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Influence Of Technical Vocational Education Training Engineering Students Challenges On The Competences Of Engineering Mathematics A Case Of Integrated Polytechnic Regional College Musanze.

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Abstract:

Backgroung: *The objective of this study is to investigate the influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics, in IPRC Musanze located in Musanze District, Northern Province of Rwanda. The study was guided by the following objectives: To identify the challenges faced by the TVET Engineering students in Engineering Mathematics, to assess the competences of Engineering Mathematics of TVET Engineering students. And to identify the influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics.*

Materials and Methods: *The researcher used a descriptive research design and the targeted population is 262 respondents from which 72 was sampled using Yamane formula. The main sampling techniques that were used was simple random and purposive techniques. Questionnaires and interviews were used to collect data and the collected data were analysed using SPSS version 20.0. Thereafter, the data were presented in frequency distribution tables.*

Results: *Based on the results of the first objective, the study concludes that lack of teaching resources, inadequate learning process, Insufficient of trained Lectures in CBT,poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics are the challenges faced by TVET students in Engineering mathematics. Based on the results of second objective, the study conclude that TVET Engineering students in the departments of Civil Enginnering and Electrical Electronics Engineering, have got the following 5 different grades in the module of Engineering mathematics, in IPRC Musanze, Those grades are, higher class followed by distinction followed by lower class followed by pass and lastly fail . Based on the results of the third objective, there is a negative impact between challenges faced by TVET Engineering students in engineering mathematics module and their competences in such way that, due to lack of teaching resources, inadequate learning process, Insufficient of trained Lectures in CBT,poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics are the challenges faced by TVET students in Engineering mathematics,and their competences of Engineering Mathematics have gone down, Due to the above mentioned challenges. hence negative relationship between challenges and competence of TVET Engineering students in Engineering mathematics.*

Keywords: *Technical Vocational Education, Engineering Students challenges, Competences Of Engineering Mathematics, Integrated Polytechnic Reginal College Musanze., Rwanda.*

i. Introduction

It is with the present work entitled "Influence of TVET Engineering Students Challenges On the competence of Engineering Mathematics". In Bangladesh according to Islam and Mia (2007), their study revealed that that both formal and non-formal TVET lacked an effective linkage between training and the world of work. It further noted that

because of its lack of coherent mode, practical skills training which does not produce the requisite skills for the job market. Additionally, the trainees also lacked training experience, initiative and motivation to discharge their duties effectively. According to Esirah (2007),Germany has innovated a very unique style "dual" system the theory is taught in educational institutions and practical skills are acquired through the apprenticeship in a company. In Ghana, the Industrial Skills Development Centre was established in 2002 and was tasked to harness the financial and material resources required for achieving excellence in skills training Suleiman, (2010). This comes to be taken into consideration as one of the practices that is remarked in quality education through vocational training program. Therefore, Polytechnics need proper functioning at the high level in direction of guaranteeing the standard of excellence in apprenticeship process, in available resources, teaching methods and techniques, and effective evaluation of learners in the program that is connected to socio economic problem solving. The evaluation of effective teaching is a process which should be based on the final product" (Idialu, 2013).

In addition, this, TVET is defined as the form of teaching and learning that deals with acquiring and preparing the persons skilled with completion of any task inclined before them in the labour market (Idialu, 2013). This type of training makes the student more active throughout performance in different economic domains. Therefore, the important achievement from which a nation's social, financial, industrial and cultural development has to be manufactured. Technical training implies the utilization of specific education procedures for the achievement of equally educational and socio- economic purposes. In addition, technical education targets to empower individual for financial satisfaction, self-actualization and to become prolific in different arenas and domains of learning.

In the 30 years after the nation's independence, the sector has encountered a variety of issues. Around the time of independence, enrolment in schools across the nation rose dramatically. Technical and vocational training was provided by different institutions with different programs such as Ecole familiales (1979)offering vocational education for female students of primary leaving school certificate of 2 years, CERAR was offering vocational training for male graduates of primary school for 2 years and then from 1980 to 1994 Centre d'Enseignement Rural Artisanal Intégré(CERAI)enrolled pupils from primary not eligible for secondary education that later gave a room to École Officielle Technique (ETO) that was in charge of offering technical education and award A3 and A2 certificates. During this period, CFJ was shifted into VTC when WDA was established, and new competency based curricula were developed through Technical Secondary School (TSS) under the umbrella of TVET and IPRCs qualification.

Then after 1994, the increase of vocational training centers, technical secondary schools and polytechnics enrollment got reinforced and however, the development of economy and social growth were generally not as rapid as the increase of technical education was prevailed. Thus, within a few years of achieving independence, the majority of nations realized that there was a big problem with youth unemployment (MINEDUC, 2008).

The Rwandan Ministry of Education has introduced vocational education through two programs for the secondary education. The first is the vocational training center (VTC) which is a three and/ or six-month training program that may be joined after the completion of primary school aiming to prepare students to be ready for labor markets after eighteen years old and they are awarded certificate of completion. The second is Technical Secondary School (TSS) which is also a three years' program after completing the ordinary level of three years after primary. This program qualifies students who are able for the national exam and get Secondary School certificate that allows them to join higher learning institutions and universities named Integrated Polytechnic Regional Colleges (IPRCs), if not they immediately join the labour market that they are trained for their life-long learning.

Moreover, the government of Rwanda, like most of other Sub Saharan countries, posits that vocational training has so to be given so much consideration in order to yield the results expected in its grounds. This means that vocational education must teach the skills required to produce craft workers, agricultural, industrial, and commercial workers, technicians, and other skilled workers who will be entrepreneurial and self-sufficient. However, the awareness of vocational training remains pertinent to the extent that the students are not interested because vocational schools are not competent enough to support life-long learning outcome. Thus far, "the population accessing both vocational educations are negligible in comparison with those who ought to access general education" (Biao, 2018). The main objective of this research was, to examine the influence of the challenges faced by TVET students on the Performance of Engineering mathematic. It was was guided by the following specific objectives:

i. To identify the challenges faced by the TVET Engineering students in Engineering Mathematics
ii. To assess the competences of Engineering Mathematics of TVET Engineering students.
iii. To identify the influence of the challenges faced by TVET Engineering students on the competencies of Engineering Mathematics.

ii. Theoretical Literature

The Rwandan TVET policy assumed that to enhance the quality of regional and international TVET system that produces skilled graduates, that are able to respond to the changing demands of employers and the countries labour market, equip them with the opportunity to engage in trustworthy work, to employ themselves, to be competent entrepreneurs and engage in long-lasting learning as a global citizen including Engineering Mathematics (MINEDUC, 2015).

TVET students' understanding towards Engineering Mathematics

The system of TVET has historically been ranked as a second chance education in many countries due to the fact that it was reserved for academic underachievers including Mathematics. As a result of this, many learners are not encouraged to pursue their studies in technical and vocational education and training. This negative perception of TVET engenders poor performance of learners in Engineering Mathematics. Therefore, training delivered to these learners that got poor marks in the national examination and unable to continue their studies in general education at tertiary level they rather joined TVET system perceive that TVET provides them with certificates (Lam &Hassan, 2018; MINEDUC, 2015).

In addition, the program recruited different students including those with low performance and those who got mediocre result in national examination for senior six that accorded the institution negative perception and low valuation of TVET and its subjects. This lies at the fact that University of Rwanda is the first to recruit the best performers from the national examinations and the rest are admitted to other IPRCs of the country. The understanding of TVET students in learning Mathematics in TVET is marked as a subject that leads to poor performance since they do not connect the benefits of Mathematics in TVET.

Besides, the core value of TVET is to generate and expand prospects for effective learning that is deliberated yield outcome and competences proven at the workplace. The purpose of vocational education has been emphasized to provide high quality that is training learners to become competent enough for their careers since "It effectively manifests itself by supplying the job market with workers in various occupations. This should help reach a balance between employment provided and sought after while also lowering concerns about a bad reputation and unemployability" (Alsa'aideh 2016, p.605).

The Influence of TVET Engineering Students Challenges on Performance of Engineering mathematics

More relevantly, the avoidance of vocational education comes from misunderstanding among both students and the society with negative attitudes towards vocational training and its teaching concepts. The curriculum and the actuality of the work done up to this point are blamed for this misunderstanding. According to the former, the educational programs is "poor and unsuitable to the needs of the students, which in turn results in the graduates' inability to compete for their academic accomplishment."(Alsa'aideh 2016, p. 60). Vocational training role in sustainable return to work has been mismatching to their success caused by the fact that learners are trained for theoretical exams and not for competence based. This leads to "the persistence of failure which is significantly increased due to decreasing moral, poor teaching strategies of the concepts" (Cedefop, 2018. p. 12). More so, the most powerful challenge for technical education is the mismatch of students' capacity, needs for individuals in accordance with the fundamental of lifelong learning.

In-spite of the efforts of government to provide funds for vocational education, it still lacks budget to implement various experiments in laboratory. Insufficient economic resources in vocational entities have the upshot of preventing the education of technical and vocational education and training from development policy level to the implementation (Idialu, 2013). As a result, inadequate finance is a major problem for Rwanda and other African nations that offer vocational education. Since it aids in the quick and significant development of any nations, vocational education is an expensive endeavour. In addition, lack of media encouragement to enrol in polytechnics as they are deeply rooted in the fact that curriculum deficiency that needs innovative and modern review matching with the new trends of modern teaching. This is meant to imply that the reality depends on technical-oriented tertiary institutions, but it also points the finger at a general lack of resources for teaching and learning, including equipment, as well as a shortage of qualified lecturers because many of them tend to teach according to how they were taught. Additionally, there are some of the vocational schools' classrooms and facilities that are improper, there aren't any seminars or memorandums of understanding with factory owners, and the students aren't motivated to work harder so that they may compete on

the job market. When training sessions are conducted without the practical exercises that may be required to showcase students' best talents, the shortcomings of the facilities have a significant impact on the teaching and learning process. Most of the few tools and equipment are archaic (Idialu, 2013, Essel, Agyarkoh, Sumaila, &Yankson, 2014,).

The lack of performance within the TVET system specifically in engineering mathematics occurs at students' levels. These performance constraints exist from the interconnectedness between lack of trained and qualified, monitoring and professional development on teachers of Engineering mathematics and poor motivation, lack of self-efficacy on behalf of students towards the subject. More so, the campus's frigid attitude of failing to provide all necessary resources dilutes even motivated students' contributions and discoveries. (Essel, Agyarkoh, Sumaila, &Yankson, 2014).

In addition, the shortage of technical qualified trainers remained a significant pertinent issue in technical vocational education and training in general and Engineering Mathematic in particular. This is well characterized by trainers who got their former education in institution whereby they acquired the knowledge and skills in their subjects of specialization for not teaching utmost in technical classes and never exercised for the field. This is done in a way that teachers' propensity is mostly to talk at students who are required to listen and respond. In fact, the lack of pedagogical qualification and upgraded skills on the teachers' side prevent them from delivering technical improved knowledge and subjects' competences to learners that can lead to the subject performance (MINEDUC, 2015).

It also has to include evaluation techniques that let students use the necessary practical expertise and abilities in fields like engineering mathematics to prove their competency. Eventually, essential buildings are not enough in TVET schools and to provide different departments within the said schools. In some institutions, the available rooms stand either for vacant or kept forum fashionable stuffs. The rigid execution of Engineering Mathematics remains "elusive without competent and well-trained teachers in the domain that leads to incompetent graduates who did not even perform well in the subject" (Idialu, 2013, P. 436). Many African educational bodies building technical instructors who are not bright to train students owning low level of acquisition of knowledge and even the methodology to use while transmitting knowledge ,which caused by the lack of equipment, laboratories, training consumables and financial resources. (Idialu, 2013). Additionally, the interaction between the current resources, course curricula, and TVET policy is essential and regarded as the fundamental factor in maintaining the quality of vocational education.

The strategies for TVET students towards competences in Engineering Mathematics

As tailored above, the present paper sheds light on the strategies to be employed when dealing with Engineering Mathematics and meet the academic performance in the subject. Solutions resulting from the present work are subdivided into six domains of methods and approaches that are reflected in "learner-centered method in Engineering Mathematics delivery, the learner' motivation and the learning environment. In addition, teaching materials that reflect modernity of the new trend in teaching and learning processes, instructional design models, media and communication as programs for making awareness and encouraging among learners, parents and other stakeholders. Finally, active participation among bodies relevant to Engineering Mathematics is instigated for fully participation towards the learners' performance in Engineering Mathematics" (Idialu 2013, p. 433).

As other developing countries, Rwandan country faces similar challenges like: liberalization of the market, high and rapid innovations in technology, luck of sensitization about country's competition advantage. Many nations are focusing on their education and training systems as the primary answer that fits to the entire range of social and economic difficulties as a result of the challenges mentioned above. The Rwandan government has taken great action to strengthen TVET in light of this. The later has come out as one of the most effective human resources development strategies that the country has embraced in order to train and modernize the technical workforce for national development (MINEDUC, 2015).

In addition, the introduction of new curriculum activities that enhance positive social image and students' attitudes in Engineering Mathematics. "The importance of efforts that can contribute to developing the social attitudes of TVET education through bringing meaningful adjustments to the related guidelines, curriculum of learning and teaching, to add more, the systems and practices of TVET guidance" is established. (Alsa'aideh, 2016, 600).

Therefore, the only way to change this perception is to demonstrate the positive outcomes achieved from TVET. From this perspective, TVET have to be oriented to the world of work (paraphrase the TVET policy 2015) and orient students' attitudes, feeling and motivation towards the benefits of studying in TVET precisely Engineering Mathematics. Therefore, improving TVET's standing and allure requires altering public attitudes toward technical and vocational education through student selection, admission, and referrals. To improve their appeal as a career choice

for secondary school graduates, polytechnic institutions must be strengthened and given a greater role in industrial and technical growth (MINEDUC, 2015).

Additionally, it is advised to promote Engineering Mathematics as a subject of preference for a future job via community engagement and improve academic achievement in the field. For this reason, it is better to set up the collaboration with the subject teachers from different TVET School and the international organizations to perform innovations for teaching and learning strategies in Engineering Mathematics. Finally, it is proposed to reduce school fees for students and to award special benefits and increased fund from government to TVET (Idialu 2013).

Engineering Mathematics ought to be adequately backed up to generate the realization and attainment of its purpose and drives. The desires of "occupational education which includes purchasing kits and constituents for teaching and learning activities, upkeep of equipment, imbursement for students' excursions, are relatively huge and need to be talked rapidly" (Biao, 2018, p. 79). As results, the government can provide and increase funds related to the subject. Quality can be obtained only in an ambience of economic, resources sufficiency which will help in the supply of facilities, classroom equipment and other related materials that lead to the learners' competences.

Furthermore, Engineering Mathematics teachers should also direct emphasis on skills acquisition. This is meant that the field needs trained teachers well equipped with competencies that can help in both performance and the labour market. Besides, teachers must have enough awareness and ability to perform any assigned job that are compulsory for transferring knowledge in the teaching and come out the examination with the orientation that focuses mostly on theoretical concepts rather than hand on skills competences (Idialu 2013). Therefore, Engineering Mathematics has given more attention in this research to replace the traditional teaching method which encouraged the students to participate actively in the classroom. Not only student-teacher interaction is advised to be applied in classroom sessions, but also group works are promoted. It is confirmed that the student can get involved in developing their comprehension and the acquisition of knowledge delivery process. All of these ultimately result in self-doubt and stress, which reduces their aptitude and creativity and leaves them without promise of success. This teaching and learning should be done in a dual system such that students learn in the classroom, and also learn by doing in the field (Idialu 2013).

The process a designer should follow to create a course, curriculum, or training manual with the aim of organizing content to fulfill learners' goals is more precisely referred to as an instructional design model (Bofill, 2016; Kelly, 2016; Mustafa *et al*., 2016). Instructional design models are important and beneficial to those who develop instruction because they support the creation of learning environments that are conducive to managing and directing the process of instructional development. This is because they bridge the gap between instructional and learning theory. (Zain *et al*., 2016; Branch &Kopcha, 2014).

More on the above, the barriers of students' academic performance include those related to the promotion of learners to upper levels. The conditions in which learners are promoted to upper levels may affect their performance. For instance, when the repetition rate is low without reflecting on mechanisms that can help in the achievement. This leads to students' laziness hoping to be promoted without any conditions. This understanding of automatic promotion may hinder learners' promotion because according to the policy, whether students succeed or not, they are promoted without any conditions. Koppensteiner (2011) in his study found that the introduction of automatic promotion significantly reduces academic achievement. According to Shittu (2004) some inconsistent government policies cause a fallen standard in academic performance of school students. The author gives an example of automatic promotion to students in the primary and secondary schools. He continues that these bandwagon promotions produced unqualified students to final classes. The TVET is a movement towards reducing the gap between the youth and the labour market demand. It is an essential tool for integrating people in society and making them productive member of community**.** Thus, in order to certify elevated quality in the schooling and enhanced training in Engineering Mathematics, it is indispensable that the students gain prospects to absorb from trainers whom they meet and continue to prove their potentials throughout their profession and demonstrate high performance in the subject (Idialu, 2013). Even though the quality standard is still crucial in Rwanda, especially in TVET, specialists who use new paradigms that integrate the realities of the workplace into the teaching activities in order to improve the students' thinking, problem-solving, and decision-making skills with regard to the choice of their future careers should teach Mathematics. (Alsa'aideh 2016; MINEDUC, 2015).

A seamless transition from upper secondary schools to tertiary training facilities and polytechnics is necessary to enable lifelong learning. This signifies that a learner must be able to perform the subjects that he or she is attending

with a positive will that he or she will benefit from his or her investment. The transition needs to consider learners' background that can affect their academic performance. Nzabihimana (2010) opined that approximately the learners' individualities as aspects to academic performance, very imperative are the progenies themselves with respect to how equipped they are to merge into the assortment called education.

There is encouraging rapport between concentration in and satisfaction of a subject and the accomplishment scores of students. In the same view, Oriahi (2009) in his study revealed that students' motivation has high positive correlation in their academic performance. Finally, tthe other learners' characteristic affecting their performance is the learners' perception. The process of evaluating information about another person is referred to as social perception, according to Nelson and Quick (1997). The progressions via which humans choose, arrange, and interpret sensory stimulations into pertinent knowledge about their workplace constitute perception. (Unumeri, 2009). Learners have their own perceptions of their competences and education features.

These insights influence broad characteristics of their tactic and styles to learning. Furthermore, there are two ways of defining perceptions such as self-concept where by students believes in their own abilities while self-efficacy declares how well students think that they can handle even difficult tasks. Both these two ways of defining perception are among learners' characteristics and have a great impact on academic performance, (Haahr, Nielsen, Hansen & Jakobsen, 2005). On the other hand, teachers also need to be motivated to teaching and one of the drivers of teachers' motivation includes their salaries and other necessities, which help the teacher to be in good conditions of living.

iii. Conceptual Framework

The relationships between the study's independent, dependent, and intervening or extraneous variables will be taken into account when conducting this investigation.

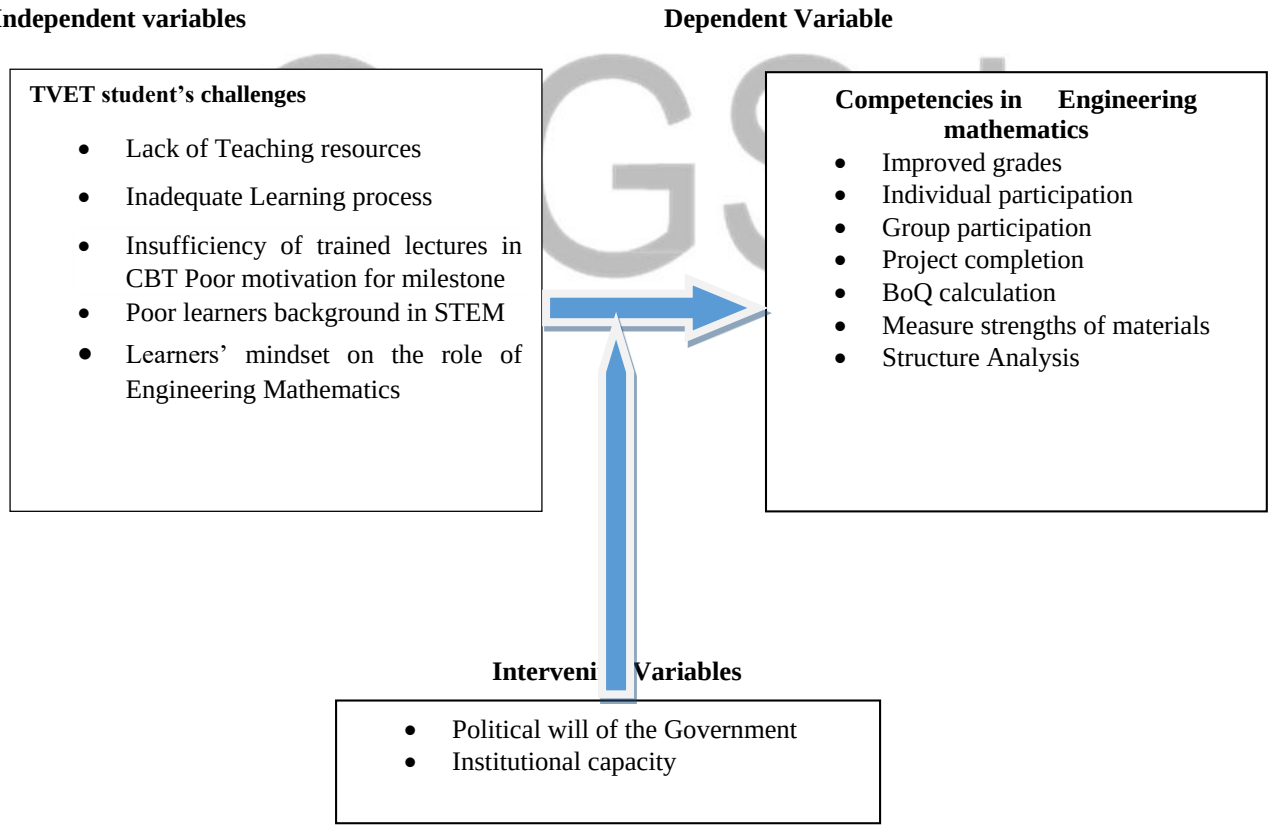

Figure 2. 1: **Conceptual Framework**

Source: researcher's data

The conceptual framework above is derived from the views of Decenzo and Robbins (1998) and Bascal (1999). The relationship between the dependent, independent, auxiliary, or intervening variables is attempted to be explained. The

investigation of influence of the challenges faced by TVET Engineering students as an independent variable and its effects on the competences in Engineering Mathematics as the dependent variable was focused on during this study. When independent and external factors are combined, Engineering mathematics Competences are affected. The researcher examined the independent variables as factors affecting TVET students' competences of Engineering Mathematics. In addition, the figure 1 attempts to explain the influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics and the intervening variables. The framework demonstrates how learning processes, teaching resources, milestone motivation, learner backgrounds, and learner mindsets are used as sub-themes of independent variables in an effort to elaborate deeply on the degree to which they can have an impact on students' performance in engineering mathematics. The framework also suggests that the extraneous variable, which is made up of its sub themes, has a significant impact on how well students perform in Engineering Mathematics. In other words, the learners' performance is likely to be positively or negatively impacted whenever one of the unrelated variables (government policy, institutional capability, and students' motivation) intercepts in between the independent and dependent variables.

v. Research Materials and Methods

Research design

A strategy for conducting fieldwork is known as a research design. It explains the type and methodology employed during field research. Useful research designs include survey, historical, experimental, exploratory, and descriptive ones. In this section, the qualitative and quantitative data collection techniques should be identified and supported. According to Denzin and Lincoln (2011), qualitative research adopts an interpretive and naturalistic perspective on the universe to make sense of or interpret events in terms of the meanings people give them. As a result, they investigated objects in their natural settings. The interpretive paradigm was deemed appropriate for the study as it sought to the influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics, at RP/IPRC Musanze. The researcher to collect the necessary information from participants used semi-structured interviews.

According to Ary, Jacobs, and Razavie (2002), the goal of qualitative research is to understand social and behavioral patterns from "insider's views." Sidhu (2002) claimed that qualitative research places more emphasis on providing a comprehensive account of whatever is being observed than comparing the outcomes of various treatments. This means that in qualitative investigation, there should be vivid description of phenomena. Although numerical data were collected during the process and evaluated as such to understand the natural occurrence of conflict in the schools, qualitative research prioritizes the description and interpretation of facts in words rather than figures. The qualitative research technique was the most suitable for analysing the influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics, in RP/IPRC Musanze because the study employed the case study approach in-depth investigation of the topic.

It used also a qualitative research method with description and interpretation of data collected by using questionnaires administration, observation and personal interviews to collect data on the Influence of the challenges faced by TVET Engineering students on the competences of Engineering Mathematics, in RP/IPRC Musanze. These approaches were approved because they are the most practical and effective ways to gather reliable data for the study. When gathering and analysing data from the field, the benefits of the research techniques and equipment outweigh their drawbacks.

Target population

In contrast to a simple, which is a group of items or a single element from which data are taken, a population is a collection of elements or cases, whether persons or occurrences, that meet specific characteristics (Mcmillan,1996). The target population of the research is made up of RP/IPRC Musanze students and academic staff. The target population of this research is composed of 262 persons. (appendix 1)

Table 1: Target Population

Category of population		**2020/2021**			**2021/2022**		
Students of year one	**Combination**	**B**	**G**	**Sub/T**	**B**	**G**	**Sub/T**
	CE	30	7	37	33	0	33

	EEE	28	3	31	29	1	30
Sub total		**58**	**10**	68	**62**	**1**	**63**
Students of year two	CE	30	5	37	33	2	33
	EEE	30	5	31	32	1	30
Sub total		**60**	**10**	**68**	**65**	**3**	**63**
Grand Total	**262**						

Sampling Design

Sample size determination

Concerning the sample used, a sample was 72 compose of 68 students and 4 Lectures from IPRC Musanze Institution. This sample was determined using Yamane formula of sample calculation cited by Mark Kasunic(2005).The formulas assumesa 95% confidence level and maximum variance(p=0.5).

The formula is $n=N/1+N(e)^2$

Where: n is the sample size, N is the population size, e specifies the desired level of precision, where precision e=1-precision, p=0.5

In this study,N is equal to 262,e(margin of error)=1-0.90=0.1

$n=262/1+262(0.1)^2=72$

Sampling Techniques

In this study, the students were selected using Simple Random sampling while purposive sampling was used to select Lectures. The selection was based on the researcher's purpose of getting information from TVET students and teachers with different academic years, in order to get insight on how challenges influence the competences of Engineering Mathematics for TVET Engineering students, According to Lodico, Spaulding, and Voegtle (2010), the goal of sampling is to choose individuals, locations, or objects that can offer the richest and most thorough information to aid the researcher in answering research questions rather than to gather a large number of representatives in a sample. Furthermore, the researcher selected the Civil Engineering and Electrical and Electronics students of IPRC Musanze with the purpose of reducing costs of transport during data collection.

Data Collection Tools

The researcher utilized questionnaires and interviews to gather data. While the teachers were given the interview, some pupils received questionnaires. Through the academic records observation form, the researcher additionally collected data using online and library-based methods. Utilizing many approaches, sometimes referred to as triangulation, is done in order to collect rich data that allowed the researcher to successfully accomplish their goals.

Data analysis

The researcher, naturally based on research judgments as per data gathered, used both inferential and descriptive analysis on the stage of analysing data after collection in order to make relevant conclusions and recommendations. The following steps were used to analyse the data: The gathered information were rearranged according to their similarities. This is how mistakes from properly filled out questionnaires and interview schedules were found, sorted out, and removed. The data was next coded. The process of coding is examining the data to find any emerging patterns, topics, or classifications (Lodico, Spaulding, & Voegtle, 2010). The researcher classed responses into their respective categories. This was done by identifying the coding frame. The responses were sorted first, filed differently according to the categories of respondents and accorded their codes. After the above process, frequency responses were summarized by using statistical tables. Finally, the collected data were tabulated. This was the process of putting data into statistical tables such as pie charts, percentages and frequency tables indicating the number of occurrences of a

response for each question. The researcher tabulated data using tables indicating the frequencies of responses and their percentages in their respective categories.

vi. Results

Profile of Respondents

In this study, respondents were drawn from gender, education, and age of respondents. In the next tables highlight the distributions and completely with explanations.

Characteristics of the Respondents

The respondents are comprised of sampled students and employees from IPRC Musanze. For reaching objectives the investigator asked them through questionnaires to clarify the information needed. The identification of the respondents was focused on the following variable: gender, group of age, departments and education of respondents as presented in Table 1.

Table 2: Personal identification of Respondents

Personal identification of respondents		Frequencies	Percentages
Gender of respondents	Male	48	66.6%
	Female	24	33.3%
Ages of respondents	19-24 Years	40	55.7%
	25-29 Years	28	38.8
	30-39Years	4	5.5
Department of respondents	CE	48	66.7%
	EEE	24	33.3%
Education Level of Respondents	Diploma	68	94.4.0%
	Masters degree	4	5.5%

Table 2 shows that the personal identification of respondents in IPRC Musanze. The results show that 24 respondents are female and 48 respondents are male as confirmed by percentages of 33.3% and 66.6 % respectively. In addition, the results also show that most of sampled respondents from IPRC Musanze have aged from 19-24 Years,25-29 Years, and 30-39 years. Here to are their numbers and percentages respectively, 40 with 55.7% followed by 28 with 38.8% and 4 respondents with 5.5%. The results also show that 48 respondents are in CE department as confirmed by 66.7% and 24 respondents are in EEE department with percentage of 33.3%.and 4 respondents (Lectures) with percentage of 5.5%.

Views on the challenges faced by the TVET Engineering students in Engineering Mathematics

The study has examined the challenges faced by the TVET Engineering students in Engineering Mathematics in IPRC Musanze, however, the section highlights the respondents view on the statement.

Table 3: Challenges faced by students doing engineering mathematics (EEE&CE)

		Frequencies	Percentages
Challenges faced by students in Engineering Mathematics	Yes	72	100.0%
	No	0	0.0%

Due to shortage of teaching resources in Engineering Mathematics	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	29	40.3%
	Strongly agree	43	59.7%
Poor Learners' background in STEM	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Poor motivation of students about Engineering Mathematics	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Discouraging class discussion by lecturers	Strongly Disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Consideration of engineering mathematics as difficulty course by students	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
The shortage of well-trained lecturers in Engineering Mathematics	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Neutral	0	0.0%
	Agree	0	0.0%
	Strongly Agree	72	100.0%

Table 3 shows that there are challenges faced by students doing engineering mathematics as confirmed by 72 respondents with percentage of 100%. The results are confirmed by Cedefop (2018) who said that the most powerful challenge for technical education is the mismatch of students' capacity, needs for individuals in accordance with the fundamental of lifelong learning. Furthermore, the most evidence castigating is that communities do not encourage students to enroll in polytechnics due to the fact that the government admit student in the program regardless of their

prior ability and choice of students. The results also show that 29 and 43 respondents agreed and strongly agreed that Shortage of teaching resources is the challenges faced by students doing engineering mathematics as confirmed by percentage of 40.3 % and 59.7% respectively.

Jacobsen (2015) who said that lack of teaching and learning facilities, lack of political will, confirms the results and curricula deficiencies lead to the failure of meeting the expected outcomes. The results also show that poor learners background in STEM is also challenge faced by students doing engineering mathematics as confirmed by 72 respondents with percentage of 100%. The results are confirmed by MINEDUC (2015) which said that many schools are faced with challenges including teaching resources, learning process, less CBT, poor motivation for milestone, poor learners' background in STEM and learner's mind-sets on the role of Engineering Mathematics. As the result, some schools fail to improve their academic performance.

Table 4.2 Poor motivation of students is also the challenge faces by students doing engineering mathematics as confirmed by 72 respondents with percentage of 100%. The results are confirmed by Huitt (2017) who said that the findings from this research are have some relationship to the current research, like Lack of motivation, students 'mind-sets and students poor background which lead to poor performance of Engineering mathematics. The results also show that Discouraging class discussion by lecturers as confirmed by 72 respondents with percentages of 100%. Table 2 also shows that Consideration of engineering mathematics as difficulty course by students is also challenge faced by students doing engineering mathematics as confirmed by 72 respondents with percentage of 100%. The results are confirmed by discouraging class discussion is the one among the hindrance of performance.

The results also show that shortage of the shortage of well-trained lecturers in Engineering Mathematics is also challenge faced by students doing engineering mathematics as confirmed by 72 respondents with percentage of 100%. The results are confirmed by (Haller & Fink, 1968) who said that the shortage of technical qualified trainers remained a significant pertinent issue in TVET in general and Engineering Mathematic in particular. This is well characterized by trainers who got their former education in institution whereby they acquired the knowledge and skills in their subjects of specialization for not teaching utmost in technical classes and never exercised for the field. This is done in a way that teachers' propensity is mostly to talk at students who are required to listen and respond. In fact, the lack of pedagogical qualification and upgraded skills on the teachers' side prevent them from delivering technical improved knowledge and subjects' competences to learners that can lead to the subject performance (MINEDUC, 2015).

Views on the performance of students doing engineering mathematics in IPRC Musanze

The study examined the classification of engineering mathematics students and their level of performance in IPRC Musanze according to their performance. However, the section highlights the respondents view in the statement.

Table 4. Shows classes and level of performance of engineering mathematics in IPRC Musanze

		Frequencies	Percentages
Students' performance in EEE	Higher class	0	0%
	Distinction	4	5.5%
	Lower class	10	13.8%
	Pass	3	4.6%
	Fail	7	9.7%
Level of performance in CE	Higher class	2	2.7%
	Distinction	5	6.9%
	Lower class	6	8.3%
	Pass	10	13.8%
	Fail	25	34.7%

The results in Table 4 shows that the 0 students which is 0 % of students in EEE Department are in higher class .The results also show that 4 students got Distinction in Engineering mathematics which is 5.5%in EEE. The results show that 10 students in EEE Department got Lower class that is 13.8% .In EEE 3 students got pass grade that is 4.6%. 7 students in EEE failed Engineering mathematics this is the percentage of 9.9% . In CE that the 2 students which is 2.7 % of students in CE Department are in higher class .The results also show that 5 students got Distinction in Engineering mathematics which is 6.9% in CE . The results show that 6 students in CE Department got Lower class that is 8.3% .In CE 10 students got pass grade that is 13.8%. And 25 students in CE failed Engineering mathematics this is the percentage of 34.7% . Sumaila, &Yankson (2014,) who said that the lack of performance within the TVET system specifically in engineering mathematics occurs at students' levels. These performance constraints exist from the interconnectedness between lack of trained and qualified, monitoring and professional development on teachers of Engineering mathematics and poor motivation, lack of self-efficacy on behalf of students towards the subject. More so, even motivated students' contributions and discoveries are watered down by the campus's cold attitude of not providing all necessary facilities

Views on the influence of the challenges faced by TVET Engineering students on the Engineering Mathematics performance

The study examined the impact of the challenges faced by TVET Engineering students on the performance of Engineering Mathematics. However, the section indicates the respondents view on the statement.

Table 5: The impacts of the challenges faced by TVET Engineering students on their performance of Engineering Mathematics

Impacts of challenges faced TVET Engineering students		**Frequencies**	**Percentages**
Due to shortage of teaching resources, performances of Engineering Mathematics of TVET students have gone down	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Due to poor motivation for milestone, individual participation in Engineering Mathematics of TVET students has decreased	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Due to poor Learners' background in STEM, a competence in Engineering Mathematics has been difficult to achieve	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Due to learners' mind-set on the role of Engineering Mathematics, performance of Engineering Mathematics has gone down	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%

Due to less CBT, the competence of Engineering Mathematics for TVET students has not been achieved	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%
Relationship between students challenges on performance of students in CE	Strongly disagree	0	0.0%
	Disagree	0	0.0%
	Agree	0	0.0%
	Strongly agree	72	100.0%

The results in Table 5 shows that 72 respondents agreed that due to shortage of teaching resources impacted the performances of Engineering Mathematics of TVET students to go down in IPRC Musanze as confirmed by percentage of 100%. The results also show that Due to poor motivation for milestone, individual participation in Engineering Mathematics of TVET students has decreased in IPRC Musanze as confirmed by 72 respondents with percentage of 100%. Table 4 also shows that Due to poor Learners' background in STEM, a competence in Engineering Mathematics has been difficult to achieve in IPRC Musanze as confirmed by 72 respondents with percentage of 100%. The results are confirmed by MINEDUC (2015) which said that many schools are faced with challenges including teaching resources, learning process, less CBT, poor motivation for milestone, poor learners' background in STEM and learner's mindset on the role of Engineering Mathematics. As the result, some schools fail to improve their academic performance (MINEDUC, 2015).

The results also show that due to learners' mind-set on the role of Engineering Mathematics, performance of Engineering Mathematics has gone down as confirmed by 72 respondents with percentage of 100%. The results also show that Due to less CBT, the competence of Engineering Mathematics for TVET students has not been achieved in IPRC Musanze as confirmed by 72 respondents with percentage of 100%. The results also show that 72 respondents are strongly agreed that there is relationship between student's challenges on performance of students in CE in IPRC Musanze. The results are confirmed by Idialu (2013) who said that shortage of teaching resources, to poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics impacted the performances of Engineering Mathematics of TVET students to go down and hence individual participation in Engineering Mathematics of TVET students decreased.

Relationship between the influence of challenges faced by TVET Engineering students and their competencies of Engineering mathematics, in IPRC Musanze

This section assessed the relationship between the influence of challenges faced by TVET Engineering students and their competencies of Engineering mathematics, in IPRC Musanze as tabulated in model summary table, Analysis of variance and coefficient of determination.

Table 6:Shows model summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate

1	.226[a]	.651	.3257	.70726

The Table 6 shows model summary was used to indicate the degree of fitness between independent variable and dependent variables and it show that through R square .651 means 65.1% the variables of independent variable which is Challenges faced by TVET Students doing engineering mathematics are highly contribute to the level of performance in IPRC Musanze. The results are confirmed by (Alwi, 2021) who said that shortage of teaching resources, to poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics and less CBT have negative influence on the level of performance of TVET students doing engineering mathematics.

Table 7: Shows coefficients

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	(Constant)	0.974	1.705		-.284	.777
	Shortage of teaching resources.	-.053	.175	.038	.306	.761
	Poor motivation for milestone.	-.071	.066	.131	1.074	.287
	Poor Learners' background in STEM	-.072	.116	-.077	-.626	.534
	learners' mind-set on the role of Engineering Mathematics	-.210	.182	.141	1.151	.254
	Less CBT	-.0174	.184	.117	.945	.348

a. Dependent Variable: Level of performance in CE

In this study in order to indicate the relationship between challenges faced by students doing TVET engineering mathematics and their performance in IPRC Musanze the regression model is used. The Table 7 was conducted to show a multiple regression analysis so as to determine the Regression coefficients (β) which shows that $\beta 0 = .974$ and which means that in absence of the challenges faced by TVET students doing engineering mathematics which are shortage of teaching resources, poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics and less CBT, the performance of students doing engineering mathematics will be equal to 0.974 which is equal to 97.4%.

$Y = 0.974 - .053X_1 - .071X_2 - .072X_3 - .0210X4 - .0174X5 + \varepsilon$. This means that if shortage of teaching resource increase by 1 unit the performance of students doing engineering mathematics decrease by 0.053. And if poor motivation for milestone increase by 1 unit, the performance of TVET Students doing engineering mathematics also decrease by 0.071. If poor learners background in STEM increase by 1 unit, the performance of TVET students doing engineering mathematics also decrease by 0,072. If learners mind set on the role of engineering mathematics increase by 1 unit, the performance of students doing engineering mathematics also decrease by 0.0210. If less in CBT increase by 1 unit, the performance of students doing engineering mathematics also decrease by 0.0174.

Therefore, there is negative relationship between Challenges faced by TVET students doing engineering mathematics and their performance in IPRC Musanze. The results are confirmed by Nichols and Street (2017) who said that there

is negative relationship between Challenges faced by TVET students doing engineering mathematics and their performance in such way that it is difficult to achieve competence in Engineering Mathematics in presence of these challenges. Due to poor motivation for milestone, individual participation in Engineering Mathematics of TVET students has decreased, due to poor Learners' background in STEM, a competence in Engineering Mathematics has been difficult to achieve, due to learners' mind-set on the role of Engineering Mathematics, and performance of Engineering Mathematics has gone down.

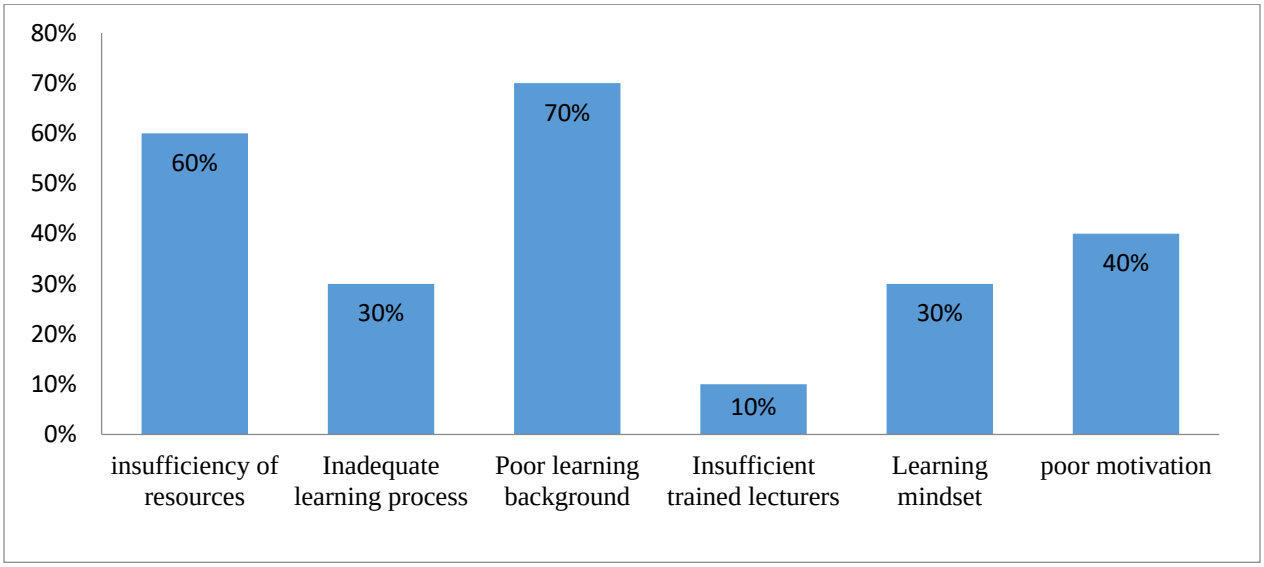

Figure 1: Challenges hindering Success of students of engineering department

The figure above is about analysis of challenges hindering Success of students of engineering department, where the insufficiency of resources is at 60%, Inadequate learning process at 30%, Poor learning background at70%, Insufficient trained lecturers 10%, Learning mind-set while 30%, and poor motivation is 40%.

F-Test Analysis of Marks of CE department against EEE department

The table below is the F-test to analysis to test whether at 5% level of significance the variance of marks of CE department does not differ significantly from the variance of marks of EEE department.

F-Test Two-Sample for Variances

	Variable 1	**Variable 2**
Mean	58	23.14705882
Variance	120.2608696	78.85650624
Observations	47	34
Df	46	33
F	1.525059571	
P(F<=f) one-tail	0.103335385	
F Critical one-tail	1.735265651	

As shown in this table above, the P-value is 0.103335385 which is greater than the 5%level significance, hence we accept the null hypothesis which means that at 5% level of significance the variance of marks of CE department does not differ significantly from that of variance of mark department. Therefore in both departments there is the same spread of marks from the average mark.

vii. Discussion

The data of this research were presented in frequency distribution tables. Based on the results of the first objective, the study concludes that lack of teaching resources, inadequate learning process, Insufficient of trained Lectures in CBT,poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics are the challenges faced by TVET students in Engineering mathematics. Based on the results of second objective, the study conclude that TVET Engineering students in the deprtments of Civil Enginnering and Electrical Electronics Engineering,have got the following 5 defferent grades in the module of Engineering mathematics, in IPRC Musanze, Those grades are, higher class followed by distinction followed by lower class followed by pass and lastly fail . Based on the results of the third objective, there is a negative impact between challenges faced by TVET Engineering students in engineering mathematics module and their competences in such way that, due to lack of teaching resources, inadequate learning process,Insufficient of trained Lectures in CBT,poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics are the challenges faced by TVET students in Engineering mathematics,and their competences of Engineering Mathematics have gone down, Due to the above mentioned challenges. hence negative relationship between challenges and competence of TVET Engineering students in Engineering mathematics.

viii. Conclusion

Based on the results the study concludes that shortage of teaching resources, to poor motivation for milestone, poor Learners' background in STEM, learners' mind-set on the role of Engineering Mathematics and less CBT are the challenges faced by TVET students in Engineering mathematics. Based on the results of second objective the study concludes that EEE &CE students for this module of Engineering mathematics are classified into 5 classes basing on their performance which are higher class followed by distinction followed by lower class followed by pass and lastly fail. Based on the results of the third objective, there is a negative relationship between challenges faced by TVET students doing engineering mathematics and their performance in such way that due to shortage of teaching resources, performances of students in Engineering Mathematics have gone down, due to less CBT, the competence of Engineering Mathematics for TVET students has not been achieve and hence negative relationship between challenges and performance of TVET students doing engineering mathematics.

This research also analysed the challenges hindering Success of students of engineering department and found that where the insufficiency of resources is at 60%, Inadequate learning process at 30%, Poor learning background at70%, Insufficient trained lecturers 10%, Learning mind-set while 30%, and poor motivation is 40%.

Then testing whether the variance of marks of CE department does not differ significantly from the variance of marks of EEE department, this research shown that at 5% level of significance the variance of marks of CE department does not differ significantly from that of variance of mark department. Therefore in both departments there is the same spread of marks from the average mark.

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