

Chapter 15

Mastery of Content Representation (CoRe) by Engineering Graphics and Design Teachers: Promotion of Equity and Inclusion Through Civil Drawing Tasks

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ABSTRACT

Engineering graphics and design teachers need a pedagogically viable teaching approach that can assist with planning and implementation procedures. This chapter explore EGD teachers' mastery of content representation (CoRe) when teaching civil drawing. A qualitative research approach was employed, and descriptive research design was used for this case study. Furthermore, Loughran notion of content representation guided this chapter through data collection and analysis of documents and semi-structured interviews. This chapter found that EGD teachers demonstrated low levels of mastery of content representation when teaching civil drawings. This was drawn from the disproportionality of their written and verbal responses. As a result, teachers could not perceive civil drawings as a means to advance equity and inclusion. This study recommended the use of a multi-user CAD (MUCAD) system which is virtual and allows for real-time collaboration with the potential to expand the learning outcomes and teaching methods for teaching civil drawing using CAD.

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INTRODUCTION

Mastery of Content Representation (CoRe) is generally concerned with the identification and selection of content to be taught and sorting learning resources for the benefit of students' concept understanding (Yanti & Suhandi, 2020). CoRe goes beyond the selection of content as influenced by the curriculum and annual teaching plans; it is a lesson goals orientated approach. During this process, a teacher should be able to identify common errors that students are likely to have during content exposition, this is so that appropriate methodologies can be employed to minimize the misconception room. Teachers with good pedagogical and content knowledge tend to excel in the implementation of CoRe (Wiyarsi, Sutrisno & Rohaeti, 2019). This is because they are able to judge which concepts should be learned first and which can come later – of course guided by pedagogically sound reasons. It is under this understanding that this chapter explores how EGD teachers implement it when teaching Civil Drawing.

Civil drawing is largely concerned with drawing interpretations of strip foundations, floor plans, walls, sanitary fixtures, doors and windows, roofing, and some electrical components (Mtshali, 2021). Students in grade twelve (12) – an exit schooling level in South Africa, are expected to demonstrate advance understanding of this drawing interpretations. However, the Department of Basic Education [(DBE), 2019] state that students are still struggling to construe graphic text correctly in that they misinterpret dimensions; unable to apply drawing scales correctly and cannot represent South African National Standards (SANS) code of practice for building drawings among other things. According to Hlatshwayo, Skosana and Khoza (2022) it is not surprising that Engineering Graphics and Design (EGD) students are performing poorly. This is because EGD teachers' pedagogical competence is worrisome. These scholars state that whilst there is an acceleration on the use of educational technologies in various subjects, EGD teachers are still fixed in traditional methodologies that do not aid students drawing conceptions.

There are reasonable grounds to believe that this chapter is embarking on a rare field of mastery of CoRe as the are no theoretical accounts of such studies in an EGD context. Atleast, no single study exists in EGD's recent scholarly contribution that investigates this matter. Currently, researchers are focussed on teachers PCK in graphical communication concept (Hlatshwayo et al., 2022); Practical application of course drawing among high school EGD Students (Zwane, Simelane-Mnisi & Skosana, 2021) and Classroom discourse to enhance the understanding of analytical drawings in EGD (Mtshali, 2021). Collectively, these studies found that the use of traditional methods in teaching EGD hinders students active involvement in drawing concepts. As a result, they were short sighted in exploring if teachers' mastery or lack thereof, of CoRe has an influence in those findings, hence this present study. This chapter will also give insight into Content Representation, what aspect of it should be looked at in the EGD perspective and the role that Computer Aided Design could play in strengthening EGD teachers' CoRe when approaching Civil drawings.

ADVANCING EQUITY AND INCLUSION THROUGH CIVIL DRAWINGS

There is rich history on the role of civil engineering in the advancement of equity and inclusion (Mehdiabadi & Atadero, 2022). We have seen that a majority of the world's material comes from the civil engineering field, making it a leading field that affects our daily lives (Chancellor & Lu, 2016). Through civil engineering, we have seen structures such as houses, schools, universities, roads, bridges, flats, stadiums, airports, dams, shopping centres and many others built with the intention to promote equity

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