

# EXPLORING THE ROLE OF TECHNOLOGICAL PROCESS IN CIVIL ENGINEERING AND CONSTRUCTION STUDIES AT TECHNICAL VOCATIONAL EDUCATION AND TRAINING (TVET)

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## Abstract

Civil Engineering and Construction studies are subjects that develop and promulgate knowledge and skills through teaching, learning and assessment. The aim of the study was to explore the perceptions of lecturers regarding the role of technological process in Civil Engineering and Construction Studies at TVET colleges in the Free State Province in South Africa. While the objective is to determine the perception role of technological process in Civil Engineering and Construction (CEC) studies during the teaching, learning, and assessment process, When the driving research question was: what is the role of technological process in Civil Engineering and Construction Studies at TVET colleges with regard to teaching, learning, and assessment? The mix method consisting of quantitative and qualitative elements was employed. A questionnaire and a face-to-face interview were used as instruments to gather data. Twenty-six (26) CEC studies lecturers from four (4) different TVET colleges in the Free State province in South Africa. The study revealed that all lecturers prefer technological process as their main teaching and learning methods, in particular for final assessment.

**Keywords:** *Technological process, civil engineering construction, technical vocational education and training.*

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## 1. Introduction

The research was aimed at exploring the perception of Civil Engineering and Construction lecturers with reference to the role of the technological process at TVET colleges. The Technological process is perceived to be a teaching method that promulgate the integration of theory and practical content through problem solving skills and its aspects. Moreover, Civil Engineering and Construction studies at TVET colleges are all about nourishing skill development competence in totality. According to Loynes (2017:2), TVET colleges should impose a large premium on employability in order to assist students to become more valuable to the industry and maintain their competitiveness.

## 2. Conceptualisation of the study

### 2.1. Technological process

The Technological process in this study defined as the teaching method that promotes critical thinking through sound development of problem solving skills. Furthermore, the technological process in this study uses purely a six step style. According to Mokhothu, (2019:118); Masoabi (2015:127); DBE (2011b:10); Van der Walt (2009:26), the six steps of the technological process are expounded as follows:

**Step 1. Identify:** Make a meaningful summary of the problem from the scenario given or created

**Step 2. Investigation:**

- Design brief describes a problem, how do you think you can solve it and draw free-hand three possible solutions,
- Write specification and constraints.

**Step 3. Design:** Formal drawing plan with full details using the scale and material list

**Step 4. Make:** Physically making your project using guided and corresponding with a formal plan

**Step 5. Evaluation and Test:** Compile a checklist for the project

**Step 6. Communication:** Presentation of the project (portfolio, project exhibition, and flow- chart)

## 2.2. Civil Engineering and Construction Studies

Civil Engineering and Construction embraces skills like bricklaying, tiling, woodworking, and plumbing among many others in the context of the building environment (Mokhothu, 2018:323; Mokhothu, Masoabi and Makura, 2021:210). As stated by the Department of Higher Education and Training (DHET) and Training, the course in Civil Engineering and Building Construction encompasses all aspects of construction, including masonry building; woodworking; drainage; and sanitation. This course therefore combines technical knowledge and theory with real-world skills and values to help students learn (DHET, 2015:8; Maeko, 2020:38).

## 3. The aim of the study

The study aimed to explore perceptions of lecturers regarding the role of the technological process in Civil Engineering and Construction Studies at TVET colleges in the Free State Province of South Africa.

## 4. The Objective of the study

The objective was to determine the perceived role of the technological process in Civil Engineering and Construction (CEC) studies during the teaching, learning, and assessment process.

## 5. Methodology

### 5.1. Context of the study

The researcher visited all the workshops and theory classes where NCV, NATED and Skill courses are presented for both theory and practical of Civil Engineering and Construction. The researcher developed a small simple conversation regarding teaching methods that are used for the teaching and learning process including the technological process. Thereafter, the researcher briefly explained the questionnaire before disseminating it to the participants.

### 5.2. The participants

The participants were all Civil Engineering and Construction lecturers from all TVET streams: NATED, NCV and Skills. Lecturers were in divers<sup>7</sup>/ diverse in gender: male n=20 (76.9%) female n=6 (23.1%); race: Africans n=25 (96.2%) and coloured n=1 (3.8%); and age (25 to 60). All lecturers studied within the building environment fields at different levels of qualifications.

### 5.3. Procedures

Disseminated questionnaires reached all participants within two to three days. On the fourth day the researcher initiated an hour-long face-to-face semi-interview session with the participants to confirm what was not clarified on the questionnaire. Collected, analysed and presented data included both qualitative and quantitative.

## 6. The findings presentation, interpretation and discussion

### 6.1. Quantitative data

Table 1. The extent lecturers use ALA in Civil Engineering and Construction studies at TVET colleges.

Q1	I use case studies as a teaching and learning technique frequently in my class.				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	4	15.4	2.08	.628
	Agree	16	61.5		
	Disagree	6	23.1		
	Total	26	100.0		
Q2	I use projects frequently as a technique to teach other aspect of the content.				
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	8	30.8	1.96	.824
	Agree	12	46.2		
	Disagree	5	19.2		
	Strongly Disagree	1	3.8		
	Total	26	100.0		

<b>Q3 I use research as a teaching and learning technique frequently to promote critical thinking in my class.</b>					
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	11	42.3	1.77	.863
	Agree	12	46.2		
	Disagree	1	3.8		
	Strongly Disagree	2	7.7		
	Total	26	100.0		
<b>Q4 I use demonstration method as the main teaching method in my class.</b>					
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	17	65.4	1.42	.643
	Agree	7	26.9		
	Disagree	2	7.7		
	Total	26	100.0		
<b>Q5 I use problem solving method to teach integration of content knowledge and practical work in my class.</b>					
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	16	61.5	1.42	.578
	Agree	9	34.6		
	Disagree	1	3.8		
	Total	26	100.0		
<b>Q6 I use technological process method to teach integration of content knowledge and practical work in my class.</b>					
		Frequency	Percent	Mean	Std. Deviation
Valid	Strongly Agree	7	26.9	1.96	.824
	Agree	15	57.7		
	Disagree	2	7.7		
	Strongly Disagree	2	7.7		
	Total	26	100.0		

Table (1) above illustrates quantitative data representing the use of the technological process and its fundamental aspects. The results from Q1, Q2, Q3, Q4, Q5 and Q6 indicated that majority of lectures are more towards agree with all questions regarding the use and effective role of the technological process in Civil Engineering and Construction studies. The findings above coincide with Teis (2010:30), which confirmed that the main purpose of problem solving is stimulating a scientific method of hypothesis generation and testing. Therefore, the technological process is significant in promoting problem solving skills.

## 6.2. Qualitative data

Table 2. Types of teaching method and assessment in CEC.

<b>Q1</b>	How do you choose types of assessment for ALA in CEC studies?
A	All assessments are from DHET, but for expanded opportunity I use six steps technological process
B	I prefer a written test to assessment to show individual capacity or understanding
C	Types of assessment are given to us by DHET (Test, simulation, practical and Exam)
D	Assessment should be relevant to the topic, if it requires theory it will test, if practical it will be practical work or simulation.
E	All assessments are based on DHET stipulation. Both theory and practical. I recommend oral test and major practical only
F	40% theory and 60% practical as stipulated in the policy but in reality is other way round 60% theory and 40% practical. All assessments are given from DHET
G	Test, simulations, practical and examination as stipulated from the policy. I recommend six steps of technological process as a main key assessment
H	Test, simulation, practical and Examination. As stated in the policy
I	Test, simulation, practical and Examination
J	I use all assessment provided: Test, simulation, practical and Exam. But I recommend Technological process
<b>Q2</b>	How are the outcomes of assessment after the use of ALA in CEC studies?
A	Based on the standards of DHET out comes differ based on topics, but through technological process outcomes are excellent.
B	Most of my students are performing well
C	The outcomes are good even if some are not clear because at TVET we need practical not exam

D	They will depend on the topic but usually outcomes are good because students are always hand on (action action)
E	Based on my experience on size does not fit all, because students do differ cognitively other love practical's over theory. When I assess practical most students perform well
F	Because this is skills, ALA is giving the best results
G	We can't measure the outcome because we are using unit standard, but if I use my old experience I always measure specific outcomes and students do well
H	Base on test student are well, but practical work is outstanding
I	Through ALA I always reach my outcomes but not perfectly as I planed
J	Outcome are good but not as I prefer them

The two questions were posted for semi-structured face-to-face interviews to determine the perceptions of lecturers regarding the technological process and the impact of the outcomes from the use of the technological process. Lecturers revealed a preference towards the utilisation of the technological process with its fundamental aspects incorporated. This finding corresponds with Mokhothu (2019:118)'s findings accentuating that the technological process works as key principle of learning and assessment in Civil Engineering and Construction studies at TVET.

## 7. Conclusion

In conclusion the study claims that the technological process should be a main effective teaching, learning and assessment method or approach in Civil Engineering and Construction studies. the study found that lecturers utilise the technological process and its fundamental aspects for an effective teaching and learning process regularly, even though others were not aware.

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