Evaluation of online formative assessment practices at higher education institutions

by

Wilhelmina Etuna Simon

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Supervisor: Dr. M. Mihai

Co-Supervisor: Prof. L. van Ryneveld

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DECLARATION

“I declare that the thesis which I hereby submit for the degree of Philosophiae Doctor in Computer Integrated Education at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.”

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ETHICS STATEMENT

"The author, whose name appears on the title page of this thesis, has obtained, for the research described in this work, the applicable research ethics approval. The author declares that she has observed the ethical standards required in terms of the University of Pretoria's *Code of ethics for researchers and the Policy guidelines for responsible research."*

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ABSTRACT

Higher Education (HE) institutions have incorporated online formative assessments as the integral part of teaching and learning. The literature points to a need for lecturers to have wide knowledge, including knowledge about student learning, domains of study, assessment and pedagogy, to effectively implement online formative assessment. The TPACK conceptual framework and the Revised Bloom's Taxonomy (RBT) were used as a lens to interpret lecturers' best practices in the implementation of online formative assessment. The study adopted a qualitative research using multiple case studies embedded with holistic cases. The purpose of the embedded case study was to investigate online formative assessment activities and document lecturers' best practices when implementing online formative assessments at HE institutions in Namibia and Finland respectively. Therefore, three research questions guided the study which focused on assessment for learning: Firstly, to understand *how* online formative assessment is implemented at HE institutions. Secondly, to determine *why* do lecturers implement formative assessment in the online courses considering strategies and tools used for the designing and development of different types of formative assessment activities. Thirdly, identify *what* the challenges and benefits for online formative assessment at HE institutions. The results revealed that lecturers incorporated several tools to design and develop online formative assessment activities. In addition, lecturers demonstrated knowledge of TPACK which is considered a professional knowledge construct in the development of online formative assessment. Furthermore, the findings of this study indicated that lecturers provided feedback to students for all formative assessment activities. Lecturers had knowledge of identifying and addressing related challenges that could hinder the effective implementation of online formative assessment. The most noted challenges include poor internet connection, dishonesty on the part of students, insufficient time to provide immediate feedback for some assessment activities and lack of funding for research and innovation.

Keywords:

best practices, HE institutions, lecturers, online formative assessment

LANGUAGE EDITOR'S DISCLAIMER

I do hereby confirm that I have proof-read the dissertation entitled:

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Presented by:

Wilhelmina Etuna Simon

18194223

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Heather S Pelger

(HED S.A) (QTS U.K)

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List of Acronyms

COP	Communities of Practice
CPD	Continuous Professional Development
e-learning	Electronic/online learning
ePCK	Electronic Pedagogical Knowledge
FPD	Faculty Professional Development
HE	Higher Education
ICT	Information Communication Technology
KLT	Keeping Learning on Track
LMS	Learning Management Systems
OLC	Online Learning Community
OLEs	Online Learning Environments
PLC	Professional Learning Community
PTechD	Professional and Technological Development
RBT	Revised Bloom's Taxonomy
SMTE	Science Mathematics & Technology Education
TALOE	Time to Assess Learning Outcomes in Education
TGAT	Task Group on Assessment and Testing
TPACK	Technological Pedagogical Content Knowledge
VLC	Online Learning Community
ZPD	Zone of Proximal Development

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CHAPTER ONE: INTRODUCTION

1.1 Preamble

This chapter discusses the background of the study (1.2) statement of the problem (1.3) rationale (1.4) purpose of the study (1.5) aim of the study (1.6) research questions (1.7) scope of the study (1.8) research methodology (1.9) limitations of the study (1.10) ethical considerations (1.11) clarifying key concepts (1.12) dissertation outline (1.13) and ends with a chapter summary (1.14).

1.2 Background of the study

Many institutions of higher education worldwide have implemented e-learning for teaching and learning (Moore, Dickson-Dean & Galyen, 2011; Cabral & Huet, 2014; Arkorful & Abaidoo, 2015). Some of those institutions have further developed online assessment strategies to support e-learning initiatives for best practices (Finch & Jacobs, 2012; Corry, Ianacone & Stella, 2014; Spector, Ifenthaler, Sampson, Yang, Mukama, Warusavitarana, & Bridges, 2016). Various studies have broadly defined e-learning in relation to the use of new multimedia technologies and the internet to improve the quality of teaching and learning (Holmes & Gardner, 2006; Moore, Dickson-Dean & Galyen, 2011; Arkorful & Abaidoo, 2015). E-learning is therefore referred to as “online access to learning resources, anywhere and anytime” (Holmes & Gardner, 2006, p. 14). In this study, e-learning will be used interchangeably with online learning.

Several international studies have documented the effectiveness of online formative assessment (Brinthaupt, Fisher, Gardner, Raffo & Woodard, 2011; Zlatović, Balaban & Kermek, 2015; Domínguez, Jaime, Sánchez, Blanco & Heras, 2016) for online learning environments (OLEs) in higher education (Cho, Choi, Shin, Yu, Kim & Kim, 2015) which offer ongoing and timely feedback and reinforces the 21st century skills such as “collaborative learning, critical thinking, communication and creativity” (Spector et al, 2016, p. 59-60). However, less attention has been paid to the evaluation of online assessments and lecturers’ best practices. Consequently, the opportunity has been provided for this study to be conducted in Namibia and Finland respectively, seemingly for the first time.

Fleming (2008), Brinthaupt et al. (2011), Dietrich (2011) and Oneal-Self (2015) all carried out inter-related research on faculty perspectives of online assessments and online best practices, separately, in the developed economy of the United States of America (USA). It is therefore important that a related study be carried out from the developing economy (Namibia) perspectives to understand lecturers' (the assessors) best practices for online assessments. In addition, previous studies by Koh (2010), Fook & Sidhu (2014) for online assessments and formative feedback respectively, looked at both lecturers' and students' perspectives. There is a need to further understand the purpose of online formative assessment with an emphasis on feedback to document best practices. This study thus supports Fook & Sidhu's (2014) call for relatively new conceptions of formative assessment which should be implemented widely in higher education to improve feedback development. Some authors documented feedback to be a key element in formative assessment (Sadler, 1989; Black, 1998; Nicol & Milligan, 2006).

Spector et al. (2016) maintain that online assessment and feedback are necessary in the support of 21st century skills development. This supports the findings by Gikandi, Morrow & Davis (2011) who reviewed literature pertinent to online assessments in higher education. This study therefore responds to the recommendation by Spector et al. (2016) who expressed a need for research studies that can address the under-emphasis on formative assessment and evaluation. Furthermore, this study concurs with Wang's (2006) position who stressed that "as practitioners and theorists continue their efforts to explore new venues to assess quality of online programs, no doubt more examples of best practices will continue to emerge" (p.273). This study, through one of the research questions, sought to document lecturers' best practices for online assessments. While quality assurance for online assessments continues to be realised in various cases, and often needs to be maintained at institutions of higher education, even so, the perceived quality assurance is not the focus of this study. For the quality assurance in online assessments to be guaranteed, the reliability and validity of online assessments ought to be dependable and effective in order to keep up confidence in evaluations (Sadler 1989; Wang, 2006; Vlachopoulos, 2016).

It is necessary to understand the online assessment practices for lecturers at Higher Education (HE) institutions in Finland and Namibia respectively. The contrast between

Finland and Namibia is probably sharper than that between Namibia and many other countries. The focus of this study however, is not to compare the online assessment practices, but merely to identify and document best practices for online assessments. The present study, through one of the main research questions, examined the implementation of online assessments by lecturers at HE institutions. Finland is considered to have maintained a higher-performing education system for academic capitalism (Lee, Hong & Niemi, 2014) while supporting the 21st century skills of learning through integrating technology in teaching and learning (Gil-Jaurena & Softic, 2016) for online assessments and feedback (Kuikka, Laakso & Joshi, 2016; Rajala, Kaila, Linden, Kurvinen, Lokkila, Laakso & Salakoski, 2016; Kaila, 2018).

Namibian studies on e-learning focus among others, on activities of champions implementing e-learning processes in higher education (Beukes-Amiss, 2011), equipping graduate trainee teachers with ICT skills whilst at tertiary institutions (Auala & Mbale, 2012) and the role of social media in networked learning (Haipinge, 2013). This indicates the need for an empirical study to document insights into online formative assessment and feedback with particular emphasis on lecturers' best practices. Further research on e-learning investigates the opportunity of various e-learning models which allows for higher education to merge and share with each other (Boer, 2013). The Namibian ICT in Education policy remains stagnant (Ngololo, 2010), although many higher education institutions have developed their respective e-learning policies to enhance their institution's pertinent teaching and learning models (Ngololo, 2013). Therefore, it is of importance that research be focused on the activities of these various HE institutions and most importantly develop a model of best practices for the Namibian context.

1.3 Statement of the problem

The Technological Pedagogical Content Knowledge (TPACK) framework has been adopted for many studies related to the integration of technology in the classroom practices. However, lecturers' conceptions of TPACK are not sufficient to provide a complete explanation (Koh, Chai & Tay, 2014). In some institutions of higher education, the online assessment component for the provision of feedback rather than assessing

students for marks upon completion of courses has been neglected (Van Gog, Sluijsmans, Joosten-ten Brinke & Prins, 2010; Fook & Sidhu, 2014; Zlatović et al, 2015).

These studies suggest that the effectiveness of online learning models had not been well researched prior to their adoption and leaves a vacuum of best practices (Corry et al, 2014). Despite research on e-learning focusing on activities of champions implementing e-learning processes in higher education (Beukes-Amiss, 2011), literature suggests a need to conduct extensive research studies on the effectiveness of e-learning management systems (Beukes-Amiss, 2011; Boer, 2013), collaborative and creative teaching (Fleming, 2008; Lin & Lai, 2013) and models of best practices (Gil-Jaurena & Softic, 2016) to enhance formative feedback (Evans, 2013; Voelkel, 2013).

In addition, Koh (2010), Dietrich (2011) and Oneal-Self (2015) all maintain that a gap exists in literature and there is a lack of research exploring formative assessment through faculty members' perspectives. Given the scarcity of Namibian literature on various aspects of online assessment, this study investigated how lecturers implement online formative assessment practices at higher education institutions.

1.4 Rationale

This study reports the motivation from three points of view, which are personal, practical and academic.

1.4.1 Personal motivation

In 2008, I took the initiative and purchased my own multimedia projector and a laptop and downloaded educational videos and e-resources to teach science at a secondary school. After seven years of using and integrating technology in my lessons, I recognized the immense power of technology as a vehicle for the 21st century skills in learning, and I pursued a master's degree in Science Education. As part of the M.Ed. program, I conducted a multiple case study research that focused on teachers' use of ICT in the teaching of Life Science in the Khomas region of Namibia. This awakened in me a desire for research focusing on educational technology and I became inquisitive about e-learning.

Subsequently, my passion for educational technology was nurtured when I volunteered in 2017 and taught Contemporary Social Issues (CSI) at the University of Namibia (UNAM) using technology. I had the opportunity to assess students online through Moodle as one of the e-learning platforms that support online assessments. I further developed a keen interest and was curious to find out how lecturers implement online assessment while maintaining the effectiveness of formative feedback. Online formative assessment has become the main domain of research for educators (Gikandi et al., 2010; Spector et al., 2016).

Furthermore, through research and teaching experience, I realized that assessment overall is an important aspect of learning that requires investigation. Hence the research focused on identifying online best practices, thereby understanding lecturers' confidence when setting-up assessments and how they address the issues of reliability and validity in online formative assessments.

1.4.2 Practical motivation

Numerous authors have documented formative online assessment for best practices, for instance, Dietrich (2011), carried out a phenomenological study of social science instructors' assessment practices for online learning from various colleges in the United States (US) context. Dietrich (2011) indicated that there is a gap in literature pertinent to instructors' online assessment practices. He recommended research to further investigate assessment practices of online instructors who teach in other content areas.

In addition, Oneal-Self (2015, p.4), argued that "there is a lack of research exploring formative assessment through faculty members' perspectives". According to Oneal-Self, there is a need for "a study to be conducted that focuses solely on faculty use of formative assessment in online courses" (p.130).

Acknowledging the above, the practical motivation for the present study recognised lecturers' online best practices through formative assessment activities, thereby addressing how and why issues of reliability and validity could affect their confidence in assessment.

1.4.3 Academic motivation

Evident in the literature, best practices for online assessment are necessary and hence offer further support for lecturers to improve formative assessment strategies for online courses, notably to enhance effective feedback while addressing issues of reliability and validity as threats to online formative assessment (Black & William, 2009; Oneal-Self, 2015; Spector et al., 2016).

Spector et al. (2016, p.65), argues that there is a need for an evaluation of "different institutions' technological capabilities with the professional development capabilities to implement sound strategy for formative assessment". In support of the above, there is a need for the present study to evaluate the implementation of online assessments at HE institutions, particularly focusing on best practices.

This study will therefore contribute to research relevant to online formative assessments by:

- Contributing new knowledge of best practices that may address the pedagogical foundations for online assessment practices.
- Recommending to the Teaching and Learning Unit (TLU) or departments of the respective institutions to coordinate the implementation of online formative assessment
- Offering further research opportunities of efficiency in online assessment.

The above motivations provided the overall rationale for the present study, namely: personal, practical and academic. Therefore, it provided the researcher with information on lecturers' implementation of formative assessment in the online practices at HE institutions. Particularly, making it possible for the researcher to document lecturers' best practices, focusing on activities and strategies for online assessment to enhance feedback.

1.5 Purpose of the study

The purpose of the study is to document online best practices by lecturers at HE institutions, thereby recognising *how and why* (activities and strategies) lecturers assess students online, and *what* the trends (challenges and benefits) for online formative

assessment are. In addition, the study investigates the extent to which lecturers maintain confidence in assessment regarding issues of reliability and validity.

1.6 Aim of the study

This study aimed at documenting lecturers' best practices for online assessment to enhance effective feedback. It also aims to identify the gap and critical issues in the implementation of online assessment practices at HE institutions with particular emphasis on online formative assessment. This study will contribute knowledge of lecturers' online best practices to address the pedagogical foundations for online formative assessments.

1.7 Research questions

1.7.1 Main research questions

The three main research questions are:

1. How is online formative assessment implemented by lecturers at HE institutions?
2. Why do lecturers at HE institutions implement online formative assessment?
3. What are the challenges and benefits of implementing online formative assessment?

1.7.2 Sub-questions

1. How does the use of the TPACK framework improve the online formative assessment content?
2. How does the use of Bloom's levels of reasoning skills improve lecturers' content knowledge of online formative assessment?
3. What guides the implementation and context for online formative assessment at HE institutions?
4. What are the best practices for online assessments?

The research questions of this study focus on *how* and *why* lecturers implement online formative assessment for best practices. Also, *what* challenges are faced by lecturers, and the benefits when implementing online formative assessment at HE institutions. These questions therefore need to be answered within an understanding of lecturers' perspectives of online assessment.

Table 1.1 below represents a conceptual matrix for the research questions.

Table 1.1 Research questions matrix

Research questions			*Lecturers*		*Institutions (online assessment practices)*	
How?	Literature	Findings	Literature	Findings	Online assessment activities	
Why?	Literature	Findings	Literature	Findings	Trending tools and best practices	
What?	Literature	Findings	Literature	Findings	TPACK Framework	Bloom's Taxonomy
					Literature	Findings

Table 1.1 represents a connection between the research questions, the lecturers, and how the research questions were addressed using findings from the relevant literature reviewed for this study.

1.8 Focus of the study

The focus of this study was on lecturers at HE institutions, specifically Namibia and Finland. Lecturers were purposively and conveniently selected based on their experience for implementing online formative assessment. Selection was further done using a checklist with specific criteria that reflects online best practices as per the reviewed literature pertinent to online formative assessments.

1.9 Research methodology

This section addresses the methodology of this study. It begins by presenting the research design, population, sampling method, and data analysis procedure.

1.9.1 Research design

This study embraced a qualitative research design, focusing on a multiple case study approach to evaluate the implementation of online assessment at HE institutions. Through multiple case study research, the researcher was able to interview lecturers, observe online assessment platforms and analyse institutional documentation, where possible. According to Yin (2009) a case study method can be used to understand a real-

life phenomenon in depth. Thus, “the case study method is most appropriate for answering the *how* and *why* questions” (Yin, 2009, p. 27). Additional details regarding the decisions taken in relation to the research methodology for this study are further discussed in Chapter 4. Data sources that were used to obtain evidence are outlined in Table 1.2 below.

Table 1.2 Summary of research questions and data collection instruments

Lecturers: Teachers *(How and Why)*	*HE Institutions: University* *(How and What)*
1) One-on-one interviews 2) Best practices (activities, tools and strategies) through observation	1) Observations of online assessment platforms 2) Analysis of institutional documents

1.9.2 Research population and sampling

Two lecturers from one HE institution in Namibia and two international lecturers from one HE institution in Finland, totaling four, participated in this study. Lecturers were selected using the purposive and convenient sampling method. As defined by Yin (2009), the purposive and convenient sampling techniques were regarded as most suitable to select a case for one of the leading HE institutions in Namibia and Finland respectively, because lecturers engage in the online formative assessment practices. The lecturers were purposively selected using a checklist based on the following criteria, namely: 1) lecturers who administered and practiced formative assessment for online courses for a minimum of 12 months were considered. 2) Participants were selected from those who were available and willing to participate voluntarily in the study.

The lecturers were conveniently selected from the institutions where the researcher had frequent academic activities. The researcher is from Namibia and has easy access to Namibian HE institutions. These institutions are geographically located in the proximity of the researcher. Additionally, the researcher had an opportunity as a visiting scholar to one of the institutions in Finland, and thus it was possible for the researcher to observe

online assessment platforms and identify lecturers who met the characteristics of online best practices, as identified from the literature and in line with the aim of the study. The above elucidation justifies the convenience aspect of the selection procedure. Furthermore, lecturers were selected from Namibia and Finland respectively for the purpose of documenting online best practices and not to compare practices between the two countries. The embedded multiple case study provided the researcher with knowledge and experience of the selected lecturers that are information-rich (Yin, 2009; Gay, Mills & Airasian, 2011; Cohen, Manion, & Morrison, 2011).

1.9.3 Data collection

First, the researcher obtained access and observed online courses in the online learning platforms. During observations as defined by Gay et al., (2011), various online formative assessment activities were identified using the observation checklist (see Appendix A). Secondly, the researcher reviewed and analysed institutional documents guiding the implementation of online assessment. Document analysis as defined by Creswell, (2014) was necessary to complement and support lecturers' perspectives of online assessments. Thirdly, semi-structured interviews as defined by Silverman (2006) were conducted with each participant using the interview guide with predetermined questions (see Appendix B). Participants gave permission for the recording of all interviews. During interviews, the researcher probed where needed, to seek clarity on the implementation of online formative assessment. Each interview lasted between 45 minutes and an hour. After each interview with participants, collected data were transcribed.

1.9.4 Pilot testing instruments

To test the research instruments, the researcher identified one of the HE institutions as a pilot study. The institution was identified for the pilot study because the informants were easily accessible and the site was geographically convenient (Creswell, 2012). In addition, the pilot case provided some conceptual clarification for the research design (Cohen et al., 2011). A pilot case study served to "help refine data collection plans with respect to both the content of the data and the procedures to be followed" (Yin, 2009, p.92). The pilot study enabled the researcher to make the necessary amendments to the observation system and procedures thereof. With regards to the guidelines for online

assessment, the researcher arranged for a pre-interview to find out about the objectives for online formative assessment and follow-up questions on emerging tools during the interviews with the lecturers. The participants from the pilot study shared similar characteristics with the research participants of the official study (Gay et al., 2011). The researcher used feedback from the pilot study to revise questions before interviewing the key participants. Thus, the interview guide and observation checklist were modified to include specific information for online formative assessment.

1.9.5 Data analysis

The researcher used cross-site analysis of data as suggested by Gay et al., (2011). Cross-site analysis was necessary to unify cases under study as one entity of analysis. First, the researcher read through all the notes, memos and comments that were written on all field notes to get the initial sense of the data. Secondly, the ideas or concepts from the notes were grouped into themes. Thirdly, six steps of data analysis as defined by Creswell (2014) were essential for referencing units of texts and were thus sorted through, coding and labeling to show meanings and patterns. Further details on the steps followed during data analysis are discussed in Chapter 4 of this report.

1.9.6 Validity and reliability

To maintain reliability and validity of research findings, the researcher sustained an audit trial and utilized member checking as suggested by Creswell (2012). Particularly, Lincoln & Guba (1985) noted that an audit trial was necessary to strengthen the dependability and conformity of the study. Reliability and validity in qualitative research are conceptualized as trustworthiness, rigor and quality as per important aspects in a qualitative paradigm (Patton, 2002; Gay et al., 2011; Creswell, 2012). On the other hand, member checking was equally relevant and helped to ensure credibility. Thus, interpretations of data were presented to the participants in order to provide feedback. Participants were further asked to correct, elaborate, extend and argue the presented findings (Creswell, 2012). More details regarding reliability and validity of the study are discussed in Chapter 4 of the thesis.

1.10 Limitations of the study

The study was limited to two lecturers from one HE institution in Namibia and two international lecturers from one HE institution in Finland that practice and are engaged in online formative assessment. Given that this small number is not statistically representative of all Namibian and Finnish lecturers, the results of the study cannot be generalized to the larger population of all Namibian and Finnish HE institutions. However, findings are limited to HE institutions with lecturers that practice online formative assessment.

1.11 Ethical considerations

The researcher ensured that ethical issues were considered. The researcher drafted a letter requesting permission and ethical clearance from the University of Pretoria. After receiving a research approval letter from the ethics committee at the Faculty of Education, the researcher then requested permission from the institutions of higher education and submitted a detailed permission letter to the Vice Chancellor, through the Director for Research & Publications, and subsequently informed participants in order to obtain verbal and written consent before participating in the study. Furthermore, the researcher assured all participants that the information obtained would be used for research purposes only and that it would be treated with utmost confidentiality. Data collected will be retained and kept for a minimum of 15 years at the SMTE department at the University of Pretoria.

1.12 Clarifying key concepts

It is necessary to clarify key concepts in the present study. It must be noted that various terminologies have been used synonymously and interchangeably. Table 1.4 below further presents the concepts and their relevance to this study.

Table 1.3 Concepts used in this thesis and their meaning

Concept	*Meaning*
Assessment	Referred to a measurement of the learner's achievements and progress in a learning process (Gikandi et al, 2011). In this study assessments were used synonymously with the term evaluation thus to assess online courses and instructional strategies.
Best practices	In this study the concept was understood as teachers' outstanding and creative abilities and strategies to use online assessment tools as web-based interface to assess students (Finch & Jacobs, 2012; Thompson & Braude, 2016).
Feedback	Enable students to become aware of the gap between their current level of knowledge or skill and the desired goal (Nicol & Milligan, 2006; Wood, 2010; Gikandi et al., 2011). In this study, the concept was understood as online formative feedback that is on-going-feedback from lecturers through online assessment platforms and how teachers communicate students' progress and shortcomings.
Formative assessment	Formative assessment is ongoing evaluation of students' learning that inform instruction (Sadler, 1989; Black, 1998; Black & William, 2009). In this study, online formative assessment was used to understand teachers' on-going assessment activities using online assessment platforms
Online learning environment	Defined as a virtual classroom where students engage in online learning (Dietrich, 2011). In this study, the concept is understood as online platforms that support online formative assessment.
Online assessment platforms	Hardware, software applications and connectivity. In this study, the term online assessment platforms were used synonymously with technology that support online assessment.

1.13 Dissertation outline

Each chapter has both an introduction to explain the structure and sequence of its sections and sub-sections, and a brief summary which draws together the main points that have been discussed.

Chapter 1: Introduction presented an overview of the background information on the implementation of online formative assessment internationally and locally. A brief background of some studies related to e-learning and online assessment is presented to put the study into context for the reader. In addition, the chapter presents the research questions, purpose and methodology of the study. Also, the limitations of the study are presented before the operational definition for terms that will be used throughout the report.

Chapter 2: Literature review presents a discussion of literature relevant to lecturers' formative assessment practices. Further, the chapter presents an overview of formative assessment at HE institutions, current technology trends in online assessments focusing on best practices, practices in HE institutions in respect of online assessments implementation and pedagogical foundations for online assessment. It also highlights the challenges of online assessment and emerging themes from the literature.

Chapter 3: Philosophical assumptions and conceptual framework are discussed. The chapter details the conceptual framework adopted and adapted for this study. First, the chapter presents philosophical assumptions in relation to constructivism theory with emphasis on social constructivism in higher education and online education. Secondly, the chapter presents concepts adopted from the TPACK framework and Bloom's revised taxonomy in relation to the implementation of online assessment practices. Thirdly, the proposed model for the implementation of online formative assessment is presented.

Chapter 4: Research design and methodology presents and justifies both the research design and the method used to collect data. First, the chapter presents a description of the qualitative research and the multiple case study approach used. Secondly, it discusses the sample and sampling procedures. Thirdly, the chapter presents the instruments, pilot study, data collection procedure and analysis. Finally, issues related to methodological norms and ethical considerations are presented before the conclusion.

Chapter 5: Presentation of research data and the results of the study gathered from the investigations of how lecturers implement online formative assessment practices at HE institutions. The chapter presents themes that will emerge from data analysis. The themes were structured according to the conceptual framework adapted and adopted for the current study.

Chapter 6: Discussion and findings presents and discusses the main research findings compared to the existing literature. This was done in line with the conceptual framework and the emerging themes. The chapter concludes with a discussion on the challenges faced by lecturers as individuals in the two HE institutions and in their online courses.

Chapter 7: Summary and conclusions summarises the research findings and provides a reflection from the study on how lecturers implement online formative assessment, followed by methodology and contribution of the study to the body of knowledge. Finally, the conclusions and recommendations are presented.

References: Consist of a list of all the sources as cited within the current study.

Appendices: Comprise attachments of the two research instruments, example of the invitation letter, the individual consent letter, codes developed from the implementation of online formative assessment at HE institutions for best practices as well as some samples from the actual data sources and the analysis.

1.14 Chapter summary

This chapter presented an overview of the implementation of online formative assessment practices at HE institutions. The chapter highlighted the research questions, significance, problem statement, methodology, motivation and limitations of the study. This research focused on how lecturers at HE institutions, particularly in Namibia, implement online assessment whilst maintaining confidence in formative assessment, considering the issues of reliability and validity.

The subsequent Chapter 2 presents a detailed discussion of relevant and related literature pertinent to online formative assessment and best practices.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents the reviewed literature pertinent to online assessment, particularly formative assessment at HE institutions. It must be noted that there has been a scarcity of local reviewed literature in this area. This chapter summarises the search strategies for the literature review (Section 2.2). The literature review is presented in three parts thereby linking the literature to the two research questions. Firstly, Part A Addresses Research Question 1 and it begins by discussing the current literature on formative assessment at HE institutions (Section 2.3) focusing on the technologies for formative assessment (Section 2.3.1) the manner in which it is being applied online (Section 2.3.2) followed by formative assessment strategies (Section 2.4) and the role of feedback in the formative assessment process (Section 2.5). Section 2.6 presents the current empirical research on the trends for online assessment. Furthermore, the literature for lecturers' best practices with respect to online formative assessment is presented in Section 2.7. Secondly, Part B focuses on Research Question 2 and centres on the challenges faced by lecturers when implementing online formative assessment (Section 2.8) and a detailed discussion of the themes that emerged from the literature review (Section 2.9). Thirdly, subsequent to emerged themes and prior to the conclusion is Part C which presents a brief review of methodologies used in recent studies that are related to the implementation of formative assessment (Section 2.10) before the chapter summary (Section 2.11).

2.2 Search approach

The critical literature review was conducted over a period of 18 months. The focus of this study narrowed the review of the literature to formative assessment in HE institutions. Some studies conducted in the college context and with specific focus on students, were included in the reviewed literature below, because of the documented information which is relevant to formative assessment at HE institutions. The literature review was therefore derived from authoritative electronic databases, journal articles, books and searching the internet. Databases and the keywords used to search the literature are noted (Table 2.1) while text box 1 presents topics explored in the literature search strategy for this study.

Table 2.1 Databases and keywords utilised

Databases	*Keywords*
Educational Database (ProQuest) Science Direct JSTOR ERIC (EBSCO) Educational Research complete Learn TechLib Teacher Reference Centre Taylor & Francis online Google Scholar *Research Journals* Review of Educational Research Internet & Higher Education Computers & Education International Journal of Computer-Supported Learning International Journal of Education, Technology in Higher Education	Online formative assessment Technologies for assessment Institutions of higher education Best practices Validity Reliability TPACK framework Bloom's taxonomy (revised)

Text box 1:	*Literature topics*

- **Online assessment**
- Formative assessment: what is formative assessment?
- Assessment strategies
- What are different types of online formative assessment?
- What are online best practices for lecturers?
- Implementation of online formative assessment
    - Assessment tools, emerging tools
    - How do lecturers assess students online?
    - Formative feedback
- Trends for online formative assessment
- Challenges for online assessment
- Institutions of Higher Education AND formative assessment evaluation

Key words were utilised as search terms and phrases to find literature from related online databases. Limiters were used to narrow the search and only include peer-reviewed and scholarly materials including full text PhD dissertations. In addition, where necessary sources cited in the reviewed articles were also considered. Also, relevant books for Educational Research and Online Assessments were procured and utilized to provide tacit information for the literature review. Table 2.2 presents a summary of search results from key references and substantial studies drawn from an extensive range of publications with countless varieties of purpose relevant to this study. The search results were categorised using record types such as journal articles, eBooks, dissertations, conference papers, reports and other relevant documents.

Table 2.2 Summary of search results

Topic	*Peer-reviewed articles & PhD dissertations*	*Books*	*Annual reports & Conference papers*
Online assessment	10	5	2
Online assessment case studies	5	1	0
Online formative assessment	15	3	6
Assessment strategies	6	2	0
Technologies for assessment	10	4	3
Best practices	7	0	0
Challenges for online assessment	5	0	2
TPACK Framework	6	1	3
Bloom's Taxonomy	10	1	0
Constructivism	10	2	0
Total	**84**	**19**	**16**

Furthermore, key studies were identified and categorised based on their contribution to online formative assessment literature. These studies were identified in the critical analysis of the methodological approaches, strengths and weaknesses, key findings, implications and conclusions of each empirical study through a systematic qualitative review (Gikandi et al., 2011). According to Gikandi et al. (2011, p. 2334) a systematic qualitative review "allows rigorous analysis, critique and synthesis of related literature" through three main steps of literature review which are: 1) *searching* 2) *reviewing* and 3) *writing the literature review*. These three steps were necessary to find, review and document literature pertinent to the implementation of formative assessment in HE institutions for online best practices.

Part A: Addressing Main RQ1 and RQ2

2.3 Overview of formative assessment

For the past two decades, formative assessment has gained considerable attention in educational research particularly in higher education. In recent years, a number of studies and articles documenting the potential role of formative assessment in online courses have been widely published (Black & William, 2009; Cornelius, 2013; Oneal-Self, 2015; Spector et al., 2016) focusing on faculty perceptions (Koh, 2010; Dietrich, 2011; Oneal-Self, 2015), and have identified effective methods and strategies (Bugg, 2013; Cornelius, 2013) in the implementation of online formative assessment and provision of feedback (Trumbull & Lash, 2013).

As part of the larger assessment umbrella for evaluating students' performance, formative assessment is often combined with instruction and furthermore generally takes the form of classroom interaction between lecturers and students (Trumbull & Lash, 2013). Some scholars (Black, 1998; Sadler, 1989; Heritage, 2007) emphasize that formative assessment is mostly defined as a 'systematic process' that allows lecturers to continuously gather 'evidence' about students' learning (Heritage, 2007). This type of assessment is deliberately done during the instructional process and developed with the purpose of improving teaching and learning (Black & William, 1998). As such, formative assessment is therefore effective when included in the course to encourage learning (McMillan, 2013).

Furthermore, the purpose of formative assessment is expressed through descriptions contained in the passage below cited from Dietrich (2011):

> …[formative] "assessments are used to inform instructor and students regarding progress towards meeting learning goals and objectives. Formative assessments are used to measure how well students understand the material, with the aim of improving instruction, providing learners with a comprehensive understanding of the material, and offering students feedback concerning their learning" (p. 9).

Besides, Sadler (1989, p. 120-121) posits that "formative assessment involves making judgements about the quality of students' responses and using those judgements

immediately to guide and improve students' understanding and skills". Hence, the extract below is necessary to further understand this description of formative assessment:

> "formative assessment is concerned with how judgements about the quality of student responses … [that] can be used to shape and improve students' competence by short-circuiting the randomness and inefficiency of trial-and-error learning" (Sadler, 1989, p.120).

The above definitions can be aligned with that of Trumbull and Lash (2013) who noted that "any instructional activity that allows teachers to uncover the way students think about what is being taught … [and] can be used to promote improvements in student learning … [which] can serve as formative purpose" (p.3). Formative purpose is what teachers consider an integral part of formative assessment. This means that lecturers should understand what constitutes purposeful formative assessment activities. However, Trumbull & Lash (2013) argued that there is no 'prescription' for how to tailor formative assessment activities aimed at meeting the needs of a certain student. Also, they caution that "conducting formative assessment requires extensive knowledge, including knowledge about student learning, domains of study, assessment and pedagogy" (Trumbull & Lash, 2013, p. 14).

This is most important particularly for lecturers to understand the requirements of implementing formative assessments in the online courses. Moreover, Heritage (2010) also noted that formative assessment is a continuous process that lecturers can integrate into instruction to indicate students' learning and progress towards their learning goals. Therefore, teachers are required to have pedagogical content knowledge to adapt instruction to assist students to close the gap between the current learning status and the goal (Sadler, 1989; Heritage, 2010). On the other hand, Koh (2010) speculated that for students to learn through formative assessment, to some extent it depends on the lecturer's engagement in the process. A study by Koh (2010) further reveals that when preparing for summative assessment, lecturers should understand the purpose of formative assessment practices by providing students with feedback on their progress. However, this is somewhat contradictory to Heritage's (2007) statement that in order to understand the purpose of formative assessment, lecturers should focus on improving learning and not merely *'audit'* it [learning]. This means that lecturers should not only use

formative assessment to modify students' learning, but also encourage improvement of students' achievements of desired learning goals through on-going assessment activities.

Although the focus of this study is central to formative assessment it is necessary to identify the difference between formative and summative assessment. Over the years scholars documented distinctions between formative and summative assessment. The most popular distinctions were noted by Sadler (1989, p. 120), who argued that:

> "Summative contrasts with formative assessment in that it is concerned with summing up or summarising the achievement status of a student and is geared towards reporting at the end of a course of study especially for purposes of certification … [thus] essentially passive and does not have profound educational and personal consequences for the student".

In addition, Black and William (1998) acknowledged that summative assessments can be used to test for mastery and are given at the end of a course or unit of instruction. Considering the distinction between formative and summative assessment as highlighted in the literature, some authors (Koh, 2010; Bennett, 2011; Dietrich, 2011; Oneal-Self, 2015; Spector et al., 2016) indicated that formative assessment offers on-going feedback and should be used by faculty members to evaluate students' progress. Shepard (2005, p. 5) clarifies that "what makes formative assessment *formative* is that it is immediately used to make adjustments so as to *form* new learning". Subsequently, scholars engaged in various research concerning formative assessment as a learning support. According to Bennett (2011, p. 7) "formative assessment is therefore, assessment *for* learning rather than *of* learning".

Thus, this study focused on assessment *for* learning thereby understanding *how* lecturers implement formative assessment in the online courses, consider strategies and types of online formative assessment activities, and identify *what* the challenges and or successes for online formative assessment are. Also, considering *why* lecturers use various technologies that are required for the effective implementation of online assessment particularly at HE institutions.

2.3.1 Technologies for online formative assessment

It is necessary to understand technologies used by lecturers during formative assessments in the online courses. Literature reveals that several technologies emerged for online formative assessments to enhance 21st century skills (Spector et al., 2016; Kaila, 2018). The effectiveness of formative assessment requires the integration of appropriate technologies also known as tools (Kaila, 2018).

According to Spector et al. (2016, p. 61):

> "learning environments in the 21st century involve and depend on digital technologies such as the computers, hand-held devices, the internet, and whiteboards just to mention but a few". This means that the purpose of formative assessment has not changed but rather "the significance of formative assessment has grown on account of new technologies and 21st century learning demands".

Some assessment tools identified in the literature are categorised and not limited to the following: web-based evaluations, surveys, examinations and portfolios among others (Gaytan & McEwen, 2007; Hood, 2009). It is necessary to understand how lecturers utilise various tools to implement online assessment. Pellegrino et al. (2001) noted that teachers are required to have tools and further supports to implement high-quality assessment competently and use the resulting information efficiently. Pellegrino et al. (2001, p. 271) proceeded to discuss technology-based assessment tools such as "software tools for creating, manipulating and coordinating structured databases that contain an element of an assessment design". In addition, assessment tools were noted to have primary 'locus' effect on the assessment triangle which requires lecturers to employ cognition, observation and interpretation when implementing formative assessment (Pellegrino et al., 2001). However, despite the landmark report on assessment *knowing what students know* (Pellegrino et al., 2001), calling for "balanced assessment systems" it did not address formative assessment and feedback (Shepard, 2005, p.17).

Ideally, specific tools are required for a particular formative assessment for example e-tools identified by Heinrich, Milne and Moore (2009) which are specialised software for marking assignments. These e-tools are categorised into generic software and Learning Management Systems (LMS). According to Heinrich et al. (2009), these tools offer support for the management of assignments and are combined with '*scoring rubrics'* that

allow, for example, lecturers to give students feedback which is detailed and summarized. Heinrich et al. (2009) findings reveal that the specialist assignment assessment tools provide support to lecturers with administrative issues and improve the quality of marking and feedback. The study recommended that lecturers employ several specialist tools such as Turnitin, Questionmark perception, WebCTconnect and marktool among others that are generic office software and LMS (Heinrich et al., 2009, p. 183-184).

Although the above-mentioned tools are limited to the assessment of assignment activities, findings are necessary to understand how lecturers at HE institutions evaluate students' assignments as part of the formative assessment implementation. The recommended tools are also pertinent to this study in that they will provide guidelines and benchmarks for the evaluation of the implementation of online assessment at HE institutions.

2.3.2 Implementation of online formative assessment

It has been argued that the integration of technology such as tools in online courses can enhance formative assessment. Several international studies concerning online formative assessment were conducted in different contexts around the globe (Van Gog, Sluijsmans, Joosten-ten Brinke, Prins, 2010; Lin & Lai, 2013; Spector, 2013; Spector et al., 2016). These researchers documented the effectiveness and harnessing of online formative assessment focusing on feedback and collaborative learning achievements of students (Lin & Lai, 2013) and the instructional design of assessment in online environments (Van Gog, et al., 2010; Spector, 2013).

When implementing online assessment, particularly formative assessment, lecturers should understand four basic types of knowledge as classified by Heritage (2007, p. 142-143) which are: (1) *domain knowledge* (2) *pedagogical content knowledge* (3) *students' previous knowledge* and (4) *assessment knowledge*. This study will focus on pedagogical content knowledge and assessment knowledge, thereby understanding how lecturers design and implement online formative assessments. For example, a lecturer should have knowledge of subject content and pedagogy when preparing activities to evaluate on-going students' performances.

Additionally, Heritage (2007, p. 141-142) documented the following four elements of formative assessment which are: 1) *identifying the gap* 2) *feedback* 3) *student involvement* and 4) *learning progression*. These four elements are necessary for lecturers to understand when implementing formative assessment. This means that assessment components should make provision for the above elements. As such, formative assessment should be understood as a continuing development that occurs during teaching and learning, which involves both teachers and students in gathering information, so they take steps to keep learning moving forward and meet learning goals (Heritage, 2010; Van Gog, et al., 2010; Lin & Lai, 2013).

Moreover, Heritage (2010) documented wide-ranging information on formative assessment in a book titled *Formative Assessment: Making it happen in the Classroom.* The book consists of eight chapters with detailed information on what teachers should do to ensure the effectiveness of formative assessment. For the purpose of this study, the following chapters are necessary to understand how lecturers implement formative assessment at HE institutions. *Chapter 2*: *Assessment with and for students*, *Chapter 5*: *Formative feedback for teaching* and *Chapter 7*: *Implementing formative assessment; what do teachers need to know and be able to do?* (Heritage, 2010).

To exemplify how these chapters will provide guidelines for the implementation of online formative assessment the following five components of teacher knowledge will be taken into consideration namely: 1) *content knowledge* 2) *knowledge of metacognition* 3) *pedagogical content knowledge* 4) *knowledge of students' prior knowledge* and 5) *assessment knowledge*. The above types of teacher knowledge are different from those presented above (see page 9) in that there is provision for content and metacognition knowledge. This information is necessary for lecturers to have awareness for higher-order thinking skills. In addition, a consideration for enhancing lecturers' knowledge of online formative assessment effectively, would require specific skills that they need to demonstrate. These skills were further identified as (a) *interpreting evidence* (b) *matching instruction to the gap*(c) *providing feedback* (d) *teaching metacognitive skills* and (e) *teaching peer assessment* (Heritage, 2010, p. 101-115). The above skills are necessary for lecturers to understand when implementing formative assessment in the online

learning environment. This means that lecturers should develop formative assessment activities that measure higher-order thinking skills, provide feedback and allow students to assess their peers.

Undoubtedly, although in the work of Heritage and the other scholars previous mentioned have added richness and depth to the literature for online assessment, there remains a gap in pinpointing how lecturers implement formative assessment at HE institutions. For instance, Heritage (2010) book *Formative Assessment: Making it happen in the Classroom* is one attempt to address this shortcoming in the literature. Likewise, although many examples highlighted by Heritage (2010) are universally applicable, there is still a need for a study to explore and document lecturers' best practices for online formative assessment with particular emphasis on current and emerging strategies and tools for on-going assessment in online courses. Previous scholars have documented insight information pertinent to formative assessment (Black, 1998; Black & William, 1998; Sadler, 1989;) which is recognised through a wide range of research of which the focus was on pedagogical skills. Nonetheless, Bennett (2011) cautions that lecturers' assessment practices should not only be constructed on *pedagogical skills* alone, as this may lead to insufficient development of online formative assessment activities. Therefore, formative assessment should be conceptualised within explicit domains (Bennett, 2011). This means that teachers need considerable "knowledge to implement formative assessment effectively, time and support to develop it, and materials that model the integration of pedagogical, domain and measurement knowledge" (Bennett, 2011, p. 20).

Additionally, the above-mentioned recommendations by Bennett (2011) are in line with that of Spector (2013) who documented five competency domains that lecturers should uphold when implementing formative assessment in the 21st century online learning environments, which are: "knowledge, process, application, personal and social as well as innovative and creative competence domain" (Spector, 2013, p. 26).

It is necessary for lecturers to understand the application of the five competency domains in the 21st century online learning environment. Hence, the extract below is necessary for lecturers to further understand when assessing students online.

According to Spector (2013, p.26):

“Knowledge competence domain is concerned with demonstrating knowledge of different types of advanced learning technologies and technology-based pedagogies. Process competence domain focuses on effective use of tools and technologies to promote learning in the 21st century […which include] a variety of tools … [that] support virtual learning environments, […] simulations and gaming. Application process domain … [concerned] with the application of advanced learning technologies in practice […example] analysis, planning, implementation and evaluation. Personal and social competence domain emphasize the need to support and develop social and collaboration skills […] autonomous and independent learning skills. Innovative and creative competence domain … [which] recognizes that technology will continue to change and that … [lecturers are] flexible and creative in making effective use of the new technologies”.

The five competency domains which Spector (2013) referred to as *competency clusters* are relevant to the current study in that they support the 21st century skills compared to the general domain knowledge identified earlier by Heritage (2007). The above-mentioned competence domains are particularly important as they will provide guidelines for understanding lecturers’ implementation of online formative assessment at HE institutions. Certainly, the effective implementation of formative assessment requires lecturers to develop and model various strategies in the implementation of online formative assessment practices. Hence, it is necessary for lecturers to recognise some strategies identified from the literature as part of the on-going students’ assessment. The online formative assessment strategies are presented in Section 2.4 below.

2.4 Formative assessment strategies

It is worth noting that assessment strategies support the implementation of online formative assessment practices at HE institutions (Heritage, 2007; Heritage, 2010; Bennett, 2011). Some authors (Sadler, 1989; Black, 1998) regarded assessment strategies as methods incorporated in a lesson or course to conduct students’ evaluations, learning needs and academic progress. Heritage (2007) documented imperative aspects in formative assessment and categorised three broad variety types of assessment strategies, namely: 1) “on-the-fly” assessment (informal assessment) which

occurs spontaneously and unexpectedly in the online learning environment 2) “planned interaction” and 3) “curriculum embedded assessment” (p. 141). This study will focus on the above aspects to understand formative assessment activities utilised by lecturers to assess students’ learning. This means that, various assessment strategies are required for lecturers to conduct effective formative assessment.

In addition, Gaytan and McEwen, (2007) and Hood, (2009) respectively noted that online assessment strategies that lecturers can implement are not limited to the extensive development of visibly clarified assignments. Also, lecturers’ provision of constructive and timely feedback to students should consider the quality of their work. To understand the importance of strategies in the online formative assessment, Gaytan and McEwen (2007), identified effective assessment methods which lecturers should employ, such as projects, quizzes, portfolios, synchronous discussions, self-assessment, peer evaluation and feedback. These methods are mostly recommended for lecturers whilst providing timely and meaningful feedback.

Subsequently, Black and William (2009, p. 4-5) documented five key strategies as identified by William and Thompson (2007) in an attempt to conceptualise formative assessment. The five key strategies are:

1. Clarifying and sharing learning intentions and criteria for success
2. Engineering effective classroom discussions and other learning tasks that elicit evidence of students’ understanding
3. Provide feedback that moves learners forward
4. Activating students as instructional resources for one another
5. Activating students as the owners of their own learning (p. 4-5).

Although the above-mentioned key strategies were proposed for teachers and learners, they are pertinent to the current study, in that they will guide lecturers when implementing online formative assessment. Thus, lecturers use key strategies to identify learning objectives, facilitate online discussion forums, provide formative feedback, encourage students to take ownership of formative assessment activities and promote peer assessment in the online learning environment.

In fact, through the concept of Keeping Learning on Track (KLT) program, Bennett (2011) identified five key strategies that lecturers can consider when implementing formative

assessment effectively which are: “sharing of learning expectations, questioning, and feedback, self-assessment and peer assessment” (p. 8-9). This means that lecturers can collaborate with students through online engagement to facilitate self and peer assessment activities. Thus, students’ engagement in the online formative assessment activities can promote effective implementation of online formative assessment at HE institutions.

According to Bennett (2011), there are two specific arguments directed to formative assessment which are ‘validity’ and ‘efficacy’. Lecturers should identify validity as strategies to support the quality of their interpretations about students’ performance and the adjustment to their instructions. The latter requires lecturers to support the impact of inferences and adjustment (Bennett, 2011, p. 14). This is particularly important to understand lecturers’ readiness and willingness to explore various strategies for online formative assessment.

Kearns (2012), affirms that various methods are necessary and should be used by lecturers to implement effective formative assessment. Kearns (2012) reviewed syllabi from 24 online courses and found that “written assignments” and “online discussions” appeared to be frequently used by lecturers (p. 201). This clearly demonstrates that there is a need for lecturers to change assessment strategies. This is supported by Bugg (2013) and Cornelius (2013) who assert that there is a need for lecturers to change assessment strategies pointing at improving the effectiveness of feedback. This is particularly vital for lecturers to understand the direct impact that strategies have towards feedback in the formative assessment process.

2.5 Role of feedback in formative assessment

Formative assessment is necessary for lecturers to provide students with feedback instead of evaluating them for course grades (Sadler, 1989; Black, 1998; Black & William, 2009). The work of Sadler (1989) contributed much of the basis for current conceptualisation of the characteristics of feedback, which is considered as an important part of formative assessment practices. This is supported by Wood (2010) who noted that formative feedback from lecturers can assist students to close the gap between their current level of understanding and the expected learning goal.

Through formative feedback, lecturers can share information with students intended to change their thinking with the purpose of expanding learning (Shute, 2008).

Considering timing and the level of information presented in feedback, Shute (2008) categorised feedback into three areas, namely i) 'immediate', ii) 'instant' and iii) 'delayed'. This means that, lecturers can provide students with feedback immediately and instantly during the assessment activities. In addition, feedback can also be delayed and be given to students at the end of the assessment activities. Secondly, she identified the common formative feedback types, namely: 1) '*elaborated feedback'*: which requires lecturers to provide an explanation to support the correctness of a specific response. Elaborated feedback includes isolation of attributes, identification of misconceptions, expansion of a topic and response, as well as hints and or prompts, 2) '*verification'*: which includes 'knowledge of results' (KR) and outcomes to inform students about the correctness of their responses and 3) *correct response*: also known as '*knowledge of correct responses'* (KCR) for lecturers to provide students with the correct answer to a specific problem with no other information (p. 163-167).

Similarly, and prior to that, Heritage (2007) identified four core elements of formative assessment of which feedback was mainly featured and are important for teachers to understand when setting-up activities. Hence, lecturers should "identify the gap, provide feedback, involve students and consider learning developments" (p. 141-142). In addition, feedback generated by students should be used to improve their learning status. Accordingly, students should be able to close the gap between what they know and the envisioned learning goal (Shute, 2008; Heritage, 2010; Wood, 2010).

In addition, Nicol and Milligan (2006) identified seven principles of good feedback practice that lecturers can utilise in supporting students' self-regulated learning in online learning environments.

The seven principles are:

1. Help clarify what good performance is (goals, criteria, expected standards)
2. Facilitate the development of reflections and self-assessment in learning
3. Deliver high quality information to students about their learning
4. Encourage teacher and peer dialogue around learning
5. Encourage positive motivational beliefs and self-esteem

6. Provide opportunities to close the gap between current and desired performance
7. Provide information to teachers that can help to shape the teaching (Nicol & Milligan, 2006, p. 1-10).

Furthermore, Nicol and Milligan (2006) argue that “e-tools (online assessment tools) that support web-based system (e.g., VLEs and Moodle) are effective when they are allied to assessment approaches that enhance the students’ ability to generate internal feedback against standards and to self-regulate their learning” (p. 11).

Also, Sadler (1989, p.121) argued that “information is only considered as feedback when it is used to alter the gap”. Therefore, lecturers should provide feedback on all formative assessment activities directed to students thereby making room for improvement in their learning. Additionally, Heritage (2010) concluded that feedback that helps learners to progress is ‘*central’* to formative assessment. Thus, lecturers through formative assessment, should involve students in *self-assessment* to determine how their learning is moving forward so that they can be active mediators in learning. Subsequently, students should engage with their lecturers to close the gap between what they currently understand and the preferred learning goals. Besides, feedback should be used by lecturers to make changes that will alter the gap between what students are currently learning and the desired goals (Heritage, 2010). This is aligned with findings from recent studies for online formative assessment (e.g., Bugg, 2013; Cornelius, 2013; Lin & Lai, 2013; Oneal-Self, 2015) that formative feedback closes the feedback loop.

Moreover, Voelkel (2013) conducted an action research project in an attempt to *combine the formative with the summative: the development of a two-stage online test to encourage engagement and provide personal feedback in large classes*. Voelkel (2013) developed and evaluated the *feasibility* and *effectiveness* of weekly online tests in higher education, using stages such as student evaluation, reflection and interventions. According to Voelkel (2013, p. 16) “the test design has the potential to significantly improve learning in classes of all sizes and can be a valuable tool for practitioners in a variety of disciplines”.

This information is necessary to understand lecturers’ perspectives on formative feedback and determine strategies in place for engaging students in their own learning through

online feedback. This study will further explore trends and developments in the online learning environments that particularly support the effective implementation of online formative assessment.

2.6 Trends in online formative assessment

Various developments in online learning, particularly those that support formative feedback, is noticeable. Research studies on the role of e-learning and online environments at the institutions of higher education have been conducted (Okur, 2011; Moore et al., 2011; Arkorful & Abaidoo, 2015). These studies have documented the effectiveness of using online learning and the role of e-learning in teaching and learning (Okur, 2011), highlighting the benefits and shortcomings associated with the implementation of e-learning in higher education (Arkorful & Abaidoo, 2015).

It is worth noting that formative assessment emerged through developments of e-learning environments, for instance, Moore et al. (2011) indicated that online and e-learning are terms that are commonly used 'synonymously' and 'interchangeably'. Moore et al. (2011) conducted a study in USA on the three learning environments which are e-learning, online learning, and distance learning. The study described different learning environment characteristics that make use of a collaborative learning environment such as an LMS for the delivery of online learning. The results collected through a survey indicated that LMS, Chat, Discussion Boards and Synchronous Video Conferencing are increasingly common characteristics of collaborative environments. The findings also suggested that lecturers should describe characteristics of instruction which are essential for demonstrating important components of the learning environments (Moore et al., 2011). However, Bennett (2011) concluded that "formative assessment is both conceptually and practically still a work-in-progress" (p. 21). This is somewhat contradictory to findings from current studies, which documented emerging educational technologies as success stories. For example, Spector (2013, p. 21) conducted a comprehensive analysis of *emerging educational technologies and research directions* with particular emphasis on *enablers* and *barriers* sustained as systemic success in the improvement of learning and instruction with new technologies. The analysis was based on two reports which are: a) *New Media Consortium's 2011 Horizon report* and b) *Roadmap for Education Technology*

Commission by the National Science foundation in 2010. The analysis further identified six trending technologies in different contexts for online learning namely 1) augmented reality 2) game-based learning 3) electronic books 4) mobile devices 5) gesture-based computing and 6) learning analytics. This study focused on the above-mentioned trends to understand how lecturers keep up with emerging technologies while embracing them in their online courses.

Spector (2013) recommended seven technology areas that were identified to significantly influence lecturers' practices on instruction for students' learning. The seven technology areas are: "user modelling, mobile tools, networking, serious games and intelligent environments, educational data mining and rich interfaces" (p. 24-25). These areas are necessary for lecturers to understand and identify those that are specific to the online learning environments and support formative assessment in their online courses. Similarly, Spector et al. (2016, p. 62-65) further documented a recent and comprehensive review on "new trends and directions in formative assessments in technology enhanced learning". The review was articulated into various themes that support *formative feedback mechanisms* which are:

- Formative feedback for problem-based and inquiry learning
- Formative feedback for e-portfolios
- Formative feedback to improve motivation and engagement
- Tools for complex learning
- Adaptive formative assessment
- Massive online formative assessment.

These themes are necessary to evaluate and benchmark lecturers' best practices for online formative assessment at HE institutions. In addition, the above themes are necessary to provide direction to lecturers when implementing formative assessment practices to support the 21st century skills for learning.

2.7 Online best practices

Studies related to online best practices have been conducted following the introduction of online courses in some HE institutions (DiPietro, Ferdig, Black, & Presto, 2010; Corry, Ianacone & Stella, 2014; Thompson & Braude, 2016). These studies documented online best practices to promote learning (Finch & Jacobs, 2012) focusing on online assessment

tools that enable lecturers to use web-based interface to assess students (Thompson & Braude, 2016) and measures for online best practices (Corry et al., 2014).

According to Wang (2006) best practices should be understood as benchmarks for quality online education. There is a need for benchmarking online best practices that support quality assurance for online formative assessment. The following five quality assurance practices for online assessment were identified by Wang (2006) namely: 1) learning effectiveness (LE) 2) access 3) student satisfaction (SS) 4) faculty satisfaction (FS) and 5) cost effectiveness (CE). However, Kearns (2012, p. 200) points out that online effective practices that lecturers should implement for effective formative assessments are not limited to "online discussions, written assignments, field work, quizzes, exams and presentations". Despite the relevance of the information emphasised above, this demonstrates that there is limited literature on best practices for online formative assessment. Hence, a need for the current study to investigate how lecturers implement formative assessment for best practices in the online environment.

Furthermore, Baran and Correia (2014) documented seven examples of practices that successful online teachers follow as identified by Baran, Correia and Thompson (2013) which requires to "(1) knowing and creating the course content (2) designing and structuring the online course (3) knowing the students (4) enhancing teacher-student relationships (5) guiding student learning (6) enhancing online courses (7) maintaining teacher presence" (Baran & Correia, 2014, p. 97).

In addition, Corry et al. (2014) documented three types of online best practice measures which are: 1) research validated: which means that findings from empirical studies can authenticate and confirm online best practices 2) field-tested: this can be attributed to practical evidence and 3) promising practices: based on lived experiences. These practices are necessary to measure lecturers' online best practices. Corry et al. (2014) conducted a *thematic analysis of understanding online teacher best practices to improve learning*. The findings suggested that emerging themes of teacher flexibility, personalized learning, innovation and globalization are necessary to provide a foundation for teachers to build their own specialized practices (Corry et al., 2014, p. 604). These findings are necessary and will provide guidelines to benchmark and determine lecturers' best

practices for online formative assessment at HE institutions, while taking into consideration some challenges that may affect the effective implementation of online assessment. In recent years, challenges associated with online assessment tools, particularly issues of access to internet, affordability and adoption of technology in general, are no longer perceived as challenges in HE institutions. This means that HE institutions are generally equipped with technologies and connectivity through unlimited internet access, which is free Wi-Fi supplied and accessible to all users.

Part B: Addressing Main RQ3

2.8 Challenges for online assessment

Studies associated with challenges for online assessments have been conducted in different contexts around the globe. These studies recommended that lecturers implement formative assessment practices while addressing learning situations that present difficult challenges through the use of technologies in the online learning environments (Kay & Lauricella, 2011; Spector, 2013; Kuikka, Kitola & Laakso, 2014). These studies documented challenges which are generally known and are typical for online assessment environments. Spector (2013) noted, however, that “internet access and supporting infrastructures are essential enablers of ongoing progress [technology-enhanced learning]. However, lack of such access becomes a barrier to progress” (p. 28). According to Spector (2013) this is believed to widen the digital divide.

Furthermore, Spector (2013) documented challenges that emerge from literature pertinent to online assessment. First “*critical challenges* associated with (a) digital media literacy (b) evaluation metrics (c) economic pressures and (d) resources, tools and devices”. Secondly, “*grand challenges* namely 1) personalizing education 2) assessing student learning 3) supporting social learning 4) diminishing boundaries 5) developing alternative teaching strategies 6) enhancing the role of stakeholders and 7) addressing policy challenges” (p. 22-24). Furthermore, Spector (2013) insisted that “challenges of developing appropriate evaluation metrics, along with associated assessments, are especially important in the sense that without such metrics, progress in any areas … [online learning] is merely speculative” (p. 22). These challenges are believed to have a

direct consequence on instruction for learning. This means that lecturers should have knowledge of identifying and addressing related challenges that can hinder the effective implementation of online formative assessment. This is particularly important as it will allow identified challenges to be addressed immediately.

These challenges are aligned with findings of Kearns (2012) which are interrelated with the implementation of online formative assessment. Kearns (2012), identified three main themes as challenges and concerns for the implementation of online formative assessment which are: “the impact of physical distance between instructor and students, adaptations resulting from the necessity of using technology to communicate with students, workload and time management” (p. 202). It must be noted that these challenges may have a direct impact and hinder effective implementation of online formative assessment.

Kuikka et al. (2014) conducted a survey and interviews with teachers at HE institutions in Finland. The findings reveal that teachers were concerned with the challenges associated with e-assessment and e-exams such as: ICT use (computer and IT skills), usability and adoption, quality of questions and copyright issues for question banks. These findings are necessary to understand how lecturers at HE institutions deal with challenges related to LMS and e-assessment systems. Thus, lecturers should identify, and address challenges associated with technology, infrastructure, human use and adoption for online learning that can hinder the implementation of formative assessment practices. As such, lecturers should also embrace the benefits associated with online formative assessment to sustain best practices in the online environments. However, benefits related to the implementation of formative assessment at HE institutions are not a direct focus of this study. Benefits are perceived and assumed to be associated with best practices and were highlighted throughout the discussion on the overview of formative assessment. Hence, themes that emerged from the literature as reviewed for this study are considered beneficial for lecturers when implementing formative assessment practices. Themes such as professional development and collaborative teaching are presented in section 2.9 below.

2.9 Emerging themes from the literature

Two themes emerged from the literature review pertinent to online formative assessment. In this study, the themes below are necessary to understand the preparedness of lecturers to implement effective formative assessment through collaboration as part of the professional development, while maintaining formative feedback in the online learning environment.

2.9.1 Professional development

The first theme that emerged was professional development. It is worth noting that, since the 19th century, professional development became a topic of interest in higher education (e.g., Boice, 1992; Guskey, & Huberman, 1995; Darling-Hammond & McLaughlin, 1995) and has gained popular interest from researchers with a keen interest in teacher education, training and evaluation (Guskey, 2002; Ebert-May, Derting, Hodder, Momsen, Long & Jardeleza, 2011; Mundy, Kupczynski, Ellis, & Salgado, 2012). Darling-Hammond & McLaughlin (1995) documented a number of characteristics for effective teachers' professional development, which are not limited to the following:

- "It must engage teachers in concrete tasks of teaching, assessment, observation and reflection that illuminate the process of learning and development.
- It must be grounded in inquiry, reflection and experimentation that are participant-driven.
- It must be collaborative, involving a sharing of knowledge among educators and focus on teachers' communities of practice rather than individual teachers.
- It must be connected to and derived from teachers' work with their students. It must be sustained, ongoing, intensive, supported by modelling, coaching, and a collective solving of specific problems of practice.
- It must be connected to other aspects of school change" (p. 1-2).

This information is necessary to understand the characteristics of teachers' professional development in relation to the literature for the purpose of evaluating specific and particular online courses at HE institutions. However, in recent years several empirical research studies were conducted to determine faculty perceptions of the usefulness for participation in the online teaching (Lian, 2014; Kennedy, 2015), through teachers' use of formative assessment (Johnson, 2015) and developmental initiatives, to address the

needs of lecturers teaching online (Baran, & Correia, 2014; Elliott, Rhoades, Jackson & Mandernach, 2015; Gehrke & Kezar, 2017).

Prior to that, Guskey (2002) documented five critical levels of evaluating teachers' professional development in an attempt to understand whether it makes a difference in improving students' outcomes. The identified levels evaluating professional development were: (1) "participant's reaction (2) participant's learning (3) organization support & change (4) participant's use of new knowledge & skills and (5) student learning outcomes" (p. 46-49). Thus, the five levels are essential and could be applicable at the university level, particularly the development of lecturers who are teaching online. Besides, "the quality of online programs in higher education is strongly correlated with how the professional development approaches respond to the needs of online teachers" (Baran & Correia, 2014, p. 96). Thus, the study proposed a framework for professional development required by lecturers when teaching online with three components, namely, 1) "*support at the teaching level* (technology, pedagogical, design and development) 2) *support at the community level* (communities of practice, peer observation and feedback) and 3) *support at the organizational level* (positive organizational culture, rewards & recognition)" (Baran & Correia, 2014, p. 97-100). The proposed professional development framework is necessary to understand the current practices at HE institutions which are pertinent and meaningful to support lecturers in all critical areas.

Subsequently, Johnson (2015) conducted a study in the US and proposed a guided Professional Learning Community (PLC) model for evaluating professional development of teachers' knowledge and use of formative assessment. Through a mixed method concurrent triangulation strategy, findings indicated that teachers' use of formative assessment is enhanced using a PLC. Consistent, convergence of findings from each method also revealed the following themes which are required for lecturers to enhance their professional development: (1) accountability (2) teacher learning (3) shared beliefs (4) designing instruction (5) teacher disposition (6) understanding the dimensions of the PLC and (7) desire to become a sustaining PLC (Johnson, 2015, p. 112-123). The conclusion by Johnson (2015) undoubtedly indicates the existing gap in the literature

pertinent to professional development for the effectiveness of formative assessment implementation through PLC. Hence, the conclusion below that:

> "The quantitative data showed no significant effect of the protocol-guided PLC model on teachers' use of formative assessment or on campuses becoming sustaining PLCs. However, the qualitative component of the study suggested that teachers using a protocol-guided PLC model of professional development established accountability to each other as a team, created collective knowledge, enhanced lesson design using formative assessment, and allowed for a deeper understanding of the dimensions of a PLC (Johnson, 2015, p. 131).

Furthermore, interpretations derived from the above conclusion by Johnson (2015) is necessary for this study, in that it clearly demonstrates a need for a qualitative study that evaluates teachers' professional development within the PLCs. Consequently, teachers with no support from PLC may not effectively implement formative assessment in the online environment. This means that, if teachers are not working together in making collective decisions and sharing strategies to enhance their lessons, they are often likely to engage in individual teacher activities which are not part and parcel of the PLC dimensions. This is supported by Sinha, Rosson, Carroll, and Du, (2010) who assert that "PLC is a community specifically oriented to teachers' professional development based on the assumption that knowledge is situated in the everyday life experiences of teachers and that actively engaging the teachers in PLCs will result in an increase in their professional knowledge as well as student learning" (p. 2392).

In addition, Kennedy (2015) reported findings of positive relationships between years of online teaching experience, overall online teaching satisfaction, satisfaction with instructor-student interaction and satisfaction with student-student interaction. Kennedy (2015) conducted a study with 540 participants from two institutions in the US. Kennedy (2015) further documented three predictors of faculty beliefs that professional development "increases satisfaction with online teaching: (1) willingness to participate in formal development (2) satisfaction with online support for online teaching and (3) perceptions of the usefulness of formal professional development" (p. 82).

These findings are also aligned with Lian (2014) who documented three major findings from Faculty Professional Development (FPD) which are: (1) relationships between faculty demographics, motivation, perceived values, usefulness of FPD activities (2)

faculty motivation and perceptions about FPD and (3) there are positive relationships between faculty motivation, perceived values and usefulness of FPD (p. 137-146). Further, Lian (2014, p. 156) recommended the implementation of faculty needs assessment that may assist FPD providers to understand faculty needs, challenges and perceptions and value of the usefulness of the FPD activities. Also, Lian (2014) emphasised that collaboration between departments and institutions can provide more opportunities to learn best practices, share limited resources and faculty expertise.

Furthermore, Roy and Boboc (2016, p. 285) noted that professional development in an online setting should mean that:

- Teachers understand what it means to teach online, the associated competencies and skill sets, as well as the rewards and challenges of instruction in virtual learning environments;
- Teachers need to be proactively involved in their own learning process so that they are equipped with competencies and skill sets and are expected to facilitate student learning by being able to understand learning from students' perspectives;
- The design and purpose of online formative assessment is to support and empower online teachers as well as raise the performance levels of both the educators and their students.

Roy and Boboc (2016) conducted a basic interpretive qualitative research that focused on the professional development needs of K-12 online teachers in Ohio. The findings through the developed professional development program based on teachers' recommendations identified four themes that emerged through coding teachers' responses: (1) teacher qualities (2) technological competence (3) collaboration and (4) experiencing online learning as a student (Roy & Boboc, 2016, p. 297-299). Despite the limitation of the designated teachers' professional development program, the findings are necessary to understand how lecturers view professional development at HE institutions. Hence, the conclusion below is important to support the purpose of this study in that:

> "There is a need for continuous professional development and reinforcement because of the novel and unique nature of online teaching in terms of instructional strategies, student-teacher interactions and the medium of teaching itself". While most of the online teachers have face-to-face teaching experience and have mastered these learned experiences and problem-solving skills … [however] these face-to-face teaching skills may not be compatible to online learning environments … [therefore] there is a need to equip teachers with an understanding of student-

> teacher interactions and challenges that arise due to the distance caused by the medium of instruction" (Roy & Boboc, 2016, p. 300).

In a recent qualitative research study (Rios-Parnell, 2017), examined how instructors that receive PTechD perceive their level of preparedness. Thus, "technological development is defined as training related to the LMS used by the academic institutions and educational technologies to enhance the teaching-learning process" (Rios-Parnell, 2017, p. 156). Results revealed the effectiveness of PTechD as it allows lecturers to teach online. Rios-Parnell (2017), caution that although participants perceived effectiveness of PTechD, "it is important to remember that the participants see PTechD as the only technological training they received to improve the use of LMS to deliver the online instruction" (p. 148). Although the PTechD was developed for the remote adjunct instructors, findings are necessary to understand the types of online professional development programs that are available for lecturers at HE institutions.

2.9.2 Collaborative teaching

The second theme was collaborative teaching which is believed to have emerged through professional development initiatives. Some scholars documented related information on collaboration in the context of education and have focused on collaborative learning (Goodsell, 1992; Bruffee, 1993), cooperative learning (Millis & Cottell Jr, 1997) and faculty collaboration (Austin & Baldwin, 1991; Allen, 2004; Sinha, Rosson, Carroll & Du, 2010) among others. Other scholars discussed collaborative teaching within the following contexts pertinent to teachers' professional development which are: (a) community of practice (COP) (b) Professional Learning Community (PLC) and (c) Continuous Professional Development (CPD) just to mention a few (Blanton & Stylianou, 2009; Sinha et al., 2010; Dietrich, 2015; Rios-Parnell, 2017).

Regrding teaching and learning, collaboration has been a topic of discussion in the field of education. Austin and Baldwin (1991) noted that collaboration generally follows a common pattern and identified four basic stages that each effective collaborative team is likely to go through but are not limited to the following: "(1) choosing colleagues or team members (2) dividing the labour (3) establishing work guidelines and (4) terminating a collaboration" (p. 6). In addition, a description below by Goodsell (1992) elaborates the

characteristics of collaborative learning and teachers' expectations in harnessing effective collaborative learning which will therefore provide a theoretical background in that:

> "Collaborative learning holds enormous promise for improving student learning and revitalizing college [university] teaching. Teachers inevitably face fundamental questions about the purpose of their classes, teacher and student roles, responsibilities, the relationship between educational form and content and the nature of knowledge itself." (p. 10-11).

Subsequently, in an attempt to assess academic programs in higher education (Allen, 2004) developed a curriculum that aligned faculty collaboration and teacher autonomy. Allen (2004) indicated that "individual faculties should find ways to meet learning objectives that are consistent to their own, their students' teaching and learning styles, [thus] faculties who foster similar learning objectives should be encouraged to compare notes on the effectiveness of the strategies they employ" (p. 47). Although, the documented information addresses relevant aspects of collaboration amongst faculties, there is limited information that represents collaborative teaching in the online environment. This means that it is necessary for the present study to further investigate how lecturers enhance effective collaboration and engagement through the community of practice within their institutions and other organizations.

However, in recent years scholars documented various professional development communities for teachers. Sinha et al. (2010) documented some comprehensive descriptions of literature on key concepts for teacher community based on the identified five themes which are: (1) Communities of Practice (COP) (2) professional communities (3) Professional Learning Community (PLC) (4) Teacher Professional Development (TPD) and (5) Online Teacher Professional Development (OTPD). According to Sinha et al. (2010) some PLC may exist and operate through the support of online services and activities known as Virtual Learning Community (VLC) and Online Learning Community (OLC). Also, they added that the online modes for TPD parallel three methods which are grouped as: online courses, online communities and self-directed learning (p. 2391-2393). This means that lecturers can enrol for online courses, engage with colleagues and participate in self-directed learning to improve their professional growth in the online learning environment. Sinha et al. (2010) concluded that "while it is clear that those

various features can help with teachers' professional development, yet how effective these various features are, is still uncertain. It is important for teachers and practitioners to understand from teachers' perspectives what they like about these various features and which is more effective than others" (Sinha et al., 2010, p. 2395). They further recommended that research should address how professional development could be grounded to the local context (Sinha et al., 2010).

This study tried to identify which communities are more specific to higher education and how lecturers collaborate with other teachers in those communities. Furthermore, studies on faculty collaboration in the online environment have been conducted in higher education thus focusing on the benefits of Google Apps Education Edition (Cahill, 2011), Virtual Collaborations Lived Experiences (Schieffer, 2014) and the use of academic technologies through collaboration (Hudson, 2010) with a particular emphasis on co-teaching (Lock, Clancy, Lisella, Rosenau, Ferreira, & Rainsbury, 2017).

Hudson (2010, p. 141) documented three categories as characteristics of effective collaboration which are: (1) expressed on the level of *individual staff* (2) part of the *institutional structure* (3) features of *collaborative relationship* themselves. According to Hudson (2010):

> "characteristics of collaborative relationship that support the development of successful partnership include the importance of the collaboration being driven by substance rather than a vague desire to work together, a shared vision of what the goals for the collaboration are, mutual respect between the partners, and both the horizontal and vertical alignment across the organization in terms of the goals of the project and means for accomplishing it" (p. 141-142).

In a recent study, Lock et al. (2017) defined co-teaching as "two instructors who teach by providing simultaneous instruction to a large group of students in a course over a period of time" (24). Lock et al. (2017) described that "co-teaching requires careful attention in the development and fostering of collaborative relationship, as well as a commitment on the part of the co-teachers to facilitate robust learning experiences for students' learning" (p. 25). The results collected through pre-and post-students' surveys, individual and focus group interviews revealed five emerging themes which are "(1) elements of co-teaching (2) previous relationship impact on co-teaching (3) nurturing a collaborative pedagogical relationship (4) learning from the co-teaching experience and (5) identifying and

addressing challenges of co-teaching" (Lock et al., 2017, p. 27-30). This information is useful to identify co-teaching approaches and strategies that lecturers at HE institutions employ in the online learning environment through effective collaboration for best practices.

Part C

2.10 Literature related to methodology

As highlighted earlier, the literature review for the present study revealed that recent studies on formative assessments in higher education addressed a range of issues using different strategies. Most recent work on the topic has been conducted in college and university education respectively (Dietrich, 2015; Thompson & Braude, 2016; Lock et al., 2017).

Recent studies conducted in higher education applied mixed methods with large surveys and group interviews to investigate the implementation of formative assessment and teachers' professional development (Johnson, 2015; Domínguez, 2016; Lock et al., 2017; Rios-Parnell, 2017). Furthermore, most of the qualitative study conducted focused on online assessment and teachers' professional development for K-12, (e.g., Roy & Boboc (2016) conducted a basic interpretive qualitative research using survey methods.

Some studies applied phenomenology research to study the lived experiences of online instructors implementing formative assessment (Koh, 2010; Oneal-self, 2011; Dietrich, 2015; Kennedy, 2015). Although interviews were conducted with online instructors to share their lived experiences, the findings are limited to the participants' experiences and were not validated through observations of online courses, LMS and available relevant documentation as evidence for the implementation of online formative assessment. Most research studies published for online formative assessment focused on a systematic review of empirical studies (Gikandi et al., 2011; Spector, 2013; Fook & Sidhu, 2014; Spector et al., 2016; Vlachopoulos, 2016).

2.11 Chapter summary

This chapter examined literature pertinent to online formative assessment practices. The present literature review has demonstrated that there is broad information regarding assessment in higher education, and not specific to lecturers' implementation of formative assessment in the online learning environment. Research studies reviewed and documented strategies and tools that lecturers can employ when implementing formative assessment practices. Formative assessment strategies have been shown to promote formative feedback (Lin & Lai, 2013; Voelkel, 2013). Furthermore, formative assessment also supported the use of emerging tools as trends in higher education for best practices (Spector, 2013; Corry et al., 2014; Spector et al., 2016). With the benefits of formative assessment being many, formative feedback has become the topic of interest. Specific themes emerged from the literature and have revealed the importance of professional communities and collaboration for lecturers as part of the professional development that will enhance the effective implementation of online formative assessment. However, little is known about how lecturers implement formative assessment for best practices. Additionally, little research has been conducted on formative assessment at the institutions of higher education. Therefore, documenting lecturers' best practices will contribute literature pertinent to the academic discourse. Challenges that can hinder the implementation of formative assessment practices were noted.

The next chapter 3 explains and rationalizes philosophical assumptions. The chapter will discuss the conceptual framework underpinning this study. Related frameworks are discussed to highlight concepts that are pertinent to the current study.

CHAPTER THREE: PHILOSOPHICAL ASSUMPTIONS AND CONCEPTUAL FRAMEWORK

3.1 Introduction

The philosophical assumptions for this study and the conceptual framework adapted are presented in this chapter. Further, a discussion of the TPACK framework and Bloom's revised taxonomy is presented in order to understand the conceptual framework adapted for this study. This is followed by an explanation of related models relevant for online assessment. Subsequently, the chapter ends with a conclusion.

3.2 Philosophical assumptions

The current study is guided by the constructivism theory as a paradigm to understand that lecturers are individuals who can create their own realities and beliefs to make individual and social meaning out of what they subjectively experience (Lincoln & Guba, 1985). This means that, lecturers could construct their own knowledge individually and collectively. Thus, several assumptions were made in the research process:

- Lecturers understand the concept of online formative assessment.
- Lecturers responded fully and honestly to all interview questions and have provided the scope of their experiences assessing students online. Hence, it was further assumed that lecturers have acquired a Masters' degree in education, have taught or assessed students in an online environment for a minimum period of 12 months.
- Lecturers are fully aware of their assessment practices and the impact of these practices on students' learning and instructional decisions. Thus, it was assumed that they constructed their own knowledge about assessment in the online instruction.
- Lecturers understand the Technological Pedagogical Content Knowledge (TPACK) framework and have knowledge of incorporating Bloom's revised taxonomy when designing and developing formative assessment activities.

3.3 Constructivism theory

Constructivism is a theory about knowledge and learning (Von Glasersfeld, 1998). Constructivism has been in education since the 18th century with roots in the work of Socrates through directed questions. Initially the constructivism theory originated from the work of ancient theorists, namely: Jean Piaget, John Dewey and Lev Vygotsky who documented that constructivism explains the nature of knowledge and how human beings learn (Von Glasersfeld, 1995). This notion is based on the idea that through individual experience people ought to construct their own perspective of the world (Mergel, 1998).

Fosnot (2013) noted that constructivism describes both *what knowing* is and *how* one comes to *know*. According to Ültanir (2012) constructivism "maintains that individuals create or construct their own new understanding or knowledge through the interaction of what they already believe and the ideas, events and activities with which they come into contact" (p. 195). Richards and Glasersfeld (1980) noted that Piaget focused on progressive education as the evolution of constructivism that shaped the foundation for individual cognitive constructivism. According to Hsueh (1997), Dewey engaged in sustained inquiry as a key part of social constructivist learning. Thus, the idea of progressive education was contributed which allows teachers to act as facilitators and students to become socially engaged (Von Glasersfeld, 1995).

Other theorists supported and extended the constructivism theory: David Ausubel (1963), Jerome Bruner (1990), and Seymour Paperts (1991), Von Glasersfeld (1995), Semenov (2017). These theorists documented aspects of curriculum change with emphasis on learning in that through active social change and based on current knowledge, students construct new ideas (Bruner, 1990). Constructivism is divided into two spectrums namely (1) individual cognitive constructivism (Piaget) which focused on radical constructivism (von Glasersfeld, 1991, 1995, 1998, 2002) and (2) social constructivism (Dewey, Vygotsky) which was further developed into cultural constructivism and critical constructivism (Phillips, 1995). Hence, constructivism is concerned with individual or social construction of knowledge. The current study focused on cognitive and social constructivism to understand *how* lecturers construct, create, invent and develop their own knowledge and meaning (Fosnot, 2013) individually and collectively (Phillips, 1995).

Accordingly, individuals construct meaning from the interaction between existing knowledge and social circumstances (Alt, 2015). This means that lecturers constructed online courses and developed formative assessment activities, individually and collectively, through professional engagements with colleagues. Therefore, the current study focused on the social constructivism, in that lecturers collaboratively and cooperatively developed formative assessment activities in the online learning environment for best practices.

3.3.1 Constructivism and interpretivism

The constructivism paradigm is part of the interpretivism philosophy (Willis, 1995; Schwandt, 1994). Constructivists believe that reality needs to be interpreted. Interpretivism is concerned with meanings and experiences of human beings (Willis, 1995; James, 2006; Pritchard, 2013). This means that people are more involved in interpreting the world around them. Thus, aiming for interpretation and understanding in that lecturers are individuals who can construct their own new understanding through interacting with each other (Schunk, 2015; Ültanir, 2012). Interpretivism remains central to this study in that it is necessary to understand how lecturers interpret online formative assessment. Thus, lecturers should be able to construct their own understanding when implementing formative assessment practices and interpret the importance of providing feedback.

3.3.2 Cognitive and social constructivism

Numerous researchers (Beukes-Amiss, 2011; Dietrich, 2011; Oneal-Self, 2015; Bennett et al., 2017) have also used social and cognitive constructivism as a lens to understand lived experiences of online teachers. These studies assumed that although individuals may create their own knowledge, it requires collective experience through social interactions. As the then new perspectives to constructivism learning theory Vygotsky (1987) proposed the Zone of Proximal Development (ZPD) as a key aspect of social constructivism. According to Vygotsky (1987, p. 86) “ZPD is the distance between the actual development level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers”. Vygotsky maintained that all learning results from

social interaction through communication, activity and interactions with others (Phillips, 1995; Vygotsky, 1987; Von Glasersfeld, 2002). Furthermore, Anderson (2016, p. 38) noted that all forms of constructivism "share the understanding that, individuals' construction of knowledge is dependent upon individual and collective understanding, backgrounds, and proclivities. Debates arise however, as to the degree to which individuals hold common understanding". This means that, lecturers' social interaction should provide exploration, thinking and reflection through teaching methods and experience (Jansen & van der Merwe, 2015). In this study, lecturers socially interact to share resources and information when developing online formative assessment activities.

3.3.3 Constructivism and Higher Education

In the context of achieving 21st century skills, lecturers should construct their own formative assessment activities using social constructivism as a strategy to address the complex factors surrounding educational technology at HE institutions (Bennett et al., 2017). Thus, lecturers are perceived to construct formative assessment activities through collaborative processes in knowledge building (Dietrich, 2011; Oneal-Self, 2015). This means that lecturers can construct new understandings of assessment activities from information of their own ideas and beliefs. Lecturers' roles in constructive education should be to: (1) provide active participation (2) provide dialogue (3) provide real situations for learning where students can form their own explanations and discoveries and (4) guide students to learn and develop content (Von Glasersfeld, 2002; Fosnot, 2013).

Furthermore, lecturers should allow students to construct new knowledge based on their experience through social interaction and collaboration (Pailly, 2013). Besides, Pailly (2013, p. 40) noted the following pedagogical goals from the constructivism perspectives in education necessary to: "embed learning in realistic and relevant contexts, embed learning in social experience, provide experience with the knowledge construction process and encourage self-awareness in the knowledge construction process".

For instance, lecturers should ensure that learning is facilitated in a reliable and actual environment to encourage social cooperation and consideration when providing information for students within a framework of the students' prior knowledge

(Bhattacharjee, 2015). This is necessary in the online education for lecturers to apply the constructivism perspectives particularly with the implementation of formative assessment.

In addition, Pailly (2013) synthesised, summarised and presented 18 characteristics of constructivist learning and teaching identified through theorists in the constructivism paradigm. These characteristics are necessary for lecturers to consider when developing online formative assessment activities, while providing feedback for best practices in the online learning environment. The following six characteristics are necessary for the current study:

1) Learning situations, environments, skills, content and tasks are relevant, realistic, and represent the natural complexities of the 'real world'.
2) Activities, opportunities, tools, and environments are provided to encourage meta-cognition, self-analysis, -regulation, -reflection and -awareness.
3) The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.
4) Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition.
5) Collaborative and cooperative learning is favoured in order to expose the learner to alternative viewpoints.
6) Assessment is authentic and interwoven with teaching" (Pailly, 2013, p. 39).

The above-mentioned six characteristics are necessary to understand how lecturers implement online formative assessment at HE institutions. These characteristics are important in that they will provide guidelines for evaluating various online courses and formative assessment activities.

3.3.4 Constructivism and online education

The constructivism approach in online pedagogy supports learning environments that are authentic and have connection to real world experiences (Ruey, 2010). Wang, Hou & Wu (2017) noted that virtual access to collaborative technologies can provide support for students engaging with lecturers that are experts. Students are given the opportunity to recognise and select learning goals, identify learning goals, inquire about their performance, keep track of their progress while putting their ideas and that of others into consideration and connect with others, communicate with others, inside and separate from the online learning community (Dietrich, 2011; Oneal-Self, 2015; Bennett et al., 2017). In addition, the use of technology tools like computers can facilitate the

implementation of strategies that can be challenging for constructivists to realise using other means of learning (Wang, 2008; Ruey, 2010). In a constructive learning environment, students come with what they previously know and experience, to construct knowledge individually or as a group in different ways. This is achieved by the use of tools and other resources considering their circumstances (Wang et al., 2017; Pailly, 2013). Cognitive tools allow students to identify multiple perspectives through self and peer assessment as part of the evaluation process (Bennett et al., 2017). Whereas, through the process-based evaluation, lecturers can understand and engage students to assist them in their progress as they develop new skills (Wang et al., 2017).

3.3.5 Implications of constructivism theory

Implications are discussed based on various questions the researcher had when conducting the present study which are concerned with (1) ontological questions (2) epistemological questions and (3) methodological questions. To understand how lecturers implement online assessment at HE institutions, the researcher asked several questions concerning the implications of constructivism, with the assumption that lecturers construct knowledge individually and collectively. The notion of knowledge construction is also noted by Phillips (1995, p.5) that:

> "These days, we do not believe that individuals come into the world with their 'cognitive data banks' already pre-stocked with empirical knowledge, or with pre-embedded epistemological criteria or methodological rules. Nor do we believe that most of our knowledge is acquired, ready formed, by some sort of direct perception or absorption".

3.3.5.1 Ontology

Therefore, considering the two key questions: What is the form and nature of reality? and what is there that can be known about it? (Willis, 1995). The above questions are necessary to understand the notion that lecturers can construct formative assessment activities. If online formative assessment activities are assumed, then what can be known about assessing students online? (James, 2006). How do lecturers implement the online formative assessment? Do lecturers develop and construct formative assessment activities at HE institutions? These questions are necessary to understand how and why lecturers implement online formative assessment at HE institutions for best practices.

3.3.5.2 Epistemology

The ultimate question to consider is: What is the relationship between the knower and what can be known? (Ültanir, 2012). This means that the relationship between lecturers and the construction of online formative assessment should be established. Consequently, the study assumed that lecturers have knowledge of developing online formative assessment activities individually and collectively. However, the relationship between lecturers and what they need to know about designing online formative assessment to support the 21st century skills, can be impacted by the nature of knowledge (Bennett et al., 2017; Wang et al., 2017) in that, lecturers' previous knowledge of online assessment can impact what they need to know about the implementation of online formative assessment.

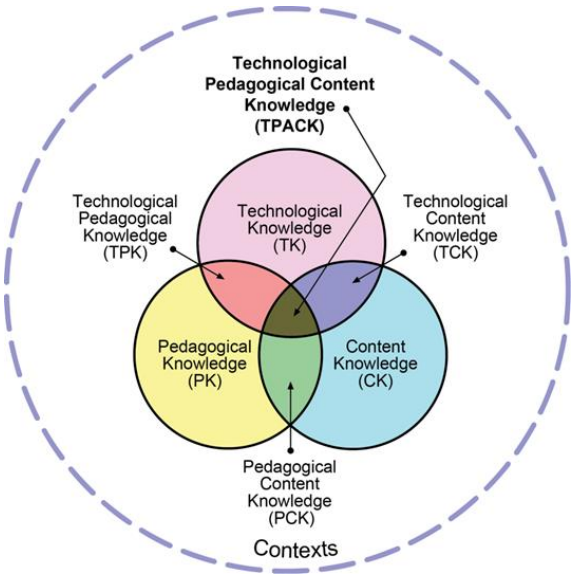
This means that lecturers' knowledge of constructing online formative assessment activities, can be impacted by their knowledge of implementing strategies for online formative assessment. Thus, lecturers should establish and understand the relationship between formative assessment activities and the implementation process for online best practices.

3.3.5.3 Methodology

How can the inquirer go about finding out what is believed to be true? What are various methods that lecturers can use to support constructivist learning and teaching? (von Glasersfeld, 2001; Phillips, 1995; Pailly, 2013). This information is necessary to understand different methods that support the implementation of online formative assessment at HE institutions. For this study, the methods used to identify meanings and new knowledge constructed by lecturers when implementing online assessments, are further discussed in the next Chapter 4.

3.4 TPACK framework

This study adopted the TPACK framework which was developed by Mishra & Koehler (2006) from Shulman's PCK (1986, 1987). Mishra & Koehler (2006, p. 1028) further developed the TPACK framework to focus on "complex interactions between a teacher's knowledge of content, pedagogy, technology and the subsequent intersections with seven components". Figure 3.1 below represents seven components of the TPACK framework. It is worth noting that lecturers should understand the joining of these three knowledge types as an innate understanding of teaching content with appropriate pedagogical methods and technologies (Mishra & Koehler, 2006).



Source: *http://tpack.org*

Figure 3.1 Components of the TPACK framework: Intersections

Figure 3.1 shows that lecturers can use the relationship between technology and pedagogy to identify appropriate tools for online assessment. Thus, content combined with activities and tools will yield TPACK. Furthermore, the seven components of the TPACK framework are presented in Table 3.1 below to help understand the concepts and their meanings (Mishra & Koehler, 2006, Koehler & Mishra, 2009; Koehler, Mishra & Cain, 2013).

Table 3.1 The seven components of the TPACK framework and their meanings

Concept	*Meaning*
1. Technology knowledge (TK)	Knowledge about various technologies, ranging from low-tech technologies, such as pencil and paper, to digital technologies, such as the Internet, digital video, interactive whiteboards, and software programs.
2. Content knowledge (CK)	Knowledge about the actual subject matter that teachers must know about to teach.
3. Pedagogical knowledge (PK)	Knowledge about the methods and process of teaching such as classroom management, assessment, lesson plan development and student learning.
4. Pedagogical content knowledge (PCK)	Knowledge that deals with the teaching process not limited to planning, implementation, evaluation and revision.
5. Technological content knowledge (TCK)	Knowledge of how technology can create new representations for specific content.
6. Technological pedagogical knowledge (TPK)	Knowledge of how various technologies can be used in teaching.
7. Technological pedagogical content knowledge (TPACK)	Knowledge required by teachers for integrating technology into their teaching in any content area. Teachers who have TPACK, act with an intuitive understanding of the complex interplay between the three basic components of knowledge (CK, PK, and TK).

Source: Mishra & Koehler (2006)

Table 3.1 represents seven components of the TPACK Framework that lecturers should understand as part of the instructional design. Thus, lecturers can use TPACK to plan an effective online assessment activity for a class of diverse students. This is necessary for lecturers when implementing online formative assessment activities.

Considering that the use of TPACK framework determines the unique and interactive roles that content, technology and pedagogy play in the online teaching and learning environments (Koehler & Mishra, 2009; Baran, Chuang & Thompson, 2011; Mishra, Koehler & Henriksen, 2011; Koh, Chai & Tay, 2014), the researcher adopted and adapted four of the seven components from the TPACK framework to understand online lecturers' best practices. Furthermore, Table 3.2 below summarized the four relevant components

that were used as a lens to understand lecturers' practices that may address the pedagogical foundations for online assessments. In this study, the concepts should thus be understood as follows.

Table 3.2 The four components from the TPACK framework adopted in this study

Concept	*Meaning*
TK	lecturer's knowledge about technology tools for online assessment platforms.
TCK	lecturer's knowledge to consider the effect of technology and content on the development of online assessment activities.
TPK	lecture's knowledge of teaching using various technologies considering changes in settings and motivations for online assessment.
TPACK	lecturer's knowledge and ability to integrate technology, pedagogy and content into online assessment practices.

Several researchers (Chai, Benjamin & Hong, 2015; Herring, Meacham & Mourlam, 2016; Tsai, Koh & Chai, 2016; Ouyang & Scharber, 2018) have used TPACK as a framework to develop a measurement model (Chai et al., 2013; Tsai et al., 2016) and TPACK instruments (Pamuk, Ergun, Cakir, Yilmaz & Ayas, 2015) to identify the gap in the existing TPACK research (Koh et al., 2016).

Thus, literature points to a need for lecturers to understand how the TPACK framework can be linked to online assessment (Rodríguez-Gómez & Ibarra-Sáiz, 2015; Herring et al., 2016; Yeh, Hsu, Wu & Chien, 2017; Ouyang & Scharber, 2018). The TPACK framework can assist lecturers in the development and design of formative assessment activities using technology to understand the implementation of professional knowledge in their online practices (Koehler et al., 2013; Mishra et al., 2016). This information is relevant to understand lecturers' online activities when implementing formative assessment.

3.4.1 Technology Knowledge (TK)

In this study, lecturers TK was determined through the definition of TK as per the reviewed literature. Koehler et al. (2013) recognised that defining TK can be difficult in that it is always in a state of change. This means that definitions related to TK are likely to become outdated due to emerging technologies. Thus, the closely related definition of TK "requires a deeper more essential understanding and mastery of information technology for information processing, communication, problem solving, and open-ended interaction with technology" (Koehler et al., 2013, p. 15). The above definition of TK was necessary to guide the researcher in the identification of lecturers with TK.

3.4.2 Technological Content Knowledge (TCK)

In this study, it was necessary to understand lecturers' development of TCK when implementing the online formative assessment. Lecturers with TCK possess an understanding of the manner in which the use of technology and content can influence and constrain each other in the implementation of formative assessment (Baran et al., 2011; Benson & Ward, 2013). Although lecturers are experts in their subject content, they are required to have a deep understanding of changing assessment content to make it suitable and supported by various technologies available for online assessment (Herring et al., 2016; Yeh et al., 2017; Ouyang & Scharber, 2018).

3.4.3 Technological Pedagogical Knowledge (TPK)

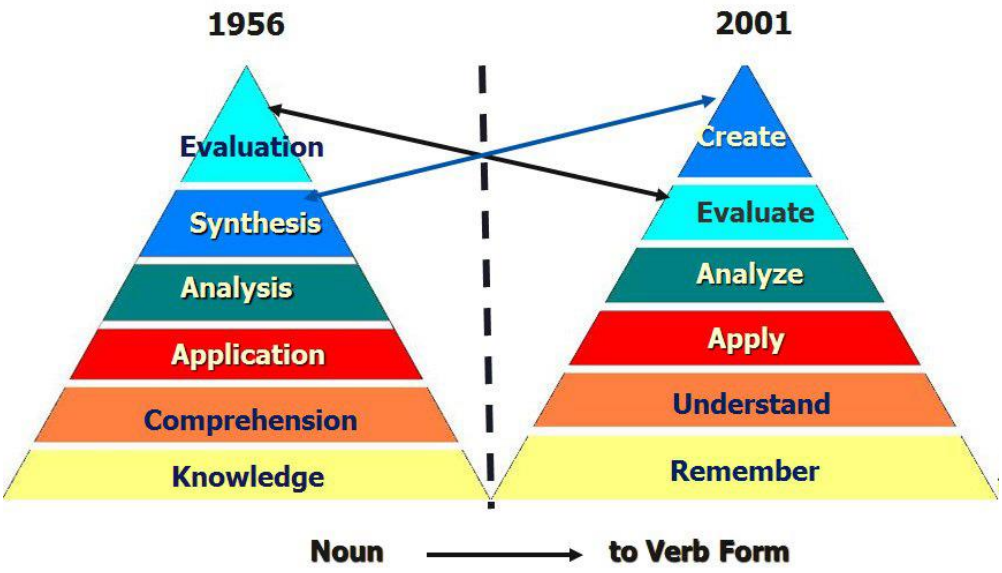
In this study, it was necessary for the researcher to determine lecturers' TPK. Thus, the description of TPK below will guide the researcher to understand what constitutes TPK for lecturers at the selected HE institutions. TPK requires lecturers to possess an understanding of changing teaching and learning methods when using technologies in a certain way (Koehler et al., 2013). To build TPK lecturers need to develop and design suitable pedagogy, strategies and techniques to support the implementation of online formative assessment practices. Thus, they need a deeper understanding of the limitations and accessibility of technologies for online assessments (Mishra, Koehler & Herring, 2016; Brouwer, Dekker, & Pol, 2017). Electronic Pedagogical Knowledge (ePCK) is necessary for online assessment (Herring et al., 2016; Mishra et al., 2016; Ouyang & Scharber, 2018).

3.4.4 Technological Pedagogical Content Knowledge (TPACK)

TPACK is considered a professional knowledge construct (Koehler et al., 2013). Lecturers should have extensive knowledge of understanding content, pedagogy and technology as interrelated constructs (Mishra et al., 2016). This study describes how lecturers create TPACK through formative assessment design and development in the online environment (Koh et al., 2015; Mishra et al., 2016).

3.5 Bloom's Revised Taxonomy

This study adopted the Revised Bloom's Taxonomy (RBT) developed by Anderson and Krathwohl (2001). The RBT is based on the original Bloom's taxonomy presented in 1956 by Benjamin Bloom. The taxonomy is founded on the behaviourist theory that classified the learning behaviour into three main domains: psychomotor, attitudinal and cognitive (Bloom & Krathwohl, 1956). In Bloom's taxonomy, the thinking skills are further classified into six cognitive levels of complexity which are: knowledge, comprehension, application, analysis, synthesis and evaluation (Bloom, 1956; Forehand, 2010; Anderson & Krathwohl, 2001). This study focused on the cognitive knowledge domain with particular emphasis on lower-order thinking skills and higher-order thinking skills (Anderson & Krathwohl, 2001). Furthermore, the RBT categorised the levels of thinking as: remember, understand, apply, analyse, evaluate and create from simple to complex and from noun to verbs respectively (Anderson & Krathwohl, 2001). Figure 3.2 below shows changes in the terminology between the old and new versions (Bloom's taxonomy, 1956 and RBT, 2001) respectively.



Source: https://thesecondprinciple.com/teaching-essentials/beyond-bloom-cognitive-taxonomy-revised/

Figure 3.2 Bloom's taxonomy terminology changes

Figure 3.2 above presents a graphic illustration of the *new verbs* from RBT linked with the *nouns* from the original Bloom's taxonomy. It shows how the original nouns were changed to verbs (e.g., comprehend to understand) to indicate changed levels of the taxonomy. Some levels are basically swapped (e.g., evaluation moved from the top and changed to evaluate while synthesis moved to the top and changed to create in the new version). This information is necessary for lecturers to understand when developing assessment activities that meet the 21st century skills.

Furthermore, the RBT levels with associated verbs are explicitly documented in the literature (Krathwohl, 2002; Churches, 2008; Forehand, 2010; Cannon & Feinstein, 2014; Scully, 2017). Studies focused on the use of RBT to develop course-based learning activities at HE institutions (e.g., Cocklin, 2005; Amer, 2006; Forehand, 2010; Boles, Wageeh, Goncher, Andrea & Dhammika, 2015; Irvine, 2017; Scully, 2017). These researchers documented the application of the RBT to the development of business simulations and experiential learning (Cannon & Feinstein, 2014), focusing on concept inventory assessment (Boles et al., 2015) and developmental views and perceptions for teaching and learning with technology (Forehand, 2010). Also, Scully, (2017) documented

information on the use of RBT by lecturers in the development of multiple choice as a questioning technique to measure a student's ability to demonstrate higher-order thinking skills.

A review that compared the RBT and Marzano's New Taxonomy of Learning Irvine (2017) noted the lack of research references to the RBT in contrast to the original Bloom's taxonomy (old version) thus encouraging the use of RBT in education to create educators' awareness. Irvine (2017) concluded that studies should further investigate the explicit inclusion of the feedback loop in the RBT. Hence, the current study investigated lecturers' implementation of formative assessment practices at HE institutions focusing on the provision of feedback.

Table 3.3 below summarizes the concept and meaning in the RBT that lecturers should consider when developing formative assessment activities at HE institutions.

Table 3.3 New terminologies for the RBT

Concept	*Meaning*
Remembering	Recognizing, retrieving, and recalling relevant knowledge from long term memory.
Understanding	Summarizing, constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, inferring, comparing and explaining.
Applying	Carrying out or using a procedure through executing or implementing.
Analysing	Breaking material into constituent parts, determining how the parts relate to one other and to overall structure or purpose through differentiating, organizing and attributing.
Evaluating	Making judgements based on criteria and standards through checking and critiquing.
Creating	Putting elements together to form a coherent or functional whole; organizing elements into a new pattern or structure through generating, planning or producing.

Source: Anderson & Krathwohl (2001, p. 67-68)

The information is necessary to understand how lecturers incorporate the RBT in the development of online formative assessment activities.

In addition, Table 3.4 below summarizes common examples of verbs identified in the literature that can be used by lectures in the development of formative assessment activities. Consequently, there have been inconsistencies in researchers' interpretations of where lower-order 'ends' and where higher-order 'begins' (Scully, 2017).

Table 3.4 The 21st century assessment

Concepts	*Examples of verbs*
Higher-order Thinking Skills	
Creating	design, plan, combine, develop, devise
Evaluating	action, judge, review, critique, assess
Analysing	compare, analyse, differentiate, order
Applying	classify, experiment, calculate, construct
Understanding	comment, discuss, explain, exemplify
Remembering	list, state, identify, describe, tabulate
Lower-order Thinking Skills	

Source: Churches (2010, p. 4-6).

The RBT is necessary to understand 21st century skills lecturers possess, in that it supports their perceptions in the development of online activities for teaching and learning to support the tools for assessment (Churches, 2008). Thus, lecturers can develop assessment activities that assess students' levels of the knowledge dimensions namely: factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge (Anderson & Krathwohl, 2001). Besides, the relationship between knowledge dimensions and the cognitive process was further elaborated with the addition of metacognition to the revised version (Anderson & Krathwohl, 2001; Krathwohl, 2002, Churches, 2008).

Table 3.5 represents knowledge dimensions that lecturers should understand when developing assessment activities.

Table 3.5 The knowledge dimensions in the RBT

Concept	*Meaning*
Factual knowledge	The basic elements of a subject that students must know to solve problems.
Conceptual knowledge	The connections between basic elements within complex structure of concepts.
Procedural knowledge	Methods of inquiry, criteria for using skills, methods and procedures.
Metacognitive knowledge	Student's cognizance of one's own reasoning and particular intellectual processes about how to solve problems or cognitive tasks.

Source: Krathwohl, (2002, p. 214).

In addition, the RBT was further updated to interpret innovative behaviours and activities developed with technology (Churches, 2008). The Bloom's Revised Digital Taxonomy developed to incorporate the aspect of collaboration as an integral part of the 21st century skills in the online learning environment (Churches, 2008). According to Churches (2010), there are no provisions in the RBT to address the newer objectives, processes and actions presented by the emerging technologies and their impact on formative assessment. This information is necessary to understand the digital verbs utilised by lecturers when developing the assessment activities at HE institutions.

Table 3.6 below summarizes the Bloom's Revised Digital Taxonomy with common digital verbs associated with the use of technology (Churches, 2008).

Table 3.6 The Bloom's Revised Digital Taxonomy

Key terms	*Digital verbs*
Remembering	bullet pointing, highlighting, bookmarking or favouriting, social networking, social bookmarking, searching or googling
Understanding	advanced searching, blog journaling, categorising and tagging, commenting and annotating, subscribing
Applying	running and operating, playing, uploading and sharing, hacking, editing
Analysing	mashing, linking, reverse-engineering, cracking
Evaluating	blog commenting and reflecting, posting, moderating, collaborating and networking, testing, validating
Creating	programming, filming, animating, blogging, video blogging, mixing, re-mixing, publishing, podcasting, directing, producing

Source: Churches (2008, p. 1-44)

Other researchers recognized that the incorporation of collaboration with the use of Bloom's digital taxonomy can support students' learning processes (El-Ghalayini & El-Khalili, 2012; Wedlock & Growe, 2017). The taxonomy was developed for lecturers to use when designing formative assessment activities (Huber, Waldis & Kennedy, 2016). The RBT is necessary to represent the students' learning outcomes (SLOs) in the online assessment (Scully, 2017). Additionally, researchers have used the RBT to inform and teach educators the effectiveness for instructional designs, methods and assessments (Airasian & Miranda, 2002; Conklin, 2005; Thompson, Luxton-Reilly, Whalley, Hu & Robbins, 2008; Boles et al., 2015). The above information on the Bloom's Revised Digital Taxonomy is necessary to understand the digital verbs that are utilised by lecturers to design and develop online formative assessment. It must be noted that the Bloom's Revised Digital Taxonomy was necessary to assess lecturers' formative assessment activities that are developed online.

3.6 Conceptual framework

The study adopted and adapted the TPACK framework and RBT to develop a conceptual framework (see Figure 3.3). The TPACK framework was developed to understand lecturer knowledge of integrating technology in online formative assessment practices (Thompson & Mishra, 2008). The RBT as a framework for classroom assessment is necessary to observe online assessment activities at HE institutions. The model is necessary to further classify lecturers' online assessment activities using the levels of reasoning skills and the four components from the TPACK framework into four different knowledge dimensions summarized in Table 3.5 above (Anderson & Krathwohl, 2001). Hence Figure 3.3 below is a representation of the conceptual framework adopted and adapted for this study and supported investigation into the implementation of online formative assessments at HE institutions.

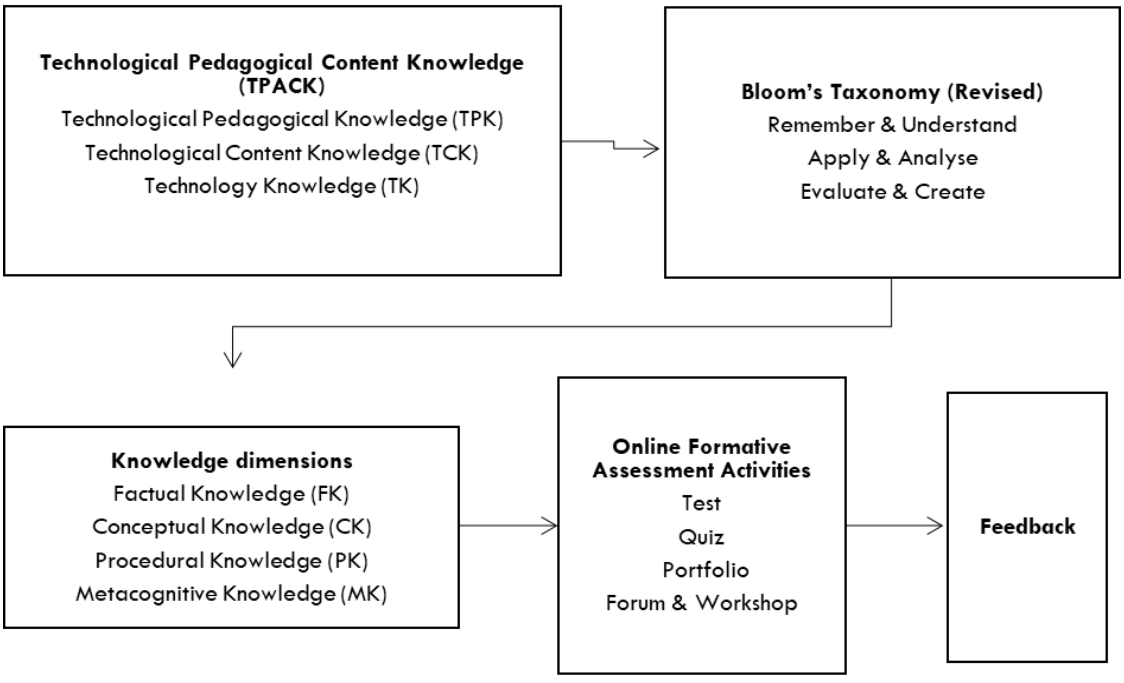


Figure 3.3 Conceptual Framework based on TPACK and RBT

Figure 3.3 illustrates the conceptual framework for this study. The arrows represent the flow of assessment design and the combination of the four concepts from the TPACK framework and RBT levels of reasoning skills with knowledge dimensions adopted and

adapted to identify various online formative assessment activities with feedback at HE institutions.

3.7 The proposed model

The proposed TPACK-RBT-Formative Assessment Activities (T-B-F) model is relevant as a contribution to the academic discourse in that it will add to the overall value of the study. However, to identify and fill the gap in literature pertinent for online assessment at HE institutions, it was necessary to propose the development of a T-B-F model. The developed model for online formative assessment combines the TPACK framework with RBT to investigate the implementation of assessment by lecturers at HE institutions that makes provisions for feedback. This means that the four components from the TPACK framework are utilised to understand lecturers' technological pedagogical and content knowledge of developing assessment activities that are guided by the RBT cognitive process and knowledge dimensions. As discussed in the previous chapter 2, feedback is believed to fill the loop in the online assessment. This means that lecturers should ensure that feedback is provided for all formative assessment activities.

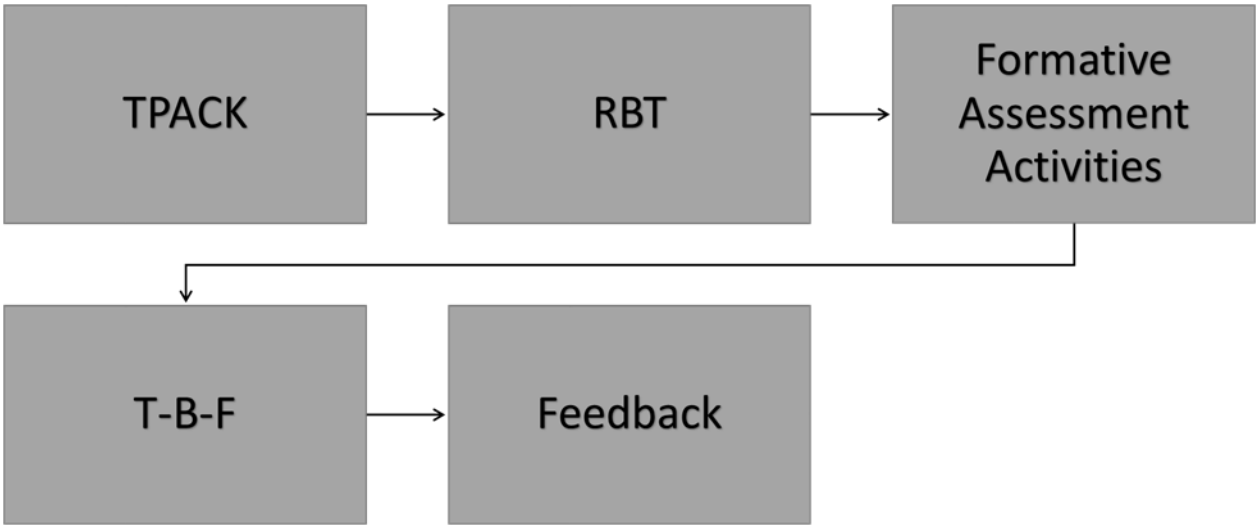


Figure 3.4 Summary of the components in the proposed T-B-F model

Figure 3.4 represents the T-B-F model adapted and adopted for this study. T-B-F represents TPACK, Bloom's taxonomy (revised) and formative assessment activities. Thus, the T-B-F model shows that lecturers can incorporate concepts from the TPACK

framework with Bloom's revised taxonomy to design and develop formative assessment in the online learning environment. The model arrows represent the flow of assessment design. This means that for best practices in the online assessment, lecturers should (1) have knowledge of TPACK (2) incorporate the RBT when developing formative assessment activities as part of the (3) T-B-F model while making provisions for (4) feedback throughout the assessment process.

Therefore, TPACK and RBT components have been adopted in the developed model as follows: (1) TPACK is utilized to represent how lecturers combine content with formative assessment activities with available tools and technologies. (2) RBT is employed to classify the online formative activities as components focusing on course content and student learning objectives and outcomes. (3) Feedback is used as an iterative approach for lecturers to design online assessment based on continual internal and external feedback (Lever-Duffy & McDonald, 2011). The proposed T-B-F model is necessary for lecturers to design assessment activities that support the 21st century skills while focusing on higher-order thinking skills.

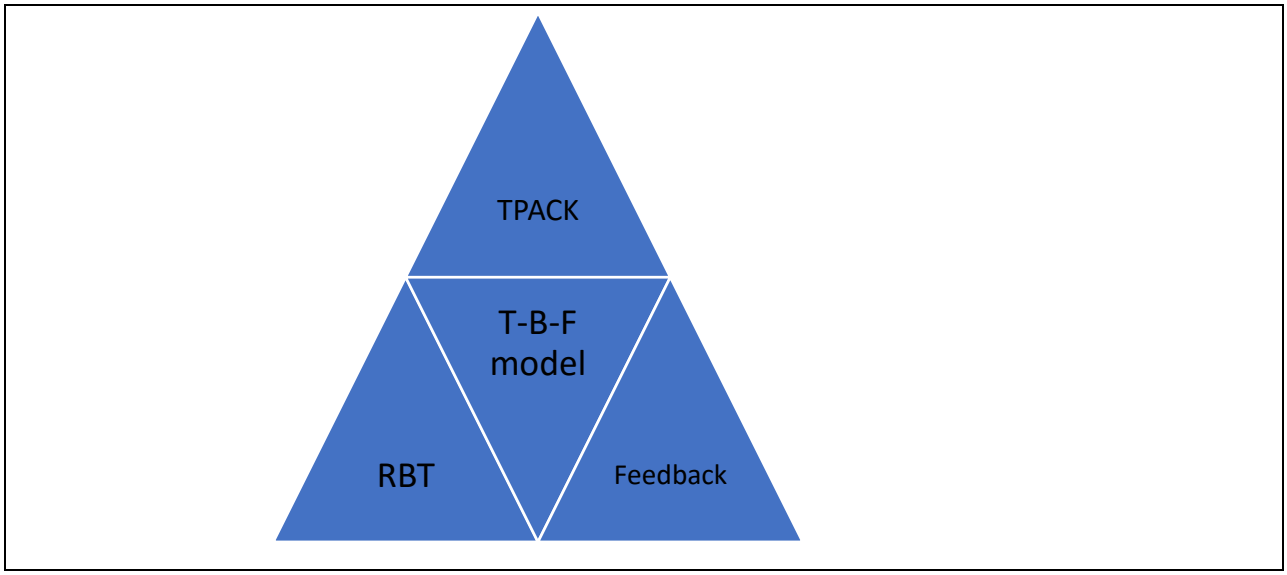


Figure 3.5 The T-B-F model developed for formative assessment activities

Figure 3.5 displays the connection amongst four concepts from the TPACK framework, RBT and feedback adopted for this study. This means that lecturers can design online

formative assessment activities, based on the new proposed model, developed for designing online formative assessment activities at HE institutions.

The current study identified four components of the TPACK framework that were used to understand the impact that TPACK has on lecturers' knowledge when implementing online assessment at HE institutions. This was necessary to understand how lecturers utilise the RBT, considering the knowledge dimensions to test the level of reasoning skills using various digital verbs, particularly those that support online formative assessment activities. It must be noted that the TPACK's Content knowledge dimensions were excluded from the conceptual framework to focus on the TCK for online formative assessment. Lecturers in this study were considered to be experts in their subject area, thus, the focus was rather on TCK for online formative assessment instead of the CK. In addition, the researcher acknowledged the commonalities between the RBT's knowledge dimensions and the content knowledge dimensions of TPACK. As presented in Section 3.4.2 and Table 3.1, the researcher opted to focus on the knowledge dimensions in the RBT to understand lecturers' development of online formative assessment.

Further, the current study established the importance of feedback in the online assessment. Thus, the proposed model incorporates the provision of feedback which can be facilitated by lectures in various ways such as peer assessment, self-assessment or feedback from lecturers to students. As discussed in Section 2.5 of this thesis, formative feedback has a role in the implementation of formative assessment in the online practices for lecturers at HE institutions. Thus, the current study identified six components of feedback necessary at the evaluation level. Lecturers are expected to deliver feedback on time which is appropriate for the specific assessment activity. In addition, feedback should be reflective as a supportive mechanism which focuses on learning to enable students with self and peer evaluation. Additionally, Table 3.7 below summarizes components of the proposed T-B-F model that lecturers should consider when designing formative assessment activities for an online course.

Table 3.7 Components of the proposed T-B-F model

TPACK framework: Content design level	RBT: Assessment activity design level	Feedback: Evaluation level
• TK • TPK • TPK • TPACK	• Remember • Understand • Appy • Analyse • Evaluate • Create	• Timely • Appropriate • Reflective • Supportive • Focused on learning • Enabling

Table 3.7 indicates that lecturers should purposefully plan technology usage to support curricular goals and learning objectives, thereby facilitating collaboration to construct assessment activities and build knowledge that encourages high-order thinking skills and develops new thinking processes in the online learning environment. This means that lecturers should have TPACK knowledge when designing the formative assessment activities that are guided by the RBT and should make provisions for formative feedback throughout the design process. Feedback is essential to refine the learning process, give assistance and direction to students.

3.8 Chapter summary

This chapter presented literature on the philosophical assumptions and the conceptual framework for this study. Similarly, a brief presentation on the historical perspectives of constructivism theory and its role in HE for the purpose of educational technology and online assessment. Constructivism as a philosophical paradigm underpinning the current study was necessary to understand lecturers' implementation of online formative assessment at HE institutions. Assumptions drawn from the present study indicated that lecturers constructed their own new knowledge of developing formative assessment

activities, individually or collectively, through social interactions. The conceptual framework adopted and adapted from TPACK framework and RBT is necessary and utilised as a lens that provides an understanding of how lecturers develop formative assessment activities with feedback aspects. The study proposed the use of the T-B-F model at HE institutions as a lens in the development of online assessment activities. Thus, the model can be aligned with the TPACK framework and RBT verbs to state the learning outcomes and provide feedback throughout the assessment process.

The next Chapter 4 discusses the methodology used to collect data for this study and begins by presenting the research design followed by a description of samples and the research instruments. This is followed by a discussion of data collection procedures, data analysis, reliability and validity of the study, methodological norms and ethical considerations.

CHAPTER FOUR: RESEARCH DESIGN AND METHODOLOGY

4.1 Introduction

This chapter addresses the methodology used to collect data (section 4.2) research design of this study (section 4.3) a description of a sample (section 4.4) the research instruments for collecting data (section 4.5) and the pilot study used to refine the research instruments (section 4.6) are rationalised. Furthermore, the context of the case study is presented focusing on the rationale for selecting HE institutions and lecturers that participated in this study respectively. Subsequently, it presents an explanation of the data collection procedures (section 4.7) data analysis (section 4.8) methodological norms (section 4.9) limitations of the study (section 4.10) and ethical procedures followed in this study (section 4.11) which ends with a chapter summary (section 4.12).

4.2 Methodology

This research embraced a qualitative research design. According to Mills and Gay (2016, p. 25) qualitative research is “the collection, analysis and interpretation of comprehensive narrative and visual data to gain insights into a particular phenomenon of interest” Gay et al. (2011, p.7). In this study, the researcher did not control or manipulate the context of the study, in that simultaneous data collection occurred in the natural settings of the respondents (Gay et al., 2011; Mills & Gay, 2016). In addition, qualitative research “is an inquiry approach useful for exploring and understanding a central phenomenon” (Creswell, 2014, p.10). Thus, qualitative research designs are “naturalistic to the extent that the research takes place in real world settings and the researcher does not attempt to manipulate the phenomenon of interest” (Patton, 2002, p.39).

4.3 Research design

4.3.1 Multiple case study

In this study, the researcher adopted a combination of a descriptive and explanatory case study (Cohen et al., 2011) to provide a narrative account of how lecturers implement online formative assessment at HE institutions. Thus, the researcher adopted an explanatory case study to understand how lecturers combine components of the TPACK framework and Bloom's taxonomy levels of reasoning skills, with knowledge dimensions to develop online formative assessment activities at HE institutions.

Hence, the current study focused on a multiple case study approach with holistic cases to evaluate the implementation of online assessment at HE institutions. The holistic cases in the multiple case study were considered as part of the main unit of analysis (Yin, 2009). Thus, the embedded units allowed the researcher to understand one unique case, that of best practices in the implementation of online assessment at HE institutions. Through the multiple case study, the researcher could interview lecturers, observe online assessment platforms though LMS, and review and analyze institutional documentations where possible. A case study method was necessary to understand lecturers' implementation of online formative assessment practices in depth (Yin, 2009). According, Yin (2009, p. 27) the "case study method is most appropriate for answering the how and why questions".

Therefore, the case study method was most appropriate to investigate *how* and *why* lecturers implement formative assessment in the online courses (Mills & Gay, 2016). In this study, the contextual conditions were covered to provide a true picture of *how* and *why* lecturers implement online assessment (Baxter & Jack, 2008). In addition, considering the context within which it occurs, this was relevant to the phenomenon under study (Yin, 2003, 2009). Thus, the researcher was able to understand the natural settings of the respondents, attempting to make sense of, and interpret events from the lecturers' own perspectives (Cohen et al., 2011; Gay et al., 2011). Mills & Gay (2016, p. 419) noted that "the case study research is appropriate for answering the explanatory questions of *how* or *why"* lecturers implement the online assessment at HE institutions.

4.4 Sample and sampling procedures

In this study, two lecturers from one HE institution in Namibia and two international lecturers from one HE institution in Finland, totaling four, participated. The selection of lecturers was informed by the purposive and convenient sampling method (Creswell, 2014). The purposive and convenient sampling technique (Yin, 2009) were regarded as most suitable to select a case for one of the leading HE institutions in Namibia and Finland respectively. The lecturers were purposively selected using specific criteria. Lecturers who administered and practiced formative assessment for online courses for a minimum of 12 months were considered. In addition, participants in this study were selected from lecturers that were available and willing to participate voluntarily (Mills & Gay, 2016).

The researcher selected lecturers from HE institutions where she had various academic endeavors. The researcher is from Namibia and has access to HE institutions which are physically situated in the vicinity of the researcher. In addition, the researcher participated in an exchange program at one of the institutions in Finland, thus managing to possibly observe online assessment platforms conveniently. With consciousness, the researcher identified lecturers who practice online formative assessment which is aligned with literature and the aim of this study. Therefore, to obtain insight and rich information, the researcher engaged participants who are experienced and have the knowledge of online formative assessment practices (Creswell, 2012).

Furthermore, lecturers were selected from Namibia and Finland respectively for the purpose of documenting implementation of online formative assessment practices. However, the purpose of this study was not to compare practices between the two institutions or countries, but rather, to understand how lecturers implement formative assessment in the online environment. Thus, understanding the similarities amongst the lecturers and HE institutions in terms of best practices within each setting and across settings (Yin, 2009). Moreover, the multiple case study provided the researcher with knowledge and experience of the selected lecturers that are information-rich (Yin, 2009; Gay et al., 2011; Cohen et al., 2011).

Table 4.1 Profile of lecturers and institutions

Lecturers profile		*Institutions profile*		
Lecturer	***Country***	***Documents analysis***		**Observations (*online assessment platforms)***
1	A	***Document***	***Country***	***Moodle LMS***
2	A	1	A	Test, Quiz, e-exams
3	B	2	A	Discussion forums
4	B	3 & 4	A	Portfolios, lecture diary

Table 4.1 represents profiles of the lecturers and institutions that participated in the study. Typically, in the HE institutions lecturers used online assessment platforms to set up online formative assessment activities.

4.4.1 Understanding institutions and lecturers selected for the case study

The multiple case study engaged two HE institutions located in Namibia and Finland respectively. Two lecturers from each HE institution participated in this study and demonstrated knowledge of implementing formative assessment in the online environment. In addition, participants had similar characteristics; that of willingness to voluntarily participate in the study. Likewise, lecturers agreed to participate in lengthy and recorded interviews with possible follow-up meetings. Thus, they were willing to share their experiences on the implementation of online formative assessment practices at HE institutions.

Furthermore, both institutions were technologically rich, in that they have a Learning Management System (LMS) (e.g., Moodle) that supports online formative assessment and had similar characteristics, that is, developing formative assessment activities and assessing students online. Besides, lecturers from both HE institutions were responsible for constructing and administering the online course for which they shared their experiences. Lecturers constructed the online course individually or collectively with curriculum specialists, cooperating lecturers or other colleagues (e.g. support staff and administrators). Therefore, participants assessed students in the online learning environment for a minimum of one year.

Finally, lecturers were also responsible for the designing and development of formative assessment activities, and the identification of appropriate tools for assessing students in the online environment. Despite the minimum requirements of attaining a master's degree in education as per the set criteria for this study, interestingly, all lecturers had a PhD in education. To provide relevant information for participants selected in this study, specific characteristics for institutions and lecturers are presented below.

4.4.2 Institution A

Institution A is one of the leading HE institutions situated in Windhoek, in the Khomas region of Namibia. Institution A offers some courses online with assessments that are also done online. Most courses are taught face to face (f2f) with provisions of assessing students online. Two lecturers (L1 and L2) who assess students online participated in this study.

Lecturer 1 (L1) is a female participant with over 15 years of experience, the last five in the online learning environment. Her research and professional goals are central to educational technology and e-learning. She has been teaching online for the past four years. L1 is actively involved with curriculum and assessment committees at the university. She promotes creative and critical thinking skills development, which she believes will prepare students for their professional and academic growth.

Lecturer 2 (L2) is a male participant with six years' experience in the online learning environment. He serves on the distance learning committee, which is responsible for developing courses for the distance learning program. He has been assessing students online for continuous assessment.

4.4.3 Institution B

Institution B is one of the leading HE institutions situated in Turku, Finland. Institution B offers some courses online and f2f with provisions of online assessments. Two lecturers (L3 and L4) participated in this study.

Lecturer 3 (L3) is a male participant with over ten years' experience teaching online and in a f2f learning context. He teaches courses in the department of future technologies. Prior to teaching online, he used the online discussion board and computerized tests. He

teaches part-time at an online university with extremely large classes that consists of 1500-5000 students.

Lecturer 4 (L4) is a male participant with seven years' experience of teaching and assessing students in the online learning environment. L4 has been designing online courses for the past three years. He served on the committee that developed the new LMS at the university.

4.4.4 Role of the researcher

In this study, a role of a complete observer maintained by the researcher was essential (Creswell, 2014). This means that the researcher observed without participating in the research activities. Thus, the researcher engaged in "nonparticipant observations which were open ended in that the researcher asked general questions which allowed the participants to freely provide their views" (Creswell, 2014, p. 190).

4.5 Research instruments

In this study, the instruments used to collect data were guided by the TPACK framework and the RBT. Thus, the instruments were guided by the constructs from the conceptual framework and are therefore consistent (see Appendix A and B). The use of multiple sources of evidence were necessary to ensure data triangulation (Creswell, 2014). This study utilized the following research instruments: a semi-structured interview guide, field notes, online course observation schedule and institutional documents.

4.5.1 Semi-structured interviews

The researcher conducted in-depth semi-structured interviews through the one-on-one sessions with lecturers at HE institutions. The "in-depth interview approach allowed the researcher to ask key respondents about the facts and their opinions" (Yin, 2009, p. 107) on the implementation of formative assessment practices at HE institutions. During interviews lecturers were asked to propose their own insights into the implementation of online formative assessment. Thus, lecturers' propositions also formed the basis for further inquiry (Yin, 2009). During informal interviews with lecturers, the unstructured interview guide provided directions for the researcher to probe more into the implementation of formative assessment for best practices. The goal of the "informal

interviews was not to get answers to predetermined questions but rather to find out where the participants are coming from and what they have experienced" (Gay et al., 2011, p. 386). Furthermore, interviews were recorded using audiotapes (audio recording) to provide a more accurate version of the interview. This made it easier to transcribe all interviews verbatim (Johnson & Christensen, 2012).

4.5.2 Online course observation schedule

The researcher obtained access to the LMS and observed eight online courses and course outlines where possible. These courses are managed by the lecturers who are administrators and responsible for designing and developing formative assessment activities. As part of the *'physical artefacts'* the researcher used a laptop to access and observe courses on the LMS. According to Yin (2009, p. 113) a physical artefact is a final source of evidence that can be observed or collected as part of a case study.

4.5.3 Field notes

The researcher documented qualitative observations with field notes and described all relevant aspects of the implementation of online assessment at HE institutions. The researcher gatherered field notes by conducting observations of online assessment through the LMS as an observer. Creswell (2012) describes field notes as text (words) gathered, recorded, and compiled during an observation in a qualitative study. According to Gay et al. (2011, p. 382), the researcher's field notes contained two basic types of information:

1. Descriptive information about what the observer has directly seen or heard on-site through the course of the study.
2. Reflective information that captures the researcher's personal reactions to observations, the researcher's experiences, and the researcher's thoughts during the observation sessions

In addition, field notes guided the resaercher to describe and understand research settings and participants (Gay et al., 2011). In this study, the researcher recorded extensive, clear and detailed field notes to understand *how* and *why* lecturers implement online formative assessment at HE institutions.

4.5.4 Reviews of documents

The researcher collected qualitative documents as written evidence to provide information on the implementation of online assessment at HE institutions. According to Creswell (2012, p. 190) “qualitative documents can be categorized into two, namely (1) public documents (e.g. minutes of meetings and official reports) and (2) private documents (e.g. personal journals, diaries and e-mails)”. In this study, the researcher reviewed various public and private documents such as e-learning policies, assessment guidelines and course outlines where possible. These documents were purposefully selected to understand the problem and the research questions (Creswell, 2014). This was necessary to provide additional insightful information on the implementation of online assessment at HE institutions.

4.6 Pilot testing instruments

To test research instruments, the researcher identified one of the HE institutions to serve as a pilot study. The institution was identified for the pilot study because the informants were easily accessible and the site was geographically convenient (Yin, 2009). In addition, the pilot case clarified some concepts for the research design (Cohen et al., 2011). The pilot study enabled the researcher to make necessary amendments to the observation system, procedures and interview questions (Yin, 2009). With regards to the guidelines for online assessment, the researcher arranged for a pre-interview to find out about the objectives for online formative assessment and follow-up questions on emerging tools during the interview of lecturers.

Furthermore, the researcher elaborated detailed information regarding the conceptual framework and key concepts adopted and adapted for this study. The pilot case study was necessary to “help refine data collection plans” as defined by (Yin, 2009, p.92). In addition, feedback was gained from the participants of the pilot study of practices of online formative assessment which was the initial case study (Gay et al., 2011). Thus, the researcher revised some research questions using feedback from the pilot study prior to interviewing the key participants of the initial study.

Moreover, the interview guide and observation checklist were modified to include specific information for online formative assessment. This resulted in the addition of related

questions that required lecturers to share their own experiences on the implementation of online assessment at HE institutions. Also, additional questions on the provision of formative feedback were necessary to probe more from lecturers in an attempt to seek lucidity in the implementation of online formative assessment. Therefore, lecturers were able to share their experiences on online formative assessment at HE institutions.

Hence, pioloting of instruments was necessary to measure the reliability and validity of the research instruents. Reliability strengthened the consistency in the research instruments while validity measured the credibility and authenticity of the research instruments. In addition, piloting was essential to validate multiple sources of evidence. Furher details on the explanation of reliability and validity of this study are discussed in Section 4.9.1 of this report.

4.7 Data collection

First, the researcher ensured that access to selected HE institutions was guaranteed and thereafter observed through online courses administered through Moodle as an LMS. Thus, qualitative observation as defined by Johnson & Christensen, 2012 was necessary to observe all potentially relevant phenomena for online formative assessment practices in the natural settings of lecturers at HE institutions. The researcher identified various online formative assessment activities using the observation checklist (see Appendix A). Secondly, the researcher had an opportunity to further review and analyse an e-learning policy guiding the implementation of online assessment at Institution A. Document analysis was necessary as it complemented and supported lecturers' perspectives of online assessments.

Thirdly, the researcher conducted semi-structured interviews with each participant using the interview guide as defined by Johnson & Christensen (2012) with predetermined questions (see Appendix B). All participants permitted the researcher to audio-record interviews. During interviews, the researcher probed to seek clarity on the implementation of online formative assessment. Thus, lecturers were asked to elaborate and explain their thoughts and experiences they shared regarding the implementation of online formative assessment practices (Creswell, 2014). The interviews ranged in length from forty-five

minutes to one hour. As indicated in Section 1.9.3 all interviews were recorded on audio, and data collected was transcribed immediately after interviewing each participant. The researcher acknowledged and thanked the lecturers for availing her of their time to participate in the qualitative interview as defined by Johnson & Christensen (2012).

4.8 Data analysis

As indicated in Section 1.9.5 cross-site analysis of data as defined by Gay et al., (2011) was necessary to unify the cases under study as one entity of analysis. Firstly, the researcher recorded ideas generated during data analysis by writing memos as defined by Johnson & Christensen (2012) to get the initial sense of the data. The researcher made reflective notes about emerging concepts, themes and patterns found in the data (Johnson & Christensen, 2012). Memoing as an important tool was essential during data collection to record insights gained from reflecting on data. Thus, the researcher read through all memos and notes with comments as written on all field notes. Secondly, to identify relationships, the researcher grouped ideas and concepts from the notes into themes and sub-themes. Thirdly, the researcher developed category systems through sorting and coding referencing units of texts to show meanings and patterns (Johnson & Christensen, 2012). This was necessary to organize and prepare raw data which consisted of transcriptions and field notes.

Furthermore, as mentioned in Section 1.9.5 six steps of data analysis as defined by Creswell (2014) were utilized to help the researcher organize data into subcategories using specific codes and themes (Creswell, 2014). The researcher sorted and organized data thereby searching for specific codes and inter-related codes to identify the relationship among codes (Creswell, 2014). Codes identified from the interview transcriptions' data were similarly coded to understand lecturers' responses in terms of the implementation of online assessment at HE institutions. Thus, emerging themes were interpreted using descriptions to get the initial meaning and patterns of the data. Both expected and unexpected themes emerged from the study. More details regarding six steps of data analysis are discussed in Section 5.2 of this thesis.

4.9 Methodological norms

Various and related methodological norms were considered during data collection which are presented below:

4.9.1 Validity and reliability

The researcher maintained the validity and reliability of the research findings through sustaining an audit trail and using member checking as suggested by Creswell (2012. Particularly, member checking will strengthen dependability and conformity of this study (Lincoln & Guba, 1985). Qualitative validity of the study focuses on the accuracy of the findings by using procedures for reliability to strengthen consistency in various research methods (Creswell, 2014).

In addition, the relevance of reliability and validity verifications indicate that the quality of control in reliability depends on the specifications of “analytical and paradigm constructs” about the theory supporting the study, the latter depends on the measurement of “credibility and authenticity” of the study, which reflects the constructs being employed (Miles & Huberman, 1994, p. 278-279). On the other hand, member checking was equally relevant and helped to ensure credibility. Thus, interpretations of data were presented to the participants in order to provide feedback. Therefore, participants were further asked to correct, elaborate, extend and argue the presented findings (Creswell, 2012). Furthermore, the researcher collected multiple sources of evidence through interviews, observations and document analysis which ensured data triangulation (Patton, 2002; Yin, 2009; Cohen et al., 2011; Creswell, 2014;). According to Silverman (2006, p. 291) “triangulation refers to combining multiple theories, methods and empirical materials to produce more accurate, comprehensive and objective representation for the object of the study”. Thus, multiple methods were utilized, thereby combining findings from interviews with lecturers, observations of LMS and reviews of relevant documents that guide the implementation of online assessment at HE institutions (Patton, 2002; Yin, 2009) aimed at ‘*corroborating’* information across these sources (Johnson & Christensen, 2012, p.272).

Further, reliability refers to the replication of findings resulting in similar conclusions (Silverman, 2006). This explains the process that measures the level of repeating the same approaches or methods in different settings resulting in similar actions in any other across studies (Silverman, 2006). Therefore, the quality of the current study is determined by the consistency and reasonable stability across other studies through time, by monitoring bias and deception (Miles & Huberman, 1994). Validity refers to the level of accuracy of findings by using various procedures (Creswell, 2014). Thus, the researcher endeavoured to obtain the accuracy and truthfulness from evidence of the study by determining *how* and *why* lecturers implement online assessment at HE institutions (Johnson & Christensen, 2012). In addition, to ensure validity in qualitative research the findings should be credible and trustworthy to maximize the evidence (Johnson & Christensen, 2012).

4.9.2 Trustworthiness

According to Gay et al. (2011, p.392); Mills & Gay (2016, p. 573) “qualitative researchers can establish the trustworthiness of their research by addressing the credibility, transferability, dependability and confirmability of the findings”. In addition, the researcher ensured trustworthiness by including descriptive and contextual relevant statements to allow the readers to identify the settings (Mills & Gay, 2016).

Furthermore, the researcher-maintained trustworthiness by employing various concepts such as credibility, transferability, confirmability and dependability to support the current study’s findings (Miles & Huberman, 1994). According to Creswell (2014), trustworthiness is necessary to obtain authenticity of the research evidence. Thus, the researcher maintained the level of accuracy for content and prediction of findings made in this study (Miles & Huberman, 1994).

4.9.2.1 Credibility

Credibility “refers to the researcher’s ability to take into account the complexities that present themselves in a study and to deal with patterns that are not easily explained” (Mills & Gay, 2016, p. 574). Thus, the researcher maintained the role of a complete observer to identify qualities and typical characteristics of the LMS platform (Mills & Gay, 2016). The researcher also utilized the practice of triangulation through observing the

LMS, interviewing lecturers and analyzing e-learning policies at HE institutions. In addition, the researcher conducted member checking by sharing interview transcriptions with lecturers to test the overall report (Gay et al., 2011).

The researcher utilized the strategies of credibility by checking and triangulating data for accuracy (Creswell, 2014). This way it impacts the interpretation of this study to obtain relevance of the findings by attaining accuracy and utilizing certain procedures such as observations, interviewing participants and using document analysis. Thus, examining the information sources collected and to support the evidence (Miles & Huberman, 1994; Creswell, 2014).

4.9.2.2 Transferability

Transferability "refers to qualitative researchers' beliefs that everything they study is context-bound and that the goal of the research work is not to develop truthful statements that can be generalized to larger groups of people" (Mills & Gay, 2016, p. 574). Therefore, the researcher included detailed descriptions of the context to allow lecturers who assess students online to emulate the findings (Gay et al., 2011). This means that findings are limited to lecturers with similar settings (Mills & Gay, 2016).

On the other hand, the researcher ensured that transferability of the findings was necessary to enable application of findings and conclusions from the current study to HE institutions and lecturers that implement online formative assessments.

4.9.2.3 Dependability

Dependability "refers to the stability of the data, which addresses issues related to the data that was collected by the researcher" (Mills & Gay, 2016, p.574). In this study the researcher acquired dependability through respondent validation (Cohen et al., 2011). Hence, the researcher considered lecturers as commentators on the interview transcriptions to validate findings (Mills & Gay, 2016).

4.9.2.4 Confirmability

According to Mills & Gay (2016, p.574), confirmability "refers to the neutrality and objectivity of the data that has been collected". In the current study, the researcher ensured confirmability through practice triangulation and reflexivity (Gay et al., 2011).

Furthermore, the researcher considered the lecturers' views, opinions and experiences on the implementation of online assessment at HE institutions to ensure confirmability of the findings (Patton, 2002). Thus, the researcher was prevented from being biased by ensuring an audit trail thereby documenting a detailed data collection process, data analysis and interpretation of data (Mills & Gay, 2016).

4.10 Limitations of the research design

This study was limited to two lecturers from one HE institution in Namibia (Institution A) and two international lecturers from one institution in Finland (Institution B) that practice and are engaged in online formative assessment. Given that this small number is not statistically representative of all Namibian and Finnish lecturers, the results of the study cannot be generalized to the larger populace of all HE institutions in Namibia and Finland respectively. However, findings are limited to HE institutions with lecturers that practice online formative assessment.

4.11 Ethical considerations

In this study ethical issues were considered. Firstly, the researcher submitted the ethical protocol to the University of Pretoria. Secondly, after receiving a research approval letter from the ethics committee at the Faculty of Education, the researcher then requested permission from the institutions of higher education and submitted a detailed permission letter. Thirdly, I drafted an e-mail and subsequently informed participants, obtaining verbal and written consent, before participating in the study. Furthermore, I took several measures to ensure that all participants were treated ethically. I assured all participants that the information obtained would be used for research purposes only and that it would be treated with utmost confidentiality. Data collected will be retained and kept for a minimum of 15 years at the Department of Science, Mathematics and Technology Education (SMTE) in the University of Pretoria. The data will be destroyed after that period of time.

4.11.1 Informed consent

An e-mail with an informed consent form was sent to lecturers individually, requesting permission to participate in the study and audiotape (recording) of interviews. The

researcher encouraged participants to ask questions and address concerns at any time during the study (see Appendix C). Additionally, the researcher informed participants that they may leave the study at any time for any reason. Each participant printed, completed the informed consent form and returned it to the researcher before the scheduled interview.

4.11.2 Voluntary participation

Lecturers volunteered themselves to participate in the current study of which they freely availed their time to share experiences. Thus, lecturers voluntarily participated while understanding the nature of the study (Cohen et al., 2011; Gay et al., 2011). This means that lecturers were not forced to participate in the study but did so of their own free will. Besides, there were no monetary influences to encourage participation of lecturers.

4.11.3 Anonymity and confidentiality

All participants' identities remained anonymous (Cohen et al., 2011). Hence, the researcher utilised specific codes to protect the identities of the participants (e.g., L1, L2, L3 and L4) in all transcripts and written work. In addition, the two HE institutions where the participants hailed from are not revealed but were identified as Institution A and B respectively. Furthermore, to ensure anonymity, last names and personal information was not used when storing data, or in any field notes. Additionally, I ensured the use of password-protected files when storing data and findings from the research study (Cohen et al., 2011). Furthermore, participants were also cautioned not to share information that might compromise their professional positions and personal well-being.

Moreover, the participants' responses, answers and opinions on their experiences with online assessments remained confidential in all forms of communication. In this regard, I did not disclose names and personal information that could lead to the identity of participants being known. (Gay et al., 2011).

4.12 Chapter summary

Undoubtedly, a multiple case study with holistic cases was appropriate to understand how lecturers implement formative assessment in the online courses. The four lecturers who participated in the study described their views and shared experiences on the

implementation of online formative assessment practices at HE institutions. This chapter described the research methodology employed for this study. I began by presenting the research design, a description of the sample, research instruments and pilot study. This was followed by an explanation of the data collection procedures, data analysis, methodological norms and ethical considerations.

The next chapter 5 presents data and research findings for this study, and begins by presenting the findings from observations of online courses and document analysis, followed by a description of interview transcriptions. This is followed by a synthesis of emerging themes from the study.

CHAPTER FIVE: PRESENTATION OF RESEARCH DATA AND THE RESULTS OF THE STUDY

5.1 Introduction

The chapter presents research data and the results of the study in an attempt to answer the research questions (Section 1.7). The results obtained from semi-structured interviews with lecturers from HE institutions in Namibia and Finland respectively, as well as from observation of e-learning platforms and institutional documents obtained, are presented in this chapter. To ensure anonymity of respondents, the researcher utilised codes to denote lecturers, HE institutions and institutional documents.

The results section is divided into two parts, each of which aims to answer research questions 1, 2 and 3. In Part A, to answer Main Research Question 1 (RQ1) and Research Question 2 (RQ2), results are presented according to the conceptual framework of the study (Section 5.3) to address the four constructs adapted and adopted from the TPACK framework which are Technology knowledge (5.3.1) Technological content knowledge (5.3.2) Technological pedagogical knowledge (5.3.3) and Technological pedagogical content knowledge (5.3.4). In addition, the results are presented based on the concepts from the Bloom's revised taxonomy and knowledge dimensions as adapted for this study (Section 5.4).

Further, data from documents are presented to address research sub question 3 (Section 5.5). The themes that emerged during data analysis are presented (Section 5.6) followed by a summary of themes synthesizing the most important keywords (Section 5.7). Furthermore, the link between the conceptual framework and emerging themes are presented in Section 5.8. In Part B, to answer Main Research Question 3 (RQ3), challenges and benefits faced by lecturers when implementing online formative assessment at HE institutions are presented in Section 5.9.1 and 5.9.2 respectively, followed by a chapter summary in Section 5.10.

5.2 Data analysis overview

During the data analysis, the researcher needed to understand the general ideas from participants. While reading through interview transcriptions, the researcher asked: *What general ideas do the lecturers have?* Thus, *''What is the tone of all the ideas?''* Creswell (2015, p.197). Therefore, the researcher analysed data collected using the following six steps of data analysis as suggested by Creswell (2014, p. 197-198):

Step 1: Organize and prepare data for analysis. The researcher organized data by transcribing interviews, typing up field notes, sorting and arranging data into different types.

Step 2: Read or look at all the data. This step provided the researcher with a general sense of the information and I had an opportunity to reflect on its overall meaning. Thus, understanding how lecturers implement online formative assessment at HE institutions.

Step 3: Start coding all the data. I organized data by bracketing chucks as text and writing categories in the margins. The categories were further labelled based on the actual language of the lecturers called an *'in vivo term'*. The identified codes were a combination of emerging and predetermined namely: 1) expected 2) surprisingly and 3) unusual. Furthermore, a qualitative codebook was developed in the form of a table with a list of prearranged codes utilised for coding the data (see Appendix E).

Step 4: Use the coding process to describe the setting, lecturers and themes. The researcher identified themes to understand how lecturers implement online assessment at HE institutions. In this study four themes emerged from interview transcriptions of lecturers. Furthermore, themes were analysed for each individual case and across different cases to document and describe each lecturer using a table.

Step 5: Themes with sub-themes were used to convey and describe each lecturer in a table. A discussion with interconnected themes and sub-themes were supported by specific illustrations, several perceptions from lecturers and citations. Also, direct quotes from lecturers as obtained through interviews, were used.

Step 6: Interpretation in qualitative research of the findings or results. The researcher asked: *What were the lessons learned?* I derived meaning by comparing findings with information from the literature and the conceptual framework adopted and adapted for the current study. The results from the multiple case study as obtained through non-participatory observation of online courses on Moodle, Ville and interviews of lecturers at HE institutions are presented.

Table 5.1 provides details about the lecturers, countries, institutions and institutional documents availed for this study. The table is presented to show the system of codes used for lecturers and institutional documents. The two countries referred to are represented as A and B respectively in a randomised order to guarantee anonymity of lecturers and institutions.

Table 5.1 Meaning of each code

Country Codes	Institution Codes	Lecturers Codes	Document Codes
Country A (CA)	Institution A (IA)	Lecturer 1 (L1)	Document 1 (D1)
		Lecturer 2 (L2)	Document 2 (D2)
			Document 3 (D3)
			Document 4 (D4)
Country B (CB)	Institution B (IB)	Lecturer 3 (L3)	
		Lecturer 4 (L4)	

Table 5.1 shows that four lecturers from institution A and B (L1, L2, L3, L4) representing country CA and CB participated in the study respectively. Documents such as e-learning Draft Policy, Academic Integrity Policy, Assessment Policy and Quality Assurance guidelines (D1, D2, D3, D4) were analysed at Institution A. Unfortunately, Institution B, could not provide documents due to their institutional policy on data protection and sharing thereof. The results from documents are presented in section 5.4.

Table 5.2 presents the profiles of lecturers in terms of their positions/ranks, number of years in the current positions in their institutions and their current qualifications.

Table 5.2 Profiles of lecturers

Lectures	*Position/Rank*	*Years of Experience*	*Highest Qualifications*
L1	Senior lecturer	6 years	PhD
L2	Coordinator Instructional design	7 years	PhD
L3	Senior lecturer	10 years	PhD
L4	Lecturer/manager	7 years	PhD

Table 5.2 indicates that the four lecturers participating in this study are experts in their fields with a PhD in Educational Technology or related fields and have been teaching online for more than five years.

Part A: Addressing Main RQ1 and RQ2

> ***'How is online formative assessment implemented by lecturers at HE institutions?' and 'Why do lecturers at HE institutions implement online formative assessment?***

5.3 Results addressing Research Sub Question 1

Section 5.3 addresses research sub-question 1: '*How does the use of the TPACK framework improve the online formative assessment content?'* The answer to this research sub-question is presented from the lecturers' perspectives and are structured according to the four concepts adopted and adapted from the TPACK framework presented in chapter 3 of this thesis. I assumed that lecturers at HE institutions are experts in their fields and that they have TPACK to improve online formative assessment practices.

5.3.1 Technology knowledge (TK)

For the purpose of this study and as stated in Section 3.4, TK is referred to as lecturers' knowledge about technology tools for online assessment. Lecturers are expected to have knowledge of various technology, particularly those that support the implementation of online formative assessment. Lecturers with TK are expected to keep themselves updated with current and trending technology. The lecturers did indicate however, that their TK is likely to become outdated due to emerging technologies.

According to Lecturer 1*:

> *"Lecturers should acquaint themselves with trending technologies to enhance their TK".*

In this section, the researcher wanted to find out the opinions of lecturers concerning their knowledge of technology in the implementation of online formative assessment at HE institutions. In this study, lecturers indicated having knowledge of various technology tools for online assessment.

* All quotes are verbatim

Asked to identify the tools commonly used for online formative assessment, lecturers mentioned using Moodle and Ville.

Lecturer 2* mentioned that:

> *"We use the Moodle which is the learning platform here in the University [IA], this is a free for use open source platform which is mostly used here in [CA], undoubtedly all of the universities use Moodle and other tools".*

Lecturer 3* added that:

> *"We are using Ville as a tool for everyone [learning platform], and it has an exam system called exam aquarium, which is developed in cooperation with a lot of [other] universities here … [CB]".*

Lecturers emphasised that the use of Moodle and other software applications such as PANOPTO 101 and 102 allows the lecturer to act as a facilitator and students to interact with one another (L1, L2, L3, L4). Lecturers also indicated using social media platforms such as Facebook with other LMSs like Edmodo to improve the online formative assessment.

> *"Moodle support development of tutorials and exercises" (L1).*

> *"I have been using some other platforms like Edmodo, in the courses which are mainly media education" (L4).*

Asked to identify tools used for online assessment at HE institutions, lecturers provided answers presented in Table 5.3 below:

Table 5.3 Technology tools used by lecturers at IA and IB for online assessment

Hardware	Software	LMS
Laptop (Apple, HP)	Soft tutor	Moodle
Desktop (iMac, HP)	Turnitin	Ville
iPads	Video editing tools	
Mobile phones	Google drive	
Tablets	YouTube	
	Microsoft office 365	
	Padlet	
	Sway.com	
	Optima	
	Tertials	
	PANOPTO Urkund Plagiarism Detection	

This study revealed the types of e-learning tools available at HE institutions as used by lecturers for online assessment. The technology tools used by lecturers were installed with educational software apps that are supported by the LMS.

When asked to indicate how they afford students the opportunity to use online tools, Lecturer 4 responded by saying:

> *"Lecturers can assign students to participate in movie projects using online tools to create a poster, write scripts and do film editing".*

5.3.2 Technological content knowledge (TCK)

In this study, lecturers demonstrated knowledge of understanding the effect of technology and content in the practices for online assessment activities. Lecturers with TCK demonstrate the understanding of the influence that technology and content has on the implementation of online assessment activities. This means that lecturers as experts in

their online courses have a deep understanding of the way assessment content can be changed with the use of tools (L1, L2, L3, L4).

In addition, this study revealed that these lecturers seem to do what they do as they are proactive (L1, L4), they know how to develop knowledge of creating new representation for specific content through technology in the online assessment (L2, L3), and have a deep understanding of TCK which leads to creativity while keeping up with trending technology.

According to Lecturer 1:

> *"Lecturers are responsible to develop question banks. Therefore, knowing your course content and how to creatively use technology to design formative assessment activities for me is most important for online practices".*

This shows that these lecturers have TCK and can use trending technologies and software applications to implement online formative assessment. Lecturers indicated that the incorporation of content in the use of simulations, augmented reality, gamifications and robotics support online formative assessment. In addition, lecturers demonstrated the use of technologies to develop online formative assessment activities that comprised of several items such as *multiple-choice questions*, *fill in the blanks*, *true/false*, *short answer questions* as well as *essay types of questions*. Different activities developed by lecturers are further discussed in section 5.6.1 of this study.

Lecturers seem to have a positive "open-minded" attitude, by referring to implementing formative assessment in the online learning environment (L4), inspiring and encouraging others to develop assessment activities with trending technology (L1). Lecturers indicated that they have requested students to read course materials, articles and watch educational YouTube videos through Moodle as part of the formative assessment activities (L2, L3).

5.3.3 Technological pedagogical knowledge (TPK)

This section focused on TPK in that the researcher wanted to understand whether lecturers have knowledge of using various technologies in their pedagogy when implementing online formative assessment practices.

Lecturers seem to have a deep understanding of TPK, in that they demonstrated knowledge of teaching using various technologies concerning changes in the setting and purpose for designing online assessment activities (L3, L2, L4, L1). As an outcome of TPK, these lecturers were able to develop strategies to implement best practices for online formative assessment. Strategies developed by lecturers are further discussed in section 5.6.2.1 of this study.

When asked about the pedagogical structure for developing online formative assessment activities, Lecturer 3 mentioned that:

> *"Pedagogical perspective is necessary and that as a lecturer one should have technically mastered the tool you are using for online assessment".*

Lecturers also mentioned that when teaching using various technologies often, you can develop assessment activities that are supported by ePCK as part of the online content. Lecturers create TPK from ePCK as part of their online course content development. This means that TPK is necessary for lecturers to understand technologies which support specific online content to develop formative assessment activities. Thus, lecturers require a *deeper understanding* of the limitations of technological tools to implement online formative assessment at HE institutions. They also indicated that if they feel like the technologies are outdated for assessment and course content, they will keep themselves abreast and up-to-date with trending technologies through personal learning environments. Personal learning environments such as an LMS, YouTube, blogs, Google docs and Facebook are necessary for lecturers to build TPK to enhance the implementation of online formative assessment (L1, L2, L3, L4).

To further understand lecturers' TK, TCK and TPK discussed above, it is necessary to look at the overall TPACK as demonstrated by all lecturers in this study.

5.3.4 Technological pedagogical content knowledge (TPACK)

This section is concerned with lecturers' opinions on how they make use of the TPACK framework to improve the online formative assessment content. TPACK refers to the importance of understanding what goes beyond content, pedagogy and technology as inter-related constructs in the implementation of online assessment within HE institutions. It should be noted that lecturers considered TPACK as a professional knowledge construct (L1, L2, L3, L4).

Most lecturers indicated having a deeper understanding of TPACK in their online course (L3, L2, L1). TPACK in the participating HE institutions has enhanced the process of using technology to develop online formative assessment. In this regard, TPACK is discussed in relation to implementation for online formative assessment. Lecturers demonstrated knowledge of *technology*, *pedagogy* and *content* as important components for the development of formative assessment activities in the online learning environment.

Furthermore, all lecturers demonstrated having content knowledge to construct their online course and develop formative assessment activities. This means that lecturers with TPACK are believed to integrate technology in the online formative assessment. Lecturers that participated in this study were found to have TPACK in that they have knowledge of e-learning tools that support various strategies developed to implement formative assessment in their online courses.

5.4 Knowledge dimensions and levels of reasoning skills in the revised Bloom's taxonomy (RBT)

Section 5.4 addresses research sub-question 2: '*How does the use of Bloom's levels of reasoning skills improve lecturers' content knowledge?'* As observed, the online courses comprised of assessment activities that were not limited to quiz, test, e-portfolio and assignments with common verbs from the RBT, that are used by lecturers to develop and understand levels of reasoning skills, while testing different knowledge dimensions.

Table 5.4 The link between knowledge dimensions and the cognitive process

		The Cognitive Process					
The Knowledge Dimensions *Anderson and Krathwohl (2001)*		Level 1 Remember	Level 2 Understand	Level 3 Apply	Level 4 Analyze	Level 5 Evaluate	Level 6 Create
A	Factual knowledge	List	Understand	Classify	Order	Rank	Combine
B	Conceptual knowledge	Describe	Interpret	Experiment	Explain	Assess	Plan
C	Procedural knowledge	Tabulate	Predict	Calculate	Differentiate	Conclude	Compose
D	Metacognitive knowledge	Appropriate	Execute	Construct	Achieve	Action	Actualize

Table 5.4 shows the connection of the six cognitive processes (Remember, Understand, Apply, Analyse, Evaluate and Create) with the four knowledge dimensions represented as (Factual, Conceptual, Procedural and Metacognitive) forming a grid between separate cells as denoted (Anderson & Krathwohl, 2001; Krathwohl, 2002, Churches, 2008).

Most questions in the formative assessment activities observed, such as quizzes, tests and assignments were structured using the levels of reasoning skills from RBT, which comprised of various verbs as examples, shown in Table 5.4 above.

Table 5.5 RBT verbs and common examples

Verbs	*Examples*
Remember	Name, list, recall, label, cite, recite, number, count, portray, draw, define
Understand	Explain, add, demonstrate, classify, guess, match, explain the similarities and differences
Apply	Organize, calculate, organize, draw an outline, follow the steps, transfer by organizing
Analyse	Summarize, separate, analyse, define in broader terms, prioritize, simplify, categorize, test, optimize, infer
Evaluate	Critique, prove, evaluate, defend, judge, propose
Create	Compose, design, organize, arrange, design, adapt, unify, reorganize, build, construct, discover

Table 5.5 shows common verbs with examples from the RBT frequently used by lecturers at HE institutions to design and develop online formative assessment activities. Lecturers indicated using Bloom's taxonomy to test levels of reasoning skills and knowledge dimensions.

All lecturers also appear to incorporate most of the verbs and examples from the RBT in their online assessment activities, because they understand the levels of reasoning skills, focusing on higher order thinking skills while considering knowledge dimensions (L1, L2, L3, L4).

According to Lecturer 1:

> *"The strategy for assessing higher-order thinking for discussion components, in terms of discussion forums is that students get time to think logically. I motivate them by marking, so you look at the level of the thinking and then award a specific mark. Lecturers can also design rubrics ahead of time for any assessment activity such as essay and blogs".*

5.5 Data from documents

This section addresses research sub question 3: *'What guides the implementation and context for online formative assessment at HE institutions?'* Data from documents as analysed for this study are presented highlighting the guidelines and context for online formative assessment. Through the participants, one of the HE institutions (IA) availed the following documents as presented in table 5.1 namely: e-Learning Policy (D1), Academic Integrity Policy (D2), Assessment Policy (D3) and Quality Assurance Guidelines (D4). Lecturers in CA mentioned that those specific policies guide the implementation of online assessment at their institution (L1, L2). However, lecturers from the other HE institution (IB) mentioned that they do not have specific policies for assessment but rather general guidelines for grading, in that it must be specific and that students need to know what parts of the course are being graded (L3). Thus, everything else is left for 'teachers' autonomy' in that every lecturer can assess students in the way they deem best for learning (L3, L4). Lecturers however, could not provide documents for general guidelines due to the privacy policy of the institution.

Documents (D1, D2, D3, D4) were analysed. These institutional documents provide guidelines on assessment with a particular focus on formative assessment to: support teaching and learning, provide feedback to the student and lecturers, diagnose the students' strengths and weaknesses, assist in the planning of future learning and contribute to the students' capacity for self-evaluation (D3) improve efficiency in the administration and management of technology enhanced learning, and train and support lecturers in the use of ICT for teaching and learning (D1). In addition, explicit guidelines on academic dishonesty and criteria of academic integrity focusing on plagiarism, fabrication and cheating (D2) and quality assurance in terms of evaluating, assessing and monitoring (D4) were documented.

Institutional documents (D1, D3, D4) referred to successful online assessment strategies that incorporate various tools and questioning approaches. This study focused mostly on D1 and particularly D3 to understand guidelines for the implementation of online assessment in that they highlighted: 1) provision of guidance on the planning, designing,

developing and delivering of online courses (D1) and 2) implementation of formative assessment and provision of constructive feedback (D3).

The institution compels all stakeholders, including lecturers and students alike, to abide by these documents (D1, D2, D3, D4). Various stakeholders from faculties, centres and schools are responsible for the implementation and monitoring (D3). They are required to communicate the assessment policy to students and lecturers. Lecturers are expected to follow specific guidelines for assessment when developing assessment activities and for testing and evaluation processes (D3). Institutional document (D3) referred to assessment strategies which require lecturers to engage in the following: 1) evidence 2) assessment methods 3) feedback 4) communication with students 5) electronic assessment 6) recognition of prior learning 7) assessment and people with disabilities and 8) assessment and language. Lecturers are expected to provide evidence that is: valid, authentic, sufficient, recorded and current (D3). Furthermore, assessment is seen as part of quality assurance in terms of fitness for purpose which is determined by teaching and learning (D4). Lecturers can access these documents which are readily available on the institution's website and downloadable through IA's intranet.

It appears that policies are implemented. However, there is no evidence available to ascertain the use of policies and guidelines by lecturers, when designing and developing online formative assessment. Also, there is no evidence to contradict the notion that policies are developed and are currently packed 'collecting dust' in that they are not necessarily utilised daily. The researcher could not establish and gather evidence to support the use of institutional documents due to the privacy policy of the institution. Certain documents are not available for public review due to confidentiality even though these documents explicitly highlight guidelines on the implementation and monitoring processes thereof. There was no evidence to prove that lecturers use policies and guidelines when implementing the online formative assessment at institution A (IA). There appeared to be minimal use of documents. D2 is relevant to deal with issues of dishonesty in academic work as far as assessments are concerned, while D3 provides guidelines for assessment and evaluation processes.

5.6 Themes that emerged: Addressing Main RQ1 and RQ2

This section addresses the main RQ1 and RQ2 respectively: *'How is online formative assessment implemented by lecturers at HE institutions?' and 'Why do lecturers at HE institutions implement online formative assessment?* Additionally, research sub question 4: '*What are the best practices for online assessments?'* The emerging themes are presented as major findings. The major themes and sub-themes as emerged from this study are presented in Table 5.6.

Table 5.6 Themes that emerged

Themes	Sub-themes
1) **Lecturers design and development of online assessment activities**	Test/quiz Discussion forums e-portfolio Assignment/Essay
2) **Processes for online formative assessment**	Strategies and techniques Structure Tools
3) **Provision of feedback**	Peer assessment evaluation Self-monitoring Timely, appropriate & reflective
4) **Motivation for engaging in online assessment**	Advantages Training, support team Collaborative teaching Best practices

Table 5.6 represents themes and sub-themes which emerged from the interviews with the four lecturers that participated in this study. The themes represent the process that lecturers engaged in when implementing the online assessment activities at HE institutions. This means that lecturers develop various online formative assessment activities and provide feedback, because they are motivated to engage in online formative assessment.

The section below addresses the first and second research question and sub question 4. To answer the research questions: *'How is online formative assessment implemented by lecturers at HE institutions?'*, '*Why do lecturers at HE institutions implement online formative assessment?* and *'What are the best practices for online assessments?'* about the formative assessment activities, the strategies, techniques and tools incorporated, the activities of lecturers must be investigated.

5.6.1 Theme 1: Lecturers' design and development of online assessment activities

Through observation, it was evident that the LMS supported the development of online assessment activities. The researcher observed the following activities from the LMS. The findings were expected to emerge because typically, formative assessments are enforced by HE institutions as part of the continuous assessment. However, the researcher did not expect lecturers' design and development of formative assessment activities in their online practices.

5.6.1.1 Tests/quizzes

Lecturers indicated that tests and or quizzes are submitted online. The online submissions through the LMS can make provision for students to practise on tests and quizzes (L4, L2). Lecturers mentioned that the LMS allows them to post homework for observations and other periodical in-class activities (L1, L3). They do this by encouraging students' engagement online which is done through conferences as well as Q&A sessions. Lecturers are responsible for developing online mini-tutorials to support scaffolding using ungraded quizzes (L4).

"Students complete an online quiz at the end of every topic. I make use of some strategies to allow the quiz run on Moodle for example three days to see what other competencies …to monitor and evaluate assessment activities" (L4).

When asked to mention the types of assessment activities available and how they assess students online, Lecturer 3 responded by saying:

"We actually assess using different activities for online courses, starting from the beginning until the end of the course. Students are doing exercises in Ville throughout the course each week and the scores influence the final grade. They also complete a multiple-choice assessment online".

Lecturer 2 added that:

"We have six assessments for this particular course consisting of about two tests, two assignments and two quizzes that students take in the 1st semester and 2nd semester respectively".

"Assessment activities comprised of essay writing, file response, fill-in-blanks, multiple-choice, ordering, opinion, Likert scale, short answer and true /false questions" (L4).

Lecturers from both HE institutions and countries (IA, IB, and CA, CB) respectively, revealed that they specifically engage in e-assessment development of online activities to promote the implementation of formative assessment in the online learning environment.

5.6.1.2 Discussion forums

Lecturers consider their involvement in the process of online assessment necessary, in that they should be part of the discussion forums (L4, L2) and go the extra mile for their students to facilitate online consultation sessions and or chat rooms as well as the student/lecturer forums (L3, L1). During observation, it was evident that the LMS supported the online interaction between lecturers and students through online educational forums such as blogs, live sessions and discussion boards. Lecturers also considered discussion forums important in that they strengthen the online engagement

for students and lecturers alike (L1, L4). The results were surprising because the researcher did not expect discussion forums to be part of formative assessment and for grading purposes. Typically, discussion forums are mainly used for collaboration and engagement thereof. Lecturer 1 indicated that:

> *"Discussion forums is one of the effective online tools because in the discussion forums lecturers can really get behind the students' thinking".*

Lecturer 3 added that:

> *"We use the discussion forum to share exercises, …either exercise students do as self-activity or group-activity, but we are not in a way assessing the communication per se".*

5.6.1.3 e-portfolio

The researcher observed that the e-portfolio as a formative assessment activity is not often used by the lecturers who participated in the current study. It was evident that only Lecturer 4 assigned students to develop digital portfolios. The results were unusual, in that the researcher did not expect online courses to have a component of portfolio development. Lecturer 4 testified to this by saying:

> *"Every course that I taught online …at the end students collect portfolios about activities, because portfolio is one of the oldest ways to present works in a visual field".*

Lecturer 4 further elaborated that:

> *"e-portfolios can contain newspaper clips used for exercises, projects like blogging, wikis, learning game, filming-making, video-editing, electronic posters, articles collections for references or reading literature, script writing, web-based articles and documents".*

5.6.1.4 Assignments/essay writing

Lecturers developed assignments which were uploaded on the LMS. Assignments were commonly used by lecturers for the purpose of assessing students' learning (L1, L2, L3, L4). The researcher observed that lecturers were able to incorporate various essays or

assignments to implement formative assessment. Lecturers mentioned that students are given assignments in different forms such as essay writing and lecture diaries as part of the formative assessment activities (L1, L2, L3, L4). The results were unexpected to the researcher, in that lecturers indicated that assignments and essay writing were some of the common formative assessment activities.

Lecturer 1 indicated that:

> *"students are given four different questioning types and they must engage that throughout the conversations. They submit an essay or assignment depending on the course and the level for instance undergraduates are required to type in some essay or assignment".*

Lecturers also added that the completion of essays by students are necessary to show their way of thinking in that they demonstrate understanding of the topic. Students are also given the opportunity to review the work of other students through reading those essays and giving constructive comments. Lecturers believed this to be an effective strategy, because students get the opportunity to learn from each other (L1, L2, L3, L4).

In summary, lecturers indicated that assessment activities for evaluating learning outcomes should reflect real-life experiences, stimulate students to apply knowledge, serve as a guide for the students to achieve the learning goal, attract the students' interests, be sensitive to the individual student's beliefs and values, and provide information that is useful to meet the intended learning outcomes.

5.6.2 Theme 2: Processes for online formative assessment

This section presents data about processes used by lecturers to design and develop online formative assessment. Lecturers revealed that processes are believed to guide the implementation and context for online formative assessment at HE institutions. The researcher observed that the LMSs allow lecturers to assign learning activities and to provide grades which are recorded in each student's gradebook. The findings were not expected by the researcher in that lecturers engaged in various processes when developing online formative assessment activities.

5.6.2.1 Strategies and techniques

Lecturers develop strategies and uses numerous techniques in terms of methods, procedures and practices when implementing formative assessment in the online learning environment. Lecturers revealed that strategies and techniques are necessary to develop and administer various online assessment activities (L1, L3, L4). When asked to elaborate on the strategies and techniques used for online formative assessment, Lecturers indicated that one needs to know what it entails when developing assessment activities and procedures for administration of assessment activities. Lecturers also shared their concerns regarding the students' beliefs that multiple-choice questions are easy. Lecturers strongly emphasised that multiple-choice questions are extremely difficult, and that they should employ strategies that are aimed at assisting students to firstly grasp the content, and secondly practise with exercises to understand the course content and the structure of questioning.

Lecturers mentioned using tutorials as a strategy to enhance formative assessment in the online learning environment. Lecturers indicated that students can complete various exercises online, comprised of learning materials like text, images or video aimed at promoting constructive learning anywhere, anytime for preparation purposes (L1, L2, L3, L4).

Lecturers indicated using strategies to draw up questions for online assessment (L1, L2, L3, L4). One of the lecturers uses a "pool of questions" to assess many students which makes it easier due to the complexities of testing online (L2). Lecturers indicated that question banks collect varieties of questions that support online formative assessment activities (L1, L2, L3, L4). They elaborated on the development of question banks which are aimed at developing various questions (L1, L2). Lecturers indicated that they embark on the process of setting-up different questions to develop a pool of questions (L3, L4). Lecturers collaborate with one another. For example16 lecturers can set-up 25 questions each to develop a question bank consisting of 300 questions (L2). Lecturers also mentioned that those questions are necessary for assessment, in that they can be used for different formative assessment activities. Lecturers also added that the process of randomizing exercises online is necessary for online formative assessment.

According to Lecturer 4:

> *"Lecturers can implement a strategy for randomization of exercises such that they are randomly distributed in that not all the students get the same questions".*

Lecturers were confident in the strategies they use when implementing formative assessment online. The findings were surprising in that the use of online tutorials as a strategy to support formative assessment at HE institutions is not a common practice by lecturers. Lecturers indicated that students are not actively engaged in the online tutorials available for various online courses. Often, students are required to complete tutorials to prepare for summative assessment.

5.6.2.2 Structure of assessment activities

Lecturer structured assessment activities which are categorised as 'learning assessments' (L1, L3) considering the learning objectives (L2, L4). According to lecturers the structure of online activities based on various questions such as multiple questions, matching questions or true/false, fill-in questions differs from one activity to another (L1, L2, L3, L4). Lecturers emphasised the use of Microsoft applications such as Word processing, PowerPoint, Spreadsheet and Notebook in Office 365 to support lecturers when implementing formative assessment in the online courses. Lecturers believed that the structure of assessment activities is important because it determines the effectiveness of the specific assessment activity (L1, L2, L3, L4).

When asked to elaborate on the structure of assessment activities they develop, lecturers were confident to share their opinion. Lecturer 2 mentioned that:

> *"Sometimes, it's advisable to have exercises where the lecturer is not asking questions to get the right answer, but students' opinions. They [students] must use and apply information to real life situations".*

According to Lecturer 4, activities are structured based on the:

> *"exercises that are randomly distributed, in that not all the students get the same questions, and that there are enough exercises that promote self-activities and group activities to support collaborative learning".*

In summary, lecturers recognize the need to develop assessment activities while taking into consideration the class size and learning objectives, structures of questions, setting-up of questions, random exercises and collaboration.

5.6.2.3 Tools

As stated in section 5.3.1 lecturers utilised various tools when implementing formative assessment in their online practices. It must be noted that the results on tools had the highest occurrence of the themes, in that lecturers indicated having knowledge of incorporating various tools when implementing online formative assessment at HE institutions. The focus of this section is on the types of tools available to support the implementation of online formative assessment. The researcher did not expect lecturers at HE institutions to implement online formative assessment activities using various tools. The tools utilised by lecturers when implementing online formative assessment are presented in Table 5.7. These tools were identified by lecturers who participated in this study and are believed to be necessary in the process of developing online formative assessment activities.

Table 5.7 Tools utilised by lecturers when implementing online formative assessment

Tools	Sources
Moodle	L1, L2, L3, L4
PANOPTO software	L2, L1
Technical devices i.e. Laptops/PC, mobile phones, Tablets, IMACS	L1, L2, L3, L4
Microsoft office 365	L4
WhatsApp /Chat-sessions	L1, L4, L3
Discussion forums	L1, L2, L3, L4
Turn-it-in	L3, L4
e-Learning tools	L1, L2, L3, L4
Microsoft bar note tool	L1, L2, L4
Blackboard	L1, L4
Microsoft OneNote	L3, L4
Ville	L4, L3
Gradebook	L1, L2, L3

It is evident from Table 5.7 that all lecturers indicated using Moodle for online assessment. Moodle as an LMS is commonly used by lecturers to assess students online (L1, L2, L3, L4). Lecturers utilise synchronous technologies to allow interaction between teachers and students as opposed to asynchronous without a time log. This is believed to address the issue of time management. It was surprising to learn that lecturers are using Microsoft OneNote because it is not a common practice in the implementation of online formative assessment. This shows that lecturers are ‘creative and innovative’ when implementing formative assessment in their online practices.

In terms of tools, lecturers strategize tools in digital books and digital courses necessary to improve assessment activities, thus expanding knowledge and capabilities to learn more regarding improvement on teaching and learning online.

According to Lecturer 4:

> *"For art education, digital books are considered as digital tools in the online courses and are useful for innovations".*

Lecturers see their involvement in the process of online formative assessment important in that they develop strategies for implementing formative assessment activities online, utilise various tools to aid the development of online formative assessment activities and design rubrics for grading purposes, particularly for online discussion, large assignments and structured activities and exercises based on various strategies and appropriate techniques.

5.6.3 Theme 3: Provision of feedback

Responses in terms of provision for feedback are discussed here. Lecturers suggested the need for institutions to implement tools that support feedback, as this is supposed to assist the student in the learning process (L1, L3). The results were expected because lecturers are expected to provide feedback for all formative assessment activities in the online courses.

Asked to mention tools that they use to provide feedback, lecturers indicated that Turnitin is one of the common tools used in the online assessment platforms (L1, L2, L3, L4). Lecturers indicated using the Audio recording feedback tool which is believed to be faster when recording information. A cloud-based system such as cloud computing and Google cloud platform is also used by lecturers to provide information online. Lecturers utilise Google drive to share information online with colleagues and students.

Asked to indicate the feedback strategy they employ to facilitate the actual use of online assessment, lecturers indicated that giving feedback immediately is most important. Lecturer 2 elaborated that:

> *"once you promise students that you will give them feedback on this day you should provide instant feedback. For instance, every time you give a comment when marking an assignment those comments are saved automatically by the computer program. Thus, lecturers can edit the same comment. These save you time in terms of the marking as far as marking online is concerned".*

5.6.3.1 Peer assessment

Lecturers also mentioned that they afford students the opportunity to monitor each other's work through peer-assessment (L1, L2, L3, L4). Lecturers seem to have confidence in their students as assessment agents, thus, they encourage peer assessment. Asked to indicate how they ensure peer assessment in their online courses, lecturers mentioned that through peer assessment platforms made available on the LMS, students can assess each other's work.

Lecturer 2 elaborated that:

> *"Through peer assessment students may assess other students' work and get a different perspective of the questions, and they see that other students think differently. This provided us with good feedback from the students".*

5.6.3.2 Self-monitoring

Through self-assessment and reflection, students are given an opportunity to monitor their own progress. Lecturers assign self-activities and group-activities such as tests, quizzes and assignments to students and provide feedback either through automated recordings or through peer-feedback (L1, L2, L3, L4). Lecturers mentioned that this strategy allows students to use critical thinking and reflection in that students are required to analyse questions on the activities and reflect on what they have learnt (L2, L3).

Lecturer 3 mentioned that:

> *"Students are encouraged to use critical thinking and do self-activity by completing reflective exercises and tutorials online".*

Lecturer 4 added that:

> *"Students can self-monitor their progress online through Gradebook".*

5.6.3.3 Timely, appropriate and reflective feedback

Lecturers indicated that a graded and recorded formative assessment activity can be helpful to both the lecturer and the student. Lecturers caution that fairness should be considered as a daily practice to support effective feedback (L1, L2, L3, L4). Lecturers

encouraged the use of technology to support online grading. This is believed to motivate students, through grading made easier with online assessment in that:

> *"Lecturers should constantly give feedback on time to motivate students" (L2).*
>
> *"Technology makes it possible to manage big courses and students' assignments by providing feedback through the use of e-learning tools" (L1).*

Lecturers and documents highlighted that feedback provided should be:

- Timely, often and in detail during the process of online formative assessment (D3).
- Appropriate, understandable and reflect the student's ability, maturity and age (L1).
- Honest, supportive and encouraging to students (D2).
- Focused on learning and linked to the purpose of the task (D4).
- Enabling students' continuous learning (L3).

In summary, lecturers indicated that the LMS provides opportunities for:

- Provision of immediate feedback for all students (L4).
- Objective grading by eliminating human error (L3).
- Easy to update and edit (L1).
- Increased accessibility by lecturers and students (anytime, anywhere) (L2).
- Items analysis that help instructors identify areas for improvement (L1).

Reflecting on the above activities, lecturers use specific strategies to design and develop online formative assessment activities. These activities involve setting-up online tests and quizzes by randomizing questions and developing a question bank (L1). In addition, lecturers' preparation of lecture notes, assessment activities and uploading on students' portal (L2). Furthermore, evaluations for all contents to measure effectiveness, the level of learning and students' achievement, by making changes through the evaluating process. Lecturers also use testing knowledge aimed at understanding the assessment activities. Lecturers develop assessment techniques based on the structure of questions for online assessment e.g., self- and group activities by using the techniques of a question bank. Lecturer 3 also allows discussion on questions (question by question), reviewing to

avoid repetition by re-checking the question structure, and using approaches to test high order thinking skills instead of just basic approaches such as writing simple tests or quizzes. All lecturers review students' diaries as part of reflective assessment activities, encourage peer-review and online-feedback, using automatic-computer-feedback based on automated systems for feedback. Lecturer 4 uses tools such as a WhatsApp group to provide feedback during discussion forums.

5.6.4 Theme 4: Motivation for engaging in online assessment

This section addresses Main RQ2: '*Why do lecturers at HE institutions implement online formative assessment?*

5.6.4.1 Advantages for using online assessment

The purpose of this question was for the researcher to get the views of lecturers on what they believed to be the advantages of using online assessment. Lecturers were confident to share some of the advantages for engaging in the online assessment (L1, L2, L3, L4). Lecturers seem to be motivated to engage in the online formative assessment at their institutions. They believed that the advantages for engaging in the online assessment outweighs the disadvantages.

Lecturer 3 elaborated on the advantages for online formative assessment by saying that:

> *"The effectiveness of online assessment particularly the electronic activities such as tests, quizzes and e-exams compared to traditional methods of assessment is necessary. We developed some more questions online and its usually faster with a key board than pen and paper".*

Lecturer 2 supported the above by elaborating on what motivates them to assess students online:

> *"There are various reasons for assessing students through online courses. First, it caters for everybody, it saves time and it is more sufficient. Secondly, you could give feedback to the students on time and thirdly, it is more manageable because we have a huge number of students that makes it very difficult for the lecturer sometimes without the use of technology" (L2).*

Providing opportunities to engage with other stakeholders within the institutions to get more support in terms of training and professional development (L1, L4) and to ensure the implementation of online assessment was mentioned. The formation of a community of practice to support collaboration amongst lecturers and support staff was also regarded as important and understood as motivational (L2, L3).

Asked to mention the advantages for engaging in the online formative assessment, lecturers mentioned the following as some of the advantages for online assessment which motivates them to assess students online:

- It saves the institution time and money (L1, L3).
- Students can take less time to complete assessment activities (L2, L1, L3).
- Multiple students can complete the online assessment at the same time (L1, L4).
- Students can engage in the assessment activities anywhere and at any time (L4).
- Provision for immediate and accurate feedback is guaranteed (L1, L2, L3).
- It assists both lecturers and students to do evaluations for improvements (L4).

5.6.4.2 Training, professional development and support team

This section is concerned with lecturers' views on the importance of training received, the role of the support team and their engagement in professional development. Lecturers indicated that there is a support team responsible for training at their institutions. Most lecturers mentioned that they were trained on how to assess students online.

Asked whether they work with the support team, Lecturer 2 responded that:

> *"Yes, we work together with the support team and from time to time they organise workshop and bring people from outside to train us. We had people that came from the Commonwealth and trained lecturers at our institution".*

Lecturer 3 added that:

> *"When we started assessing students online, we received the support from the technical department and we were trained on how to develop the material to design assessment activities online".*

Lecturers expressed the need for institutions to have more support teams to provide technical support and training to specific faculty members (L1, L2). Lecturers believed that the technical support team, including instructional designers, are not enough to provide technical support to all faculty members. Lecturers recommend that the HE institutions investigate the matter and employ additional technical support team members for each faculty (L1, L2). Lecturers however, added that they provide support to other lecturers and teachers alike, by developing assessment activities and collaborate through the LMS to provide training on the operations and administration of online formative assessment through Moodle (L3, L4). Lecturers also mentioned receiving training for learning analytics and LMS (L2, L3). According to lecturers they can integrate learning analytics in their online courses. In addition, the LMS provides tracking information on the number of courses taken by students, and data about time taken to complete activities online (L3, L4). Lecturers believed the statistical information obtained through the LMS to promote learning and provide guidance to students. Regarding professional development, lecturers confirmed having participated in various training sessions for professional development.

Lecturer 1 mentioned that:

> *"I participated in the 'African Leadership' for technological leadership development of ICT in a 'knowledge society' which is relevant from a perspective of design thinking about knowledge society and economy. Additionally, I have knowledge of programming and I can also merge my technological knowledge with that of pedagogical knowledge".*

Lecturers also added that training focusing on mobile phones in education is necessary to embrace mobile learning (L1, L3). Lecturers at both Institution A and B recommended the integration of mobile learning at HE institutions to support online formative assessment, considering their accessibility and portability anywhere, anytime. Furthermore, lecturers encouraged other educators to embrace the concept of augmented reality, developing games and online study materials (L3, L4). Lecturers also mentioned the memorandum of understanding (MOU) with partner institutions that is currently in place to promote training and benchmarking on the use of e-tools to assess

students online (L2). Lecturers confidently mentioned that they received training as e-moderators and are facilitating online learning (L1).

Furthermore, lecturers also shared their experiences for participating in conferences and seminars, which they believe to have contributed to their understanding of teaching with technology and implementing formative assessment activities for their online courses.

According to Lecturer 2:

> *"The biggest professional development I have been going through considering conferences and workshops, through sharing ideas with teachers in the active teacher network as part of the community of practice".*

5.6.4.3 Collaboration and collaborative teaching

The purpose of this sub-section was for the researcher to seek opinions of the lecturers on how they promote collaboration amongst lecturers and students. All four lecturers mentioned that they co-teach to support teaching and learning. Lecturers indicated engaging with teachers and other stakeholders through collaboration (L1, L2, L3, L4). Lecturers collaborated with other educators by developing flipped learning to support co-teaching.

In addition, lecturers collaborate through research conferences, workshops and seminars. Lecturers elaborated on the collaboration they share with specialists from industry to enhance the implementation of formative assessment in the online practices. Lecturers were of the view that through collaboration, they inspire their students by encouraging them to link up with students from other fields of study and industry, to familiarize themselves with trending technology and the support for online formative assessment.

Lecturers see their engagement and involvement with other colleagues in the process of online formative assessment as important, in that they co-teach and deliver research publications, understand the importance of sharing assessment activities, collaborate through seminars and conferences and design and develop various formative assessment activities in the online learning environment.

Lecturers mentioned the opportunity given to their students to collaborate as part of the motivation to encourage participation in the implementation of online formative assessment at HE institutions. Student collaboration is realised through the LMS in that students are given the opportunity to anonymously review other students' learning diaries and provide feedback online (L4).

In addition, lecturers' collaboration through social media platforms, such as Facebook and WhatsApp groups, was considered necessary in that they support the implementation of online formative assessment through sharing of resources, including assessment activities (L1, L2, L3, L4). Furthermore, lecturers expressed the need to embrace other platforms such as YouTube and Google drive to support collaboration and enhance pedagogical approaches (L2, L4).

5.6.4.4 Best practices

Lecturers from both the countries (CA1, CB2), revealed that they were specifically involved in the implementation of online formative assessment by designing and developing assessment activities and by providing effective feedback. Lecturers mentioned that they collaborate with support and technical teams at their respective institutions to expand the implementation of online formative assessment (L1, L2). Lecturers seem to be proactive and have demonstrated creativity to support the implementation of online formative assessment (L1, L2, L3, L4).

In addition, lecturers collaborate through research and publications as co-authors and have demonstrated their creativity which promotes best practices in the online learning environment. Lecturers mentioned that they encourage other lecturers to develop formative assessment activities online (L1, L3, L4). Lecturers also go the extra mile to train other lecturers on how to implement online formative assessment with the support of the technical team at their institutions (L1, L3).

In summary, online best practices for lecturers include the following: engagement in the development of online assessment activities using strategies and techniques for online formative assessment, obtaining knowledge of trending technology and application thereof, effective application of software on the LMS for online formative assessment, providing timely, accurate and appropriate feedback online, close and regular

collaboration with the support team and faculty in and outside institutions, creation of conducive online learning platforms through collaboration and engagement with students to enhance implementation of formative assessment, and engagement in research and innovative practices to improve the online assessment platforms.

5.7 Synthesis of emerging themes for the implementation of online formative assessment

A summary synthesising the most important key words in terms of emerging themes from interview transcriptions of lecturers when implementing the online formative assessment at HE institutions is presented in Table 5.8.

Table 5.8 Synthesised summary: emerging themes and the implementation of online formative assessment

Themes	Keywords	Sources
Lecturers' design and development of online assessment activities	LMSs, trending tools, self-activities, group-activities, chat rooms, discussion forums, e-portfolio	L1, L2, L3, L4
Processes for online formative assessment	Strategies, techniques, methods, structure, 21st century skills, setting-up questions, learning objectives, random exercises, Gradebook, question bank, class size	L1, L2, L3, L4, D1, D2
Provision of feedback	Reflection, critical thinking, instant feedback, enabling, support learning, peer assessment, proactive, Turnitin, automated	L1, L2, L3, L4, D3, D2
Motivation for engaging in online assessment	Collaborations, community of practice, training, support team, professional development, best practices, WhatsApp group, Facebook, open-minded, creativity	L1, L2, L3, L4, D1, D2

Table 5.8 presents a synthesised summary of the emerging themes to represent the important keywords in the implementation of online formative assessment and the sources from which the keywords emanated.

5.8 The link between the conceptual framework and emerging themes

The diagrams below represent the link between the conceptual framework and the themes that emerged from this study. The results are presented to show the relationship between the concepts from the TPACK framework, Bloom's revised taxonomy levels of reasoning skills and the knowledge dimensions adopted and adapted for the current study.

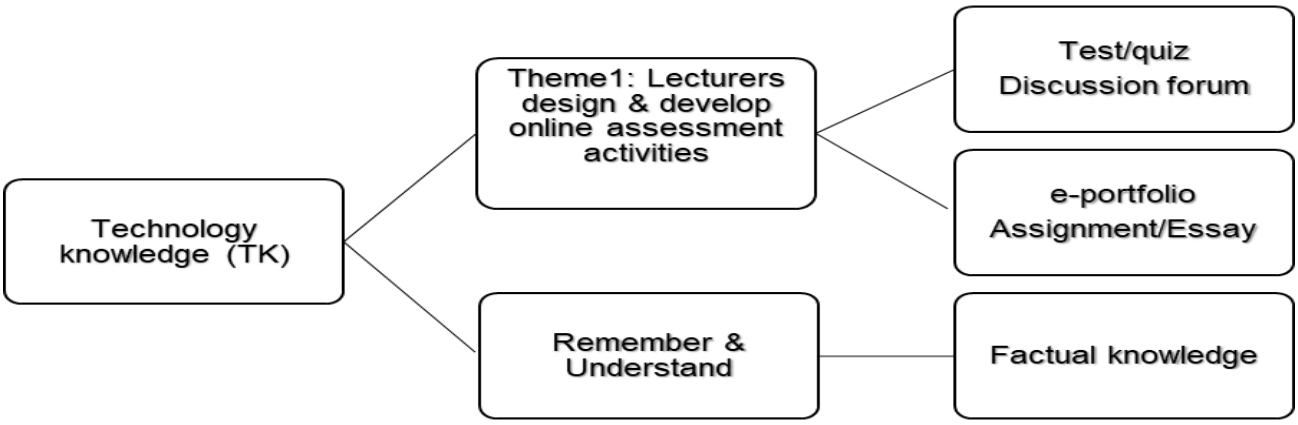


Figure 5.1 Link between conceptual framework and theme 1

Figure 5.1 shows the link between technology knowledge, theme 1, Bloom's revised taxonomy and knowledge dimensions. This means that lecturers have knowledge of various technology which they utilise to design and develop online assessment activities such as a test/quiz. Students are given opportunities to participate in the discussion forums. Also, students can build on the e-portfolio and complete assignments and essays. Furthermore, lecturers make use of levels of reasoning skills such as remember and understand to test for factual knowledge when developing online formative assessment

activities. The arrows represent the link between the conceptual framework and the emerging themes.

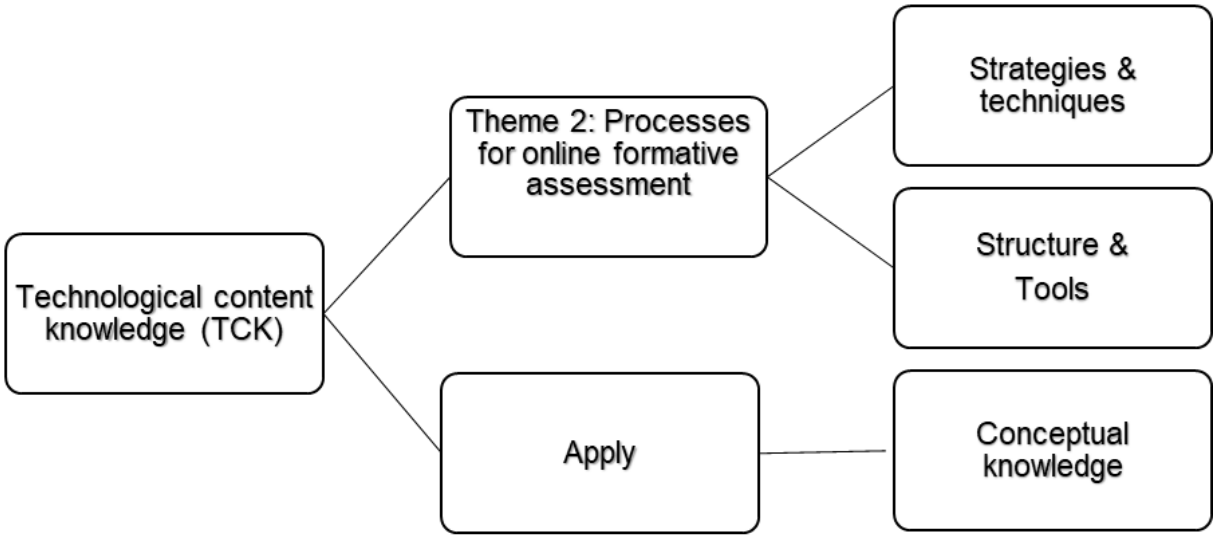


Figure 5.2 Link between the conceptual framework and theme 2

Figure 5.2 shows that lecturers have knowledge of understanding the influence that technology and content has on the online assessment practices, particularly activities that require strategies and techniques for developing structured online formative assessment, using advanced technological tools for specific online content, that allow students to apply conceptual knowledge.

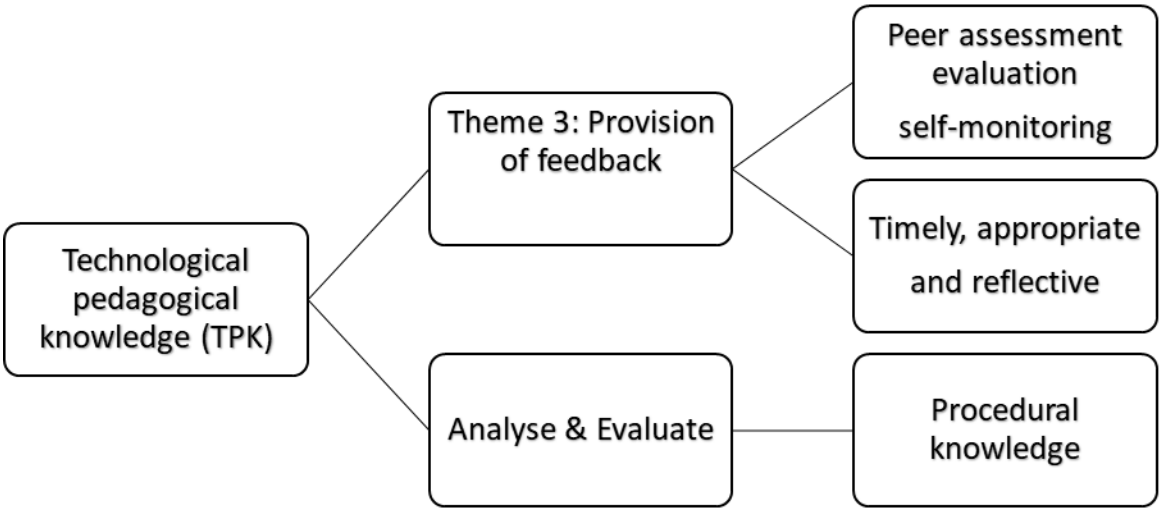


Figure 5.3 Link between the conceptual framework and theme 3

Figure 5.3 shows the link between lecturers' knowledge of teaching, using various technologies according to changes in context and purposes for online assessment, and can provide timely, appropriate and reflective feedback. This means that lecturers analyse and evaluate assessment activities through peer assessment evaluation and self-monitoring while testing for procedural knowledge.

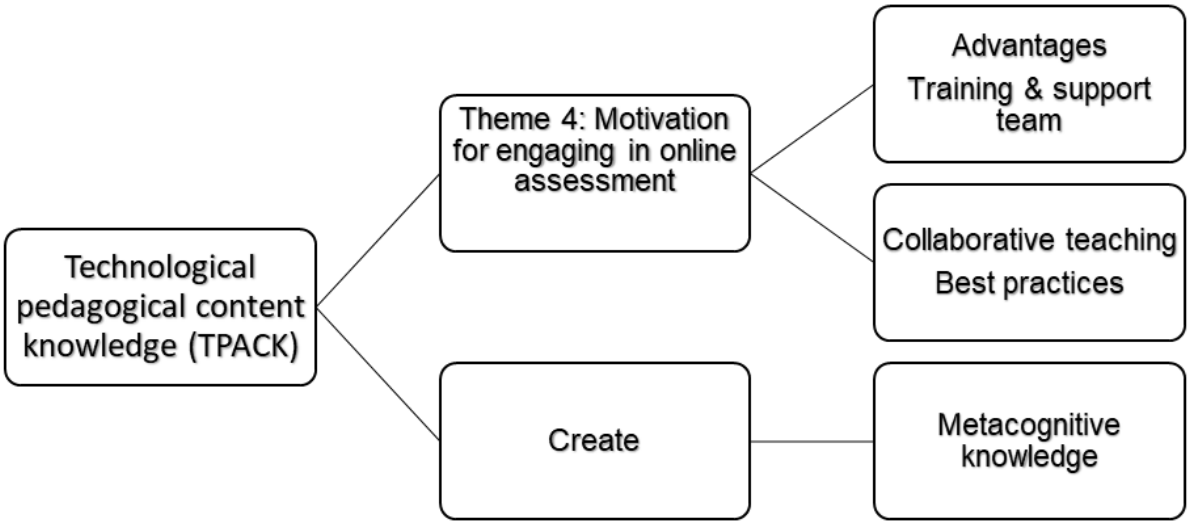


Figure 5.4 Link between the conceptual framework and theme 4

Figure 5.4 represents the link between lecturers' expert knowledge concept of integrating *technology*, *pedagogy* and *content* into online assessment and theme 4. This means that lecturers are motivated to engage in online assessment considering advantages, training, support teams, collaborative teaching and best practices. Assessment activities should allow students to create new meaning while testing for metacognitive knowledge.

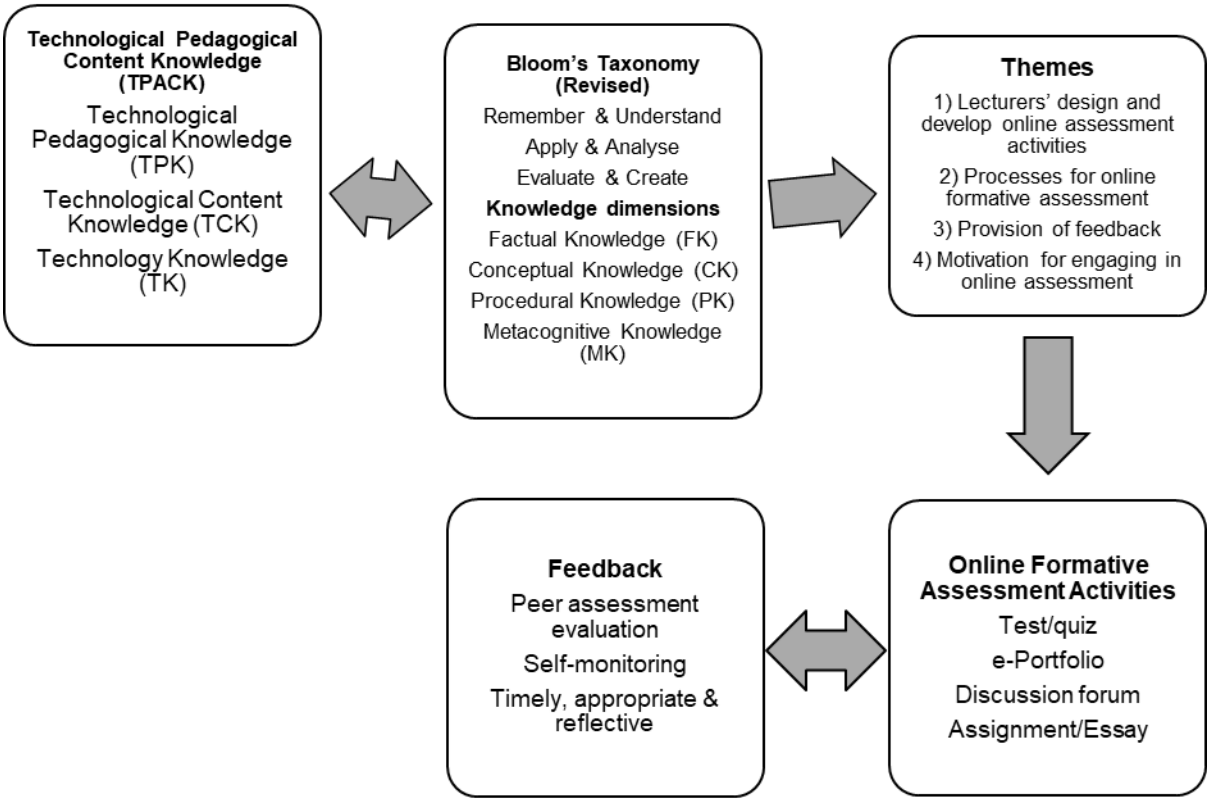


Figure 5.5.1 The link between the conceptual framework, emerging themes, online formative assessment activities and feedback

Figure 5.5.1 shows the link between the conceptual framework adopted and adapted for this study and the themes that emerged from interview transcriptions of the four lecturers that participated in this study. Lecturers demonstrated knowledge of TPACK and RBT application in the online assessment platforms which yielded the four themes that emerged from the interview transcriptions. The arrows represent the relationship between constructs in the conceptual framework, themes with sub themes, assessment activities and the provision of feedback. Some arrows are two-way direction (e.g., between TPACK and RBT; Online Formative Assessment and Feedback). This means that the processes are back-and-forth in that lecturers can combine either components of the TPACK framework with that of the RBT. Additionally, lecturers can either give feedback and then continue with the development of online formative assessment activities or vice-versa. The one-way arrows (e.g., between Themes and Formative Assessment) shows that the

process themes emerged as a result of linking TPACK with RBT in the development of Online Formative Assessment Activities.

Resulting from Figure 5.5.1 the output is summarized below in Figure 5.5.2.

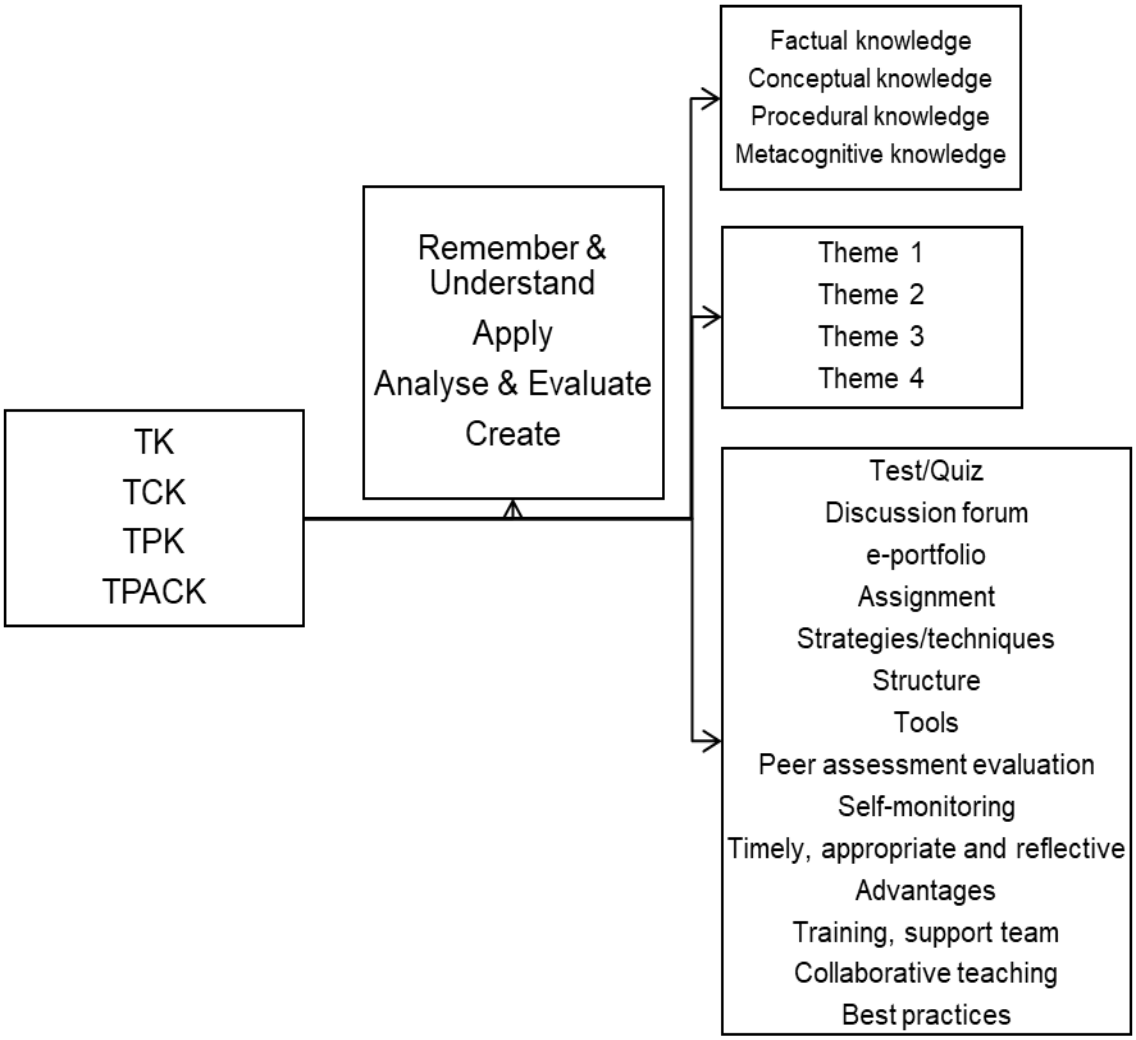


Figure 5.5.2 Link between conceptual framework, assessment activities, emerging themes and sub-themes.

Figure 5.5.2 shows the connection between TPACK framework and the RBT that represents various types of lecturer's knowledge and the themes with sub-themes that emerged from the study as a result of the adopted conceptual framework to inform lecturers on the implementation of online formative assessment.

5.9 PART B: Addressing Main RQ3

This section addresses the main research question 3: *'What are the challenges and benefits of implementing online formative assessment?'* Both the benefits and challenges must be considered. The benefits for implementing online formative assessment seemed to be linked to the success of using Moodle as an LMS and advantages of online formative assessment, while the challenges are linked to technology access, human adoption and supporting infrastructure (L1, L2, L3, L4).

5.9.1 Challenges when implementing online formative assessment

Lecturers appear to be challenged when implementing the online formative assessment at HE institutions, with reference to access of supporting infrastructures (L1, L2, L3, and L4). Other explicitly mentioned factors hindering lecturers in engaging in online formative assessment activities are human use and adoption of technology. It is believed that for a successful adoption of technology and infrastructure to be achieved, there should be widespread, affordable and unfettered access to the internet (L1, L4). Lecturers mentioned that some challenges related to cloud computing, internet access and supporting infrastructure are widening the digital divide (L1, L2).

Some lecturers must accommodate many students to ensure the full participation in some formative assessment activities in the large online learning environment (L1, L2, L3, L4). Lecturers thus believe that lack of accessibility for certain e-tools may slow the development of online formative assessment activities.

According to Lecturer 2:

> *"We are challenged with lack of virtual labs, there are not enough virtual labs for students to carry out experiments by arousing their curiosity and using simulation to create real world environment".*

Some lecturers are concerned with Internet connections; there seems to be errors with network access in institution A and this challenged the effective implementation of online assessment (L1, L2). Lecturers emphasized that issues with power failure and connectivity can cause problems to assess students online.

According to Lecturer 2:

> *"Sometimes the net [Internet] is not working very well, thus we make provisions to give students 3 attempts on the online quizzes to accommodate all the hiccups that may arise e.g., the network problem, power off and when student need to restart they have 3 chances to take this test or quiz and we record the highest score".*

Lecturer 3 added that:

> *"Technical restrictions such as the inability of the computer software and hardware to achieve some functionality can fail us to access some features on Moodle".*

Lecturers are also concerned about the complexity of advanced technology that may cause challenges for themselves and students.

> *"Searching information can be challenging or difficult at times for example using Google Arts and Culture to check all the museums in the world and make virtual collection you can get lost because there is so much information" (L4).*
>
> *"Sometimes, lecturers need to find a way to navigate the questions for a particular assessment on Moodle" (L2).*

Prototype technical software problems were also mentioned by Lecturer 1 and 3 respectively.

> *"We sometimes find it difficult to preview some incoming comments in the group discussion forums for large groups for instance when you have 400 students registered for the online course, the lecturer should divide them into groups of 40 students to promote engagement and collaborations" (L1).*

> *"Challenging part in Ville can also be how to use the tool for its original purpose for subjects such as history it can be a little bit formal to judge according to the system. The system only detects some course subjects and selective content for instance Mathematics exercises" (L3).*

Lecturers also caution the need to promote blending of online formative with traditional assessments. Lecturers believe that they cannot rely on one type of learning assessment. Thus, they emphasized the need to blend the two types of assessments to improve

instruction and support learning objectives (L1, L2, L3, L4). Lecturers highlighted some uncertainties in the online learning environment because there is no face to face contact. Lecturers indicated that the limitation of face-to-face interaction with their students, challenges opportunities for further engagement to address uncertainties regarding assessment activities in that the interaction is always mediated by the computer (L1, L2, L3, L4). This is believed to be a common challenge because lecturers feel that students are not given the platform to direct their views and concerns face-to-face.

Lecturers were also concerned with the issue of dishonesty on the part of students when engaging in the online formative assessment activities. Lecturers emphasized the issues of dishonesty in that:

> *"Most students tend to cheat a lot during online tests and quizzes whereby they tend to help each other or find answers on the internet. One of the concerns is that how is the student doing the exercises, are they doing it themselves or are they getting the answers from the internet" (L1).*
>
> *"Online exercises and activities are done outside the classroom which makes it difficult to tell whether students are completing individual activities such as test or quiz with assistance of others or the internet" (L3).*

Lecturers were also concerned with time as a challenge. Lecturers believed that time is limited to provide instant and timely feedback for some of the online formative assessment activities. According to lecturers, activities such as essays and assignments are lengthy in nature and take up so much time for grading online. Discussion forums are also deemed to be time consuming in that lecturers must follow through the discussions and give feedback to most of the students who are participants in the discussion forums (L1, L2, L3).

Encouraging students' participation in online formative assessment was raised as a concern. Lecturers mentioned doing their best to encourage students to complete online formative assessment. They mentioned that most students do not meet the submission deadline for most of the assessment activities due to reasons known to themselves. However, lecturers indicated the need to encourage students' participation in various

online formative assessment activities. Lecturer 1 elaborated on the challenges they face while encouraging students' participation:

> *"Encouraging students can be difficult at times, you essentially force them. The initial motivating factors for most students are the grade or marks awarded to be the pushing factor that helps them engage online. I believe that lecturers still have a long way to go in terms of making the online formative assessment valuable to students".*

Lecturers also perceived that provision of feedback does not always interest some students; they only look forward to their grades as far as results and scores are concerned. Although this is not considered to be a major problem, lecturers caution the enforcement of students' participation. Lecturers mentioned that only a few students are motivated and curious to receive feedback while other students only seem to be interested in their final grade.

Expectation of immediate feedback from lecturers, misunderstanding of feedback, wrong interpretations or misinterpretations of feedback by students as well as provision of general feedback to all students was mentioned as far as the implementation of effective feedback is concerned (L2, L4). Some lecturers mentioned that a one-on-one discussion approach is expected to be maintained to assist students with different learning styles; for eg. slow learners and students with learning difficulties (L1, L3). They further indicated that assignments based on reflective activities could be challenging for lecturers, in that students expect to get feedback immediately. Another concern shared by lecturers is the issue of general feedback in discussion forums which does not seem to address specific students' needs (L2, L3).

The e-portfolio was deemed unsuccessful amongst the online formative assessment activities by some lecturers in that:

> *"Students who lack content and technological knowledge may find e-portfolio not as successful because they do not fully understand that the work they have done throughout the course cumulatively affects their final mark" (L4).*

Finally, lack of funding was noted as a hindrance in terms of research and innovations. Lecturers view their contributions to research and innovations as equally important to support the implementation of online formative assessment. Lecturers believed that insufficient or not enough funding can have a negative impact on the number of publications (L1, L2). This means that lecturers will be discouraged to embark on projects that can contribute to the body of knowledge. Lecturers were confident to mention that research projects can improve online formative assessment practices, in that new strategies for developing effective online formative assessment activities can be identified to support the emerging technology (L1, L2, L3, L4).

5.9.2 Benefits for online assessment

As stated in section 5.6.4.1 some of the benefits for online formative assessment are linked to the advantages of using online formative assessment in the development of the 21st century skills. Some of the advantages mentioned by lecturers were: 1) cost effective 2) requires less time 3) accommodates multiple students 4) can happen anywhere anytime 5) provision of immediate feedback and 6) supports evaluation (L1, L2, L3, L4). Lecturers recognised emerging trends, challenges and opportunities when implementing the online formative assessment (L1, L2, L3, and L4). Lecturers seem to have knowledge of effective practices when implementing formative assessment in the online courses. Among the many advantages of online administration of assessments, lecturers and documents mentioned the following benefits for Moodle and Ville as LMSs:

- The assessment scores are immediate and provide a real image of the students' progress.
- Students can receive feedback for each question.
- Online assessment offers opportunities to repeat the quiz which will provide students not only with correct answers but also references.
- There are possibilities for lecturers to analyse the time spent on each question and the history of responses to identify difficulties and patterns of responses.

- Online learning and assessment encourage independent learning and self-evaluation.
- Online learning and assessment assists students to develop effective time management strategies.

5.10 Chapter summary

This chapter presented the results from this study in relation to the conceptual framework and according to the themes that emerged from data analysis. Emerging themes were discussed to address the three main research questions and sub-questions. In addition, emerging themes were synthesized to highlight important keywords. Furthermore, the emerging themes were linked with the conceptual framework adapted and adopted for the current study. This was necessary to establish the link between concepts in the conceptual framework, themes with sub themes, assessment activities and the provision of feedback. The findings on the challenges and benefits of implementing online formative assessment were presented to establish a rapport from lecturers at the selected HE institutions.

The next chapter 6 presents a discussion and findings for this study and begins by discussing the results according to the structure of the conceptual framework and supporting literature. The researcher begins by presenting the findings of the study based on the constructs of the conceptual framework and the emerging themes. This is followed by a discussion of the challenges faced by lecturers when implementing online formative assessment practices. Subsequently, the chapter presents consolidated findings as the chapter summary.

CHAPTER SIX: DISCUSSION AND FINDINGS

6.1 Introduction

The preceding chapter 5 reported the main results of this study and findings were consolidated and discussed according to emerging themes from responses by lecturers, the conceptual framework and analysis of institutional documents. This chapter presents a discussion of findings in relation to the literature pertinent to online formative assessment. It begins with a discussion of findings emanating from the conceptual framework focusing on TPACK (Section 6.2) and Bloom's Revised Taxonomy (Section 6.3) respectively. Subsequently, a discussion of findings from institutional documents analysed for the purpose of this study (6.4) followed by a discussion of findings from emerging themes (Section 6.5). The chapter also presents findings addressing main research question 2 (Section 6.6) focusing on challenges faced by lecturers when implementing online formative assessment (Section 6.6.1) and benefits for online assessment (Section 6.6.2). The chapter ends with some consolidated findings as the summary (Section 6.7).

In the discussion, results are interpreted in terms of supporting sources reviewed in Chapter 2 with a specific emphasis on the proposed model that has been integrated into the conceptual framework (Chapter 3). In addition, the section in which a source was originally reviewed is supported by relevant literature as presented in Chapter 2 and 3. Furthermore, the section in which data is presented in Chapter 5, is provided where relevant, within the discussions in this chapter. Table 6.1 below provides a synthesised summary of emerging themes and concepts, with relevant sections within the discussions in this chapter, with supporting relevant literature as reviewed in Chapter 2.

Table 6.1 Concepts and themes in relation to supporting literature with applicable sections for discussions

Concepts and themes	Supporting literature in respective sections
Technological pedagogical content knowledge (TPACK): TK, TCK and TPK (Section 6.2)	Mishra & Koehler (2009), Pellegrino et al. (2001), Koehler et al. (2013), Spector et al. (2016), Koehler et al. (2017), (Section 6.2.1); Schmidt et al. (2009), Koh et al. (2014), (Section 6.2.2); Koh et al. (2014), Mishra et al. (2016), Herring et al. (2016), Yeh et al. (2017), Ouyang & Scharber (2018), (Section 6.2.3); Mishra et al. (2016), Koh et al. (2015), Herring et al. (2016), Bennett (2011), (Section 6.2.4).
Knowledge dimensions and levels of reasoning skills in the RBT (Section 6.3)	Anderson & Krathwohl (2001), Churches (2008), Churches (2010), Scully (2017), Irvine (2017), Forehand (2010), Wedlock & Growe (2017), Huber et al. (2016), (Section, 6.3).
Implementation and context for online formative assessment at HE institutions (Section 6.4)	Trumbull & Lash (2013), Oneal-Self (2015), Dietrich (2011), Spector et al. (2016), Bennett (2011) and Koh (2010), Heritage (2007; 2010), Bhattacharjee (2015), Sadler (1989), (Section 6.4).
Emerging themes (Section 6.5): Lecturers design and develop online formative assessment (Section 6.5.1); processes for online formative assessment (Section 6.5.2); provision of feedback (Section 6.5.3); motivation for engaging in online assessment (Section 6.5.4)	Gaytan & McEwen (2007), Wang et al. (2017), Vygotsky (1987), Oneal-Self (2015), Lin & Lai (2013), Voelkel (2013), (Section 6.5.1.1); Gaytan & McEwen (2007), Koh (2010), Kearns (2012), (Section 6.5.1.2); Koehler et al. (2017), Spector et al. (2016), Kearns (2012), (Section 6.5.1.3); Gaytan & McEwen (2007), Hood (2009), Koh (2010), Sadler (1989), Black & William (1998), McMillan (2013), Bennett (2011), Shepard (2005), Heritage (2007), (Section 6.5.1.4); Gaytan & McEwen (2007) Bugg (2013) and Cornelius (2013), Heritage (2007), Bennett (2011), Trumbull & Lash (2013), (Section 6.5.2.1); Spector (2013), Heritage (2010), Bennett (2011), (Section 6.5.2.2); Kaila, 2018, Pellegrino (2001), Gaytan & McEwen (2007), Hood (2009), Heinrich et al. (2009), Spector et al. (2013), (Section 6.5.2.3); Oneal-Self (2015), Dietrich (2011), Spector et al. (2016), Bennett (2011), Koh (2010), Shute (2008), (Section 6.5.3.1); Nicol & Milligan, 2006 (Section 6.5.3.2); Heritage, 2010; Shute, 2008; Wood, 2010, Van Gog et al. (2010), Heritage (2007), Spector et al. (2016), (Section 6.5.3.3); (Section 6.5.4.1); Rios-Parnell (2017), Spector (2013), Baran & Correia (2014), Kennedy (2015), Lian (2014), Roy & Boboc (2016), (Section 6.5.4.2); Moore et al. (2009), Allan (2004), Cahill (2011), Schieffer (2014), Hudson (2010), Lock et al. (2017), (Section 6.5.4.3); Finch & Jacobs (2012), Thompson & Braude (2016), Corry et al. (2014), Wang (2006), Baran & Correia (2014), (Section 6.5.4.4).
Challenges when implementing online formative assessment (Section 6.6.1) Benefits for online assessment (Section 6.6.2)	Kearns (2012) (Section 6.6.1); Kuikka et al. (2014), Spector (2013), Dietrich (2011), Kearns (2012) (Section 6.6.2).

Part A addressing Main RQ1 and RQ2

'How is online formative assessment implemented by lecturers at HE institutions?' and 'Why do lecturers at HE institutions implement online formative assessment?'

6.2 Technological pedagogical content knowledge (TPACK)

Section 6.2 addresses research sub-question 1: *'How does the use of the TPACK framework improve the online formative assessment content?'*

6.2.1 Technology knowledge (TK)

Lecturers from IA and IB were found to have knowledge of technology (TK) which will likely become outdated as technology changes and they thus need to keep themselves updated. This result follows the description from Mishra and Koehler (2009) in that various thoughtful ways about technology are applicable to all technology tools and resources. However, any meaning associated to TK is in danger of becoming outdated. Similarly, Koehler et al. (2013) noted that TK is always in a state of change and there is a possibility of it becoming obsolete. Koehler et al. (2017) mentioned that lecturers with TK have the ability to work with technological tools and resources.

In this study, lecturers demonstrated the ability to work with e-tools and resources to implement online formative assessment. However, it must be noted that lecturers in this study are not restricted by TK becoming outdated because they acquaint themselves with the latest technology to enhance the development of online formative assessment content. Lecturers indicated using tools such as Moodle and Ville as LMS at their respective HE institution to assess students online. This shows that lecturers are equipped with current tools to support the implementation of online formative assessment. The findings are expected in that lecturers at HE institutions typically have access to technologies that are necessary to implement the online formative assessment. The findings are consistent with literature in that lecturers are required to have tools that support the implementation of high-quality assessment (Pellegrino et al., 2001). The tools utilised by lecturers are further discussed in Section 6.5.2.3.

6.2.2 Technological content knowledge (TCK)

Additionally, lecturers were found to have a deep understanding of TCK in that they frequently use diverse e-tools and are technically equipped to solve technical problems. Lecturers who have a deeper consideration of the use of specific technology can transform students' understanding and practice ideas for specific content areas in online courses. This means that lecturers have knowledge of technologies that they can use for students to understand specific content for an online course. The finding is similar to that of Schmidt et al. (2009) in that through the use of specific technology, lecturers can modify students' understanding of concept preparation in a specific content area.

Therefore, lecturers should sustain thoughtful understanding of the way assessment content can be altered through application of various technologies (Yeh et al., 2017). In the same light Koh et al. (2014) indicated that the use of computer and software programs by teachers to design ICT lessons demonstrate a deep understanding of TCK. In this study, lecturers demonstrated a positive open-minded attitude and inspired and encouraged other lecturers to use trending technologies when developing assessment activities for the 21st century skills. This concurred with literature that several technologies emerged for online formative assessment to enhance 21st century skills (Spector et al., 2016).

6.2.3 Technological pedagogical knowledge (TPK)

Furthermore, all lecturers in this study demonstrated TPK in that they created new representations for specific content through technology, and demonstrated knowledge of teaching, using various technologies according to changes in context and purposes for online assessment (Ouyang & Scharber, 2018; Koehler, et al., 2017). This is interpreted to mean that lecturers can select tools that improve teaching approaches for online courses, students' progress in a lesson and development of the use of technology for several assessment activities. This means that lecturers have knowledge of using different technology to teach online, and they consider the use of technology to alter methods of assessing students online (Herring et al., 2016).

Lecturers at both HE institutions, with over five years of teaching experience, served as an administrator for an online course. The criteria are consistent with the results of Koh

et al. (2014) where teachers in Taiwan typically taught for about eight years and were found using both hardware and software to support the construction of TPK. In my opinion, all lecturers were suitable for this study because they have the professional knowledge construct (Mishra et al., 2016). This means that lecturers have knowledge to utilise strategies while combining content, technologies and approaches of teaching to enhance development of formative assessment activities. Strategies in the development of formative assessment activities online necessary for lecturers to construct ePCK (Ouyang & Scharber, 2018; Koehler et al., 2017). As a result of ePCK construction, lecturers collaborated with other lecturers to design and develop online formative assessment activities using technologies. Strategies developed by lecturers are further discussed in Section 6.5.2.1.

Although literature suggests that the three knowledge domains (technology, pedagogy and content) should be treated in an integrated manner, and not as separate constructs (Mishra & Koehler, 2009; Koehler et al., 2013; Mishra et al., 2016), the current study focused on TK, TCK, TPK and TPACK considering that lecturers in this study are experts and have had experience teaching online. Thus, it is believed that lecturers constructed TPACK and have a deeper understanding of relating technology to instruction and content. This means that lecturers developed various strategies and pedagogy to support the construction of online content for the implementation of formative assessment. The current study coded lecturers' responses from the interviews, with a focus on how they relate content knowledge to pedagogy and technology for online assessment, in an attempt to understand how lecturers at HE institutions construct TPACK. The construction of TPACK is considered necessary to improve formative assessment content. The formative assessment content for online courses is believed to support designing and development of online formative assessment activities by lecturers at the selected HE institutions.

6.2.4 Technological pedagogical content knowledge (TPACK)

This study found that all lecturers constructed TPACK to improve the online formative assessment content. This means that lecturers connected the TPACK framework to the instruction while integrating technology in their online assessment practices. This result

is in support of one of the four identified areas in the field of TPACK which requires further development by Koh et al. (2015) who suggested the spreading of TPACK framework to the development of online assessment activities. Besides, lecturers' understanding of TPACK in this study, match the description of TPACK as a professional knowledge construct by Mishra et al. (2016) in that lecturers have knowledge to select technologies that enhance the content for online lessons, to appropriately combine the use of technologies and teaching approaches. Also, lecturers can coordinate and assist others to implement online assessment with the use of technology, content and teaching methods at their respective HE institutions (Mishra et al., 2016).

Furthermore, results indicate that TPACK is a promising instrument for measuring lecturers' implementation of online formative assessment, which was validated through observation of online courses, particularly activities on the LMS at the selected HE institutions. The finding is consistent with the research findings by Herring et al. (2016) in that lecturers created TPACK through the application of various technologies. Online activities developed by lecturers are further discussed in Section 6.5.1. Mishra et al. (2016), (Section 3.4.4) mentioned that TPACK is necessary for the development of online assessment activities. This study has found online formative assessment activities developed by lecturers on the LMS (see Table 5.6). The results are not surprising as this justifies the purposive sampling used for this study.

In the present study, results show that significant interactions between technology, pedagogy and content knowledge are evident. The current study focused on TK, TCK, TPK and TPACK to understand how the use of the TPACK framework improves the online formative assessment content. Findings from the current study support the intertwined relationship between the three knowledges with emphasis on technology as suggested in the literature (Mishra et al., 2016; Koh et al., 2015; Koehler et al., 2017). In fact, lecturers at Institution B see the value of integrating appropriate educational technologies and pedagogies into the content, when designing online formative assessment to support students' learning (Bennett, 2011).

6.3 Knowledge dimensions and levels of reasoning skills in the RBT

Section 6.3 addresses research sub-question 2: *'How does the use of Bloom's levels of reasoning skills improve lecturers' content knowledge?'* An analysis of activities and the levels of reasoning skills used by lecturers to test for various knowledge dimensions is discussed in this section.

Anderson and Krathwohl (2001) classified the thinking processes and learning objectives into six levels (remember, understand, apply, analyse, evaluate and create) and four knowledge dimensions (factual, conceptual, procedural and metacognitive) (see Table 3.3 and 3.5 respectively). Lecturers in this study were found to be using Bloom's levels of reasoning skills to improve content knowledge for online formative assessment. The researcher observed that lecturers were able to incorporate levels of reasoning skills in the online formative assessment activities. For instance, common verbs represented by various examples such as name, list, draw, explain, classify, calculate, infer, critique, evaluate, compose and construct were evident in related online assessment activities such as quizzes, tests and assignments. The above-mentioned common verbs occurred more in the assessment activities observed on the LMSs of IA and IB exclusively.

Hence, the observed activities on the LMS had various questions comprised of common verbs to support the learning objectives. Lecturers mentioned the development of rubrics and blogging in the online learning environment. The finding agrees with the result of Churches (2008; 2010) in that digital verbs were identified for Bloom's Revised Digital Taxonomy, namely: blogging, categorising, linking, uploading and sharing. The above digital verbs were incorporated for the development of various activities by lecturers in this study. However, lecturers could not mention having knowledge of the Bloom's Revised Digital Taxonomy. This is interpreted to mean that lecturers in this study developed assessment activities in the online learning environment but may not be familiar with the 'terminology' of Bloom's Revised Digital Taxonomy.

It must be noted that the current study considered the Bloom's Revised Digital Taxonomy to support the RBT as a conceptual framework in an attempt to provide evidence on the

effectiveness of assessment. Therefore, the finding is not surprising in that it is expected that some lecturers may be unfamiliar with the term “Bloom’s Revised Digital Taxonomy”. Hence, lecturers are expected to incorporate the digital verbs in the online formative assessment activities (Wedlock & Growe, 2017) regardless of the concepts associated with the digital taxonomy. Huber et al. (2016) developed the Bloom’s Revised Digital Taxonomy as a tool to structure learning focusing on defining objectives to enable effective assessment. Assessment activities developed by lecturers are further discussed in Section 6.5.1.

In addition, this study revealed activities comprised of multiple-choice questions and other questioning structures developed by lecturers and are commonly used to test for higher-order thinking skills. Thus, the integration of questions to test for higher-order thinking skills in the assessment activities is deemed as necessary by lecturers to support the 21st century learning. However, there does not seem to be clear evidence that lecturers developed tools to determine the boundaries of lower-order and higher-order thinking skills. This could be interpreted to mean that lecturers do not see the need to identify where lower-order ends and where higher-order begins, when using various reasoning skills in the assessment activities. Besides which, lecturers would prefer to incorporate questions that test for both lower-order and higher-order thinking skills regardless of their boundaries. It could also be attributed to the fact that lecturers are not consistent with the boundaries but only focused on the development of higher-order thinking skills. This result also supports the finding by Scully (2017) that there are inconsistencies in the interpretations of where lower-order ends and where higher-order begins. Consequently, in this study, the participating lecturers are not expected to master the identification of the boundaries as far as the lower-order and higher-order thinking skills are concerned.

Lecturers indicated using Bloom’s taxonomy to test levels of reasoning skills and knowledge dimensions. However, lecturers did not mention using RBT nor did they indicate knowledge of the terminology RBT. This means that even if they used RBT to develop assessment activities, they may not always have known the formal term for RBT. However, findings showed that levels of reasoning skills were incorporated by lecturers during the designing and development of online formative assessment activities. One

reason for the findings could be that lecturers are not aware of the terminology RBT but of the old Bloom's taxonomy. Another reason could be that lecturers are focusing on incorporating Bloom's taxonomy with technology, even if they do not know the term for what they are doing. This could be interpreted to mean that, lecturers in this study incorporate the RBT when implementing online formative assessment activities but with the same knowledge of Bloom's taxonomy. The findings support a recommendation by Irvine (2017) who encouraged the use of RBT in education to create educators' awareness. However, there is a need to create awareness amongst lecturers at HE institutions to understand the RBT. This result also supports the finding by Irvine (2017) that there is a lack of research references to the RBT in contrast to the original Bloom's taxonomy. The participating lecturers' practices within their respective HE institution partly satisfies Anderson and Krathwohl (2001) expectations in that they assess students' levels of knowledge dimensions. Anderson and Krathwohl (2001), suggest the need for lecturers to design formative assessment activities that assess the four levels of knowledge dimensions namely: factual, conceptual, procedural and metacognitive knowledge. The RBT requires an understanding of knowledge dimensions focusing on metacognitive knowledge when developing assessment activities (Anderson & Krathwohl, 2001).

Anderson and Krathwohl (2001), Krathwohl (2002) and Churches (2008) all discuss students' levels of knowledge dimensions in terms of the basic elements and inter-relationships among the basic elements, as well as methods, techniques of inquiry and awareness of one's own cognition (see Table 3.5). This study has found activities of lecturers in terms of the strategies and techniques that lecturers use while developing online formative assessment activities. These activities are presented in Section 6.5. In addition, this study revealed that lecturers developed assessment activities that focused on metacognitive knowledge. This means that lecturers developed assessment activities to measure higher-order thinking skills. Hence, metacognitive knowledge was regarded as most important by lecturers in that they assess students for higher-order thinking skills to support the 21st century learning. The result is in support of two of the five components of teacher knowledge documented by Heritage (2010) which are knowledge of

metacognition and assessment knowledge. Forehand (2010) recommended the use of RBT to support emerging perspectives on learning, teaching and technology.

6.4 Data from documents

This section addresses research sub-question 3: *'What guides the implementation and context for online formative assessment?'*

This section presents a discussion of data from documents analysed for this study. It should be noted that specific documents are available at HE institutions which are believed to provide guidelines for lecturers when implementing formative assessment in the online practices. However, documents in one of the participating HE institutions has enhanced the implementation of online formative assessment. This means that lecturers believed the guidelines as provided by institutional documents to improve the implementation of online formative assessment at the selected HE institution. In this light, findings from documents will be discussed in relation to the guidelines and context for implementing online formative assessment.

This study revealed several institutional documents to be available at Institution A (IA) focusing on the guidelines and setting for implementing formative assessment online. The data as presented in Section 5.5 already highlighted some reasons for the use of specific documents in the implementation of online formative assessment. Institutional documents refer to improvement of efficiency in the administration and management of technology enhanced learning; to train and support lecturers to use ICT when teaching and assessing students online. These documents provide guidance on the planning, designing and development of online courses for the implementation of assessment practices and the provision of constructive feedback.

The finding is aligned with a description by Trumbull and Lash (2013) who caution that conducting formative assessment activities requires lecturers to have extensive knowledge about student progress, pedagogy and assessment.

Oneal-Self (2015), Dietrich (2011), Spector et al. (2016), Bennett (2011) and Koh (2010), all discuss some characteristics of formative assessment which offers on-going feedback and learning support to benefit students. In addition, Bennett (2011) cautions that

lecturers who are rooting formative assessment in pedagogical skills alone are likely to develop insufficient assessment activities online. Bennett (2011) recommended that lecturers should identify validity as strategies to support the quality of inferences about students' progress and the adjustment to their instruction. Findings on formative feedback is further discussed in Section 6.5.3.

Institutional documents refer to assessment strategies which require lecturers to engage in assessment methods, recognition of prior knowledge and provide evidence which is valid, authentic, sufficient, recorded and current. The findings support two of the six characteristics necessary for the implementation of online formative assessment developed by Pailly (2013) namely: (1) learning situations, settings, skills, content and tasks are relevant, realistic and represent the natural complexities of the real world, and (2) authentic assessment interwoven with teaching, that demonstrates an important link between activities of lecturers and reliability and validity. The finding is supported by Heritage (2010) in that formative assessment is integrated into instruction to collect evidence. Thus, the result is in support of two of the four basic types of knowledge identified by Heritage (2007) which are students' previous knowledge and assessment knowledge.

Additionally, Bhattacharjee (2015) noted that lecturers should ensure that learning takes place in an authentic and real-world environment considering students' prior knowledge. Students' experience, beliefs and attitudes are considered in the knowledge construction process (Pailly, 2013). Details in respect of the strategies developed by lecturers can be seen from the discussion in Section 5.6.2.1 and are not repeated here. Although institutional documents are readily available and accessible through IA's intranet, there appears to be minimal use of these documents. This could be due to participating lecturers having experience assessing students online, for which they developed strategies and methods where they may not require the daily use of policies. Over the years, lecturers became confident when implementing online formative assessment to support the 21st century skills.

Institution B (IB) indicated that there are no specific policies for assessment available but rather general guidelines for lecturers when implementing formative assessment online.

However, lecturers mentioned that they have 'teachers' autonomy' whereby lecturers assess students in the way they see best for learning. In this study, this is interpreted to mean that IB may not have found it necessary to develop policies and documents for the implementation of online assessment in that they have confidence and trust in their lecturers. It must be noted that this does not imply that other HE institutions with policy and institutional documents, do not have trust and confidence in their lecturers. Therefore, the finding is limited to the selected HE institution which participated in this study and cannot be generalised to all HE institutions. This may imply that lecturers preferred to follow general guidelines which are specific for online courses. The finding is consistent with literature on formative assessment, in that it requires lecturers to make judgements about the quality of students' responses and the instant use of those judgements to guide and improve students' understanding and skills (Sadler, 1989). Dietrich (2011) noted that assessments are utilised to inform instructor and students regarding progress towards meeting learning goals and objectives. Thus, formative assessment requires lecturers to measure students' understanding of course material aimed at refining instruction and providing students with a complete understanding of course material (Dietrich, 2011).

6.5 Themes that emerged: Addresses main RQ1 and RQ2

The sections below address the main RQ1 and RQ2 respectively: *'How is online formative assessment implemented by lecturers at HE institutions?'* and '*Why do lecturers at HE institutions implement online formative assessment?'*. Additionally, research sub-question 4: *'What are the best practices for online assessment?*

6.5.1 Theme 1: Lecturers design and development of online assessment activities

Findings in terms of the activities as developed by lecturers are discussed in this section. Table 5.6 represented emerging themes from the study ranked from most frequently to least frequently used activities. It appears though that the strategies used by lecturers in the development of formative assessment activities are linked to structures of activities (Section 5.6.2.1). The data as presented in Section 5.6.1.1 already highlighted some reasons of *how* lecturers administer some assessment activities online and were summarised in Section 5.6.1. Hence, the use of an LMS supports the development and

administration of online formative assessment regarded as continuous assessment at selected HE institutions.

6.5.1.1 Tests/quizzes

The findings revealed that tests and quizzes are commonly used by lecturers to assess students online for many reasons, such as in-class activities (exercises) and mini-tutorials to support scaffolding. This is interpreted to mean that lecturers developed graded and ungraded assessment activities to support students' learning. The finding supports the Zone of Proximal Development proposed by Vygotsky (1987) as a key aspect of social constructivism. The finding is supported by Gaytan and McEwen (2007) who identified effective assessment methods comprising projects, quizzes and self-assessment that lecturers can employ to implement the online formative assessment. The finding is in agreement with Wang et al. (2017) that lecturers can encourage the use of web-based collaborative technology to assist students with problem scaffolding, in the form of virtual access to knowledge experts and online support, which was the case in the current study. Similarly, Lin and Lai (2013) and Voelkel (2013) proposed annotating activities such as tests and quizzes to support collaboration amongst students online. This result also supports the finding by Oneal-Self (2015) that lecturers can use the results from quizzes to guide content of the next lesson that actively involves students closing gaps in knowledge.

6.5.1.2 Discussion forums

The finding revealed that discussion forums were utilised by lecturers for various reasons; mainly for engagement and collaboration with students as well as for online consultation sessions and student/lecturer forums. This is interpreted to mean that lecturers in this study value their engagement in the discussion forums to enhance the development of students' 21st century skills. These forums take place through chat rooms, blogs, live sessions and discussion boards to support students' learning. This means that lecturers are motivated to encourage students' participation in the implementation of online formative assessment. The finding is similar to that of Gaytan and McEwen (2007) in that synchronous discussions through chat room conversations, e-mail messages and discussion board postings offer opportunities for instructors to determine students'

understanding of instructions and interpretation of assessments. Online discussions are considered as a potentially useful formative assessment activity (Koh, 2010).

Lecturers considered discussion forums important in that they strengthen online engagement but did not mention the frequent use of them. The finding partly contradicts that of Kearns (2012) who reviewed syllabi from 24 online courses and found online discussions to be frequently used by lecturers. Besides, the result revealed that lecturers share exercises in the discussion forums to support self-activity and group-activity. This is interpreted to mean that, although lecturers did not mention how frequently they use discussion forums, they view it as one of the effective online tools supporting the implementation of online formative assessment.

6.5.1.3 e-portfolio

The findings revealed that e-portfolios are not often used by participating lecturers. As observed, only one lecturer implemented an e-portfolio in his online practices. This is interpreted to mean that assessing students through e-portfolios is not a common practice in this study. It appears some lecturers opted to develop other activities to assess students' learning. This could be that participating lecturers were well experienced and may have used e-portfolios in the past. However, they may have preferred to use other formative assessment activities at the time of the interviews as they did not indicate to be using e-portfolios.

Koehler et al. (2017) examined 589 online portfolios created by educators to assess teachers' understanding of technology through analysis of the portfolio platform, artefact technology and technology flexibility. The similarity between the finding by Koehler et al. (2017) and the participating lecturers is that the e-portfolio was used for the online formative assessment purposes. However, the researcher is aware that this study sampled lecturers and was found to use digital portfolio in a limited way whilst Koehler et al. observed many portfolios. In this regard I could only observe a few activities for the online courses on the LMSs hence the results cannot be generalised. The finding is in agreement with Spector et al. (2016) who noted that whereas e-portfolios provide opportunities for authentic formative assessment, they require significant human time, in

that initiatives associated with e-portfolios have significant complexities and challenges. Findings on the challenges faced by lecturers are further discussed in Section 6.6.2.

6.5.1.4 Assignments/essay writing

The findings revealed that all lecturers commonly developed assignments and essays to assess students online. Lecturers refer to the development of assignments in a form of essay writing and lecture diary as an effective way to implement online formative assessment, in that students get the opportunity to review and learn from each other's work. This is interpreted to mean that lecturers in this study are comfortable to assess students through the development of assignments and considered students as partners in the assessment process. This means that participating lecturers have confidence in their students to give constructive feedback during peer-assessment reviews. Findings regarding provision of feedback are further discussed in Section 6.5.3.

The findings are consistent with the literature on the implementation of formative assessment practices. Thus, I was not surprised to learn that lecturers frequently utilised assignments to assess students online. This is considered a common practice at the selected HE institutions. Kearns (2012), Gaytan and McEwen (2007), Hood (2009) and Koh (2010) confirmed this to be one of the potential benefits of formative assessment online. Therefore, the development of effective online assignments and essays ought to comprise a wide variety of explained assignments accompanied by grading rubric (Hood, 2009). The finding supports the result of Kearns (2012) who found assignments to be frequently used by lecturers when implementing the online formative assessment. Oneal-Self (2015) found that many faculty members perceived formative assessment as a means to finding learning gaps and fill them. Similarly, this study found that lecturers perceived formative assessment as part of the continuous assessment, which is aimed at helping to close the gap between students' current learning progress and the common goal (Heritage, 2007).

Lecturers expressed the importance of using assessment activities for evaluating learning outcomes with several reasons, namely: reflect real-life experiences, stimulate students to apply knowledge, guide students to achieve learning goals, attract students' interests, be sensitive to the individual student's beliefs and values, and provide information that is

useful to meet the intended learning outcomes. McMillan (2013) advised that formative assessment can be effective when embedded in the instruction to promote learning. Sadler (1989) and Black and William (1998) (Section 2.3) confirmed the use of formative assessment which is deliberately done during the instructional process to improve teaching and learning, in that it guides and improves students' understanding and skills. Additionally, Shepard (2005) noted that when lecturers immediately make use of formative assessment they can adjust the instruction and form new learning.

Bennett (2011) cautions that formative assessment should be assessment *for* learning rather than *of* learning. Hence, the current study focused on assessment *for* learning in an attempt to understand *how* lecturers implement formative assessment in their online courses, focusing on the strategies and the development of different types of online formative assessment activities, as well as the provision of formative feedback.

6.5.2 Theme 2: Processes for online formative assessment

Trumbull and Lash (2013, p.14) argued that there is no *'prescription'* for how to tailor formative assessment to meet the needs of a specific student. Thus, for students to learn from formative assessment, is to some extent dependent upon lecturers' involvement in the process (Koh, 2010).

6.5.2.1 Strategies and techniques

Lecturers refer to the use of numerous strategies and techniques, procedures and practices to develop strategies when implementing formative assessment online. Strategies for the development of online formative assessment activities, as perceived by lecturers in this study, include tests and quizzes, discussion forums, e-portfolios, assignments and essays. The finding is similar to that of Gaytan and McEwen (2007) in that instructors perceived effective assessment methods such as projects, portfolios, self-assessments, peer evaluations, timed tests and quizzes, weekly assignments and synchronous types of communication. Similarly, Heritage (2007) categorised three broad types of assessment strategies which are similar to the strategies developed by lecturers in this study. The strategies are: a) on-the-fly assessment b) planned interaction and c) curriculum embedded assessment (Heritage, 2007). Black and William (2009) conceptualised formative assessment with various strategies which allow lecturers to

clarify, sharing intentions for learning and progress criteria, and identifying instructional tasks that elicit evidence of students' understanding.

Lecturers refer to strategies of using tutorials comprised of learning materials such as text, images or video and exercises structured with multiple-choice questions developed from question banks. In addition, lecturers expressed the importance of collaboration amongst faculty when developing the question banks. Lecturers perceived question banks necessary to support randomising of exercises online. Lecturers refer to the importance of engaging students in the online formative assessment. The findings support five key strategies identified by Bennett (2011) which are: sharing learning expectations, questioning, peer-assessment, self-assessment and feedback. Thus, lecturers in this study expressed their readiness and willingness to explore various strategies for online formative assessment. Bugg (2013) and Cornelius (2013) emphasised that there is a need for lecturers to change assessment strategies for improving effective feedback.

6.5.2.2 Structure of assessment activities

Lecturers refer to the effectiveness of assessment activities which is determined by question structure, setting-up of questions (questioning), class size, learning objectives, random exercises and collaboration. In addition, lecturers structured learning assessment activities which are categorised into multiple-choice, fill-in, matching and true/false questions. This means that lecturers have content and assessment knowledge to construct various questions when developing online formative assessment. These activities are developed to support collaborative learning through self-activities and group-activities. The findings support three of the five components of teacher knowledge documented by Heritage (2010), which are: a) content knowledge b) knowledge of students' prior knowledge and c) assessment knowledge. Additionally, when implementing the online formative assessment lecturers demonstrated skills of interpreting evidence, matching instruction to the gap and providing feedback (Heritage, 2010). Findings about the provision of feedback are further discussed in Section 6.5.3.3.

Furthermore, lecturers consider the need to have substantial knowledge to implement effective formative assessment, time and support to develop it as well as materials that

model integration of domain, pedagogical and measurement knowledge (Bennett, 2011). Similarly, the finding supports three of the five competency domains documented by Spector (2013), necessary for lecturers when implementing formative assessment to support the 21st century skills development which are: knowledge, process and application competence domain.

6.5.2.3 Tools

The effectiveness of formative assessment requires the integration of appropriate technologies (Kaila, 2018). This study revealed the types of tools available at HE institutions as used by lecturers. The e-tools used by lecturers ranged from educational software apps including e-books to educational websites that are supported by LMSs. Lecturers were in possession of hardware (laptop, desktop, tablets and mobile phones). In addition, lecturers indicated using Moodle and Ville as LMS, and software applications (Turnitin, PANOPTO, Padlet, Microsoft Office 365 and video editing tools). It appears that Moodle, discussion forums, e-learning tools, Gradebook and technical devices were frequently used by lecturers (see Table 5.7) (Section 5.6.2.3). This means that lecturers have knowledge of various technology tools for online assessment. This is interpreted to mean that lecturers were able to use numerous tools to assess students online for the purpose of implementing formative assessment. The finding is similar to that of Pellegrino (2001), Gaytan and McEwen (2007) and Hood (2009) who identified assessment tools such as web-based evaluation and technology-based assessment tools (software tools).

Thus, Heinrich et al. (2009) recommended the use of generic software and LMS which offers support for the management of assignments and integrating scoring rubrics. The finding is partly contrary to that of Heinrich et al. (2009) who found that the specialist assignment assessment tools provide support to lecturers with administrative issues and improving the quality of marking and feedback in New Zealand. However, lecturers in this study did not mention having administrative issues. Heinrich et al. (2009) recommended lecturers to use tools such as Turnitin, Questionmark perception, WebCTconnect and Marktool that are generic software and are supported by the LMS. Findings related to challenges faced by lecturers when implementing online formative assessment are further discussed in Section 6.6.2.

Lecturers demonstrated being innovative and creative with the use of Microsoft OneNote and Turnitin to implement the online formative assessment. The use of electronic books, augmented reality, game-based learning and mobile devices as supported by Spector et al. (2013) is considered to promote trends in the implementation of online formative assessment.

6.5.3 Theme 3: Provision of feedback

Oneal-Self (2015), Dietrich (2011), Spector et al. (2016), Bennett (2011) and Koh (2010) indicated that formative assessment offers on-going feedback and should be embraced by faculty members to evaluate students' progress. This study revealed how lecturers collaborated with students through online engagements to facilitate self-and-peer assessment activities. This means that lecturers encourage engagement between students and lecturers and their peers to promote provision of formative feedback.

6.5.3.1 Peer assessment

Research participants expressed a desire to involve students in the formative assessment process by using peer review and requesting feedback from students. Lecturers refer to peer assessment platforms available on the LMS. Similar to Oneal-Self (2015) findings, the students' role in the formative assessment process must be an active one for formative assessment to be most effective. Lecturers in this study encouraged peer-review and the provision of online feedback made possible using automatic-computer-feedback. It must be noted that peer assessment and self-monitoring are perceived by lecturers to promote formative feedback. Shute (2008) noted that lecturers promote formative feedback through information communicated to students projected to change their thinking for the purpose of improving learning.

6.5.3.2 Self-monitoring

Findings revealed the opportunity given to students to monitor their own progress through self-activities and group-activities respectively. Students engaged in tests, quizzes and reflective assignments as exercises and tutorials to self-monitor their progress. This means that lecturers in this study design activities which are graded and recorded using the Gradebook to allow students to monitor their progress online. This finding supports four of the seven principles of good feedback practice identified by Nicol and Milligan

(2006) which are: a) facilitates the development of reflections and self-assessment in learning b) encourages teacher and peer dialogue around learning c) encourages positive motivational beliefs and self-esteem and d) provides opportunities to close the gap between current and desired performance.

6.5.3.3 Timely, appropriate and reflective feedback

Wood (2010) noted that provision of formative feedback closes the gap between students' current level of understanding and the desired learning goal. Findings revealed that feedback is a crucial element in the online formative assessment that is appropriate, meaningful, delivered on time and should reflect on students' learning. This is interpreted to mean that lecturers in this study provided feedback immediately and instantly depending on the formative assessment activities. Lecturers also mentioned delaying feedback for online quizzes and tests to prevent issues of cheating and dishonesty amongst students. The finding supports three categories of feedback as proposed by Shute (2008) that is immediate, instant and delayed (see Section 2.5). Lecturers refer to the provision of feedback which is focused on learning and linked to the purpose of tasks enabling students' learning to be honest, supportive and encouraging to students. Therefore, lecturers should use feedback generated by students to improve their learning status and close the gap between what they know and the intended learning (Heritage, 2010; Shute, 2008; Wood, 2010). Similarly, Heritage (2007) documented four elements of formative assessment which are: a) identifying the gap b) feedback c) student involvement and d) learning progression. Lecturers in this study involved students in the process of formative assessment to gather information, move learning forward and meet learning goals Van Gog et al. (2010).

Furthermore, the findings support Spector et al. (2016) (Section 2.6) four of the seven themes identified in a comprehensive review on new trends and directions in formative assessment for technology enhanced learning namely: a) *formative feedback for problem-based and inquiry learning* b) *formative feedback for e-portfolios* c) *formative feedback to improve motivation and engagement* and d) *teacher support in technology-enhanced formative assessment*.

6.5.4 Theme 4: Motivation for engaging in online assessment

Findings in terms of the advantages for using the online assessment, training and professional development offered to lecturers, benefits of having a support team as well as collaboration and collaborative teaching, reflecting on motivations for engagement in the implementation of online formative assessment at HE institutions are discussed in this section.

6.5.4.1 Advantages and successes for using online assessment

This section presents a discussion of findings in terms of advantages for online assessment as mentioned by lecturers that is presented in Section 5.6.4.1. Lecturers specified the importance of engagement in the online assessment in terms of advantages for assessing students online. Lecturers perceived the advantages to outweigh disadvantages of engagement in the implementation of online formative assessment. This is interpreted to mean that lecturers in this study are not concerned with the perceived disadvantages of engagement in the online formative assessment if they exist at all. It must be noted that lecturers did not mention the disadvantages of engagement in the implementation of online formative assessment. Additionally, the focus of this study was on the advantages for engagement in the online assessment as perceived by lecturers to motivate them when implementing the online formative assessment. Furthermore, advantages for engagement in the online formative assessment did not emerge from the reviewed literature for this study. I acknowledge this to be a limitation.

The advantages for engagement in the implementation of online formative assessment as mentioned by lecturers in Section 5.6.4.1 are not repeated here. The findings revealed that online assessment can be accomplished in less time, multiple students can engage in the assessment activities at the same time, anytime and anywhere, provision for immediate and accurate feedback is made, as well as to assist lecturers and students with evaluation for improvements in the online formative assessment. Lecturers refer to the link between the advantages of online assessment and successes for online assessment in that they support the implementation of online formative assessment. Findings related to successes when implementing online formative assessment are further discussed in Section 6.6.1.

6.5.4.2 Training, support team and professional development

Findings of this study on aspects of training and professional development indicate insights expressed by lecturers about online formative assessment and the role played by the support team in the implementation of online formative assessment. Lecturers mentioned the visibility of the support team at their selected HE institutions. However, lecturers expressed the need for institutions to increase the number of support teams to offer training and support for specific faculty members. Lecturers demonstrated skills of being proactive and innovative in that they provide support to other lecturers and teachers while developing assessment activities through the LMS. Rios-Parnell (2017) defined technological development as training related to the LMS at academic institutions and educational technologies to enhance the teaching-learning process.

Findings revealed that lecturers were trained in the implementation of online formative assessment for professional development. For instance, lecturers mentioned training that focused on learning analytics, augmented reality, development of games and online study materials. The findings of this study agree with Spector (2013) in terms of the six trending technologies identified in different context for online learning such as: augmented reality, game-based learning, electronic books, mobile devices, gesture-based computing and learning analytics.

In addition, opportunities for participation in conferences and seminars is seen as motivational by lecturers in this study. This is interpreted to mean that lecturers are provided with opportunities for training and benchmarking in the use of e-tools when assessing students online. Lecturers recommended that HE institutions invest in resources for training that focus on mobile phones in education to support online formative assessment, considering their accessibility and portability anywhere, anytime. The finding is similar to the three components of professional development framework proposed by Baran and Correia (2014) with three main reasons, firstly: support at the teaching level which includes technology, pedagogy, design and development. Secondly, support at the community level which is not limited to community of practice, peer observation and feedback. Thirdly, support at the organizational level such as positive organizational culture, rewards and recognition. Also, Kennedy (2015), Lian (2014), Roy

and Boboc (2016) (Section 2.9.1) documented several major findings from Faculty Professional Development (FPD) in terms of beliefs, motivation, perceived values, usefulness and increased satisfaction with online teaching. In this study, lecturers perceived usefulness and satisfaction with training and professional development in that it improves the effectiveness of online formative assessment.

6.5.4.3 Collaboration and collaborative teaching

Allan (2004) indicated that faculty should be encouraged to share notes to promote the use of effective strategies. Findings revealed that lecturers co-teach and engage with other stakeholders through collaboration in terms of research and publications. Lecturers collaborate with colleagues and students through the LMS and social media platforms such as Facebook and WhatsApp and utilise other platforms like YouTube and Google drive to support collaboration in the implementation of online formative assessment. Findings also revealed that lecturers collaborate within their community of practice and with other stakeholders as part of the professional development. Similarly, Cahill (2011), Schieffer (2014), Hudson (2010), Lock et al. (2017) conducted studies on faculty collaboration in terms of benefits of Google Apps Education Edition, Virtual Collaborations, Lived Experiences and the use of academic technologies through collaboration with particular emphasis on co-teaching. Likewise, Moore et al. (2009) found that LMS, chat, discussion boards and synchronous video conferencing are increasingly common collaborative environments. Lecturers in this study affirmed engagements through collaborative environments.

Although lecturers indicated belonging to a community of practice, they did not mention the official name of their community of practice. However, lecturers referred to the active teacher network as the platform for collaboration. This is interpreted to mean that the development of online formative assessment activities was shared amongst lecturers indicating collaboration with colleagues. Lecturers mentioned development of co-teaching relationships to support the implementation of online formative assessment. Lock et al. (2017) noted that co-teaching is achieved when two instructors teach by providing simultaneous instruction to a large group of students in a course over a period of time.

6.5.4.4 Best practices

Wang (2006) noted that best practices should be understood as benchmarks for quality online education. Finch and Jacobs (2012), Thompson and Braude (2016), Corry et al. (2014) (Section 2.7), identified best practices in the online learning environment which are compared with those found in this study (Section 5.6.4.4). Findings revealed that lecturers in this study have content knowledge that supports the designing and development of online formative assessment activities and provides feedback online through engagement with students. The findings support five of the seven examples of practices that are followed by online teachers, documented by Baran and Correia (2014) which are: a) knowing the students b) knowing and creating the course content c) designing and structuring the online course d) guiding student learning and e) enhancing teacher-student relationships. Lecturers in this study demonstrated creativity by encouraging and providing training for other colleagues to implement online formative assessment as well as promoting research and publications as co-authors. This is interpreted to mean that lecturers in this study promoted best practices in that they collaborated, engaged in research and innovations, utilised trending technologies, and provided accurate and appropriate feedback to promote the implementation of online formative assessment. Thus, lecturers encouraged students' participation in the implementation of online formative assessment through peer review and self-monitoring.

Findings revealed that lecturers made contributions through various research publications and shared their lived experiences when implementing online formative assessment. These warrant the measures for best practices in the implementation of online formative assessment for the participating lecturers. The findings support two of the three types of online best practice measures, documented by Corry et al. (2014) which are practical evidence and promising practices, in that lecturers in this study demonstrated online best practices which are field-tested, and based on their experiences when assessing students online.

6.6 Part B addressing Main RQ3

"What are the challenges and benefits of implementing online formative assessment?"

6.6.1 Challenges when implementing online formative assessment

Spector (2013) noted that lack of internet access and supporting infrastructure becomes barriers to progress. Particularly, access to supporting infrastructure envisaged by lecturers is lacking at some HE institutions and lecturers are thereby hindered when engaging in the implementation of online formative assessment (Section 5.9.2). Lecturers are challenged with lack of accessibility for some e-tools in terms of virtual labs, connectivity and technical restrictions, which may slow the implementation of online formative assessment. These challenges are perceived as minor issues, in that they are manageable and that lecturers can find alternatives. The finding is supported by Spector (2013) who documented challenges that emerge from literature pertinent to online assessment which are categorised into critical challenges and grand challenges (see Section 2.8).

Similarly, the findings of this study revealed that lecturers had knowledge of identifying and addressing related challenges that can hinder the effective implementation of online formative assessment (Spector, 2013). In addition, Kuikka et al. (2014) examined challenges when introducing electronic exams in Finland (a similar context to the setting here) but focused on e-assessment and e-exams, and identified the challenges faced by lecturers in Europe at HE institutions which agree with the challenges highlighted by this study. Equally, Kearns (2012) documented challenges associated with the impact of physical distance between lecturers and students, adaptations resulting from requirement for utilising technology to communicate with students, workload and time management. The above challenges were indicated by lecturers in this study to have a direct impact and are considered to hinder effective implementation of online formative assessment.

Although lack of time is a shared challenge mentioned by lecturers when implementing online formative assessment (Dietrich, 2011), the study's results showed that in spite of devoted time for the development of online formative assessment activities, lecturers still

approached innovations through a blended learning approach. One reason for the findings could be that lecturers had to prevent potential challenges when assessing students online. This may have led them to focus more on matters associated with alternative assessment than the online formative assessment activities. Alternative clarification of the results could be that students' levels had consequences on their ICT skills which in turn influenced the use of online tools. Similarly, Dietrich (2011) noted that instructors spend more time teaching online than when they teach and assess students in f2f classrooms.

Lecturers refer to challenges associated with dishonesty on the part of students when engaging in the online formative assessment activities. For academic integrity to be maintained it is expected that students demonstrate their honesty when participating in the formative assessment activities online. Lecturers indicated the need to encourage students' participation in the online formative assessment activities. Thus, lecturers caution the enforcement of students' participation in the implementation of online formative assessment at HE institutions.

Lecturers refer to a lack of funding as a major hindrance to research and innovations. Lecturers indicated that lack of funding can have a negative impact on research outputs in terms of publications and execution of projects related to the implementation of online formative assessment.

6.6.2 Benefits for online assessment

As mentioned in Section 6.5.4.1 the benefits for online formative assessments are linked to the advantages of online formative assessment. Findings revealed that lecturers recognised emerging trends and opportunities as benefits for online assessment. Lecturers refer to the benefits of LMSs which are believed to improve the implementation of online formative assessment (see Section 5.9.1). This is interpreted to mean that the use of LMSs promote provision of immediate assessment scores, and a real image of student progress through lecturers' feedback to encourage independent learning and self-evaluation, as well as helping students to develop effective time management (Kearns, 2012).

However, it must be noted that literature reviewed for this study did not provide explicit information pertinent to benefits when implementing online formative assessment. I recognise this as a limitation. Thus, the recommendation for an empirical study to further investigate and document the benefits associated with the implementation of online formative assessment at HE institutions.

6.7 Chapter conclusion

This chapter discussed findings from this study in relation to the literature reviewed in (Chapter 2), and the conceptual framework with philosophical assumptions (Chapter 3). The structured discussion was guided by the conceptual framework of the study (Section 3.6) and emerging themes with sub-themes summarised in Chapter 5, Sections 5.6.1, 5.6.2, 5.6.3 and 5.6.4. Subsequently, Table 5.7 presented a summary synthesising the most important keywords in terms of emerging themes from interview transcriptions of lecturers when implementing the online formative assessment at HE institutions. The discussion of findings as presented in Chapter 6 are mapped according to the main research questions and sub-questions of this study respectively. Table 6.1 provided a synthesised summary of emerging themes and concepts with relevant sections within the discussions in this chapter.

Lecturers at HE institutions who engage in the development of online formative assessment may be guided by ISD models presented in (Section 3.7.1, 3.7.2, 3.7.3 and 3.7.4). Although, it is necessary for lecturers to understand the ISD models when engaging in the development of online formative assessment activities. However, lecturers might not find them effective when compared to their creativity and innovations in the implementation of online formative assessment. Thus, the proposed T-B-F model (Figure, 3.4, Figure 3.5 and Table 3.5) is necessary for lecturers at HE institutions with knowledge of TPACK and RBT in the designing and development of online formative assessment activities. The T-B-F model makes provision for feedback throughout the assessment process. HE institutions could consider the type of support that should be made available for lecturers as they engage in the development of online formative assessment activities. Therefore, the development of online formative assessment activities requires strategies, techniques and the support of trending technologies.

Lecturers indicated hindrances in the implementation of online formative assessment. However, findings revealed that lecturers at the selected HE institutions demonstrated their creativity and knowledge in identifying and addressing related challenges that could hinder the effective implementation of online formative assessment.

In the next Chapter 7 the researcher presents a summary of the findings from this study. The chapter includes methodological and practical reflections to highlight contributions of the study to academic discourse. A summary of research findings and concluding remarks are presented before recommendations for practice and future research.

CHAPTER 7: SUMMARY AND CONCLUSIONS

7.1 Introduction

This chapter begins by presenting the overview of research processes (Section 7.2). Additionally, a description of the research findings regarding the implementation of online formative assessment by lecturers at HE institutions is presented (Section 7.3). This chapter also presents a statement on methodological reflections and limitations from the study (Section 7.4). Furthermore, it provides practical reflections focusing on the contributions the study will make to the academic discourse presented in Section 7.5. Finally, based on the evidence presented in this study, the chapter concludes (Section 7.6) with recommendations on the implementations of online formative assessment to inform Lecturers at HE institutions (Section 7.7.1) and for future research (Section 7.7.2).

7.2 Summary of the research processes

This study focused on assessment *for* learning to understand *how* and *why* lecturers implement formative assessment in the online courses, considering strategies and tools that lecturers employ in the designing and development of formative assessment activities and identifying *what* the challenges and benefits for online formative assessment at HE institutions are.

Three main research questions guided the study:

The first question was:

- **How is online formative assessment implemented by lecturers at HE institutions?**

Lecturers' engagement in the online formative assessment is evident from the literature (Heritage, 2010; Spector et al., 2016). Through this question, the researcher established how lecturers at the two selected HE institutions designed and developed online formative assessment activities. Of particular interest towards understanding the implementation of online formative assessment by lecturers, was the strategies and tools they use to develop the assessment activities. Lecturers developed techniques and constructed assessment activities aligned with the learning outcomes.

The second question was:

- **Why do lecturers at HE institutions implement online formative assessment?**

This question sought to establish and determine lecturers' reasons and actions that could motivate them to engage in the online formative assessment, while recognising the importance of giving effective feedback. This question further qualifies the activities of lecturers as best practices in that they did not only design and develop online formative assessments but have also provided feedback to students using the LMS.

The third question was:

- **What are the challenges and benefits when implementing online formative assessment?**

This question sought to establish the challenges faced by lecturers when implementing the online formative assessment at HE institutions. The question also sought to address the benefits when lecturers implement online formative assessment considering the advantages of using an LMS and tools that support online assessment.

The research questions of this study focused on *how* online formative assessment is implemented by lecturers at HE institutions through design and development of formative assessment activities and *why* lecturers at HE institutions implement the online formative assessment. Also, *what* challenges and benefits are experienced by lecturers when implementing the formative assessment activities in the online learning environment. However, these questions need to be answered with an understanding of the lecturers' context. As such the research questions were qualified by lecturers' best practices for online formative assessment. These best practices are linked to lecturers' creativity and innovations in the implementation of online formative assessment.

The *how* question was answered through lecturers' engagement in the online formative assessment activities, considering several strategies and techniques used to develop activities through the analysis of motivating factors and provision of feedback. The *why* question was answered in that lecturers shared their lived experiences focusing on the motivation for implementing online formative assessment. These warrant the measures

for best practices in the implementation of online formative assessment for the participating lecturers. The *what* question was answered through challenges and benefits identified by lecturers that could respectively hinder and support the implementation of online formative assessment. This study focused on lecturers to gain understanding of their setting on *how* and *why* they implemented formative assessment activities in the online practices for the 21st century skills, which required an enquiry at the two selected HE institutions.

Following the presentation of the literature review in Chapter 2, the philosophical assumptions and conceptual framework underpinning this study are presented in Chapter 3. Subsequently, the adopted and adapted conceptual framework and the four themes with sub-themes that emerged from the study directed the structure of discussion presented in Chapter 6. The study was designed as a qualitative research using a multiple case study approach with holistic cases. In this study, the holistic cases are unique in that Institution A is from a developing economy while Institution B is from a developed economy. The researcher recognised Finland as one of the world's first-class countries when it comes to higher-performing education systems for academic capitalism (Lee, Hong & Niemi, 2014). As presented in Section 1.2, the purpose of this study was not to compare practices between the two countries. However, it must be noted that lecturers at the selected HE institution in Finland supported the 21st century skills learning through integrating advanced technology in teaching and learning (Gil-Jaurena & Softic, 2016). Surprisingly, lecturers at the two selected HE institutions used the LMS for online formative assessments and provision of feedback.

Lecturers were selected according to the purposive and convenience sampling techniques. Interviews were held with four lectures from two HE institutions in Namibia and Finland respectively. Some online courses were observed through the LMS of each HE institution. Four institutional documentations from institution A (IA) were analysed to provide supplementary information. However, lecturers at institution B (IB) could not provide institutional documents due to the privacy policy and data protection of that institution. The researcher coded and analysed data and followed six steps of data analysis suggested by Creswell (2014). Chapter 5 presented results and findings from

this study derived from the emerging themes and conceptual framework. In Chapter 6, the researcher developed findings through the use of conceptual framework and linked the discussion to the literature pertinent to online formative assessment practices.

7.3 Summary of the research findings

The main findings are presented in this section, as documented in Chapter 5 and discussed in Chapter 6, concentrating on the general aim, conceptual framework and research questions of this study:

7.3.1 How is online formative assessment implemented by lecturers at HE institutions?

The answer to the main research question presented is based on emerging themes and is structured according to the conceptual framework of Chapter 3. How lecturers are involved in the implementation of online formative assessment was discussed putting into consideration their activities through strategies, techniques and online tools.

The profiles of the four lecturers interviewed for this study were presented in Chapter 5, Table 5.2. In this study, all lecturers were directly involved in the execution of online formative assessment at their respective HE institutions. Three of the participants are senior lecturers which makes them take a lead in supervision and decision making as far as implementation of online formative assessment is concerned. All the lecturers have more than five years working experience and have doctorate degrees in educational technology and related fields.

Lecturers demonstrated knowledge of TPACK which is considered a professional knowledge construct in the development of online formative assessment. Lecturers incorporated knowledge dimensions from the RBT to test the levels of reasoning skills with online formative assessment activities. Lecturers' creative and innovative strategies, techniques and the use of trending technologies in the development of online formative assessment warrant measures associated with their best practices in the online learning environment.

As a result, it is important for lecturers to determine the purpose of the assessment while identifying learning outcomes. To achieve the above, lecturers should prepare test

specifications and construct items which match the learning outcomes as well as organise assessment activities to align with learning outcomes. In addition, lecturers should review online assessment activities to support the implementation of formative assessment in the online practices.

7.3.2 Why do lecturers at HE institutions implement online formative assessment?

The answer to this research question was presented based on lecturers' best practices and the reasons associated with engagement in the online formative assessment. Lecturers indicated that online formative assessment requires knowledge of incorporating various tools. Lecturers revealed using several tools that enhance the implementation of formative assessment practices. Lecturers appeared to engage in their activities in order to support their respective institutional strategy of embracing online assessment for the 21st century skills. Findings from this study showed that lecturers' design and development of assessment activities is achieved collaboratively considering the setting of their professional relationships and prior experience. As a result, it is imperative that lecturers are knowledgeable about strategies that support creative and innovative assessment practices. The findings of this study indicated that lecturers provided feedback to students for all formative assessment activities. As a result, it is imperative for lecturers engaging students through peer assessment and self-monitoring to effectively provide feedback. To achieve the above, lecturers ought to receive training in best practices for online students' assessment as part of the professional development strategy. To supplement training offered to lecturers, it is vital that HE institutions that offer online courses and online programs provide support for lecturers through workshops, seminars, conferences and mentorship with experienced lecturers.

7.3.3 What are the challenges and benefits of implementing online formative assessment?

The answer to this research question was presented based on the findings of the challenges faced by lecturers when implementing the online formative assessment at HE institutions. Challenges identified in this study were believed to hinder lecturers when

engaging in the online formative assessment. These challenges are categorised with reference to access of supporting infrastructure, human use and adoption of technology.

The most noted challenges to delay the implementation of online formative assessment included poor internet connection, particularly at Institution A, which slows down the network, dishonesty from the side of students when completing activities online, insufficient time to provide immediate feedback for some assessment activities, lack of motivation for students to engage in the online formative assessment activities as well as lack of funding for further research and innovations. The participants indicated that identified challenges have a direct impact on online assessment, in that it can hinder the effective implementation of online formative assessment.

Additionally, the findings were structured according to the benefits considering the advantages of using online formative assessment in the development of the 21st century skills.

7.4 Methodological reflections and limitations

This study followed a qualitative research design that permitted wide-ranging data collection about lecturers' implementation of formative assessment activities in the online learning environment at the two selected HE institutions. The study used a small sample and is therefore not intended to represent all lecturers at HE institutions in Namibia and Finland respectively. Due to the sample size of four participants, generalizations cannot be made about the population. Therefore, findings are limited to lecturers at HE institutions that implement formative assessment in their online practices. However, the findings do add to the knowledge of online assessments and lecturers' development of formative assessment. The purpose of the study however was not to compare the online assessment practices in those countries, nor for comparison of developing and developed economies per se, but merely to document best practices for the implementation of online formative assessment. This is considered to be a limitation; thus, the researcher recommends an empirical study to further investigate the differences and similarities between the settings and lecturers' practices in the implementation of online formative assessment.

The conceptual framework adopted and adapted for this study as discussed in Section 3.6 was used as a lens through which the researcher investigated lecturers' implementation of online formative assessment at HE institutions. This study is in line with the description of the conceptual framework, in that lecturers demonstrated how they creatively combine the concept of the TPACK framework with RBT and knowledge dimensions, notwithstanding their knowledge of RBT as they indicated using the old Bloom's revised taxonomy to design and develop formative assessment activities. This is also considered to be a limitation; thus, the researcher recommends that lecturers familiarize themselves with the RBT to support the implementation of online formative assessment. In other words, lecturers have sufficient skills to use online tools and the LMS to assess students online, and collaborate with other lecturers online to promote best practices. Lecturers were able to develop formative assessment activities such as tests, quizzes, assignments and essays online. From the data, four themes emerged and are presented in Section 5.6.

In particular, the convenience and purposive sampling techniques prolonged the data collection period, in that I depended on finding access to the respondents at the time convenient to them. This posed some challenges as I had to make frequent follow-ups. The role of the researcher as a complete observer was discussed in Section 4.3.3. I asked general questions which allowed the participants to freely provide their views. I did not influence participants' views in any way. To minimise the personal biases, I engaged in what is referred to as *"epoche"*, in which the researcher temporarily suspends his or previous experiences and judgements to examine the phenomenon under investigation (Miles & Huberman, 1994).

One of the HE institutions did not provide their policy documents for the reason that the privacy and data protection policy of the institution does not permit sharing of confidential documents. This limited the completeness of documents as an additional data source. However, interviews with lecturers and observations of the LMS provided substantial evidence.

7.5 Contribution of the study

This study contributes to the body of knowledge in the implementation of online formative assessment practices through a refined understanding of lecturers' best practices, considering strategies and technological tools in the development of formative assessment activities for online practices.

The proposed T-B-F model is a contribution to the academic discourse as an important output. The T-B-F model will provide guidelines to lecturers at HE institutions when practising the development of online formative assessment activities. It is recommended that lecturers incorporate TPACK, RBT and feedback to effectively implement online formative assessment at HE institutions. The proposed T-B-F model can assist lecturers when setting up online formative assessments to align teaching and learning activities with intended learning outcomes and appropriate formative assessment. Similarly, the projected conceptual framework is a contribution to academic discourse. The structure of this report, as guided by the conceptual framework, contributed to the analysis of lecturers' involvement in the implementation of formative assessment practices. Figure 7.1 below presents a merged conceptual framework developed in this study as adapted from figure 5.5.1 to show the best practices for online assessment. Resulting from the analysis, added to the conceptual framework is the provision of evaluations in terms of validity and reliability of formative assessment activities. Lecturers and students alike are expected to evaluate courses online and program to achieve objectives for implementing online formative assessment practices. Evaluation is necessary to increase validity and reliability of formative assessment activities. This can be achieved through the development of question banks comprised of diverse questions which are randomized.

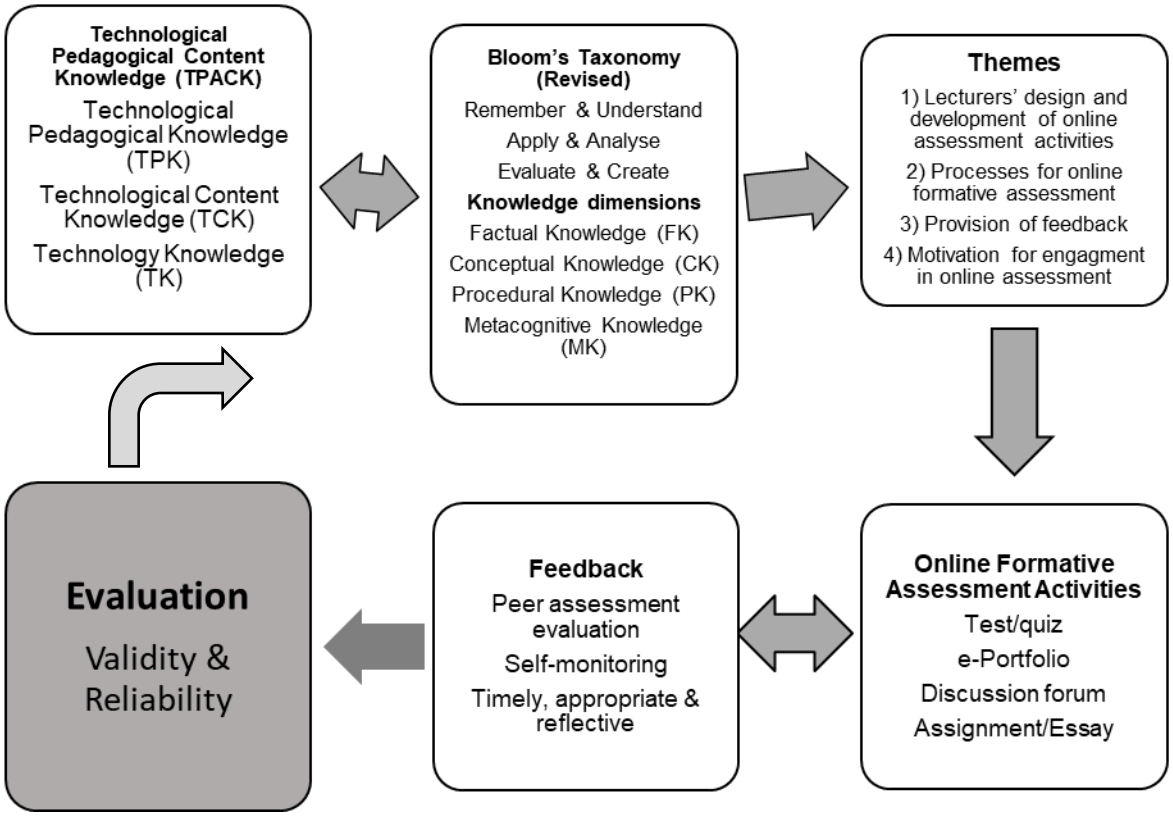


Figure 7.1 Consolidated summary of the best practices for the implementation of online formative assessment

Figure 7.1 represents a consolidated summary that shows the link between the conceptual framework adopted and adapted for this study and the emerging themes from interview transcriptions of four lecturers that participated in this study. Lecturers demonstrated knowledge of TPACK and RBT which yielded to the four emerging themes and the formative assessment activities with the provision of feedback. The arrows are back and forth between TPACK and RBT as well as between online formative assessment activities and feedback. This means that the lecturers can start with either constructs back-and-forth when implementing the online formative assessment. Once feedback is provided then lecturers and students alike can evaluate the assessment activities for validity and reliability. The process can resume after evaluation anytime to support the implementation of online formative assessment at HE institutions.

7.6 Recommendations

Derived from this study the following practice and future research recommendations for HE institutions are proposed:

7.6.1 Recommendations for practice

Established from the findings of this study, the following are recommended:

- Lecturers need to stress the importance of formative assessment to students and encourage students' participation in the formative assessment processes.
- Lecturers need to develop formative assessment activities focusing on higher-order thinking skills to support the 21st century skills development.
- Lecturers must continuously undergo professional development to keep up with emerging technological tools that support the implementation of online formative assessment.
- Lecturers must be encouraged to consider the course setting, course level and number of students when designing and developing online formative assessment activities.
- There is a need for lecturers to establish a community of practice within which activities are clearly defined as well as the terms of reference. For participating members, lecturers must be encouraged to collaborate with the technical and support team at their respective institutions.

7.6.2 Recommendations for future research

The findings of this study could be extended in the following ways:

- A study involving lecturers at HE institutions who do not use formative assessment could illuminate more lecturers' perceptions of formative assessment.
- Themes from this study could be used to construct a survey about formative assessment use at HE institutions considering a quantitative approach.
- A future study to investigate the advantages of implementing online formative assessment, with specific focus on lecturers' motivation for engagement in the online formative assessment at HE institutions, could be conducted.

- An empirical study to further investigate and document the benefits associated with the implementation of online formative assessment at HE institutions could be conducted.
- There is a need to seek further study on the feasibility of the proposed T-B-F model.

7.7 Conclusion

This study investigated the implementation of online formative assessment at HE institutions to document best practices in the online learning environment. In Namibia, information about lecturers' implementation of online formative assessment practices is not well documented, if it exists at all. Therefore, the aim of this study was to document lecturers' best practices for online formative assessment to enhance effective feedback. The study falls within a qualitative paradigm, using a multiple case study approach with holistic cases. The data collection methods were non-participatory LMS observation schedules, semi-structured interview protocols and analysis of institutional documents. Four lecturers participated in the study on the basis that they implement online formative assessment. The findings of the study revealed that lecturers have TPACK and were able to use various e-tools to develop online formative assessment activities, based on the RBT with knowledge dimensions to provide formative feedback online.

Lecturers who participated in this study use varieties of assessment activities when assessing students online. These practices emerge in the setting of preceding teaching experiences and professional development, which assisted with the confirmation of collaboration and creativity in the social construction of knowledge in communities of practice. Lack of time for the implementation of online formative assessment was the most prominent concern shared by lecturers. The present study has contributed to the field of best practices in the implementation of online formative assessment for these lecturers. This study concluded that lecturers demonstrated best practices for online assessment in their respective HE institutions. The findings from this study were in agreement with the literature. While these results are limited to four lecturers at the selected HE institutions, it is hoped that lecturers from similar settings and those that engage in the implementation of online formative assessment can emulate.

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List of appendices

Appendix A

1. Introduction

To investigate and understand the extent to which lecturers implement online formative assessment, the researcher will obtain access to online courses and use a checklist to review the online assessment platform.

2. Online course observation

Online course observation for assessment component

Background information	
Code of HE institution	
Code of online course	
Code of lecturer	
Observer's name	
e-learning platform	
Type (s) of online assessment	
Additional information	
Date	
Time	

Component	Activities			Comments
Digital technologies *Technology knowledge (TK)* *Thompson and Mishra (2008)*	**What type of digital technologies are available for assessment?**			
		Yes	**No**	
	Internet connection			
	Software programs used			
	Digital video available			
	Forum engagements among different users, e.g. student portal			
	Online platforms available, e.g. Moodle, MOOCs, LMS			
Technological Content Knowledge (TCK) *Thompson and Mishra (2008)*	**What type of online courses are available?**			
		Yes	**No**	
	Provisions of course guides and protocols			
	Clear description of online course			
	Lecturer able to create online assessment activity (activities?)			
	Variety of online activities			
Online assessment tools *Technological Pedagogical Knowledge (TPK)* *Thompson and Mishra (2008)* *Ngololo (2010)* *Simon (2014)*	**What is the context for online assessment?**			
		Yes	**No**	
	Lecturer as a course administrator			
	Tutorial/exercise software			
	Description of learning outcomes			
	Multimedia production tools (e.g. media capture and editing equipment, drawing programs, production tools webpage/multimedia)			
	Simulations/modeling software/ digital learning games			
	Communication software (e.g. internet, email, chat, discussion forum)			
	Digital resources (e.g. portal, dictionaries, encyclopedia)			
	Mobile devices (e.g. personal digital assistant (PDA), mobile phone)			
	Smart board /interactive white board			
	Learning management system (e.g. web-based learning environment)			

Component	Activities			Comments
Online formative assessment approaches & strategies *Technological Pedagogical Content Knowledge (TPACK)* *Thompson and Mishra (2008)* *Simon (2014)*	**What can be done to improve online formative assessment approaches and activities?**			
		Yes	**No**	
	Reinforcement of online assessment			
	The use of grading schemata and rubrics			
	Finding useful teaching resources on the internet			
	Using course tools for monitoring students' progress and evaluating learning outcomes			
	Using course tools to give effective presentations/explanations			
	Opportunities for peer-to-peer engagement online			
Online formative assessment activities *Remember and Understand* *Anderson and Krathwohl (2001)*	Formative assessment activities			
	Using the internet (e.g. select suitable websites, user groups / discussion forums to support student learning			
	How is online formative assessment implemented by lecturers at HE institution?			
		Yes	**No**	
	Alignment of learning activities and assessments with learning outcomes			
	Learning skills required for activities			
	Basic elements of/in assessment activities			
	Problem solving skills			
	Appropriate course level and duration requirements			
Apply and Analyse *Anderson and Krathwohl (2001)*	**What are the challenges and benefits of implementing online formative assessment?**			
		Yes	**No**	
	Are all assessments relevant, challenging, clear and complete?			
	Support effective student engagement and learning			
	Other challenges or successes observed 1. 5. 2. 6. 3. 7. 4. 8.			
Evaluate and Create *Anderson and Krathwohl (2001)*	**What guides the implementation for online formative assessment?**			
	Clear criteria, techniques and methods	**Yes**	**No**	
	Methods of enquiry			
	High order thinking skills			
	Expectations of knowledge about cognition			
	Feedback activities			
	Self-assessment			
	Pre-knowledge evaluation activities			
	Reinforcement of learning evident			
Feedback	Provision of immediate and continuous feedback			

3. Recording online formative assessment

The researcher will record different types of online assessment and identify the knowledge and cognitive process dimensions as outlined in the revised Bloom's taxonomy.

Online assessment activities	Test	Quiz	Forums	Feedback	Workshop	Project-based
Mark with a cross						

		The Cognitive Process					
The Knowledge Dimensions *Anderson and Krathwohl (2001)*		Level 1 Remember	Level 2 Understand	Level 3 Apply	Level 4 Analyze	Level 5 Evaluate	Level 6 Create
A	Factual knowledge						
B	Conceptual knowledge						
C	Procedural knowledge						
D	Metacognitive knowledge						

Appendix B

Interview guide for lecturers

1. Introduction

This interview will be conducted for research purposes only. Your institution was selected to participate in this study to provide information about how lecturers implement online formative assessment. This interview, which will last for about 45 minutes to an hour, will be conducted in an informal manner and in a conducive environment. The information gathered will be treated with the utmost confidentiality and anonymity.

2. Interview (a semi-structured interview will be conducted)

Component	**Questions**	**Indicator**
Biographic information	Tell me a bit about yourself. How long have you been lecturing at this institution? Which course are you responsible for? As an instructor, how do you administer the online course?	Self-confidence / motivated Positive attitude
Digital technologies *Technology Knowledge (TK)* *Thompson and Mishra (2008)*	What are the different digital technologies available for assessment at your institution? Which digital technologies do you normally use and why? What is some of the most useful online or web-based programs that you use when preparing online assessment?	Evidence of digital technology Evidence of software
Component	**Questions**	**Indicator**
Online assessment tools *Technological Content Knowledge (TCK)* *Thompson and Mishra (2008)*	What types of online tools do you normally use when setting up assessment activities? Why do you use these online tools? What motivates you to use the online assessment tools? What can you do to motivate students who show low interest in online engagements in your course?	Knowledge of online tools operational Evidence of online tools

Component	Questions	Indicator
Technological Pedagogical Knowledge (TPK) *Thompson and Mishra (2008)* *Ngololo (2010)* *Simon (2014)*	How do you ensure that formative assessment allows students to take responsibility for their own learning? Describe cooperative and collaborative learning online. How do you make it a priority in your course to give students the opportunity to work together online when you are not directing them? How do you encourage students to self-monitor progress during learning online? What are some of the strategies you employ to facilitate the actual use of online assessments? How would you describe your own abilities to use technology in your assessments? Would you describe your online course development as a crucial variable that accounts for effective online formative assessment? Elaborate. Is your course presentation based on computer assisted instruction (CAI)? If yes, why? How do you incorporate assessment strategies into teaching to support student learning?	Evidence of online formative assessment Evidence of online platform Evidence of online workshops Evidence of online forums
Technological Pedagogical Content Knowledge (TPACK) *Thompson and Mishra (2008)* *Simon (2014)*	Do you have technical support staff at your institution? Describe the support available. Who assists you with online formative assessment development? How would you describe your knowledge of TPACK application in your online course as an instructor? How do you distinguish online formative assessment from traditional assessments? Describe how you make decisions in your course with regard to: ➢ Instructional approaches (lecturers, discussions, labs) that will help to capture students' interest or to achieve learning objectives. ➢ Instructional design in relation to learning opportunities for students, including interaction with the content, their peers and the instructor. ➢ Online organisation and design. How do you ensure that the instructors' design and choice of technology effectively delivers course content and supports the learning process? How do you determine the students' workload that is appropriate to the course level and duration?	Job descriptions of individuals Evidence of knowledge of TPACK application

Component	Questions	Indicator
Online formative assessment activities & guidelines *Remember and Understand* *Apply and Analyse* *Evaluate and Create* *Anderson and Krathwohl (2001)* *Van Gog, T., Sluijsmans, D.M., Joosten-ten Brinke, D. and Prins, F. J. (2010)*	Are you familiar with knowledge of incorporating levels of reasoning skills as suggested in the revised Bloom's taxonomy? If so, how do you apply various verbs in your assessments? Which verbs that require high order thinking skills do you frequently use in your assessments? What specific grading criteria or rubrics do you normally use to evaluate the students' work online? Identify different types of assessment in your course? Identify a variety of activities available? Why do you implement online formative assessment? Identify knowledge dimensions from Bloom's taxonomy incorporated in the online formative assessments. Which ones are appropriate for which assessment activities? Give examples. How do you ensure that online formative assessments promote metacognition and reflection by students on their work? As an assessor, what is your understanding of developing an assessment literacy? and viewing assessment through an inquiry-based lens? How do you ensure that your online formative assessment provides opportunities for feedback and deepens the understanding of learning objectives? How do you encourage students to engage in online activities? How do you use a variety of assessment strategies in your online platform? How do you involve students in evaluating their own work and that of their peers? How do you afford students an opportunity to review online participation? How do you assess students' progress online?	Evidence of assessment preparation Evidence of online formative assessment activities such as Quizzes; tests; project-based assignments; workshops; and forums.
Professional development *Simon (2014)*	Have you undergone any professional development? Elaborate. What would you highlight as positive impacts on your online formative assessment practices? Describe the PD training you think is relevant. Indicate if you received the training or not. Do you belong to a community of practice? Such as professional community, research committees, or groups? If so, which one?	Evidence of belonging website or online platform Proof of training (Evidence of certificate)

	Do you collaborate with lecturers in your institutions and educators or practitioners out of your institution? If so, how do you work with those educators or colleagues?	
Component	**Questions**	**Indicator**
Challenges and benefits for online assessment *Simon (2014)*	What successes have you experienced after implementing online formative assessments? Elaborate on the challenges you face when implementing or developing online formative assessment. What could be the solutions to these challenges? What is your opinion on the fundamental issues of assessment such as validity, reliability, fairness and honesty? How would you improve your online formative assessments with regard to the following? ➢ Open to new ideas and more willing to experiment with new assessment strategies. ➢ Experiment with instructional design and online assessment development. ➢ Seek improved assessment tools and strategies. Are there any tools and strategies for online assessments that you would recommend?	

Appendix C

Dear Sir/Madam

INVITATION TO PARTICPATE IN RESEARCH STUDY –

EVALUATING THE IMPLEMENTATION OF ONLINE ASSESSMENTS IN NAMIBIAN HIGHER EDUCATION INSTITUTIONS FOR BEST PRACTICES

I am currently enrolled for the PhD in Computer Integrated Education at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a research dissertation in the field of education.

You are hereby invited to participate in this research project, which aims to:

- Understand how lecturers implement the online formative assessments.
- Explore what guides the implementation and context for online formative assessments.
- Investigate to what extent technological tools are used for online assessments.
- Investigate what the successes and challenges are in the implementation of effective online formative assessments.

In the study, informed consent of participants is seen as highly important. The researcher guarantees that all personal information of participants will remain confidential, and their names will never be mentioned. The study will involve interviews of lecturers; I will use an audio tape recorder for the interview process and take field notes during this time.

Once the study is completed, the results will be in the form of a dissertation report and used to meet the requirements for the PhD in Computer Integrated Education in the Education faculty, University of Pretoria. The research will become public domain to be scrutinised by examiners and the academic community.

Your consent for the study will be highly appreciated, I promise to abide by the University of Pretoria's research ethics and all information obtained through the study will be used solely for its stated aims and nothing else.

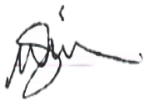
The study's research findings will make a credible contribution of knowledge creation to produce a composite model or logic framework of best practices for online assessments

and the context within each of the implemented assessments in the Namibian Institutions of Higher education.

Your signature below will serve as a declaration of voluntary participation in the research study.

Thanking you in anticipation.

Yours in service of education,



Wilhelmina Simon
Student Researcher
University of Pretoria
jetuna@gmail.com
264812866812

Dr M Mihai
Supervisor
University of Pretoria
maryke.mihai@up.ac.za

LETTER of CONSENT

INDIVIDUAL PARTICIPANT

VOLUNTARY PARTICIPATION IN THE RESEARCH PROJECT ENTITLED: EVALUATING THE IMPLEMENTATION OF ONLINE ASSESSMENTS IN NAMIBIAN HIGHER EDUCATION INSTITUTIONS FOR BEST PRACTICES

I, _____, hereby voluntarily and willingly agree to participate as an individual in the above-mentioned study introduced and explained to me by Ms. Wilhelmina Simon, currently a student enrolled for the PhD at the University of Pretoria.

I further declare that I understand, as they were explained to me by the researcher, the aim, scope, purpose, possible consequences and benefits and methods of collecting information proposed by the researcher, as well as the means by which the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

_____ _____

Full name Signature

_____

Date

Appendix D

The Vice Chancellor

[redacted]

Dear [redacted],

INVITATION FOR THE UNIVERSITY OF NAMIBIA TO PARTICPATE IN RESEARCH STUDY– EVALUATION OF THE IMPLEMENTATION OF ONLINE FORMATIVE ASSESSMENT PRACTICES AT HIGHER EDUCATION INSTITUTIONS

I am currently enrolled for the PhD in Computer Integrated Education at the University of Pretoria. Part of the requirements for the awarding of this degree is the successful completion of a PhD Dissertation in the field of education.

The study aims to:

- Understand how lecturers implement the online formative assessments.
- Explore what guides the implementation and context for online formative assessments.
- Investigate to what extent technological tools are used for online assessments.
- Investigate what the successes and challenges are in the implementation of effective online formative assessments.

In the study, informed consent of participants is seen as highly important. The researcher guarantees that all personal information of participants will remain confidential, and their names will never be mentioned. The study will involve interviews of lecturers; I will use an audio tape recorder for the interview process and take field notes during this time.

Once the study is completed, the results will be in the form of a dissertation report and used to meet the requirements for the PhD in Computer Integrated Education in the Education faculty at University of Pretoria. The research will become public domain to be scrutinised by examiners and the academic community.

Your consent for the study will be highly appreciated. I promise to abide by the University of Pretoria's research ethics, and all information obtained through the study will be used solely for its stated aims and nothing else.

The study's research findings will make a credible contribution of knowledge creation to produce a composite model or logic framework of best practices for online assessments and the context within each of the implemented assessments in the Namibian Institutions of Higher education.

Your signature below will serve as a declaration of voluntary participation of your institution in the research study.

Thanking you in anticipation.

Yours in service of education,

Ms Wilhelmina Simon
PhD Candidate
University of Pretoria
jetuna@gmail.com
264812866812

Dr M Mihai
Supervisor
University of Pretoria
maryke.mihai@up.ac.za

LETTER of CONSENT

UNIVERSITY AS PARTICIPANT

VOLUNTARY PARTICIPATION IN THE RESEARCH STUDY ENTITLED: EVALUATION OF THE IMPLEMENTATION OF ONLINE FORMATIVE ASSESSMENT PRACTICES AT HIGHER EDUCATION INSTITUTIONS

I, _____, the Vice Chancellor of

_____hereby voluntarily and willingly agree to allow the University of [redacted] to participate in the above-mentioned study introduced and explained to me by Ms. Wilhelmina Simon, currently a PhD Candidate enrolled for the PhD in Computer and Integrated Education at the University of Pretoria.

I further declare that I understand, as they were explained to me by the researcher, the aim, scope, purpose, possible consequences and benefits and methods of collecting information proposed by the researcher, as well as the means by which the researcher will attempt to ensure the confidentiality and integrity of the information she collects.

_____ _____

Full name Signature

_____

Date

Official Stamp

Appendix E

Codes – Implementation of online formative assessment at HE institutions for best practices.

1. Processes of Online Assessment (Strategies) **[Theme 2]** **Bloom's revised Taxonomy (RBT)** **{TK}**
2. Assessment Activities **[Theme 1]** **{TCK}**
3. Tools **(sub-theme 2.3)**
4. Challenges (Why) **[Theme 5]**
5. Structure of Assessing (How) **(sub-theme 2.1)**
6. Strategies used in the Online Assessment Course **(sub-theme 2.7)**
7. Evaluation **(subtheme 1.1)**
8. Motivation for engaging in online Assessment **[Theme 4]** **{TPACK}**
9. Advantages for using Online Assessment **(subtheme 4.1)**
10. Techniques used in Assessing online **(sub-theme 2.2)**
11. Training, Support Team & Professional Development **(subtheme 4.2)**
12. Feedback **[Theme 3]** **{TPK}**
13. Concepts, Framework & Theory **(sub-theme 2.5)**
14. Effectiveness (not sure what to call this) **(subtheme 4.3)**
15. Verbs used to assess the online activities **(sub-theme 2.4)**
16. Progression or Self-Monitoring or Peer-Assessment **(sub-theme 3.1, 3.2, 3.3)**
17. Encouragement for students **(sub-theme 4.4)**
18. Subjects/Sources provided Online Assessment **(sub-theme 2.6)**
19. Recommendations **(sub-theme 5.1)**

20. Collaborations and Collaborative Teaching (Relationship) **(sub-theme 4.5)**

No.	Codes	Themes	Sub-themes	Conceptual framework
1	Processes of Online Assessment (Strategies)	Theme 2		Bloom's revised Taxonomy (RBT) {TK}
2	Assessment Activities	Theme 1		{TCK}
3	Tools		Sub-theme 2.3	
4	Challenges (Why)	Theme 5		
5	Structure of Assessing (How)		Sub-theme 2.1	
6	Strategies used in the Online Assessment Course		Sub-theme 2.7	
7	Evaluation		Sub-theme 1.1	
8	Motivation for engaging in online Assessment	Theme 4		{TPACK}
9	Advantages for using Online Assessment		Sub-theme 4.1	
10	Techniques used in Assessing online		Sub-theme 2.2	
11	Training, Support Team & Professional Development		Sub-theme 4.2	
12	Feedback	Theme 3		{TPK}
13	Concepts, Framework & Theory		Sub-theme 2.5	
14	Effectiveness (not sure what to call this)		Sub-theme 4.3	

15	Verbs used to assess the online activities		Sub-theme 2.4	RBT
No.	Codes	Themes	Sub-themes	Conceptual framework
16	Progression or Self-Monitoring or Peer-Assessment		Sub-theme 3.1, 3.2, 3.3	Feedback
17	Encouragement for students		Sub-theme 4.4	
18	Subjects/Sources provided Online Assessment		Sub-theme 2.6	
19	Recommendations		Sub-theme 5.1	
20	Collaborations and Collaborative Teaching (Relationship)		Sub-theme 4.5	