

# **Factors Contributing to Effective Implementation of Competence Based Education and Training : A moderating effect of Information and Communication Technology; A Case of Selected VET and NACTE Colleges in Mbeya-Tanzania.**

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## **Abstract**

The study aimed at assessing the factors for effective implementation of competence Based Education and Training (CBET) where Information and Communication Technology (ICT) was a mediating variable. The study was carried out in Mbeya from four selected VET and NACTE Colleges including Kyela Polytechnic College; VET and NACTE College; VET-Mbeya Zonal Office; and KAP'S Community Development Institute. The causal-effect design was applied while cluster sampling was used to drive to 300 sample of Tutors, Principals, Deputy Principal-Academic, Registrars and management from a total of 1,200. Data from the obtained sample frame was collected using questionnaire. The collected data were subjected to data cleaning and normality testing. Moreover the cleaned data were subjected for factor analysis, reliability and validity testing through SEM employment. From the analysis, it was found that ICT positively and significantly moderate students' centered teaching curriculum, learning by doing and discoveries in effective and quick adoption and implementation of CBET. It is from this innovation what this study recommends that VET and NACTE Colleges have to adopt and use ICT technologies for quick and effective implementation of CBET.

**Keywords:** CBET, ICT, VETA, NACTE

## **1. Introduction**

Competence based education and training has been a topic of discussion in most of education institutions worldwide. CBET is a curriculum system in which a student is at the centre of discussion (Tambwe, 2019). It is with CBET in which a teacher or tutor become just a facilitator called instructor (Chappell, Gonczi & Hager, 2020). CBET differ from knowledge based education and training in a manner that with this system of education or training, a teacher is at the center. Introduction of CBET has darned the education system from being a process of transmitting knowledge to transformation (Hadad & Bejinaru, 2020). It is under CBET in which a leaner /student become an active participant of the whole discussion. Simply a student or learner chooses what to learn called pragmatism (Mulenga & Kabombwe, 2019). CBET a learner is accessed to materials as those accessed to materials as those as those accessed by a teacher who then become a facilitator (Foley, 2020). It is through access to available visual aids and tutorials in which capturing ability of a leaner become high which then enhance learning by doing philosophy. It is indeed under CBET where a learner is not just deposited with materials but participates in accessing materials and gets acquainted with the knowledge and even with supplement materials which could even not notified if a teacher could be at the center of discussion.

By a learner being accessed to learning materials become active participant in discussion. This is quickly fostered through electronic platforms. That is to say following inventions over information and communication technologies, ease access to electronic materials enable student to choose what to learn while a tutor or teacher remain as an instructor (Chappell, Gonczi & Hager, 2020). This then makes teaching learning process in which then a pedagogy of learning is reversed ( i.e. become down top and vice versa) and not only one-way i.e. top down pedagogy which could happen if teaching could be teachers' or tutors' centered.

It is through interactions with electronic tutorials, u-tubes teachings and more other electronic databases and simulation where the visual aids model of teachings is experienced which then facilitate learning by doing. This then increases capturing ability of learners (Van Griethuijsen, Kunst, van Woerkom, Wesselink & Poell, 2020). This moreover has made learner /student require a minimum supervision called instruction from a teacher and not a total incubations as it is under knowledge based training if electronic platforms could not be there. Student centered learning is influenced from the fact that visual/video, sound a millions of words than if it could be voice or audio-sound from a teacher, indeed if a teacher is not used to visuals media ( Field,2020). Moreover being used to computer and information technologies help quick retrieval of visual aids indeed if the computer is installed with internet different from when a teacher is in remote not used to computer enabled internet.

Adoption to information and communication technologies platform enhances discoveries (Akala, 2021). This is from the fact that a learner interact with different materials, concepts and theories about the subject matter under discussion. By being accessed to these learning staffs enable a learner being acquainted with a new knowledge and also identify , the gap (the issues) not said by authors about a particular matter studied which then invert over discoveries value adding issues. That means it is through use of ICT technologies what makes a learner become creative while being non-incubated (Mulenga & Mwanza, 2019). This is then a typical approach towards effective implementation of CBET, from the fact that a student become at a center of discussion.

The study by Bratianu, Hadad and Bejinaru, (2020) revealed on the innovativeness over uses of ICT in secondary schools in USA. Due to effective adoption and use of information and communication in the early of 1980s, secondary schools in United States of America revealed to be quickly invented to competence based education and training curricula. It is through intrusion of ICT earlier in that time while to developed countries such as USA, secondary school graduates found to be competent and resourceful to the society.

Invention, adoption and use of ICT in teaching and learning as it was reported by Nsengimana, Rugema Mugabo, Hiroaki and Nkundabakura (2020) in Nigeria found to be an effective platform that caused much of discussions to be students' centered. It was moreover revealed that use of ICT helped students to choose what to learn under minimum supervision from teachers. Most of school discussions were revealed to be exploratory while a teacher being just a facilitator.

While other studies revealed on effects of using ICT on ease access to teaching and learning, other studies have revealed use of ICT in facilitating students centering teachings/learning. Moreover while other studies have been associating learning by doing being facilitated through use of visuals media, others were associating interactive teachings through use of visual aids and effective implementation of CBET. What other studies did not stipulate the moderating

effect of the variable, ICT against student centering teachings; learning by doings and discoveries for quick adoption and effective implementation of CBET. This then was the point of focus this study centered at. The four objectives guiding the study were to analyze the effects of student centering teaching/learning on effective implementation of CBET; examine the effects of learning by doing on effective implementation of CBET; investigate the effects of discoveries on effective implementation of CBET; and assess the contributions of ICT on student centering teachings, learning by doing, discoveries for effective implementations of CBET.

## **2. Literature Review**

### *2.1 Theoretical Literature Review*

This study was guided by pragmatic model. The model was found by Dewey & Imagination (2020) proposing on student centering way of teaching/learning. The model proposed on merits of a student participates in the whole process of teaching and learning instead of being left behind as passive recipient. It is with pragmatic theory where a student chooses what to learn in reflection to home environment. It is with pragmatic theory where a learner participates fully in discussion while a tutor (teacher) remains just an instructor or facilitator of discussion. This theory either explicitly dictates on the sparsely 25% to be offered by a teacher, now a tutor and 75% left with students. This is to say pragmatic model detail over how competence based curricula (CBET) is to be underwritten.

Despite of the innovative proposal of pragmatic model on how competence based teaching and learning is to be adopted but the model failed to stipulate on the best way to take for its fast and effective implementation. This is the reason why despite of introduction of this model of education and training since 2005s in Tanzania but still the system is not well acquainted with facilitators who are teachers (Kihwele & Chuma, 2020). It is now more than 15 years since its introduction but still teachers in most cases were found using teachers' centered teaching and learning technique called knowledge or content based method (KBET). It is through this study therefore, ICT is to be used as e-platform in enhancing fast adoption and effective implementation of CBET. Thus, this study has brought in a blended model in teaching and learning which expect to fasten diffusion of competence based curriculum.

### *2.2 Empirical Literature Review*

The study by Khosrow-Pour (2020) in Northern Carolina revealed the factors that determine the competence based education and training including the student centering teachings and learning; interactive teaching, students accessed to learning materials; and access to tutorials. The study by Khosrow-Pour (2020) was exploratory and the findings were presented and analyzed through the use of content analysis technique.

Liang, Chai, Dong and Tsai (2018) pointed out the influence of use of ICT technology on quick adoption of CBET in Chinese secondary schools. It was more over revealed that use of U-Tubes, zoom video conferencing platforms and access to a number of application programs and other electronic database sources were the enhancers towards quick adoption and fusion over implementation of competence based training and education. Moreover the study by Liang, Chai, Dong and Tsai (2018) used descriptive research design while a population size of the focus group which was teachers and secondary schools inspectorate unit was 10,200. It is from this population size where a sample size of 300 through employment of purposive sampling

technique was extracted. Moreover the data analysis tool applied was thematic prior to data collection using semi-structured interview.

In Rwanda it was found by Nsengimana, Mugabo, Ozawa and Nkundabakura (2021) that effective implementation of CBET in universities was due to adoption of technology and visual media. With the study by Nsengimana, Mugabo, Ozawa and Nkundabakura (2021) it was misacted that visual media speak a millions of words than words that were the reason why effective implementation and quick adoption of CBET was sustained in Rwanda. The study was furthermore descriptive from which statistical tools including standard deviation; variance, mean and coefficient of skeweness were employed.

Kanyonga, Mtana and Wendt (2019) in Tanzania commented on the factors influencing effective implementation of CBET in which it was pointed out that adequate furnished infrastructures and adequate access to teaching/learning materials (resources) counted for the fact. Adequate chairs, tables, classrooms, toilets, cafeteria, stationery were the counting for effective implementations of CBET in technical colleges in Arusha, Tanzania. This study was exploratory in nature and the ground theory was the research design applied while collected and processed data being analyzed through interpretation.

### 2.3 Research Gap

The studies above differ from this underhand in a manner that while the said other studies have no moderating variable; this one under discussion has ICT as a moderating variable. Moreover while other studies has applied data analysis tool including explorations, content, thematic, descriptive, this one underhand has used structural equation modeling (SEM). More other differences was over the research area and target population where this study underhand was conducted in Mbeya from four selected VET and NACTE Colleges and the targeted group being tutors, VET/NACTE Colleges' management.

### 2.4 Conceptual framework

The variables revealed from the literatures were operationalised through three forms of constructs which were independent, moderating and dependent. The independent variables were teaching and learning materials (TLM), learning by doing (LD) and inventions (I) while the dependent variable was competence based education and training (CBET). The moderating variable was information and communication technologies (ICT).

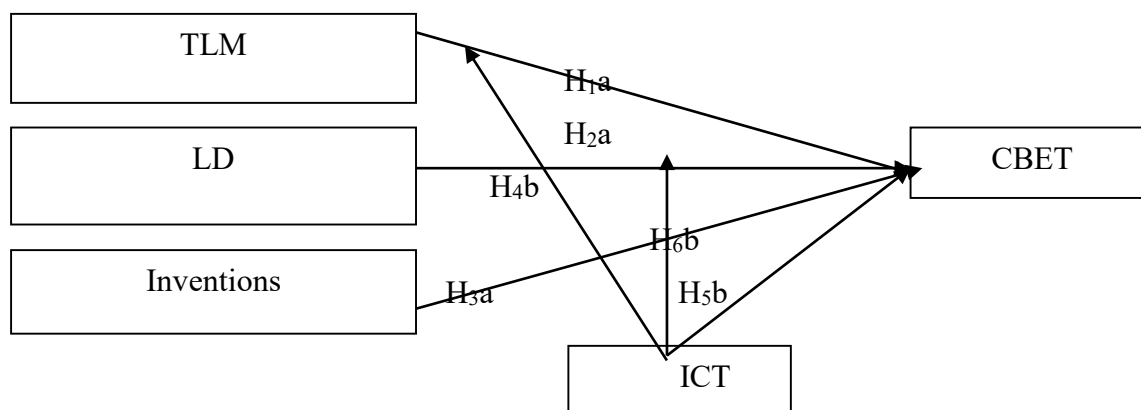


Figure 1: Conceptual framework of factors contributing to effective implementation of CBET: A moderating effect of ICT

*Source: Dewey & Imagination (2020); and Kihwele & Chuma (2020)*

### 3. Research Method

The study was positivistic in which causal-effect research design was applied. The study was conducted in Mbeya from four selected (2) VET and (2) NACTE Colleges. These colleges included Kyela Polytechnic College which runs both VET and NACTE programs. The other VET College involved was VETA-Mbeya Regional zonal office and KAP'S Institute of Community development which is under NACTE. The area was chosen following a pilot study prior conducted which revealed the controversial from which instead of fostering only 25% being teaching and learning, tutors were found depositing materials by 75% where the popular method of teaching was mostly lectures. This was moreover a proven fact in which despite of VET introducing VCI and VC2 system of awarding certificates, still majority of graduates revealed to be good at theory and not practical and thus not employable. From a population of 1,200 being students, tutors and management from the four colleges, n=300 sample of respondents was obtained given the confidence level of 95% and Cochran formula,  $n = \frac{N}{1 + N(\alpha)^2}$  where N= population size =1,200,  $\alpha$ = margin of error=0.05. The 300 sample of respondents was obtained by employing cluster sampling technique. The clusters focused on whether it was a VET or NACTE College.

From the two (2) clusters, 300 respondents being chosen, data were collected using questionnaire while likert scales were used as measurement level from which a sample size of 20 respondents was used. The selected sample size of respondents for pilot study was enough the same as it was proposed by (Source...) over the range of 10-30 of sample to be adequate for the specific study. Pilot study was done to ensure construct validity and reliability. The results of cronbach's alpha reliability testing regarding the pilot study conducted were 0.74 for information and communication technology; 0.83 for teaching and learning materials (student centering teachings); 0.75 for learning by doing; 0.84 for inventions and 0.71 for competence based education and training curriculum (See Table 1).

The collected data were processed before actual data analysis. Data processing involved screening and normality testing. In data cleaning the missing values were captured by using list wise data deletion. It was from a dataset, 6sets of missing values were deleted occupying only 2% in-significance not to understate or overstate the final data of analysis. Through computing Mahalanobis distance values, 40 extreme data were deleted. The responses remained from this data cleaning process was therefore 256. It was from this sample frame were the normality testing was carried out in which from the use of coefficient of skeweness and kurtosis spreading of data was attained at +/-2

Data analysis employed inferential statistical analysis from which Keiser-Meyer-Oklin, Bar lets' test, multivariate regression and fit indices were employed. Hypothesis testing applied standardized path coefficients. The analysis sustained by using SPSS AMOS version 25 was guided by the following structural equation:-

$$CBET = \beta_0 + \beta_1 \sum TLM + \beta_2 \sum LD + \beta_3 \sum I + e$$

where CBET = Competence based education and training curriculum; TLM= students'-participatory teaching methods; LD=learning by doing; I= Inventions



## 4. Findings and Discussions

### 4.1 Exploratory Factor Analysis and Model Fit Development

This section helped to consider if the proposed conceptual framework was indeed consistent with actual data. This is because at the beginning, the conceptual framework was developed without data; it is now not clear if the constructs are aligned with their underlined measure.

First exploratory factor analysis with varimax rotation was conducted to assess the underlying structure for the thirty five items of the conceptual framework. In selecting factors to retain four criteria were adopted namely Eigen values scree test (i.e. scree plot), theoretical assumptions and factors that have at least three items. Watkins (2018) recommended the use of a combination of criteria to help to offsite the weaknesses of using one criterion.

Given this situation, four factors were extracted based on those four criteria which explain 72.962% of the cumulative variance. The four factors had Eigen values >1 attached at appendix in a scree test all factors above the cut-off point a retained and those below the break/cut off point were dropped. Finally, all retained factors had met the recommendation made by Watkins (2018).

After discovering that the four factors have met the criteria and now are qualified to be retained, further analysis of indicator variables was done in-order to see if this indicator really fits their underlying factor. The following criteria recommended by Yongo and Pearce (2013) were adopted for retaining or dropping an item or indicator as follows:-

First, all items loaded into their associated factors were retained and those loaded into more than one factor were dropped. Second, if more than two items loaded in one factor, all items were retained and if less than three items loaded in one factor were dropped. Third all items with KMO, p-value greater than 0.5 were retained and those with less than 0.5 were dropped. Fourth, all items with loadings from 0.5 to 0.8 were retained and loading less than 0.5 or above 0.8 were dropped. As far as this part is concerned, the three to five items in each factor were retained indicating to adequately fit the model (See Table 2).

Table 1. Rotated Component Matrix<sup>a</sup>

Factors	Items	1	2	3	4	5
ICT	ICT1	0.74				
	ICT2	0.71				
	ICT3	0.76				
TLM	TM		0.74			
	LM		0.71			
	Journals		0.70			
	SCT		0.72			
LD	T/Aids			0.75		
	Video			0.78		
	Tutorials			0.75		

Simulations		0.69
I	New theories	0.70
	New concepts	0.73
	New/methods/materials	0.74
	Specialization	0.78
CBET	T/L Resources	0.760.7
	L/Doing	2
	Inventions	0.70
	Transmission	0.80
Eigen Values		6.408    3.321    2.413    2.100    1.964
% of Variance		19.582    19.905    19.593    18.882    6.000

Extraction Method: Principal Component Analysis

Rotation method: Varimax with Kaiser Normalization

<sup>a</sup>Rotation converged in 5 iterations

#### 4.2 Confirmatory factor analysis

After exploratory factor analysis, the next step was to perform confirmatory factor analysis to account for measurement error which was not addressed in exploratory factor analysis as described in detail above. To carry out confirmatory factor analysis, the measurement model was developed based on the factors from exploratory model to test for measurement error. The following criteria were used to guide the model refinement process to achieve a better model fit a recommended by Barbra (2018), asserts that a standardized regression weights (S.R.W) = values should be above 0.5; the value of GFI  $\geq$  0.90, AGFI  $\geq$  0.90 and CFI  $\geq$  0.95; and RMSEA  $\leq$  0.08. Therefore to enhance the model fitness, items with modification indexes that reveal high covariance between measurement errors accomplished by high regression weights between these construct errors were dropped.

After initial run of the AMOS 25, the model performed poorly and refreshment process of the model was done by removing the following items namely (SCT); (Simulations); (Specialization); and (Transmission) which had high modification index to improve the model. After the deletion of those items performed poor, a re-run of CFA using AMOS 25 revealed a GFI=0.962; AGFI= 0.967; CFI = 0.986 and RMSEA = 0.062. All items retained had standardized regression weights (S.R.W) values greater than 0.5 (accepted fit), hence falling within the acceptance framework, this means that the selected observed variable used fit the model as described in Figure 2, measurement model. Having established the model fit and all hypothesis of the relationship between observed (indicators) and unobserved variables (latent constructs) have agreed in the measurement model. The next step was to move to a structural model which hypothesized the relationship between information and communication technology; students' centering approach; learning by doing; inventions and competence based education and training curriculum was analyzed. The results of analysis of the basic structural model using AMOS version 25 are diagrammed in Figure 3.

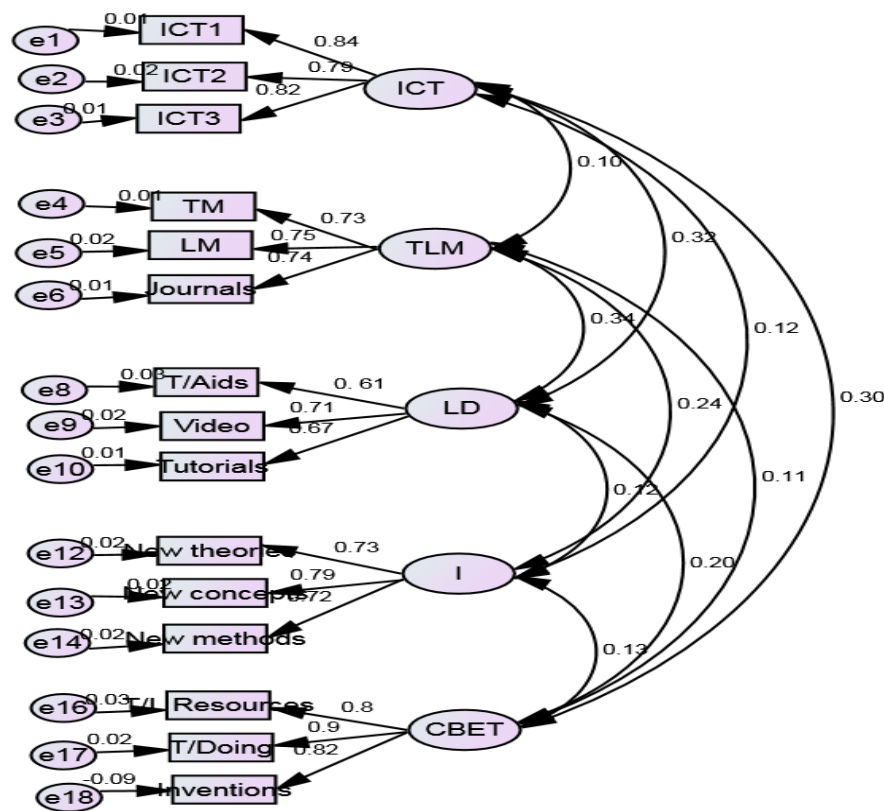


Figure 2: Measurement model

Keynote:

ICT: Information and communication technology; TLM=Teaching and learning materials/Students' centering teachings; LD=Learning by doing; I=Inventions/discoveries; CBET=Competence based education and training; TM=Teaching materials; LM=Learning materials; T/Aids =Teaching aids; T/Doing=Teaching and learning by doing.

#### 4.3 Reliability and Construct Validity Testing

Reliability was evaluated in terms of composite reliability as described in Table 3. The composite reliabilities (CR) in Table 3 range from 0.804 to 0.859, which were all above recommended value of 0.7, suggesting adequate internal consistency (Yang, Lin, She & Huang, 2015). Convergent validity and discriminant validity assessed based on the results of the measurement model as described in Table 3. Convergent validity was evaluated in terms of average variance extracted (AVE) which explained the variance that was measured by the construct in relation to measurement error. Lee (2019) argued that convergent validity requires an AVE of not less than 0.5; Table 3 shows that all AVE values were above the recommended value of 0.5 ranging from 0.721 to 0.889, thus demonstrating adequate convergent validity. On the other hand, discriminant validity was evaluated by comparing the AVE of each individual construct with the shared variances between this individual construct and all of the other constructs. A higher AVE than shared variance for an individual construct suggests discriminant validity (Lee, 2019). A comparison of all of the correlations and square roots of the AVEs on the diagonal in Table 2



indicated adequate discriminant validity.

Table 2. Reliability and Validity Testing Results

Latent constructs	CR	AVE	MSV	Max R (H)	ICT	TLM	LD	I	CBET
ICT	0.851	0.860	0.100	1.001	<b>0.894</b>				
TLM	0.846	0.853	0.118	0.952	0.310	<b>0.921</b>			
LD	0.804	0.721	0.064	0.872	0.165	0.212	<b>0.840</b>		
I	0.859	0.889	0.124	1.005	0.131	0.291	0.254	<b>0.945</b>	
CBET	0.838	0.793	0.124	0.962	0.098	0.301	0.132	0.125	<b>0.893</b>

#### *4.4 Testing Through Structural Equation Modeling*

##### *4.4.1 Students' centering teaching and learning for effective implementations of CBET*

In here the study aimed at determining the effects of students' centering teaching and learning effectively drained by invention and use of ICT on effective implementation of CBET. Use of ICT revealed to accelerate quick adoption and immediate implementation of CBET. Results in Figure 3 showed the reality and being the reason on how learners'/students' centered teaching and learning was enhanced. With  $S.R.W = 0.64$  (See Figure 3) over ease access to available teaching and learning resources on quick adoption to CBET teaching pedagogy proved the extent to which students' centered approach was quickly enhanced through invention and use of ICT platforms. The  $S.R.W = 0.66$  at  $p=0.02$  (See Table 3) being indirect effect was a proven fact that availability of teaching /learning materials, e-books, journal articles and lesson notes helped learners accessed to them. This was either what made students to be an active participant in discussion while a tutor/teacher remained an instructor. It was with the positivistic results over the association between variables what proved the facts that ease access to learning materials from different electronic databases such that over "thl" prove the fact why a teacher or tutor remains as instructor and not a depositor. For a student being easily ascertained with learning materials gives a learner a confidence to choose what to learn with little supervision from a tutor or a teacher. This either is what invent teaching pedagogy in which instead of teaching being one way, then it become interactive kind of juncture while at the center there is a student retrieving materials by 75% while only 25% being left with a tutor who become a facilitator.

##### *4.4.1.1 ICT and Ease Access To Teaching /Learning Resources*

Under this subtitle the study aimed at examining the effects of ICT on ease access to teaching and learning resources. This was the fact that use of Google, applications such as thl, U-tube platforms, and learners were easily accessed to learning materials. In here therefore the essence of students choosing what they want to learn (students' centered teaching and learning) was fostered. The reality from the field was revealed and presented as shown in Table 3. Ease access to teaching and learning resources following adoption and use of ICT represented by

S.R.W=0.81 at  $p=0.000$  (accepted) indicated the positivistic relationship that existed between the variables. This was the proven fact that because of ease retrieval-ability of materials/resources from special websites; electronic databases; application programs and Google search engines. From these websites such that over Mama Vista, the digital, current and up-to-date materials were accessed. From u-tube and other electronic platforms, students learn and read on themselves if it is not listening to tutorials. Use of special dedicated application programs, adobe photoshops revealed to have positive contributions in producing drawings, architectural drawings, maps and more other technical drawings. This is what competence stipulates about where during class discussions, a student become equipped with materials-knowledge to contribute to the discussion, the fact which is consistent with what was said by Vare, Arro, De Hamer, Del Gobbo, De Vries, Farioli and Zachariou (2019). Moreover, this is a students' centered approach what competence based curricula dictates indeed over student choosing what to learn what pragmatism philosophy anvils.

#### 4.4.2 Learning by Doing and Effective Fusion Of CBET Teaching and Learning Pedagogy

Under this subtitle the study aimed at revealing the effects of learning by doing and effective implementation of CBET. To reveal the reality beyond doubt on how learning by doing lead into quick adoption and effective implementation of CBET was revealed and results presented in Figure 3. With S.R.W=0.72 this indicated that learning by doing being enhanced through interacting with visual teaching media. This is obvious because easily forsake to video and visual media student get learn on own self. This indeed was found to be fostered through interacting with tutorials, special websites and electronic databases. At the time when research was conducted, it was revealed that the tutorials from u-tubes were concrete and interactive platforms for learners get accessed to "learning by doing" indeed by own self. Visual aids normally create an effective implementation of psychomotor domain which is easily captured through the use of 'touch training' what was also said by Brauer (2019). It is through use of visual media what enhances simulation studies, the embarkation over effective learning by doing.

##### 4.4.2.1 Adoption of ICT and Promotion of Learning by Doing

Indeed with S.R.W=0.67 (See Table 3) this showed a positivistic association that existed between use of ICT platforms and learning by doing. Learning by doing in positively emanated due to ease access to learning aids and videos. Indeed the tutorials the tutorials easily retrieved from u-tubes and other websites found to enable students learnt by self that enhanced learning by doing. The videos and other technological media through internet technologies revealed to increase capturing ability of a learner for juncture adoption to psychomotor domain. Normally and as per the purpose of VET and NACTE students' curricula learning by "touching" is a great philosophy emphasized. It is indeed and obvious that use of visuals aids, video or post lay millions of words than use of words. It is with use of visual media extracted from interacting with visual u-tubes and visual websites what make learner capture well and therefore being in position to convert all listening tutorials and read materials into practical reality what is called "learning by doing". It was innovatively reported that use of software/programs found to enhance automated trouble shooting of problems to happen in motor vehicle engines and other parts; electric circuits, metal parts ;and building constructions.

#### 4.4.3 Discoveries in Education And Effective Implementation of CBET

With this subtitle, the study aimed at assessing the effects of inventions or discoveries amended

through using ICT and effective implementation of CBET. The reality why enhanced discoveries were revealed to be a tool effective for implementation of CBET was presented in Figure 3

With  $S.R.W = 0.67$ , this indicated that positivistic relationship existed between enhanced discoveries and effective implementation of CBET is normally new inventions for innovations. For a students' directly interacting with materials from different electronic sources following inventions over ICT revealed to come with different theories, concepts and methods of acting. It is from these theories and models where student intrude them from those sources and convert them from those sources and convert them into environmental practical reality. The new discoveries may mean innovated concepts and methodology which were not there in the home environment but they have just adopted and convert them to real local environment, using the materials available on that area. It is with inventions in which a learner become adopted and used to new technology. For instance the dismantling technology over diesel engine to water and/or more other light gas such as 'helium', 'hydrogen' motor vehicle engines is the new technology, what currently the VET curricula has not yet accommodated. Through the positivistic results produced,  $S.R.W = 0.67$  showed that a learner was in a position to learn new technologies even if not stipulated in the curricula or not learnt in class. This is then a typical competence based curricula what aimed at. In here either a learner is not left aside as if taboralassa, but has a choice what to learn, what pragmatism theory (Dewey, 2020) proposed on. Discoveries indicate a student/learner being innovative to learn beyond what is produced or given by a tutor/teacher in class (Gulikers, Runhaar & Mulder, 2018). This philosophy either dictates on phasing out incubation /knowledge based training which was hand cupped into the so called competence based trainings what this study is focused at to be quickly and effectively focused at in adopting ICT technologies.

#### 4.4.3.1 ICT and Inventions in Education

Discoveries found to positively correlate with the use of and adoption of ICT technologies given  $S.R.W = 0.66$  (See Table 3). This either was a proven fact because by a learner being interacted with materials from different electronic databases, come across with different theories, concepts, methods and techniques which means a learner is subjected to new materials and concepts said by other authors not known before, while fostering in her/hi ideas or concepts not reported by other studies. This was either a gap fulfilled by the learner called contribution to existing knowledge or model. This is either an essence of establishing VET and NACTE Colleges. Normally as per the policy and public acts stipulating establishment of VET and NACTE Colleges, it has clearly disclosed that the graduates are to become doers or creators/technicians and not specialists. These findings either post lay that through adoption and use of ICT, learners become inventors or creators while a tutor or teacher remain just a facilitator of teaching and learning, the facts which were consistent with those by Mulenga and Kabombwe (2019).

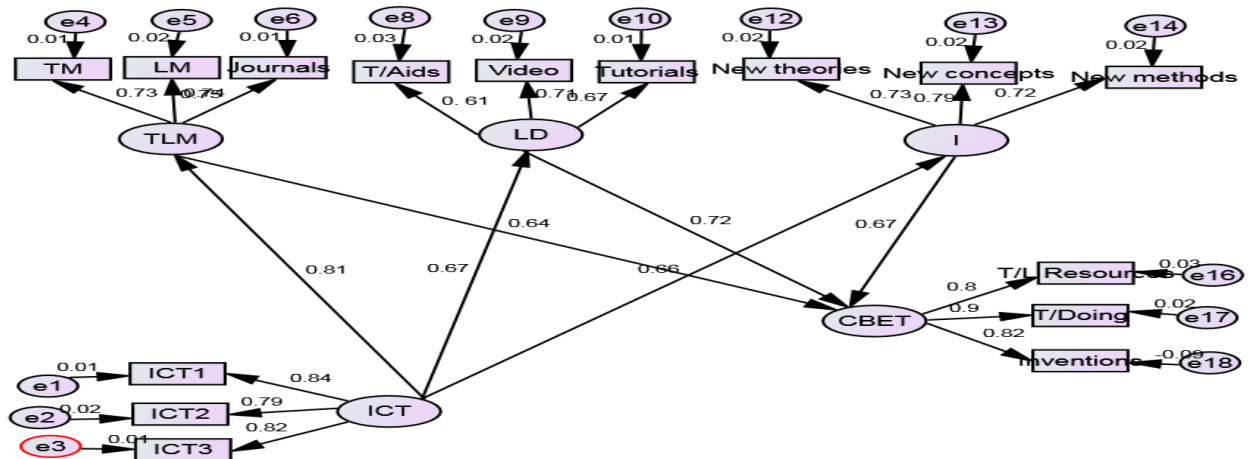


Figure 3. Structural model

#### 4.5 Hypothesis Testing

With hypothesis testing, the study aimed at determining the strength of relationship given the factors to fit the model revealed in structural equation modeling despite of significance showed. Hypothesis testing used the standardized path coefficient,  $\gamma$ , critical value (CR) and significance level (p). According to Murti (2016) the relationship between variables is revealed positive and significant when  $\gamma > 0.2$ ;  $CR > 1.96$  and  $p < 0.05$

Table 3. Table of results

Hypothesis	Relationships	Estimate	error	CR	p	Path coefficients	Results
H <sub>1a</sub>	CBET<- - -TLM	0.64	-1.00	1.97	0.30	1.01	Partially supported
H <sub>2a</sub>	CBET<- - - LD	0.72	0.01	1.99	0.65	0.48	Partially supported
H <sub>3a</sub>	CBET<- - - I	0.67	0.02	3.11	0.61	2.10	Partially supported
H <sub>4b</sub>	CBET<- - - TLM<- - - ICT	0.81	0.04	2.00	***	0.41	supported
H <sub>5b</sub>	CBET<- - - LD<- - - ICT	0.67	0.01	1.98	0.01	0.50	supported
H <sub>6b</sub>	CBET<- - I<- - - ICT	0.66	0.10	1.99	0.02	3.13	supported

Under hypothesis 1 (H<sub>1a</sub>), it was assumed that students' centering teaching and learning is a positive and significant determinant of effective implementation of CBET. Thus given  $\gamma = 1.01 > 0.2$  at  $CR = 1.97 > 1.96$  and  $p = 0.30 > 0.05$  (insignificant) showed the variables in

relationship to be positively though insignificantly related. This is the reason why the conclusive results indicated partially supported (See Table 3). These results were consistent with what was said by Murti (2016) on when causal–effect response is said to be positive and significant. That means participatory interactive teachings/learning positively and significantly influences effective implementation of CBET.

With hypothesis 2 (H<sub>2a</sub>); it was expected that learning by doing is positive and significant influencing factor for effective implementation of CBET. Thus with  $\gamma=0.48>0.20$ ; C.R.=1.99>1.96 at  $p=0.65>0.05$  it indicated that the causal-effects relationship between the variables L/Doing and CBET was positive but insignificant. Therefore this means that learning by doing which is facilitated through interactive teachings, use of teaching aids, video media and simulation positively influence effective implementation of competence based education and training curriculum. This is from the fact that visual aids, video and real objects in teaching sound a million of words than use of audio media.

With hypothesis 3 (H<sub>3a</sub>); it was reported that discoveries influenced through students' centering learning where student has a choice on what to learn has a positive though insignificant influence on effective implementation of CBET. Given the results  $\gamma=2.10>0.20$ ; C.R.=3.11>1.96; at  $p=0.61>0.05$ , this indicated that inventions or discoveries had a positive determination despite of insignificant effect on effective and quick adoption of CBET. This therefore shows that discoveries resulted from students' are easily accessed to materials, methods revealed to have a positive influence on effective implementation of CBET.

To determine the moderation effects of ICT on students' centering teaching; learning by doing and inventions on effective implementation of CBET multi-group moderating analysis was carried out. Thus with  $\gamma>0.5$ ; C.R.>1.96 at  $p<0.05$  showed that use of ICT platforms had a positive and significant moderation effects of students' centering teaching (H<sub>4b</sub>); learning by doing (H<sub>5b</sub>) and inventions (H<sub>6b</sub>) on effective implementation of CBET. These positive results over standardized path coefficients were also significant than those over H<sub>1a</sub>; H<sub>2a</sub>; and H<sub>3a</sub> respectively with what ICT was not a moderator.

## 5. Conclusion and Recommendations

ICT is the digital inventions in which transactions are fostered through e-platforms. ICT has been an influencing platform o different fields where education is included. Thus ICT and education has been two variables which correlate each other. From the findings it was revealed that ICT had moderating effects on effective implementation of competence based education and training curricula (CBET). Moreover it was found that students' centering teachings/learning; learning by doing; and inventions had positive but insignificant effects on CBET. Furthermore it was comprehensively found that students centering teachings/learning; learning by doing; and inventions as determinants of CBET were revealed to have positive and significant effects on CBET only when ICT is a moderating variable. It was from these positivistic and significance found thus the study recommends the following:-

The government should continue declaring for workshops, seminars and tutors from VET and NACTE colleges and the budget being fostered to cuter for such trainings being a blended model of ICT and CBET. Moreover furnished infrastructures which facilitate ICT for quick implementation of CBET should be enhanced. The quality assurance unit or inspectorate unit from VET and NACTE should be furnished and conducted in that totality way ie total quality management (TQM).Moreover tutors from VET and NACTE should take this into serious by



adopting and used to ICT in teaching and promote sophisticated learning where pragmatism philosophy entails. Furthermore students have to be made ready for transformation, adopted and used to ICT.

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