching material(resource), student capacity, OS (occupational standard) and teacher's ability. Almost all the respondents have put resource at first place that affect the implementation of teaching curricula.

It is clear how much difficult it is to purchase single laboratory equipment for vocational education school. Fulfilling AI teaching resources is more challenging as far as we can understand (respondent 3)

4.2.1 Enterprise and industry participation in automotive technology curriculum design, teaching mode, and internship training of VET education

P. Andersson and K. Muhrman [23] described that the cooperation training of vocational education in the form of apprenticeship with not less than 70% practical in workplace and the rest in school must be the requirement. L. Geleto [24] stated that Ethiopia adopted the current TVET from Australia and Philippines. The industry experts are the direct participants in curriculum development as per his reference.

All of the respondent emphasized that industry participation in school teaching and learning activities means solving the problem of skill and knowledge mis-match between graduate and job requirement. The copy of every work in industry shall be taught in training school.

letting them to take part in curriculum design and teaching process will definitely develop the field. What is needed for AI? What learners needed to know? What are the graduate requirements after they complete their studies? All these questions shall be answered by the industries! So as a remark industries participation is huge/significant (respondent 3).

Some of the interviewees have pointed out that there is poor industry- to- training school relation for this purpose, even though, it exists in principle. On the other hand, there is a doubt that industry personnel have clear cut knowledge and skill on preparing curriculum and related tasks at which the school needs the most.

Actually, how competent are those individuals in industries and institutes to design teaching curriculum is the big question. Definitely, enterprise participation in curriculum development has brought change in developed countries and it is great in principle (respondent 5)

Similarly, L. Geleto [24] described that there is lack of knowledge and experience to develop curriculum at local in institution (TVET) level. Therefore, the automotive technology training school need to collaborate with the enterprise to train students with the right knowledge and skill present in job site.

4.2.2 Teacher's capacity and career development

Teaching ability as per the curriculum is the main responsibility of teachers. They have to have good knowledge on the subject which they have specialized for. As the technology advances they also have to upgrade their prior knowledge. The existing teaching staff's capacity needs to be build based on the modern technologies. Previous degree profile should not be guarantee for teachers rather it is trend of teachers' self-growth and continuous professional development.

Teachers who are being trained or going to be trained shall take appropriate AI course as per the OS training requirement. The only way i think is to incorporate courses in the curriculum of post graduate degree training module (Respondent 3).

Remedial training for teachers can be in the form of short-term, long-term, scholarship, peer learning, mass training as respondent 4, 6, and 5 emphasized.

Short term (cooperative) training in the company to bring teachers and AI technology closer. Peer learning, company trainings, online training and aboard training (scholarship) are also ways to build their capacity. Establishing trainer's training is also the key one (respondent 14).

Furthermore, establishing trainer's training center in the country and recruiting expatriate teachers for this purpose can improve teacher's capacity for AI integrated automotive curriculum.

4.2.3 Student ability and prior knowledge

Prerequisite knowledge of students for the particular major training has impact on the out-come of the training and in the process of learning. According to the respondent, teaching integrated automotive major on the background of AI is possible at this stand because vocational education entrants with the new policy is from 12^{th} grade who relatively with better abilities.

4.2.4 Resource

Resource is a decisive factor which can affect the educational process of automotive technology in particular and vocational

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education in general. Accordingly, interviewees were asked whether special resource are required for integrated automotive technology curriculum on the background of AI and they all have replied "yes" it needs special resources like teaching staffs, budget, latest vehicle systems, computers and learning platforms.

A system that can be used to simulate the operation is required. Workshops materials, e-learning and internet-based learning (interviewee 13)

Inadequate internet connection coverage and electric power supply would limit lecturers access to new technology and tutorial in which they can strengthen their knowledge as a result avoid frustration to teach. While students can optimize effective use of technologies in teaching and learning process.

4.2.5 Curriculum structure

The curriculum structure like the numbers of courses, organization, length of semester, competence type and the proportion of practical and theories have detrimental effect of the goal of vocational education. Interview has been conducted to assess suitable curriculum structure for the newly employed integrated curriculum. Currently, the mandate is given to industries to design each and every element of curriculum so they can provide better insight on the issue, respondent 9, 3 and 6). They have added that taking experience from other country education system and customize it to our context is crucial. On the other hand, respondent 4 and 13 have suggested the proportion of theory and practical to be 70% practical and 30% theoretical. And from the total practical works 70% to be in industry and 30% in school training. The current curriculum structure might not need change for the start-up purpose (respondent 14 and 4). In the era of digitalization more practice is important than theory in vocational curriculum crucial M. Munir et al [22]. Therefore, the overall response indicates that they do not have clear cut knowledge on how curriculum structure be reconstructed for the integrated automotive technology major in VET. Many of the interviewee also refused to suggest on this issue due to their limited knowledge.

5. CONCLUSION

Vocational education is to cultivate personnel with advanced technology applications who can work directly in important technical jobs after graduation. To achieve this goal, vocational schools need to allow students to fully exercise enterprise's. Vocational curriculum of automotive major from level 1 up to level 5 has been assessed for the presence of artificial intelligence content. This major has three types of occupational standards namely automotive mechanic, body repair and paint work and automotive electrical and electronics. These occupations have levels from 1-5 each with different graduation outcomes and years of training. Interview, observation and literature was the data collection methods.

Qualitative research method has been employed and analyzed with the help of MAXQDA 2020 software. The result has shown that there is no single course related to one of the disciplines of artificial intelligence. All the training courses in these curriculums are automotive major focus. In each level of qualification, the unit of competence/ courses are all limited to the fundamental/ conventional systems of automotive systems. Courses are at the level of conventional systems and laboratory equipment are also traditional that are equipped with conventional systems which are being substituted with modern systems. In addition, there is no ICT or language courses which can help learners achieve real world of work after graduation. For instance, learners would not do accident analysis without sufficient knowledge and skill of computer science but there are unit of competence like performing accident analysis and project cost analysis at level five as occupational standard. Therefore, AI in Ethiopian vocational education is not yet implemented or will not be implemented in the near future even though AI fitted vehicles are being serviced in local garages. There should be strong cooperation with industry to fulfill the infrastructure and technology transfer. Vocational education needs to establishing practical and theoretical classes based on the concept of recent technologies.

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