

Chapter 11

Curriculum Development and Open Distance E–Learning for the 21st Century: Natural Sciences and Technology Education Modules

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ABSTRACT

The purpose of the study reported on here was the curriculum development of suitable natural sciences and technology education modules, including practical investigations to complement the theoretical content of these for open and distance e-learning (ODeL) in the 21st century. In light of this purpose, the chapter will especially mention assessment practices and tools, curriculum development, multimedia use, student engagement, learning management systems, and multiculturalism and diversity in the online classroom. The objectives were related to establishing the aspects that must be considered during the curriculum development of well-designed natural sciences and technology education modules, which will include practical investigations, and that students should be able to have opportunities to reflect on their engagement with practical investigations to complement the theoretical content of the modules for ODeL purposes in the 21st century and demonstrate their pedagogical content knowledge after having successfully completed natural sciences and technology education modules.

DOI: 10.4018/978-1-7998-7653-3.ch011

INTRODUCTION

The management of North-West University (NWU) decided, in 2014, to offer the B.Ed. (Intermediate and Senior/Further Education and Training phases) qualification via distance learning. The Education Faculty was tasked with developing new modules for both full-time and distance students.

Figlio, Rush and Yin (2013), however, warned that students' process could be harmed by distance learning. According to Minnaar (2013), the Open and Distance e-Learning (ODEL) planning process is vague, and universities are not ensuring quality distance education.

While describing the history and context of the University of South Africa (UNISA), Goosen and Van Heerden (2019b) mentioned a system using so-called postal or correspondence courses as part of distance learning. The "concept of providing higher education at a distance" is not "new: the first correspondence course, teaching shorthand, was offered in the 1700s" (Wildavsky, 2016). "Correspondence courses continued to catch on, and ... in 1858, the University of London became the first college to offer distance learning degrees" (Florida National University, 2019) "to students around the world" (Wildavsky, 2016). Fifty years ago, the Open University (OU) of the United Kingdom "began broadcasting its first lectures over" the television and radio stations of the British Broadcasting Corporation (BBC).

The seventh in a series of reports, "produced by The Open University in collaboration with the Centre for the Science of Learning & Technology (SLATE)" from the University of Bergen, Norway, proposed "ten innovations that are already in currency but have not yet had a profound influence on education in their current form" and explored "new forms of teaching, learning and assessment for an interactive world, to guide teachers and policy makers in productive innovation" (Ferguson, et al., 2019).

By embarking on the research reported on in this chapter, the authors wished to contribute in a pragmatic and meaningful way to the curriculum development of online modules for student educators. Additionally, it is envisioned that the chapter will contribute to the methodology of educational research by scrutinizing the research **problem** to ensure the appropriate structuring thereof through comprehensive analysis. By accurately analyzing the research **problem**, researchers can prevent difficulties during the research process (Dunn, 1994) and failure by reaching the wrong **solutions**, because of this methodological deficit.

Rationale of the Study

The NWU offers a B.Ed. degree with specialization in Natural Sciences, Technology and Mathematics (Intermediate Phase). This is a new B.Ed.-program and students can either complete it on a full-time, face-to-face basis or via distance learning. Of the distance learning students, many are "employed on a full-time basis" (Goosen & Van Heerden, 2013b, p. 1439) and while they study on a part-time basis, they "need to spend as much time on each of their subjects as they would if they were attending classes as a fulltime residential" student (Goosen & Van Heerden, 2019a, p. 221); students could potentially, for various reasons, choose to study full-time via distance learning.

The implementation of the new B.Ed-program coincided with a decision of the NWU management to migrate to use the online **learning management system** (eFundi) as the preferred platform for teaching and learning. As was the case reported on in the chapter by Biney (2021) in Ghana, this decision revitalized the blended learning approach to contribute to fostering self-directed learning among all students through the distance education mode of learning. These actions led to the unfortunate situation that staff, who had previously only been teaching full-time students, had to accommodate distance students

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