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SIGNIFICANCE AND ATTITUDE OF TEACHING APPLIED MECHANICS CALCULATIONS IN CIVIL TECHNOLOGY: STUDENTS ANALOGY

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Abstract

The principles of mathematics and science play a significant role in the Civil Technology curriculum. The study aimed to investigate the attitudes of the prior and topical students/teachers towards Civil Technology applied mechanics calculations. The objective of the study is to explore the significance of Civil Technology applied mechanics calculations to the teachers, also to evaluate the attitudes of the prior and topical students/teachers towards Civil Technology applied mechanics calculations. The purposive sampling applied to review data of the sample of 8 teachers (prior students) from five education district in the Free State province, also to select 24 students (topical). All 32 participants were from BEd and PGCE programme at the University of Technology. The research used mixed method consists of quantitative and qualitative to gather data, questionnaire and face to face interview were used as the instruments. The researcher analysed data, interpreted the results, and discuss the finding. The results revealed that participants do not have negative attitude towards Civil Technology applied mechanics calculations, moreover, they are ready to teach calculations. The results also indicated that few teachers need a refresher training on challenging area of the calculations. The participants suggested that the Department of Basic Education (DBE) should include applied mechanics back in the curriculum and partner with the Institutions of Higher Learning to provide them with special formal training on Civil Technology calculations. The results implicate that participants have positive attitude to teach Civil Technology applied mechanics calculations as they conduct a meaningful integration of practical and theory in the subject.

Keywords: *Civil Technology, mathematics and science principles, attitude and curriculum, applied mechanics calculations.*

1. Introduction

Mathematics and Science principles ground the skills application in Civil Technology and the building environment in general. Hence, applied mechanics is regarded as a pillar to integrate science, mathematics, and Civil Technology or Technology subjects in general (DoE 2014: 9; Van der Walt, 2012: 46). Therefore, the study seeks to investigate and explore the significance of Civil Technology applied mechanics calculations to the teachers and to evaluate the attitudes of prior and topical students/teachers towards Civil Technology applied mechanics calculations.

2. The conceptualisation of the study

2.1. Applied mechanics in Civil Technology

Applied mechanics is the application of fundamental scientific and mathematical principles theory to practical meaning through calculations such as angle of forces, centroid, moments in general (beams), elasticity module (stress and strain), and frames, all of which concepts are considered the cornerstone of Civil Technology or all engineering programmes (Van der Walt, 2012: 46).

2.2. Civil Technology

Civil Technology, conferring to the Curriculum and Assessment Policy Statement (CAPS), concentrates on principles and concepts in the built environment as well as the technological process (DoE, 2014: 9). It further concentrates on practical skills in addition to the application of mathematical and scientific principles (DoE, 2014: 9; DoE, 2014: 11; Maeko, 2016; Mokhothu, 2020; Mtshali, 2020).

3. The aim of the study

The aim of the study was to investigate the attitudes of the prior and topical students/teachers towards Civil Technology applied mechanics calculations.

4. The objective

The objective of the study was to explore the significance of Civil Technology applied mechanics calculations to the teachers, also to evaluate the attitudes of the prior and topical students/teachers towards Civil Technology applied mechanics calculations.

5. Assumption

Students seem to have positive attitudes towards applied mechanics in Civil Technology. Also, students deem applied mechanics a correct chapter to integrate mathematics and scientific principles in Civil Technology theory and practical work.

6. Methodology

6.1. The context of the study

The researcher revisited Mokhothu's (2015) finding about the attitude of the teachers about Civil Technology applied mechanics calculations. Further revisited official policy documents and empirical literature about the history of Civil Technology as a subject. Additionally, from the reading, the researcher developed an assignment to inquire about the views of topical students in all the departments of the relevant field of study in order to compile and develop analogies of perspectives from both prior and topical students.

6.2. Participants

All participants were Civil Technology students (both prior and topical), males and females, from one of the University of Technology in South Africa. The total number of participants was N=32, which consisted of n=8 teachers (prior students) from five education districts in the Free State Province and n=24 students (topical) enrolled at the University of Technology. All 32 participants were from the BEd (FET) specialisation Technology, BEd (SP & FET) Technology and the PGCE programme at the University of Technology. All PGCE participants were NQF level 6 and 7 graduates from Civil Engineering, Construction Management, and Quantity Survey, or the building environment in general.

6.3. Procedure

Purposive sampling was applied to review data, both quantitative (questionnaire) and qualitative (interviews) of 8 teachers (prior students), in Mokhothu's (2015) MEd dissertation. The assignment was given to 24 students (topical) to analyse the history of Civil Technology from three Department of Basic Education (DBE) documents: the Learning Programme Guidelines (LPG), the Curriculum Assessment Policy Statement (CAPS 1), and the Curriculum Assessment Policy Statement (CAPS 2). They were also asked to find the gaps and make recommendations. The analysis was presented and discussed in class, and common conclusions were grasped.

7. Results presentation, interpretation, and discussion

Table 1. applied mechanics and mathematics and science principles prior students.

	Total Number (N)	**Frequency (n)**	**Percentage (%)**
More towards strongly agree			
Q1 Civil Technology curriculum establish general background of civil engineering			
	8	**8**	**100%**
Q2 Integration of mathematics and science principles applications shows the important of Civil Technology curriculum			
	8	**8**	**100%**
Q5 I recommend full training course in applied mechanics			
	8	**8**	**100%**
More toward strongly disagree			
Q3 Mathematics and scientific principles make Civil Technology less interesting subject			
	8	**8**	**100%**
Q4 I lack confidence in teaching applied mechanics in Civil Technology curriculum			
	8	**8**	**100%**

Interviews: Main question to both prior and topical students: Did you find mathematics and scientific principles applied in Civil Technology beneficial to the integrated curriculum?

Main Theme: Role of Mathematics and Physical Science in Civil Technology.

Table 2. Mathematics and Science in Civil Technology responses.

Responses of prior student
All 8 participants responded positively; they pronounced that mathematics and science principles play a major beneficial role as they translate theory into practical through an integrated curriculum. They further claimed that to understand the strength of material and its behaviour, it requires students to have a clear background in physical science, and to manipulate calculations, it also requires a clear background in mathematics. Therefore, applied mechanics integrates all these three subjects.
Responses of topical students
In summarising all the responses from 24 topical students, they also arrived at the same conclusion as they mentioned mathematics and physical science as being an opener to analysis and logical thinking, or critical thinking, to become a problem solver. They further highlighted a few examples, such as how to design a bridge, a foundation, and a roof, which require a student to have both scientific and mathematical knowledge. One also asked how you design a cantilever beam without a calculation; that would require a student to learn applied mechanics. In addition, for the student to understand the reinforcement of concrete, it requires applied mechanics. If we keep on ignoring applied mechanics, we will only produce artisans without critical thinking and engineers without a strong foundation in Civil engineering calculations.

In table 1, Q1, Q2 and Q5 students in majority strongly agree with frequency of n=8 and percentage of 100%. While in Q3 and Q4 majority of students strongly disagree. The finding in table 1 proves the assumptions of the study correct. In general, all the results revealed that participants do not have negative attitude towards Civil Technology applied mechanics calculations, moreover, they are ready to teach calculations. The results also indicated that few teachers need a refresher training on challenging area of the calculations. The participants suggested that the Department of Basic Education (DBE) should include applied mechanics back in the curriculum and partner with the Institutions of Higher Learning to provide them with special formal training on Civil Technology calculations. Therefore, results concur with Nugent *et al*, (2010) when pronouncing that the increasing workforce demands necessitate the development of even more sophisticated skills in science, mathematics, engineering, and technology for the next generation of workers (Nugent, Kunz, Rilett, & Jones, 2010:4)

8. Conclusion

The results implicate that participants have a positive attitude towards teaching Civil Technology applied mechanics calculations as they conduct a meaningful integration of practical and theoretical knowledge in the subject. Therefore, students uphold the continuation of teaching applied mechanics in the Civil Technology curriculum.

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