University of the Witwatersrand

M.Ed. Dissertation

An investigation of the quality of first year and Honours online biodiversity summative assessments administered at a South African teacher training institution, during covid-19 lockdown

By: Kholofelo Carol Makgopa

Student no: 1420746

Supervised by Dr Monde Kazeni

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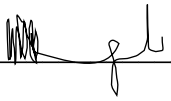
CERTIFICATION BY SUPERVISOR

I certify that Kholofelo Carol Makgopa (Student no: 1420746) prepared this dissertation at the University of the Witwatersrand, under my supervision, and that that it has been examined and approved as meeting the required level of scholarship for the fulfilment of the degree of Master's in Education.

Dr. M.M.M. Kazeni

SUPERVISOR (University of Witwatersrand)

Signature: 

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DECLARATION OF ORIGINALITY BY STUDENT

I, Kholofelo Carol Makgopa (Student no: 1420746), hereby declare that this dissertation is the result of my own investigations and has not been submitted previously for any degree or diploma in any University. To the best of my knowledge, this dissertation contains no materials previously published by any other person. I further declare that ideas from other sources used in this dissertation have been duly acknowledged.

Kholofelo Carol Makgopa (Student no: 1420746),

STUDENT (University of the Witwatersrand)

Signature: _____

Date: ___10 March 2022_____

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DEDICATION

I dedicate this dissertation to every woman looking into chasing after their dreams. The completion of this study serves as proof that you can achieve anything you put your mind to. Yes, it will take a few sleepless nights, a bit of frustration and often the desire to quit, but remember, quitting only closes the possibility of you attaining your goal. Therefore, woman! Go for that dream, chase after it and see if you will not be thankful you went for it!

ABSTRACT

Education institutions are tasked with the responsibility to educate, transform, and train students in their respective fields of study. This education involves assessing students' acquisition of content, skills, and values. These assessments, especially summative assessments are used to make high stake decisions, which have long term implications for students, educators, and institutions. The assessments need to be of high quality to ensure that they yield accurate, objective, and dependable results for making the relevant decisions. Low quality assessments could lead to unfair decisions and mediocre graduates. This is particularly true with online assessments that are rarely invigilated. In addition, the assessment of students' understanding of Biodiversity content has been cited in literature as problematic. This qualitative case study therefore investigated the quality of first year and Honours 'online biodiversity summative assessments administered at a South African teacher training institution, during covid-19. Data were collected using documents analysis and a semi-structured interview and analysed qualitatively. For Documents analysis, a total of eight biodiversity summative assessments, four from first year, and four from Honours level of study were collected and analysed against frameworks for content validity, authenticity, cognitive levels, and alignment of the assessments with course objectives to determine their quality. Interviews were conducted to determine the lecturer's perceptions regarding the quality of online summative assessments. Documents analysis results revealed that even though online biodiversity summative assessments at the institution of study were content valid, they were mostly based on topic one of the prescribed contents which were 'principles of classification' and 'The notions of biodiversity and climate change' for first year and Honours levels respectively. Furthermore, it was found that the summative assessments were also commonly aligned to objective one of the specified course objectives. Regarding Cognitive levels of the summative assessments, findings revealed that most items were pitched at lower order thinking skills which are 'remembering' and understanding. It was also determined that all first-year biodiversity summative assessments were highly unauthentic while all Honours' summative assessments were authentic with over 50% of authentic items for each paper. Interview results revealed that the lecturer at the institution could be confused about what constitutes a quality assessment and he did not know how to ensure most quality assessment attributes within his summative assessments.

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EXCERPTS FROM ANALYSED EXAINATION PAPERS

8.0 ABREVIATIONS

CVI- Content Validity Index

N/A- Not aligned

Chapter one: INTRODUCTION

1.1 Introduction

Educational institutions have a mandate to educate, transform and train students in their respective fields of study (Shukla & Dungsungnoen, 2016). This is to equip students with the knowledge and skills that would prepare them to confidently take up their roles as responsible citizens and future employees. The level of expertise that students exit learning institutions with, determines how successfully they will function in the working space and industry (Msila, 2014). Therefore, learning institutions need to have some form of measures put in place to check students' mastery of knowledge and skills in specific learning areas. This is to ensure that students who graduate from these institutions are ready to enter the corporate world and perform according to the expected standards. In this regard, assessments play a major role of collecting evidence about students' competencies and learning progress (The great Schools Partnership, 2013; States, Detrich & Keyworth, 2018). Furthermore, evidence gathered from assessments results can be used to shape and enhance the quality of education offered in educational institutions, which could contribute to the country's sustainability and advancement (States, Detrich & Keyworth, 2018). Assessment in the context of the study refers to a process of tracking students' learning progress, grading, and providing students with feedback, as well as structuring teaching, accordingly, using the results generated from them (Black & Wiliam, 1998; Oyinloye & Imenda, 2019).

The two common types of assessments used in the education field include formative assessments, and summative assessments. A formative assessment is an assessment that takes place during teaching and learning to check students' understanding of the unit being taught, so that support can be provided where necessary. Because of their supportive role, formative assessments are often called 'assessment for learning' (Dunn & Mulvenon, 2009). On the other hand, summative assessment also called 'assessment of learning' is used to evaluate students' learning progress, skill acquisition, and academic achievement at the end of a defined instructional period (The great Schools Partnership, 2013). This type of assessment often takes the form of examinations, assignments, projects, or end of block tests. It differs from formative assessment in that it is commonly graded and used to make high stakes decisions about those involved (The great Schools Partnership, 2013; States, Detrich & Keyworth, 2018).

Despite the high-stake decisions associated with summative assessments, literature reveals that most summative assessments do not provide accurate and dependable results that can be used to make important decisions about students' lives, because of the way they are designed (States Detrich & Keyworth, 2018). It seems that most summative assessments are set at lower standards that compromise their quality. This is in relation to their content validity, authenticity, alignment with course objectives and the cognitive levels they are pitched at (Bezuidenhout & Alt, 2011; Department of basic Education: DBoE, 2012-2014). This is particularly true in the Life science learning area, and specifically the topic of biodiversity, which has been argued to give many assessors a difficult time, as they do not know how to assess it because of its complexity (Sadler et al, 2013). Subsequently, assessors design summative assessments that are below standard, which include items that lack cognitive complexity, and which do not provoke students to apply learnt skills and knowledge to real-world situations. Yet these are the summative assessments used to make life-changing decisions about students, educators and learning institutions. It is therefore necessary to establish the quality of these assessments, to get insights into their accuracy in determining students' competencies.

An educator in the context of this study refers to an individual who teaches at a learning institution, including primary, secondary, and tertiary institutions. An educator would therefore refer to a teacher or a lecturer. The term lecturer denotes an individual who teaches at tertiary educational level, while a teacher designates an individual who teaches at primary or secondary educational levels. The background of the study is discussed in the succeeding section.

1.2 BACKGROUND

In 2021, the world was hit by the corona virus pandemic that saw numerous countries locking down, world-wide. The corona virus causes a disease known as COVID- 19, which spreads at a very fast rate. Due to the COVID-19 national lockdown, South African learning institutions had to promptly shift from physical forms of learning to online forms to mitigate the devastating effects of COVID-19. This also meant that summative assessments had to be administered using online platforms. This change in assessment administration seems to have further thwarted the quality of the biodiversity summative assessments, which were already considered poor (Junus et al, 2021).

During the COVID-19 pandemic, I was a post graduate student and I also worked as a life sciences tutor at the university where the study took place. Tutors at the university mark some assessments and record assessment marks. Therefore, they are privy to students' assessment results, including summative assessments. During my tutorship in 2020, when the university adopted online educational offering, due to the COVID-19 pandemic, I noticed that most students' summative assessment marks were exceptionally high (around 80 to 100%), with very few of them failing. This upsurge in students' performance in life sciences was not observed previously when lessons and assessments were administered using face to face educational delivery methods. Discussions with my fellow tutors revealed that the tremendous increase in student performance in online assessments was widespread, which indicated the possibility of students cheating during online assessments.

Online assessments are usually not invigilated, which means that students can easily cheat by accessing any available learning materials during the assessments, especially if the assessments are of low quality. In other words, assessments, especially summative assessments need to be of high quality for them to accurately measure students' capabilities. I personally witnessed students' cheating in assessments at the university, when marking summative assessments as a tutor. Some students had the same answers, while others copied and pasted information directly from online sources, such as the internet, lecture notes and past assessment scripts, without any effort of contextualizing this information. It dawned to me that if the assessments were of high quality, students would find it difficult to cheat, as they would require higher cognitive thinking capabilities. This raised the question of the quality of online life sciences summative assessments. The failure to set credible online summative assessments could lead to students cheating during examinations, tests, and other summative tasks, by copying information from the internet, textbooks, class notes, and by consulting knowledgeable others (Junus et al., 2021).

Summative assessments are used to make high stakes decisions about the curriculum, educators' competencies, and an institution's effectiveness in delivering quality education (States, Detrich & Keyworth, 2018). It is reported that some educators could lose their teaching jobs following evaluation of summative assessment results, as they are declared incompetent, while some students could give up on schooling because of poor summative assessment results (Harlen, 2005). The high stakes decisions associated with summative assessments warrants them to be of very high

quality and credibility, so that decisions made from them can be reliable and of satisfactory standing. Unfortunately, it seems that summative assessments administered in many education institutions worldwide are of low quality as literature shows that they lack reliability, validity, and authenticity which are key features of a good assessment (Mansell & James, 2009).

In addition, it seems that, the recent rapid transition of institutions from physical to online learning due to Covid-19, could have further impacted the quality of summative assessments negatively. This is because some institutions, assessors, and students were not ready for this sudden change in the mode of assessment (Junus et al, 2021). It is alleged that in using online delivery, assessors simply plan summative assessments that are easy to grade by including items that only measure factual knowledge, even though they do not necessarily correlate with course objectives (Junus et al, 2021). This entails that the summative assessment items might not mime real-life and work experiences (Carless, 2015; Sambell et al, 2013). Another issue seems to be around the idea that some assessors are not accustomed to online administration of assessments, as a result they may have continued to use the same summative assessments designed for use in invigilated venues, without adapting them to the online environment (Junus et al., 2021). This situation could be particularly dire in developing countries, such as South Africa, where online teaching, learning and assessment are relatively new to most educational practitioners.

The concern about the quality of online summative assessment is strengthened by the fact that students have been receiving very high grades, which suggests that the design and nature of the summative assessments could have enabled them to copy answers from the internet and other sources, and exchange them amongst themselves (Junus et al., 2021). This could imply that the summative assessments administered online might not capture true evidence of students learning ability and progresses. As a result, students may be progressed to the next educational level or into the corporate world, without possessing sufficient knowledge and skills in their respective fields. Furthermore, the country at large could suffer as a consequence of poorly skilled workers who cannot contribute effectively to the economy.

Students' ability to easily pass and obtain high grades in online assessments is probably because expected answers to most assessment items are generic and do not promote authenticity, individual creativity, or higher order thinking (Junus et al., 2021). According to Junus et al., (2021), this reduces the quality and subsequently the dependability of online summative assessment results.

Unreliable results from summative assessments which do not capture the true learning achievements of students could lead to unfair judgements such as retaining or progressing students undeservedly. The use of unreliable summative assessments could further lead to incompetent graduates and entry of insufficiently skilled employees into the working space (Shukla & Dungsungnoen, 2016). Conversely, high quality summative assessments can help to ensure that individuals entering the workspace are the ones that have truly mastered the necessary skills and knowledge to operate successfully in the revolving industries (Mansell & James, 2009).

As discussed earlier, one of the areas where the quality of online summative assessments is questionable is in the Life sciences subject, especially at tertiary level where teaching and learning, as well as assessments, normally follows traditional pedagogies. In these assessments, students only need to accurately reproduce, through memorizing and recalling facts, what was taught during lectures or what they read. For online assessments, the answers to such assessment tasks can easily be accessed from many sources, if the student fails recall what was taught. However, summative assessments need to be of high quality so that they can measure students' intellectual abilities and skills, not their ability to copy from sources. Regarding this matter, Sadler et al (2013) reasoned that even though the life sciences subject is full of facts and diagrams, it is still necessary for summative assessments in this discipline to test students on various skills and their ability to use knowledge in different scenarios.

Biodiversity is one of the Life sciences topics that require students to go beyond recalling and comprehension, to higher mental functions as well as showcasing creativity and individuality (Sadler et al, 2013). However, it is argued that assessors treat the biodiversity topic as though it is purposed at just adding on to the content of assessments for the sake of curriculum coverage, while ignoring the important parts of the topic that require students to think and work critically (Siddiek, 2018).

One of the reasons for treating the biodiversity topic as just an 'add on' content in assessments is that some educators might have poor knowledge and understanding of the topic and are unable to justifiably assess it (Sadler, et al., 2013). As a result, they only ask surface level questions pitched at low order thinking ability, to make it easy for them to grade without having to go deeper into the concrete elements (Sadler et al., 2013). This raises a concern and a question of whether the biodiversity summative assessments administered online are at an acceptable standard to be used

as the basis for making high stake decisions about students' academic achievement. Hence this study investigated the quality of first year and Honours' online biodiversity summative assessments administered at a South African teacher training institution during Covid-19 lockdown. The levels of studies chosen for this investigation were first year and Honours. This is because the biodiversity unit is only taught at these levels at the selected institution of study. Furthermore, it was necessary to determine whether there was any improvement in the quality of Biodiversity summative assessments as students progressed to higher levels of learning. The problem statement of the study is described below.

1.3 Problem Statement

Summative assessments are an essential part of any effective teaching program, hence they should be planned, designed, adjusted, and revised frequently to ensure all quality measurements are sufficiently met, and that they serve their purpose without fail (Siddiek, 2018). However, it seems that summative assessments are habitually given less consideration by educators than any other educational task, even though they are an activity that normally creates unease and pressure for both the student and educators, as they are used to make high stakes decisions (Mansell & James, 2009; Harlen, 2005). Subsequently, they fail to provide accurate and dependable results that gives a true measure of students' capabilities, especially in developing countries such as South Africa (Mansell & James, 2009; Harlen, 2005).

The declaration of most summative assessments as being poor in quality is usually due to their lack of validity, authenticity, cognitive complexity, and other quality measures (Mansell & James, 2009). For a summative assessment to be of an acceptable status, amongst many other attributes, it needs to be valid, authentic, aligned with course objectives and when graded, should reflect the true progress of the teaching and learning process (Siddiek, 2018; Reform Group, 2009; Bezuidenhout & Alt, 2011; DBoE, 2012-2014).

The concern with poorly designed summative assessments is that decisions made following their results have a huge impact on students, educators and learning institutions, ranging from financial implications, emotional status, self-esteem, social lives, future success, reputation, and credibility (Kibble, 2017; States Detrich & Keyworth, 2018). It seems that from history, unfair and life

changing decisions about individuals have been made following results from summative assessments that were not steeped at the correct standard (Bezuidenhout & Alt, 2011). This matter has worsened in the past two years, particularly in South Africa due to the rapid transition to online mode of assessment, without adequate training of lecturers in design, administration, and monitoring of online assessments, as well as how to evaluate the quality and integrity of online summative assessments (Junus et al., 2021).

Summative assessments need to be of high quality, to increase the credibility and dependability of results obtained from them. This is so that they can be used to make accurate, fair, and authentic decisions about students' competency (Kibble, 2017). It should be noted that, at the selected institution of study, apart from the internal and external moderations of summative assessments, there are no established organizations for monitoring the quality of online summative assessments. The extent to which the institution-based moderations establish the quality of the online summative assessments in terms of their validity, authenticity, cognitive levels, and alignment of the assessments with curriculum objectives has not been determined.

Furthermore, there is limited literature that reports directly on the quality of online biodiversity summative assessments administered during the covid-19 lockdown. Therefore, it became necessary to explore the quality of first year and Honours 'online biodiversity summative assessments administered at a South African teacher training institution, as stated in the purpose statement described below.

1.4 Purpose Statement

The purpose of this study was to investigate the quality of first year and Honours 'online biodiversity summative assessments administered at a South African teacher training institution, during Covid-19 lockdown. The specific objectives of the study were to determine the:

- Content validity of first year and Honours' online biodiversity summative assessments.
- Alignment of first year and Honours' online biodiversity summative assessments with course objectives.
- Cognitive levels of first year and Honours' online biodiversity summative assessments.

- Authenticity of first year and Honours' online biodiversity summative assessments.
- Lecturer's perceptions of the quality of online biodiversity summative assessments.

The research questions investigated in the study are stated below.

1.5 Research questions

Primary research question:

What is the quality of first year and Honours online biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown?

Sub-research questions:

1. What is the content validity of first year and Honours' online biodiversity summative assessments?
2. How aligned are first year and Honours' online biodiversity summative assessments with course objectives?
3. What are the cognitive levels of first year and Honours' online biodiversity summative assessments?
4. How authentic are first year and Honours' online biodiversity summative assessments?
5. What are lecturer's perceptions of the quality of online biodiversity summative assessments?

The rationale and significance of this study is explained in the succeeding texts.

1.6 Rationale and Significance

Given the huge impact of summative assessments on both students and educators (Kibble, 2017; States Detrich & Keyworth, 2018), assessors have a great responsibility to develop summative assessments that are unambiguous, have a good educational impact and can be proven valid, reliable, and authentic (Capraro et al, 2012). In this regard, the American Psychological Association, and National Council on Measurement in Education (NRC, 1999) argued that when

stakes are high, it is predominantly significant that the inferences drawn from an assessment are accurate and steady. This study aimed at providing insights into the quality of first year and Honours' online biodiversity summative assessments administered at a teacher training institution in South Africa to ascertain their validity, cognitive levels, authenticity, and alignment to course objectives.

The results of this study could encourage assessors to re-visit their online assessment methods and perhaps make use of available frameworks for developing high quality summative assessments that students cannot simply manipulate or cheat their way out. The study might also reveal the challenges of developing high quality online assessments, which could be mitigated, and the solutions emulated by other higher institutions of learning. Moreover, the department of higher education might consider providing workshops and guidelines to assessors for quality assurance, when planning and designing online summative assessments. The findings from the study could also increase confidence and trust in the online summative assessments offered at the institution where the study was conducted, if the findings show that the assessments are of high quality.

1.7 Terminologies definitions

Assessment - All activities that assessors and students engage in to obtain evidence that can be used to advance teaching and learning as well as report on learner progress and achievement (Black & Wiliam, 1998, cited in Oyinloye and Imenda, 2019).

Summative Assessment - Assessments that take place at the end of a certain learning period and used to judge the level of competency and achievement of learning outcomes by students, against benchmarks (The great Schools Partnership, 2013)

Learning outcomes - Statements about what students should achieve during or at the end of a learning period (McCarthy, 2011).

Validity -The accuracy of measurement by a specific method and is considered the most fundamental aspect of assessments (Kibble, 2017).

Authenticity - The applicability of the assessment outside of the classroom environment (Mueller, 2005). The succeeding chapter presents the literature reviewed in relation to the study.

Chapter two: LITERATURE REVIEW

This chapter presents a review of some of the existing literature related to the quality of assessments. The review includes definition of assessments; purpose and impact of summative assessments on students; quality of summative assessments; effect of the quality of summative assessments on stakeholders; online summative assessments; summative assessments in the study of biodiversity and lastly; the conceptual framework that guided this study.

2.1 Definition of assessment

Different scholars have put together various definitions of assessment, as best suited for numerous purposes. For instance, Brown (1990) defined assessment as a series of measures used to gather and interpret information about students' level of achievement of learning outcomes. Additionally, Delclos et al (1992) explained assessment as, "a process for documenting, in measurable terms, the knowledge, skills, attitudes, and beliefs of the learners" (p.2). As explained earlier on, for the purpose of this study, assessment was looked at as a process encompassing all activities that assessors and students engage in to obtain evidence that can be used to advance teaching and learning, as well as reporting on learner progress and achievements (Black & Wiliam, 1998, cited in Oyinloye and Imenda, 2019). There are several types of assessments, which include diagnostic (baseline), formative and summative assessments. Of these, the two commonly adopted types of assessments in education include the formative and summative assessments and I describe these in the proceeding texts.

Formative assessment

Formative assessments, also known as assessment for learning, are continuous assessments that evaluate students' progress, without grading them, but using the data obtained to guide teaching and learning to meet the student's needs (Black & Wiliam 1998; 2002; Bell & Cowie, 2001). Formative assessments are typically used during an instructional period to determine the effectiveness of the pedagogies, to foster learning, as well as providing immediate feedback to students to advance the quality of education administered (Renard, 2017). Furthermore, formative

assessments are used to 'update' educators' understanding of students' needs and accomplishments (Afflebach, 2008, p.3). Examples of formative assessments may include class discussions, multiple questions, concept-card mapping, quizzes, student generated questions, think-pair-share, etc.

Summative Assessment

This study focused on the quality of summative assessments. Different scholars have defined the concept of summative assessments differently, which include the following.

- Summative assessments are procedures used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period - commonly at the end of a teaching period (The great Schools Partnership, 2013; States Detrich & Keyworth, 2018).
- Summative assessments involve evaluation of students and summarizes their progress at a specific time within a course program, through feedback and grading (Taras, 2005)
- Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (Bhat & Bhat, 2019).

What all these definitions have in common is that summative assessments are conducted at the end of a learning cycle and that they are used to judge students' capabilities for the sake of progression or certification. The definition that is mostly applicable to this study is that provided by the great Schools Partnership (2013), which states that summative assessments are procedures used to evaluate student learning, skill acquisition, and academic achievement at the conclusion of a defined instructional period - commonly at the end of a teaching period. This is because the university where the study took place administers summative assessments at the end of teaching cycles and these assessments are meant to determine the level of students' academic achievement. The results generated from these assessments are used to make decisions about undergraduate and post-graduate student teachers. Examples of the summative assessments include examinations, term tests and assignments, projects, portfolios, educator, and student evaluations (Khaled & El Khatib., 2020).

2.2. Purpose of summative assessments

As stated earlier, this study undertook to determine the quality of summative assessments administered at a selected teacher training institution. Scholars argue that unlike formative assessments, which are continuous and purposed at evaluating students' engagement with the learning process, summative assessments have a bigger role of measuring outcomes using pre-defined yardsticks (Khaled & El Khatib., 2020). Scores generated from these summative assessments are used to make 'high stake' decisions about students (States, Detrich & Keyworth, 2018). For example, the decision of whether a student should be promoted to the next level, should be kept at the same level, or should qualify for a certain degree, is based on summative assessment scores, which can in turn affect their employability and potential as citizens. Moreover, institutions and educators could be held accountable by stakeholders, based on the results of summative assessments.

It is often argued that even though summative assessments are generally used for a good cause of determining the learning process, there are also unintended outcomes associated with their high stakes rank. Issues such as high student dropouts, students cheating during exams, and educators resigning from the teaching profession could be consequences of summative assessments (Amrein & Berliner, 2002). Moreover, research evidence shows that most summative assessments are in disarray and fail to provide dependable accounts of student learning (Mansell & James, 2009), as they are deemed unable to meet the quality measures prescribed above (Cook, Kuper, Hatala & Ginsburg, 2020). This shortcoming has led to the lowering of assessments quality and dependability.

It is assumed that most assessors use external summative assessments, which do not reflect what they have taught students (Mansell & James, 2009). Furthermore, while the curriculum specifies the overall knowledge and skills that should be achieved by students through the learning process, it appears that most educators abandon the curriculum specifications, arguing that the curriculum is not helpful (Black et al, 2011). This could mean that educators might not be familiar with how to achieve the specified learning outcomes and therefore may be planning assessments that do not assess the objectives accurately. To compound this problem, educators spend insurmountable time 'teaching for the test', which takes away time for learning other valuable skills, which may not be tested (Valli & Chambliss, 2007).

There are also questions about whether summative assessments promote complex cognitive skills, as findings from existing literature suggest that most educators only assess students on lower order thinking skills, such as remembering and comprehension (Shukla & Dungsungnoen 2016; Yusuf, Sadia & Suharsono, 2019). The reason for this has been assumed to be the lack of knowledge and training from the educator's side, on how to integrate higher order thinking skills (HOTS) within summative assessments as well as the large amount of work that is required for grading HOTS integrated assessment questions (Shukla & Dungsungnoen, 2016). In Kibble (2017)'s reasoning, the failure to test students at high cognitive levels compromises the quality of these summative assessments as students 'ability to solve complex problems using higher mental functions may remain unknown. Additionally, the dependability of results obtained from these assessments is compromised (Harlen, 2005; Stimpson, 2006).

While the purpose of summative assessments is clear, it seems that educators are not provided with sufficient informative guidelines and training on how to ensure dependability of such assessments, which has led to unsatisfactory outcomes for the members involved (Harlen, 2005; Stimpson, 2006). My view here is that, if summative assessments have such a prodigious impact on stakeholders and contribute significantly to high stakes decisions about individuals, then, education institutions have an obligation to ensure that the summative assessments administered are of high quality, are unambiguous and can produce results that are a true reflection of students, educators, and institution' aptitudes in their respective roles. While the term 'quality' in assessment may be described and used for varying purposes, the next section discusses the meaning and use of the term 'quality' in the contexts of this study.

2.3 Quality of assessments

Quality in general terms, is defined as the standard of something when it is compared with other related things (Wiliam, 2008). According to the Simpson et al: Oxford Dictionary **(**1989), 'quality' refers to "the degree to which an object or entity will satisfy a specified set of attributes or requirements". The set of attributes related to the quality of assessments include; fairness, appropriateness, manageability, validity, reliability, readability, authenticity, alignment with

learning outcomes and the cognitive levels at which it is pitched, as well as other factors such as the assessors' knowledge and experience in planning, designing, and administering summative assessments, which have been enumerated in literature as measures of the quality of assessment (Bezuidenhout & Alt, 2011; DBoE, 2012-2014; Gardner, 2006; Hadjerrouit, 2010; Mansell & James, 2009).

An investigation of all the quality attributes of assessments is beyond the scope of this study due to time and resources limitations. Therefore, in this study, only a few assessment quality attributes were examined, which include Content Validity, Authenticity, Cognitive levels of assessment items, and the Alignment of the items with course objectives. These quality measures were selected because they provide a relatively good measure of assessment quality, they are easier to quantify, and they could be determined from the documents (examination papers) analysed. Other studies have also investigated these attributes, to determine the quality of assessments (Gareis and Grant, 2015; Kabombwe, Machila, & Sikayomya, 2021; Siddiek, 2018; Smith, 2012). It was assumed in this study that if these quality attributes are met by the investigated summative assessments, then it would signify high quality assessment.

Although it is difficult to measure whether an assessment is good or bad, there are some common attributes that any assessment should possess (Worthen, Borg & White, 1993). These include that, an assessment should be a representative of students' competence and the results should be trustworthy (Tuckman, 1991). Carey (1994) also included that an assessment should be aligned with the content of the subject. Moreover, assessments should have some level of authenticity and should test learner's abilities in solving rea-life problems (Mansell & James, 2009; Bezuidenhout & Alt, 2011; DBoE, 2012-2014). Worthen, et al. (1993, p. 238) reasoned that failure to set an assessment that is reliable will lead to incorrect judgement of the learning progress and eventually wrong decision-making about students, which could result in students getting demotivated or motivated wrongly.

Rice (2003) reasoned that assessments that meet the quality assurance attributes have been proven to promote learning in school contexts. Besides, assessments that meet the quality measures discussed above will not only promote learning of stipulated outcomes but will also expose students' talents and abilities that were perhaps not initially known. This idea could be supported

by Mansell and James (2009)'s reasoning that, assessments that are of good quality are a step in the right direction to achieving learning outcomes and creating a positive learning atmosphere.

Furthermore, I assume that assessments that probe students to use their individuality, promote the development of different cognitive skills, expose them to actual experiences of the workspace and enable them to see the correlation of the test items, classroom lessons, and the overall outcomes, could create enthusiasm, and positive attitudes towards learning. Moreover, students exposed to low quality assessments that require the recall of facts might feel frustrated by their inability to recall facts during exams, hence, increase their anxiety which could lead to poor performance in such assessments.

Lastly, results obtained from quality assessments will most likely indicate true accounts of students learning achievements and readiness to move to the next level, as they would have been tested in various ways, opposed to the traditional and monotonous 'multiple choice', recall facts and columns matching types of assessments. My argument is accurately summed up by Jimaa (2011, p.719) who said that "Quality of assessment is one of the key features of good teaching". Assessments should question students in a way that demands evidence of understanding, and it is therefore important to use a variety of test items for discovering what students have learned and are capable of. For an example, an assessment item that requires students to provide justifications for their response could enable students to perhaps provide a broader scope and insight of the assessed concept which might have not been accounted for in the assessors' criteria of correct answers. This is what the education field in the current century should achieve. Creating learning environments that allow for constructive interactions between students and their educators to not only learn knowledge that is already established but to also expand on this existing knowledge. Differently, an assessment item that only requires a single correct answer without trying to understand learner's reasoning in choosing such an answer could lead to students guessing answers. This could lead to a lack of appreciation of the rationale aspect of it which is what leads to most students failing to apply what they learnt to new situations.

In addition to assessments that do not probe students to rationalize, it seems that most assessors only focus on designing assessments for the purpose of providing students with grades while neglecting other important roles such as using assessments to assisting students with learning. In

this regard, Cliff, and Bradford (1981) reasoned that an assessment must encourage students to learn. Furthermore, he stipulated that while there are a lot of guidelines on how to set tests and other assessments, there is still a great disregard of important attributes of an assessment. This lack of attention to quality assessment attributes could be due to designers not having sufficient knowledge about testing techniques and lack of recognition of the importance of assessment quality attributes.

Siddiek (2018) conducted a study titled "The impacts of content validity on language teaching and learning". One of the objectives of this study was to determine the extent to which the educators' designed assessments are of good quality, not only in terms of content validity but also looking at other attributes such as alignment with curriculum objectives and authenticity. One of the methods he used for collecting data was unstructured questionnaires, to determine educator's perceptions and knowledge of the terms used in testing. In his findings, he noticed that most of the participants had very little knowledge about key terms used, such as: validity, content validity, authenticity, reliability, curriculum objectives, taxonomy of educational objectives, high-stakes examinations. Due to this poor knowledge of testing techniques, the exams reviewed were found to have too many major faults. It was apparent that educators took very little time in planning their assessments and had little knowledge on what constitutes a good assessment (Siddiek, 2018).

The aim of this study was to look at the quality of biodiversity summative assessments by looking at the attributes of a good assessment, such as content validity, authenticity, cognitive levels, and alignment with course objectives. These attributes are discussed individually in the following sub-headings, starting with Validity, which is considered one of the most important measures of assessment's quality.

2.3.1. *Validity of assessments*

The importance of validity in assessment cannot be over emphasized. To illustrate the importance of validity, consider an object created to measure one thing and when put to the test, it measures something completely different. Such an object would be of no value and would have failed its purpose. However, an object that measures precisely what it is intended to measure has great value

and use as it will give true accounts of the variable it is intended to measure. Well, this is at face level what the notion of validity speaks to. It is in simple terms, the extent to which an object measures what it is created to measure (Kibble, 2017). In education, students are put to the test using summative assessments, which act as the 'measuring object'. The extent to which, for example, these summative assessments measure the knowledge and skills intended is what 'validity of assessments' entails. Assessment validity is furthermore, "the process of collecting rational evidence to evaluate the appropriateness of the interpretations, uses, and decisions based on assessment results" (Cook et al., 2016, p. 2). In the context of this study, validity speaks to the accuracy with which summative assessments measure one's competence in the content prescribed for a course.

Cook et al., (2016) stated that assessments should be valid so that results from them can be trustworthy. Apart from the trustworthiness of test results, educators also need to be aware of the practical and logistical issues which may arise during administration of assessments. In this regard, Cook et al., (2016) denote validity as "a process and not an endpoint" as it involves collecting evidence and interpretation of test scores in relation to context and purpose, so that any inferences made from them could be truthfully accounted for (p.2).

There are different types of validities, which an assessment should satisfy, namely; Construct Validity, Face Validity, Criterion Validity and Content Validity (Kibble, 2017; Koller et al, 2017). Construct validity checks whether a measurement instrument denotes what we are interested in measuring (Kibble, 2017; Koller et al, 2017). Face Validity evaluates how appropriate the content of an assessment is on surface value (Kibble, 2017; Koller et al, 2017). Criterion validity measures how closely the results of an assessment relate to the results of another assessment, with similar objectives. Lastly, Content Validity, which the study is focused on, measures whether an assessment is a representation of all facets of the domain being tested (Kibble, 2017; Koller et al, 2017). While all types of validity are important in assessment, the content validity of Biodiversity assessments was investigated in this study because this type of validity speaks directly to the coverage of the content that students are expected to know. Biodiversity, like other science topics, is content based, as it requires the knowledge of theories, laws, facts, principles, formulae, concepts, and terms, in addition to the acquisition of relevant skills. It therefore becomes important to check whether this content is sufficiently accommodated in summative assessments.

Content validity is argued to be one of the most difficult to ensure and to quantify in assessments, as it requires an identification of content that is relevant and sufficient to adequately measure the construct being tested, and to meet the overall objectives of the course (Webb, Katz & Decker, 2006). Webb and his colleagues put forth that "the science of content specification draws on conceptual frameworks, expert judgment and balancing the many trade-offs that must be made (2006, p. 165). In line with Webb, Katz & Decker (2006)'s idea, Siddiek (2018) said that many assessments are not well balanced in terms of their content validity because it is a complex concept that most assessment designers do not know how to ensure. In addition, he reasoned that many educators fail to thoroughly plan and design assessments that adequately represent all facets of the subject area. They often over present or inadequately present certain strands.

Moreover, it seems that most educators do not invest time in planning assessments, hence they often use questions from past papers, which may not be relevant to the current curriculum. Additionally, educators may not be following tables of specifications to ensure adequate sampling of assessments 'items, as there are too many responsibilities and tests to plan for. Due to the many responsibilities, most educators do not have sufficient time to re-visit designed assessments for the purpose of validating them (Siddiek, 2018). It is also claimed that there is lack of training for assessors, in designing and administering valid assessments, and there is limited monitoring of the quality of assessments, which leaves the design of quality assessments to the discretion of the educators (Siddiek, 2018).

In a study titled "Assessing Content-Related Validity and Internal-Consistency Reliability of Tests Constructed by Seychellois teachers (Siddiek, 2018)", grades 5 and 7 Mathematics papers were collected and reviewed using a scale of 1-10. Expert judges rated the content validity of the assessments and results revealed that the assessments had poor content validity. The average rating was 2.90, with only one paper rated at 6.7. The underlying reasons for such results included that the items of the assessments were unclear and there were too many basic questions, such as true or false, label and define (Siddiek, 2018).

Another study titled "The validity of educator-made assessments" by Gareis and Grant (2015) was carried out to investigate the content validity of assessments planned by educators in three Chinese primary schools. A questionnaire with 6 items was distributed to 30 educators, to collect the data."

The content validity of the survey instrument in this study was obtained by issuing a 6-item analysis instrument by subject matter experts; two senior assistant principals and a principal selected from different Chinese primary school in Johor, Malaysia to seek their judgments. The selected experts were requested to comment if the items were clear, systematically captured the content of the tested domain and could be easily understood by students. The results indicated that the educator-planned assessments were content valid, even though the assessment items were not evenly sufficiently distributed amongst the different topics of the construct tested (Gareis and Grant, 2015).

Currently, there are not enough studies that report on the validity of university assessments and the few that exist show inconsistent results, as can also be seen in the two studies described above. The study reported in this report is also purposed at filling in the gaps and contributing to current studies by investigating the content validity of online biodiversity summative assessments, at a South African teacher training institution. The following segment discusses measurements used to determine the content validity of summative assessments.

Measurement of Content Validity

There are various methods for measuring content validity. There are methods such as the Delphi measurement and Multidimensional measurements (Lawshe, 1975; Sireci & Geisinger, 1998). Both methods involve expert judgement of assessment items in relation to the construct being tested. For example, in the Delphi method, which is subjective in nature, expert judges rate the extent to which the assessment items represent the construct being tested on a scale of 1-10. The multi-dimensional method involves an analysis of the inter-item correlation matrix obtained from the students' answers (Sireci & Geisinger, 1998). The resulting factors are then reviewed against the structure of the content area specified in the outlines (Sireci & Geisinger, 1998).

Subjective methods of measuring content validity, such as the Delphi measurement, use 'experts' judgment, whereby an expert reviews assessment items and rates them according to their scale of relevance for measuring the content domain they are aimed at measuring. An example here would be the measurement of content validity index, which requires an expert to review test items and categorize each item as either content valid or not valid according to their expertise of the tested strands, domains, and objectives. A Content Validity Index (CVI) is calculated by adding the

number of items that counted as valid divided by the total number of items in the assessment and then multiplied by 100 to get the percentage of content coverage by items. The CVI is determined by dividing the total percentage of content coverage by a 100, and a CVI of less than 0.7 classifies the assessment as invalid, while a CVI of 0.7 and above would indicate that the assessment valid.

The Delphi measurement method was used in the current study to determine the content validity of first year and Honours online biodiversity summative assessments. This is because the method does not require an analysis of an inter-item correlation matrix obtained from the students' answers, which were not available in the present study. The content domain to which the assessment items were measured against was obtained from the course guidelines of the courses involved in the study. There are many assessment quality attributes, which include the alignment of assessment tasks to course objectives, and this quality attribute is discussed in the succeeding sub-section.

2.3.2 *Alignment of assessments with course objectives*

Literature suggests that assessments should be strictly determined and informed by the prescribed specific learning objectives, which are clearly communicated to students (Kurt, 2020). Alignment in the education context refers to accurate links between course objectives, learning activities, and the assessments administered (Kurt, 2020), whereas course objectives refer to statements about what students should achieve during or at the end of a learning period, often expressed as 'by the end of the lesson, students should know or be able to' (McCarthy, 2011). The objectives could encompass students' knowledge, understanding of the topic, and their ability to demonstrate certain skills (McCarthy, 2011).

McCathy (2011) reasoned that learning objectives should be clearly communicated to students so that they are fully aware of what is expected of them. Additionally, teaching strategies and learning activities must drive students towards achieving the intended outcomes. Summative assessments in this light play a role of measuring how well the students have met these intended objectives at the end of a prescribed learning period. Furthermore, studies show that as far as students are concerned, assessments are the actual representation of the curriculum (Bull & McKenna, 2004). In their thinking, it is the assessment that determines what is to be learnt and how it will be learnt.

Consequently, they channel their efforts towards only what they believe will form part of the assessment (Bull & McKenna, 2004). This implies that course objectives that are not frequently assessed might not be paid attention to, by students.

Existing studies also reveal weak correlations of assessment items with learning activities and the overall course objectives (Rise Insight note, 2020). These studies show that educators have difficulty probing students during instructional time because of factors such as lack of time, students being too slow, and having objectives that are beyond some students' capabilities (Rise Insight note, 2020). As a result, educators assess what they think their learners could comprehend then, they teach for the test, while abandoning other important aspects of the course.

Moreover, some course objectives require assessments to be pitched at higher thinking levels and educators find it difficult to develop assessments items that correctly align with these course objectives (Rise Insight note, 2020). For example, a case study titled "Alignment of Intended Learning Outcomes, Curriculum and Assessment in a Middle School Science Program" (Smith, 2012) was conducted to determine the alignment of science course objectives, learning activities and assessments. The reviewers analysed curriculum materials and assessment tasks from two different science courses at the school. These curriculum materials and assessments were scored against a series of instruments adapted from curriculum evaluation models. The reviewers scored the curriculum materials and assessments against curriculum objectives to determine the degree of alignment between the intended outcomes, curriculum materials and assessment tasks. The results revealed that educators could not maintain correlation and consistency amongst the three attributes. For instance, where the intended objective stated that students should be able to explain, questions were designed in a form of multiple-choice items where students could simply guess the answers without explaining anything. Moreover, instruction and teaching strategies were teacher-centred and did not foster students to explain the concepts.

The assumption in the current study, was that there could also be inconsistencies even in higher education institutions, where online biodiversity summative assessments are concerned, and thus, one of the quality measures adopted to measure the quality of first year and Honours' online biodiversity summative assessments was their alignment with course objectives. The current study followed the method used by Smith (2012) described above, where assessment materials were

scored against course objectives, to determine the alignment of online Biodiversity summative assessments with course objectives.

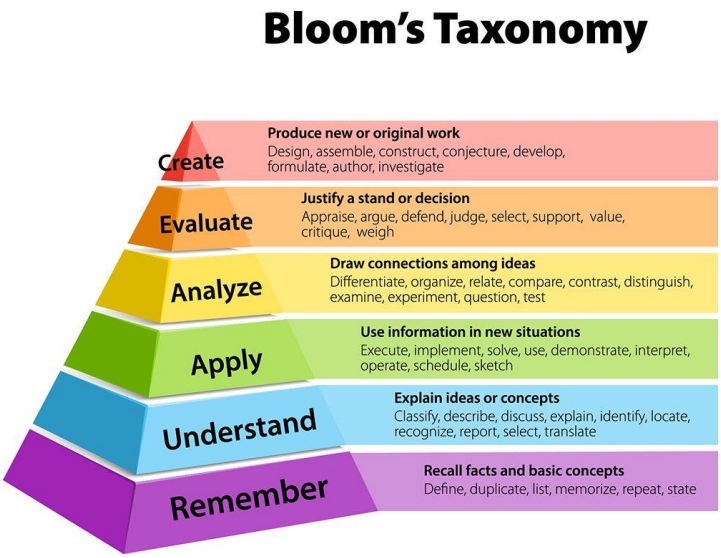
2.3.3 *Cognitive levels of assessments*

While the alignment of assessments to course objectives is important, there is also a need to determine the cognitive levels at which assessments are pitched. In the educational context, the most adopted framework for determining the cognitive levels of teaching and assessment materials is Bloom's Taxonomy of learning objectives (Bloom, 1956). This is because the taxonomy clearly states different cognitive levels that pedagogical practices and assessments should accomplish (Anderson & Krathwohl, 2001). The original Bloom's taxonomy (1956) consisted of six cognitive levels namely, knowledge, comprehension, application, analysis, synthesis, and evaluation. However, the taxonomy was revised by Anderson and Krathwohl (2001) into, Remembering, Understanding, Applying, Analysing, Evaluating, and Creating. In the revised taxonomy, the cognitive level of knowledge is replaced with remembering, while that of the Evaluation level was swapped with the creating level, with the latter now being the last and most complex level. The remaining cognitive levels stayed the same, but changed their verb forms (Anderson & Krathwohl, 2001). The revised Bloom taxonomy further involves a two-dimensional framework involving knowledge and cognitive processes, which are very useful for classifying objectives, activities, and assessments to provide a clear and concise visual representation of a particular course or unit of study (Anderson & Krathwohl, 2001). The revised Bloom taxonomy was therefore perceived as a useful framework for measuring the cognitive levels at which the online Biodiversity summative assessments from the institution of study are pitched.

The revised Bloom taxonomy clearly arranges six levels of successful learning objectives from low to high mental development. In other words, these cognitive levels are ordered from Lower Order Thinking (LOT) levels to Higher Order Thinking (HOT) levels, as shown in Figure 3.1 below (Anderson & Krathwohl, 2001). In the taxonomy, the first three cognitive levels represent lower order thinking levels; remembering, understanding, and applying, while the last three represent higher order thinking levels; analysing, evaluating, and creating. To ensure that assessments are aligned with the stated cognitive levels, Anderson and Krathwohl (2001)

suggested verbs, which represent the different levels of Bloom's revised taxonomy (Anderson & Krathwohl, 2001). The following figure displays the various levels of Bloom's taxonomy as well as their representative verbs.

Figure 2.1 Bloom's taxonomy of learning objectives (Anderson & Krathwohl, 2001)



Bloom's taxonomy suggests that a good assessment is one that tests knowledge and skills across the six cognitive levels. This means when planning and designing assessments, educators must be careful not to assess only one of the cognitive skills but ensure the inclusion of items that correlate with 'all' the different levels of Bloom's taxonomy (Robles and Braathen, 2020). However, studies reveal that assessors place great emphasis on assessment of lower order thinking levels, which are remembering, comprehension, and applying. For instance, a study titled "Analysis of Assessment Levels of Students' learning according to Cognitive Domain of Bloom's Taxonomy" was conducted to investigate the assessments of students' learning, according to Blooms' Taxonomy (Anees, 2017). The study used documents reviews, where examination items were evaluated and rated according to the cognitive levels they represented. Findings indicated that the examinations' items were mostly focused on lower order levels of Bloom's taxonomy, which are knowledge, comprehension, and application, with just a few items set to reflect analysis, evaluation, and synthesis, considered to be HOTS (Anees, 2017). It was concluded that the results were due to educators having little or no knowledge about bloom's cognitive levels and how to integrate them into their assessments.

Another study titled "A Comparative Analysis of the Zambian Senior Secondary History Examination between the Old and Revised Curriculum using Blooms Taxonomy looked at the Examination Council of Zambia's Grade 12 History examination past papers" (Kabombwe, Machila, & Sikayomya, 2021). The research method employed included a qualitative content analysis and documents study. The sample for this research was purposively selected and included 10 History test papers from the old curriculum and the new curriculum. The results of the study indicated that all the reviewed history papers (both from old and new curriculum) lacked the assessment of the higher-order thinking skills from Bloom's taxonomy.

Furthermore, a study titled "Unpacking the South African physics examination questions according to blooms 'revised taxonomy" by Motlhabane (2017) looked at Physics examination questions in terms of how they cover higher and lower order cognitive level questions according to Bloom's revised taxonomy. To explore this topic, Physical Sciences' examination questions of the year 2014 and 2015 were reviewed by relating assessment items to Bloom's revised taxonomy of learning objectives. The examination questions were coded and the frequencies and percentages of occurrence of different learning objectives were calculated. This method of determining the cognitive levels of assessment, used by Motlhabane (2017), was also used in the study described in this dissertation, to determine the cognitive levels at which online Biodiversity summative assessments were pitched. The results from Motlhabane (2017)'s study showed that third level cognitive skills (application) were more prevalent than the other cognitive levels.

From the studies above, there seems to be an over-reliance of assessments on low levels of Bloom's revised taxonomy of cognitive domains. This reduces the quality of the assessment, as they do not promote the complex thinking and problem-solving skills necessary for successful living in the 21st century (Shukla & Dungsungnoen, 2016). The implication thereof is that students may receive high grades following assessments that only tested their ability to recall and comprehend content, without assessment of their ability to utilize higher mental functions. These students could be allowed to progress to higher levels of study and eventually into the marketplace with little or no critical thinking abilities. This has been known to cause mediocrity in the workspaces, as employees are unable to meet their employer's demands because they are not bearers of the necessary skills to work effectively and successfully.

According to Wilson and Narasuman, (2020), the reasons for the consistent and prominent assessment of lower order thinking skills within summative assessments include the following:

- Educators lack the necessary training on how to integrate HOTS questions in their assessments.
- Most educators are confused about what HOTS entail.
- HOTS questions are time consuming as there can be more than 1 correct response.
- Educators do not know how to grade HOTS questions.
- Educators struggle to implement the assessment instrument itself.

To mitigate these issues, educators need to be equipped through training in assessments and should be provided with guidelines on how to integrate various cognitive levels in their assessments. According to Shukla and Dungsungnoen (2016), in their study of "Student's Perceived Level and Teachers' Teaching Strategies of HOTS" discovered that some educators thought they were integrating HOTS in their assessments, while in fact, they were promoting lower order thinking skills. In a case where items were set at high cognitive levels, educators were not aware that they were promoting HOTS. It is therefore necessary for assessors to be well trained on what HOTS are and how to include them within assessments. Assessments should also have some form of authenticity to prepare students for workplace and real-life activities and functions. This assessment quality attribute is discussed below.

2.3.4 Authenticity of assessments

The core aim of any individual going to school is to attain knowledge and skills necessary for them to operate successfully in the corporate world, and in society as effective participants (Carless, 2015). In one way or another, learning institutions have a mandate to instil in students, knowledge and skills that are sustainable, transformative and can be transferred to the outside world (Carless, 2015; Sambell, et al, 2013). Assessments play a pivotal role of evaluating whether students are ready to progress and ultimately enter the industry. Hence, they should not only require students to showcase what they learnt in class, but also demonstrate how what they learnt can be useful to similar cases in their future career fields. This is what the concept of assessment authenticity addresses. In basic terms, authenticity of an assessment denotes the assessment's applicability to

real-life situations (Boud, 2007; Sambell et al, 2013). Assessment authenticity is described as an explicit measure of student's ability to use knowledge and skills learned through formal education to carry out realistic tasks Mueller (2005). Mueller (2005) reasoned that:

> *"We do not just want students to know the content of the disciplines when they graduate. We of course want them to be able to use the acquired knowledge and skills in the real world. So, our assessments must also tell us if students can apply what they have learned, in authentic situations"* (p.1).

An assessment that is high in realism contributes positively to the quality and dependability of that assessment. Additionally, it encourages students to integrate what they know with who they are becoming (Vu, 2011). This way, students engage in activities that mirror life outside and after school. Consequently, they are enabled to imagine themselves as employees and active citizens. Authentic assessments do not only provide students with realistic challenges but also provide them with numerous ways and freedom to demonstrate their competencies as compared to the old forms of assessments that promote narrow thinking (Gurnam & Fook, 2010). Using authentic assessments, educators are enabled to evaluate whether a student who can solve a problem in one context can transfer the skill to a similar setting and, they can make informed decisions about the student's competency and readiness (Gurnam & Fook, 2010).

In one study, a 'web-based' search survey was conducted to investigate 'assessment in higher education, mainly looking at whether assessment practices advance student learning through the formulation of authentic assessments items (Rawlusyk, 2018). A questionnaire was employed to collect data from lecturers in Alberta, purposed at addressing authentic assessments. The results generated revealed that only 3 out of 15 assessments had some degree of authenticity. According to the authors of the study, this compromised the quality of the assessments. This could be the case with summative assessments in higher learning institutions and such as the one involved in this study.

Various methods and frameworks are used to determine the authenticity of assessments. One such framework is Wiggins' framework for authentic assessment (Wiggins, 1998). This framework provides indicators for what an authentic and unauthentic assessment tasks entail. The authenticity

indicators can be used to analyse assessment items, by comparing each item with the indicators and determining whether the item is authentic or unauthentic, depending on which criteria they sufficiently fit in. For example, an item that requires one correct answer, has isolated skills, and does not promote complex thinking would be grouped as unauthentic while an item that prompts students to justify answers, relates learnt knowledge and skills to real life situations would be considered as authentic (Wiggins, 1998). This framework was considered to be suitable and relevant for use in this study.

The succeeding narratives discuss the effect of the quality of summative assessments on test designers, test takers and educational institutions.

2.4 Effects of the 'quality' of summative assessments on stakeholders

Summative assessments are used world-wide to determine students' competencies and to make life changing decisions about students, such as progression to the next academic level, graduation from an educational institution and employment into the corporate world. However, even though summative assessments are globally accepted as the main way to measure academic progress, several glitches and limitations have been identified, which negatively affect the individuals involved and the industry. Because of these limitations, there are currently debates and a suggestion to shift from summative evaluation of students to a more formative assessment approach, which is argued to promote and measure learning accurately (States Detrich & Keyworth, 2018).

The reasons for calls to move from summative to formative assessment are many, but some of them are worth mentioning here. First, it is argued that summative assessment scores can motivate or demotivate students in their 'schooling journey'. Poor quality summative assessments could send wrong signals to students, which might influence the process of learning and eventually their success or failure. It is therefore imperative that summative assessments that could hold so much hope and despair for students should be of very high quality.

Second, although the major focus of summative assessments is on students, educators and learning institutions are not exempt from the impacts of poor-quality summative assessments (Khaled & El Khatib, 2020). This is because summative assessment scores could be used to evaluate the effectiveness of both instruction by lecturers and the curriculum itself. In this light, summative assessments can be used to hold educators and institutions accountable following their assessment results (Khaled & El Khatib, 2020).

The use of summative assessment scores to judge educators and institutions' competencies is thought to be absurd (Baker et al, 2010). In this case Baker et al., (2010) reasoned that student's test scores are not only determined by the pedagogical choices of the educators nor the competence level of the institution. Assessment scores can be largely influenced by other factors such as learner attendance, learner's socio-cultural status and other school unrelated experiences. For example, a child coming from a well-resourced family and with educated parents has better chances of doing well in school compared to a child with a poor background and solely relies on instruction from the educator. To use summative test scores to judge the educator's competency is to eliminate all other factors that influence learning and look at the educator as the only medium though which knowledge can be attained (Baker et al, 2010).

Despite the defence in favour of educators and institutions, regarding the results of summative assessments, educators play a significant role in these assessments, in that they plan, design, administer and determine the quality of the assessment. Furthermore, some educators end up manipulating test scores or even setting assessment papers that guarantee high pass rates than the actual quality of learning, as they fear consequences that could follow 'bad' results. Some educators end up spending too much time teaching only aspects of domains specified for assessments, leading to the abandonment of other valuable knowledge and skills (Black et al, 2011; Harlen, 2005; Stimpson, 2006). It is therefore worthwhile to find out from the educators themselves, their perceptions about the quality of their assessments and the challenges they face when designing and administering online summative assessments.

Third, in most cases, standardized assessments only assess a small portion of the bigger construct (Black & William, 1998). Even though there is justification that the items are selected from random content of the tested domain and can therefore provide a valid estimation of the students'

knowledge and skills in that domain, studies show that there is no valid evidence that the randomly selected items can reveal true mastery of knowledge in the subject (Black & William, 1998). This means students could perform poorly or well on the selected parts of the domain whereas if they were tested on the unselected parts, they would perform differently. To mitigate this problem, assessments need to be aligned to course content and objectives, in addition to being authentic and steeped at all cognitive lees.

Lastly, the issue of timed assessments has been deemed to be problematic. Summative assessments mostly occur within a particular time frame and the inability to showcase competence within the set time frame is often considered failure (Black & William, 1998). In this regard, it is reasoned that, timed assessments only assess limited forms of skilfulness and cannot provide full account of students' abilities (Black & William, 1998). Some of these challenges of summative assessment have recently been compounded by the shift from sit-in to online summative assessments, due to the Covid-19 lockdown. Hence online assessments are discussed below.

2.5 Challenges of online summative assessments

The Covid-19 pandemic forced learning institutions, including universities to suddenly move from the conventional face-to-face teaching and learning to online educational delivery. Due to this sudden change in educational offering, lecturers training educators had to immediately adapt to online teaching to complete the academic program (Coman, Tîru, Mesesan-Schmidt, Stanciu & Bularca, 2020). This meant that lecturers had to administer assessments, such as summative assessments online, without training and sufficient preparation for the change.

Research findings reveal concerning matters regarding the administration of online summative assessments. It seems that summative assessments administered using the online mode of educational delivery have several shortfalls. Amongst the many shortfalls, it has been argued that most summative assessments administered online do not promote problem solving, instead, they consist of items that require lower order thinking. Moreover, they are designed in a way that enables students to easily cheat, because they are of poor-quality as they lack attributes of good assessments (Junus et al., 2021).

In a study titled 'Full time online assessments during Covid-19 lockdown' (Abduh, 2021), findings from interviews conducted to determine instructor's perceptions regarding online assessments, including summative assessments, revealed that many instructors experienced serious challenges. Amongst the mentioned challenges was the issue of student identification during summative assessments. For example, instructors put forth that because they were unable to see students during examinations, they could not be sure of their identity, in terms of who was writing the assessments (Abduh, 2021). Their concern in this regard is that there is no form of evidence that the individuals completing the online summative assessments are the students themselves. The inability to monitor students during assessments further leads to more challenges, such as students exchanging answers during exams, and there is nothing assessors could do about it.

While some educators may blame the cheating on the fact that the online summative assessments are completed without contact supervision, some studies revealed that the issue of cheating is enabled by the low quality of online assessments, which are characterized by simple multiple choice, true/false, match column A with B questions, and recalling of facts (Robles & Braathen, 2002; Abduh, 2021). To overcome this problem, Robles and Braathen (2002) suggested that online assessments should comprise of formats that measure learning at higher levels of cognition, such as including more open-ended questions and authentic tasks, where students are required to display their individuality. In cognizance of these concerns, this study investigated the quality of first year and Honours' online Biodiversity summative assessments administered online during the Covid-19 lockdown at a South African teacher training institution. In addition, the study sought to establish the challenges experienced by lecturers when designing online Biodiversity assessments, with the hope of finding ways of mitigating them. The succeeding narratives review literature on summative assessments in the study of Biodiversity.

2.6 Necessity of quality biodiversity summative assessments

In the current state of the world, the biodiversity construct needs to be thoroughly taught and instilled within students, as it can expand their understanding and knowledge of plant and animal life on earth and how organisms and systems interact with each other (Sadler et al, 2013). This

knowledge could further yield valuable contributions in the industry, such as knowing how to improve the economy using raw materials and how to utilize natural resources for ecological life support (Morton & Hill, 2014). Additionally, most medication to diseases is said to be made from natural resources, therefore, future employees in the field of medicine should have a deeper understanding of biodiversity in general to be able to contribute valuably to the society and the industries they occupy (Morton & Hill, 2014). Therefore, the competence of science education students, who are the prospective educators of future medical practitioners need to be measured using high quality assessments.

Summative assessments in this regard play a role of evaluating whether student teachers at the institution of study have acquired sufficient Biodiversity knowledge and skills to be able to successfully impart them in their students, who will in turn take up different roles as employees and effective participants in the economy and the society at large. My opinion in this light is that it is of great importance that the summative assessments used to evaluate the biodiversity topic should be of a standard that can yield true results about students' readiness and competency to carry out their roles successfully as educators.

Of utmost importance regarding the need for quality biodiversity summative assessments is the requirement for citizens to be able to engage in sustainable development, as proposed by the *Sustainable Development Goals '2030 Agenda* (Agbedahin, 2019). Over many years, academic scholars have engaged in debates about how to achieve 'quality education', which addresses sustainability issues. These debates have given rise to declarations such as the *Sustainable Development Goals '2030 Agenda* (Agbedahin, 2019) and Education for sustainable development (UNESCO, 2017). These calls were meant to highlight the importance of sustainable development and the role that educations play in achieving sustainable development.

Although there are various definitions of sustainable development, the United Nations charter defines it as; "development that meets the needs of the present generation without compromising the potential (and/or ability) of future generations to meet their own needs" (United Nations, 2017, p. 4). The needs of present and future generations include existing natural resources that are used for development. Sustainable development requires knowledge of the availability of these resources and the processes they are involved in, in order to manage them effectively in a sustainable manner, for the benefit of both current and future generations. The knowledge of

existing resources is acquired from the study of Biodiversity. There is therefore a need for biodiversity assessments to be of high quality to accurately measure students' capabilities in issues that are required for sustainable development.

Despite the importance attached to the study of Biodiversity, existing studies (Tshiningayamwe, 2016a; 2016b) show discrepancies in the quality of the summative assessments administered to evaluate the biodiversity topic. These discrepancies are thought to be caused by, first, lack of guidelines on how to plan high quality biodiversity assessments. For example, in a study titled 'Enhancing Life Sciences Educators' Biodiversity Knowledge by Tshiningayamwe (2016a)', during interviews, educators indicated that they struggle with allocating marks to biodiversity assessments, especially if they must include open-ended questions and higher thinking level question, according to Blooms' taxonomy. Hence, they often resort to using questions from past assessment papers, which may not reflect what students have learnt during the respective learning period (Tshiningayamwe, 2016b).

Secondly, it was discovered that although the curriculum clearly specifies the biodiversity concepts to be taught and assessed, there are no guidelines to help educators plan and ensure a high-quality assessment that validly evaluate biodiversity concepts. This has resulted in confusion among educators when planning and administering Biodiversity assessments, where they each design their assessments according to their own will. This could possibly be one of the reasons for the argued low quality of biodiversity assessments.

In view of the issues and challenges discussed above, it is necessary to ensure that Biodiversity summative assessments are of high quality. Every study is guided by a conceptual framework, which directs the design of the study, as well as data collection, analysis, interpretation and understanding of findings. The conceptual framework that guided this study is described below.

2.7 Conceptual Framework

The LINQED Quality Assurance Framework for Student assessment (Jiang, 2011) was adapted to serve as the guiding framework for this study. LINQED is a network of educational institutions and government–related partners providing postgraduate training in human and animal tropical

medicine, public health, and international health. One of the aims of the LINQED is to assure good assessment practices.

Acknowledging that assessment is one of the fundamental processes in higher education, LINQED formulated a guiding criteria and standards as a foundation for ensuring that assessments administered in higher education are of high quality, so that judgments and decisions generated from assessment data are fair and reliable (Jiang, 2011). LINQED's assessment standards are structured according to key criteria, which include Fitness for purpose; Authenticity; Cognitive complexity; educational consequences; Fitness for Self-assessment; Fairness; Transparency; Meaningfulness; Reproducibility and comparability; Cost Effectiveness and Acceptability.

Each criterion is further categorized into two levels of attainment namely, basic standards, and quality Development (Jiang, 2011). 'Basic Standards' are criteria that should be met by all education institutions - often expressed with a 'must' be adopted, while 'quality Development' are criteria that should be in accordance with international consensus about best practice in assessments - often expressed with a 'should' be adopted.

For this study, due to time and resources constraints, the LINQED quality Assurance Framework for Student assessment was adapted to focus only on the first three criteria, which are (1) 'Fitness for purpose' which speaks to content validity and alignment of assessments with course objectives (2) 'Authenticity' and (3) 'Cognitive complexity' (Jiang, 2011). The LINQED framework is best suited for the current study as its criteria for quality assessments is consistent with the selected quality measures against which the investigated online summative assessments were analysed. Table 2.1 below displays and describes the three criteria adopted from LINQED, in relation to the two stated levels of attainment.

Table 2.1 LINQED'S Quality Assurance Framework- Student Assessment-Criteria and Standards

Criteria	Basic standard	Quality Development
1. Fitness for Purpose **1.1 Content Validity** **1.2 Alignment with course objectives**	➢ Assessment's content must be clearly compatible with educational objectives and what has been taught.	➢ Assessment should be appropriate for assessing pre-defined practice requirements.
2 Authenticity	➢ Assessments must be a representation of real-life problems of the assessed construct. ➢ Assessment must cover all skills, knowledge, and attitudes of the required competence for student's future career.	➢ Knowledge, attitudes, and skills should be integrated as will be in the occupation space. ➢ Items should be as realistic as possible.
3 Cognitive Complexity	➢ Assessment items must probe students' different cognitive levels according to Bloom's revised taxonomy (Anderson & Kraathwohl, 2001).	➢ Assessment should provoke the thinking process required to solve complex problems as within the workspace.

Source: (Jiang, 2011)

The first criteria of the LINQED quality Assurance Framework, 'Fitness for Purpose' proposes that there should be a correlation between the test items, the content taught, and the objectives of the overall course. 'Fitness for purpose' speaks to content validity as well as the alignment of assessments with course objectives. In relation to content validity, the framework suggests that an assessment should represent all aspects of tasks within the domain being assessed. Furthermore, Fitness for purpose also advocates for "Assessment items that are clearly compatible with educational objectives" (p1). The attributes of content validity and alignment of assessments with course objectives were therefore adopted in the study as attributes to determine the quality of first year and Honours online biodiversity summative assessments in response to research question 1 and 2 respectively.

The second criterion of the LINQED quality Assurance Framework is 'Authenticity', which proposes that assessments should provide a realistic practice through items that probe students to apply knowledge and skills that can be used in real life to solve problems. This criterion was used as a yardstick for data collection to answer research question 4, which was purposed at determining

authenticity of the online biodiversity summative assessments. Furthermore, Wiggin's framework for authenticity was used to categorize items as either authentic or unauthentic (Wiggins, 1998).

The third criterion of the LINQED quality Assurance Framework suggests that test items should cause students to apply different cognitive skills ranging from lower order to higher order as will be required in the workspace. In the context of this study, the revised Bloom's taxonomy (Anderson & Krathwohl, 2001), was used determine the levels at which online Biodiversity summative assessments items were pitched, which was in response to question 3.

The LINQED's framework was best suited for the current study because the central theme of LINQED is quality in education, which includes assuring good assessment practices (Jiang, 2011). The selected criteria from the LINQED's framework helped in collecting, analysing and making sense of data collected, in response to the four measures of quality assessments considered in this study.

All the measures of quality considered in this study were affected by contextual factors as the summative assessments that were investigated were designed and administered by a subjective individual. Factors such as the assessor's experience and knowledge in designing online assessments could have either enhanced or diminished the quality of online Biodiversity summative assessments. Research question 5 therefore sought to look at these factors by seeking the educator's perspective on the quality of Biodiversity summative assessments.

The methodology for investigating the quality of online Biodiversity summative assessments is discussed in chapter three on the next page.

Chapter three: METHODOLOGY

This chapter discusses the research paradigm, research approach and design, population and sample, data collection and analysis methods, as well as the ethical issues, which were considered in the study.

3.1 Research paradigm

A paradigm refers to a researcher's school of thought and assumptions that inform how he or she collects and interprets research data (Mackenzi & Knipe, 2006). It speaks to a researcher's philosophical way of perceiving the world. It is, furthermore, a set of principles that guide or inform how a researcher sees and interprets data (Mackenzie & Knipe, 2006, as cited in Kivunja & Kuyini, 2017). Paradigms are used in research to determine the methods that would be used and how data would be analysed (Kivunja & Kuyini, 2017).

The study reported here was guided by the interpretivist research paradigm, which is centred on understanding the subjective state of phenomena and how social factors influence how certain activities are shaped (Kivunja & Kuyini, 2017). Being relative in nature, its users believe that reality is socially constructed, and it can be studied and understood through interactions with a variety of platforms such as humans, or human composed text (Kivunja & Kuyini, 2017).

This study involved dialogues amongst the researcher and participants to gain deeper understanding of how they ensured quality in their online summative assessments. Secondly, human composed texts, which in this case were the biodiversity summative assessments designed by educators, were used to determine their quality. Lastly the collected summative assessments were gathered and interpreted by the researcher and her supervisor who are also subjects shaped by socio-cultural factors.

3.2 Research Approach

The study employed a qualitative research approach involving some numerical computations. The use of numbers was necessary for presenting the results in a succinct, clear, and understandable

manner, but they were interpreted and reported qualitatively. A mixed methods approach was not appropriate in the context of this study because the sample was too small to provide credible quantitative interpretations, inferences, and conclusions.

Qualitative research is described as research which seeks to understand a natural phenomenon by interacting with subjects, to understand how their environment, cultures, values, and experiences shared within the society shape how they make meaning (Merriam, 1988). While the focus of this study was to measure summative assessments against a set criterion to determine their quality, the researcher did not look at summative assessments as existing devoid of human factor. She acknowledged human involvement in planning, designing, and administering the summative assessments. The lecturers' environment, cultures, values, and experiences shared within the educational society could have shaped their decisions about how to design the summative assessments. Therefore, lecturers' perceptions and the challenges faced when designing assessments could have had an impact on the quality of the summative assessments they developed. Based on this understanding, it was necessary to interact with the lecturers who designed the assessments, to gain an in-depth understanding of their perspective around quality summative assessments, as well as the challenges they experienced, which could have affected their quality. To start with, I discuss the design of the study.

3.3 Research Design

The design used in this study was a case study, which refers to a research design used to study phenomena through analysing units, such as events, decisions, documents, policies, and institutions (Zainal, 2007). Yin (2009) suggested that case studies focus on a phenomenon that has a real-life context. Furthermore, a case study is best suited for in-depth explanations of a complex social phenomena, which in the case of this study is the quality of online Biodiversity summative assessments.

The aim of this study was to gain an in-depth understanding of the quality of biodiversity summative assessments administered online at a teacher training institution, and the challenges of developing them for online administration. The concept of quality in relation to assessments can be viewed as a complex phenomenon with real-life implications because assessment results can

inform important social decisions made about individuals involved. In the case in this study, document analysis was conducted to establish the quality of educator designed online biodiversity summative assessments, while semi-structured interviews were conducted to get a perspective of how educators think around the concept of assessment's quality and the challenges they encounter in assuring quality in their online summative assessments. The study's population and sample are described in the following section.

3.4 Study population and sample

The main unit of study was first year and Honours' online Biodiversity summative assessments. However, since biodiversity lecturers plan, develop and administer summative assessments, as part of their teaching duties, they were perceived to be repositories of knowledge about the quality of these assessments. Therefore, lecturers were a constitute unit of study. The population of the study therefore comprised of biodiversity lecturers and the summative assessments that they developed and administered.

A sample is "a small group of subjects or participants from whom data is collected (McMillan & Schumacher, 2010, p.11)". A sample was selected from the population of biodiversity lecturers as well as from the summative assessments that they designed, for participation in the current study.

To ensure reliable results, the following eligibility criteria were used to select samples from the populations of the study.

i. Eligible assessments had the following features:
   - Contained biodiversity content, which was the topic whose assessment was investigated.
   - Were summative, as the study focused on the quality of summative assessments.
   - Were administered online in 2020 and 2021 (during the COVID-19 lockdown).
   - Were administered to first year and Honours student teachers. These levels of education were selected because biodiversity is only taught at these levels at the selected institution.

ii. Eligible lecturers comprised those who had:
   - Designed and administered online Biodiversity summative assessment to first year and Honours students in 2020 to 2021 (during the COVID-19 lockdown period).

- At least 3 years of designing biodiversity summative assessments, to ensure that they had experience in designing summative assessments.

To measure the quality of summative assessments, eight past summative assessments were conveniently and purposively selected from the population of biodiversity summative assessments administered in 2020 and 2021 at the selected university. Convenience sampling generally refers to the selection of participants due to their readiness and accessibility (Ackoff, 1953), while purposive sampling is the deliberate selection of participants or events that hold the information required for the study, which cannot be accessed anywhere else (Maxwell, 1996). A summary of the sample of online biodiversity summative assessment papers administered in 2020 and in 2021, is presented on Table 3.1 below.

Table 3.1 Sample of online Biodiversity summative assessments

Level of study	2020		2021		Total
	Main exam	Deferred exam	Main exam	Deferred exam	
1st year	1	1	1	1	4
Honours	1	1	1	1	4
Total	2	2	2	2	8

One lecturer who developed the online biodiversity summative assessments at the selected institution, and who met the stipulated criterion was purposively selected to participate in the study. Majid (2018) stated that one of the objectives of sampling in research is to obtain a statistically representative sample of the population of interest, such that the results obtained can be realistically generalizable to the rest of the population. Unfortunately, the science division at the university where the study took place only had one lecturer teaching Biodiversity at first year and Honours level. Thus, the sample size was limited to this one lecturer as well as the summative assessments he developed in 2020 and 2021. The research process followed is described below.

3.5 Research process

First, the researcher sought permission to conduct the study from the authorities at the relevant institution and from the institutional ethics committee. Secondly, permission was sought from the

eligible lecturer to allow his summative assessments to be used in the study, and to participate in an interview. The aim of the study was explained to the prospective participant in writing, via letters and emails. The participant was requested to voluntarily sign a consent form, before he participated in the study. Thereafter, appointments for data collection meetings were discussed and agreed upon between the researcher and the participant. All meetings were conducted virtually, online, and telephonically, due to covid-19 restrictions. Summative assessments were also accessed online, and were collected, analysed, and interpreted to make inferences and conclusions about their quality. Explanations about how data were collected and analysed are provided below.

3.6 Data collection instruments

Data collection involves the gathering of information about the variables investigated in a study (McMillan & Schumacher, 2010). This study involved the collection of biodiversity summative assessment papers, which were reviewed to determine their quality in response to research questions 1 to 4. In addition, semi-structured interviews were used to obtain the lecturer's perspectives about the quality of his summative assessments, to respond to sub-research question 5, and to substantiate data from the document reviews. The instruments used for data collection are discussed below**.**

3.6.1 *Document Analysis*

To collect data to answer sub-research questions 1 to 4, related to the quality of summative assessments, biodiversity summative examination papers administered online in 2020 and 2021 were collected and reviewed. The review involved an examination of summative assessment items, by the researcher and life sciences experts, in terms of their content validity, authenticity, the cognitive levels at which they were pitched, and the extent to which they were aligned with course objectives. The analysis of the data collected from the review of Biodiversity summative assessments is explained in detail under section 3.8.

3.6.2 *Semi-structured interviews*

An interview is a social activity where the researcher asks questions relating to the research topic and the participant responds either using their own words or choosing from a wide range of given answers (Easwramoorthy & Zarinpoush, 2006). Interviews are used to gain in-depth information on participants' feelings, opinions, experiences, perceptions, and behaviour around an issue (Gill, Stewart, Treasure & Chadwick, 2008). Guided by this narrative, the researcher wanted to understand a Biodiversity lecturer's perceptions of the quality of the online Biodiversity summative assessments that he had designed, and the factors that could have affected their quality. In this light, semi-structured interviews were used to collect data to better understand the quality of online Biodiversity summative assessments administered at a South African teacher training institution, from the perspective of the lecturer.

The semi-structured interviews conducted in the study involved pre-determined questions, which allowed interviewees to respond in their own words, but with the possibility of follow-up questions and answers (Easwramoorthy & Zarinpoush, 2006). The semi-structured Interview questions were related to the pre-determined themes of: (1) lecturers' perceptions about the quality of online Biodiversity summative assessment; (2) lecturers' experiences of developing online Biodiversity summative assessments, and (3) factors that impact on the development of quality online Biodiversity summative assessments. The interview was audio recorded for transcription and analysis of the participant's responses. After transcription of the interview responses, soft copies were sent to the participant for validation, to ensure transparency and accurate capturing of the responses. The data collected using the described instruments were analysed as explained under the next section.

3.7 Validation of data collection instruments

The instruments used to collect data from both the assessment papers (data collection schedules) and the participant (interview schedule) were developed by the researcher, under the guidance of her supervisor. These schedules were then reviewed by two life sciences experts to ensure that they were suitable for collecting the intended data. Thereafter, the instruments were piloted on an assessment paper that was not analysed in the actual study, and the interview schedule was tried

out using a life sciences Masters student who did not participate in the study interview. Unclear information and irregularities were corrected before the schedules were used to collect data in the actual study.

3.8 Data analysis

The data gathered using documents analysis and semi-structured interviews was analysed using content analysis, as described below.

3.8.1 Document's analysis

The analysis of items from the online biodiversity summative assessments are discussed according to the different measures of quality, which are, content validity, authenticity, cognitive levels, and alignment with course objectives. All analyses of assessments papers for the different quality measures were done by the researcher and two life sciences experts, to increase the reliability, validity and trustworthiness of the findings.

3.8.1.1 Content validity of online biodiversity summative assessments

To analyse the content validity of the first year and Honours online Biodiversity summative assessments, the collected assessment papers were coded, and each assessment paper was analysed discretely by the researcher and two subject specialists, using the method described by Yusuf, Sadia and Suharsono (2019). This method calculates the content validity index (CVI) of assessment items to determine their correlation with prescribed content. It involves the allocation of assessment items under different topics (strands) of a course by experts. The items under each topic are added and the total percentage of items relating to each topic (or strand) is calculated. This percentage is then divided by 100 to determine the CVI, which ranges from 1- 0. A CVI of 0.7 and above is considered to represent a valid assessment, its alignment to prescribed content, whereas a CVI of less than 0.7 would mean the assessment is not content valid (Polit & Beck, 2006).

Similarly, in this study, Biodiversity topics (strands) prescribed for first year and Honours levels of study were established from the respective course outlines. The researcher and two subject experts examined each item in the summative assessment papers to determine its correlation with the biodiversity content. Content validity indices were calculated as explained above. Subject experts with a minimum of 5 years teaching experience in the chosen learning area, and who were available, were selected to participate in the study.

The data collection schedule used to capture data on the validity of the summative assessments is shown on Table 3.2 below.

Table3.2. Tool for correlating summative assessments items with Biodiversity content.

Question number	Correlation of summative assessments items with biodiversity content					
	Topic 1	Topic 2	Topic 3	Topic 4	Not aligned	CVI*
1						
2						
3						
“						
Total %						

CVI*represents Content Validity Index

The next sub-section discusses the analysis of the alignment of online biodiversity with course objectives.

3.8.1.2 Alignment of online biodiversity summative assessments with course objectives

To determine the alignment of online biodiversity summative assessments with course objectives, first year and Honours Biodiversity course objectives were identified from respective course outlines. Thereafter, items from the summative assessment were examined by the researcher and two experts to determine their alignment with the identified course objectives. The total number of items aligned to the course objectives, per assessment paper, were determined and entered on a table, such as the one shown below.

Table 3.3 Alignment of online summative assessment items with biodiversity course objectives

Question number	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective “	Not aligned
1		√					
2					√		
“							
Total							

The total number and percentage of items aligned with each objective was determined and used to make inferences and conclusions regarding the alignment of biodiversity assessment items with course objectives. The cognitive levels of the online biodiversity summative assessments were also considered as explained in the texts that follow.

3.8.1.3 Cognitive levels of online biodiversity summative assessments

To measure the cognitive levels at which the online Biodiversity summative assessment items were pitched, the revised Bloom's taxonomy of learning objectives was used as a benchmark. For each biodiversity summative assessment, the researcher and experts examined the assessment items and categorized them under the Bloom's cognitive levels. The allocation of assessment items to different cognitive levels was done using the characteristic verbs suggested by Anderson and Krathwohl (2001). The specific verbs contained in assessment questions signify the cognitive levels of Bloom's taxonomy, at which the question is pitched. The identified cognitive levels at which each assessment item was pitched were entered on a table, such as shown below.

Table 3.4 cognitive levels of online summative assessment items

Question number	Bloom's cognitive levels					
	Remembering	Understanding	Applying	Analysing	Evaluating	Creating
Q 1						√
Q 2			√			
“						
Total						

Proportions of items under each cognitive level were used to make inferences and conclusions regarding the cognitive levels at which the assessment papers were pitched. The following

segment involves an explanation of how the authenticity of online biodiversity summative assessments was determined.

3.8.1.4 Authenticity of online biodiversity summative assessments

To determine the authenticity of online Biodiversity assessments, Wiggin (1998)'s framework of authentic assessments was used. Wiggin's framework of authentic assessments provides guidance and indicators about how to identify typical and authentic assessment items (See Table 3.5 below). Typical tasks are, in the context of this study, referred to as unauthentic assessment items.

Table 3.5 Wiggin's framework (1998)

Typical tasks	Authentic tasks	Indicators of authenticity
Require correct responses	Require a high-quality product or performance, and a justification of the solutions to problems encountered	Correctness is not the only criterion; students must be able to justify their answers.
Must be unknown to the student in advance to be valid	Should be known in advance to students as much as possible	The tasks and standards for judgment should be known or predictable.
Are disconnected from real-world contexts and constraints	Are tied to real-world contexts and constraints; require the student to "do" the subject.	Practitioners in the discipline, like those encountered in the context and constraints of the task.
Contain items that isolate particular skills or facts	Are integrated challenges in which a range of skills and knowledge must be used in coordination	The task is multifaceted and complex, even if there is a right answer.
Include easily scored items	Involve complex tasks that for which there may be no right answer, and that may not be easily scored	The validity of the assessment is not sacrificed in favour of reliable scoring.
Are "one shot"; students get one chance to show their learning	Are iterative; contain recurring tasks	Students may use knowledge or skills in several different ways or contexts.
Provide a score	Provide usable diagnostic information about students' skills and knowledge	The assessment is designed to improve future performance, and students are important "consumers" of such information.

Source: (Wiggins, 1998)

To determine the authenticity of collected biodiversity summative assessments, the items were identified by the researcher and experts as either authentic or unauthentic (typical tasks), and they were recorded on a table (see Table 3.6 below). Assessment items that had both unauthentic and authentic indicators were allocated to a column based on the indicator, which weighed more.

Table 3.6 Tool for displaying the Authenticity of summative assessment items

Question number	Authentic	Unauthentic
1.1	✓	
		√
	✓	
Totals		

The proportions of authentic and unauthentic items were used to make inferences and conclusions regarding the authenticity of each assessment paper. For instance, if more than 50% of the assessment items fell within the unauthentic category, it meant that the assessment was not authentic, and the quality would have been compromised, and vice versa.

Descriptive statistics obtained from the analysis of the various measures of assessment quality were used to display information on comparative tables and bar graphs, to make sense of the data. These were used to make inferences and conclusions regarding the quality of online biodiversity summative assessments administered at the selected institution, with respect to their validity, authenticity, alignment to course objectives and the cognitive levels at which they are pitched.

The succeeding section discusses the analysis of semi-structured interview responses.

3.8.2 Semi-structured interviews

The first step in analysing interview responses was to listen to the recorded interviews severally, followed by a transcription of participant's responses, which were coded for easy identification. Interview responses were coded using the letter T, to represent a theme and the letter Q to represent a question, followed by numbers, as shown in the following example: The participant's response to question 1 of theme 1, was coded T1Q1, where; T1 represents the theme number and Q1 represents the question number. Thereafter, the coded responses were categorized into the pre-determined themes of:

- Lecturers' knowledge, understanding and usage of assessments' terminologies.
- Lecturers' experiences of developing online Biodiversity summative assessments.

- Factors that impact on the development of quality online Biodiversity summative assessments.

Finally, statements from these categories were used to make meaning about the lecturer's perceptions about the quality of online summative assessments and the factors that impact their quality.

3.9 Ethics considerations

Voluntary participation and consent

A consent form, which clearly explained what the study was about was provided to the prospective participant. To ensure that the participant did not feel coerced to participate, the researcher requested him to sign the consent form voluntarily, to indicate his explicit consent and willingness to take part in the study.

Confidentiality and anonymity

Research involving human require confidentiality and anonymity. In other words, the confidentiality of the information supplied by participants and the anonymity of subjects must be respected. In this regard, the participant's identity, and that of the university where he works were not revealed in this research report and to the public. Instead, both participant and the university where he works were not named, so that any information he provided and that obtained from document analysis could not be traced back to him and the university involved. Furthermore, all recordings and documents were stored on the researcher's personal computer and encrypted so that only the researcher could access them.

Right to privacy

To ensure the participant's right to privacy. Meetings only took place on the dates recommended by the participant and only during working hours. Before making any telephone contact, the

participant was sent emails requesting permission to call him. The participants were also given the freedom to answer only the questions he was comfortable with.

Protection from harm

To protect the institution and participant from harm, their names were not revealed in any discussions and in the study report. Responses from interviews and data from document reviews were coded to make sure that they could not be traced back to the participant and the institution. The participant was informed that if at any point he felt threatened or uncomfortable and wanted to withdraw from the study, he was free to do so without any repercussions.

Ethics approval

To ensure that the overall study was ethical, the researcher applied for ethics clearance from the ethics committee at the institution where the study took place. This ensured that the study was ethical and did not infringe on the participant's rights. The following chapter presents the data collected to respond to the study's investigative questions.

Chapter four: STUDY RESULTS

The purpose of this chapter is to present findings from the study regarding the quality of first year and Honours online biodiversity summative assessments administered at a South African teacher training institution, in 2020 and 2021 during the COVID-19 lockdown. The primary research question for the study was, "What is the quality of first year and Honours online biodiversity summative assessments administered at a teacher training institution in South Africa, during the Covid-19 Lockdown?" This primary question was further broken into investigative questions, which were:

1. What is the content validity of first year and Honours online biodiversity summative assessments?
2. How aligned are first year and Honours online biodiversity summative assessments with course objectives?
3. What are the cognitive levels of first year and Honours online biodiversity summative assessments?
4. How authentic are first year and Honours online biodiversity summative assessments?
5. What are the lecturer's perceptions about the quality of online biodiversity summative assessments?

A case study was employed, where documents analysis and semi-structured interviews served as the data collection instruments. Document analysis was used to respond to questions one to four which sought to determine the quality of first year and Honours online biodiversity summative assessments in terms of their content validity, alignment with course objectives, the cognitive levels at which they are pitched, and their authenticity.

Interviews served to determine participants' perceptions about the quality of their online biodiversity summative assessments, in response to research question five, and to triangulate data from document analysis. Document analysis and semi-structured interviews were used to provide multiple sources of evidence so that there could be deeper understanding of the topic of study. The results from document analysis and semi-structured interviews are discussed in the respective sub-sections below.

4.1 Document analysis results

For document analysis, four first year, and four Honours biodiversity summative assessments administered online in 2020 and 2021, at a selected South African university were collected and reviewed against a criterion for quality assessments. The criteria used to analyse the assessment papers were based on Bloom's taxonomy of educational objectives to determine the cognitive levels of the assessments, Wiggin's framework for authentic assessment to establish their authenticity, and course outlines for determining both the alignment of assessments with course objectives, as well as their content validity. Summative assessments from the two educational levels were reviewed to determine whether there were any discrepancies in the quality of online biodiversity summative assessments between lower and higher levels of tertiary education. The analysed summative assessments comprised of main and deferred examinations for both first year and Honours levels, administered online in 2020 and 2021.

To determine the quality of the online biodiversity summative assessments each paper was analysed separately, to determine its content validity, alignment with course objectives, cognitive levels, and authenticity. The following sub-sections present the results of the analyses of online biodiversity summative assessments, in tables and graphs, according to the four stated attributes of quality assessments, starting with content validity.

4.1.1 Content validity of online biodiversity summative assessments.

The content validity of summative assessment was determined to find out whether the online biodiversity summative assessments collected were a representation of all facets of the biodiversity constructs prescribed for the courses involved (Webb, Katz & Decker, 2006). The prescribed topics for the two levels of study are presented on the table below.

Table 4.1. Prescribed first year and Honours 2020-2021 biodiversity topics

Topic number	first year topics	Honours topics
1	Principles of Classification Nomenclature, three domain trees of life (Bacteria, Archaea, Eukarya.	The notions of biodiversity and climate change
2	Kingdoms Protista, Fungi, Plants and Animals	Biodiversity in the caps
3		Teaching for biodiversity and climate change
4		Assessment for biodiversity and climate change

Source: (Life science & NS course outlines, 2020-2021)

In order to determine the content validity of the analysed formative assessments, items from each summative assessment were reviewed against the content under the biodiversity unit (see Table 4.1) for both first year and Honours educational levels. The items were then categorized as either 'based on' or 'not based' on the stipulated topics. For example, from the 2020 first year deferred examination, the following assessment items were considered to be based on topic one, which was 'Principles of Classification'

Excerpt A

Question 1

1.1 Demonstrated using a table the shared and derived characteristics in echinoderms (4)

Shared characteristics	**Derived characteristics**

Item 1.1 on the above excerpt A, was categorized as 'based' on topic one which is 'principles of classification', because the shared and derived characteristics in echinoderms related to the classification of the species. Alternatively, an example of an assessment item from the 2020 first year main exam that was considered 'not based' on any of the stated topics for the biodiversity unit for the specified level of study, is shown in Excerpt B below.

Excerpt B

1. Leeches secrete hirudin into body of host. What is the function of hirudin?

A. It thins the blood and changes the proteins in the cell.
B. It thins the blood to prevent blood clotting.
C. It thickens the blood causing the blood to clot.
D. It thickens the blood to prevent blood clotting.

(2)

The above question was classified as not based on the two stated topics for first year biodiversity because it requires students to recall what the function of hirudin in leeches is, which is not covered within the scopes of the 'principles of classification' nor the aspect of 'Kingdoms'.

Using this process, all the items in the analysed assessment papers were categorized as either based on the prescribed topics or not, and the validity of the assessment were determined as explained under section 3.8.1.1. The following table (4.2) represents the validity of first year' and Honours' online biodiversity summative assessments from the selected institution of study.

Table 4.2 Content validity of first year and Honours online biodiversity summative assessments.

		First year summative assessments					Honours' summative assessments					
Year	Assessment type	Topic 1(%)	Topic 2 (%)	Not Aligned (%)	**CVI***		Topic 1 (%)	Topic 2 (%)	Topic 3 (%)	Topic 4 (%)	Not Aligned (%)	**CVI***
2020	Main Examination	49	48	3	**0.97**		87	0	0	0	13	**0.87**
	Deferred Examination	39	47	14	**0.86**		100	0	0	0	0	**1**
2021	Main Examination	69	25	6	**0.94**		75	17	0	8	0	**1**
	Deferred Examination	69	21	10	**0.9**		75	0	0	0	25	**0.75**

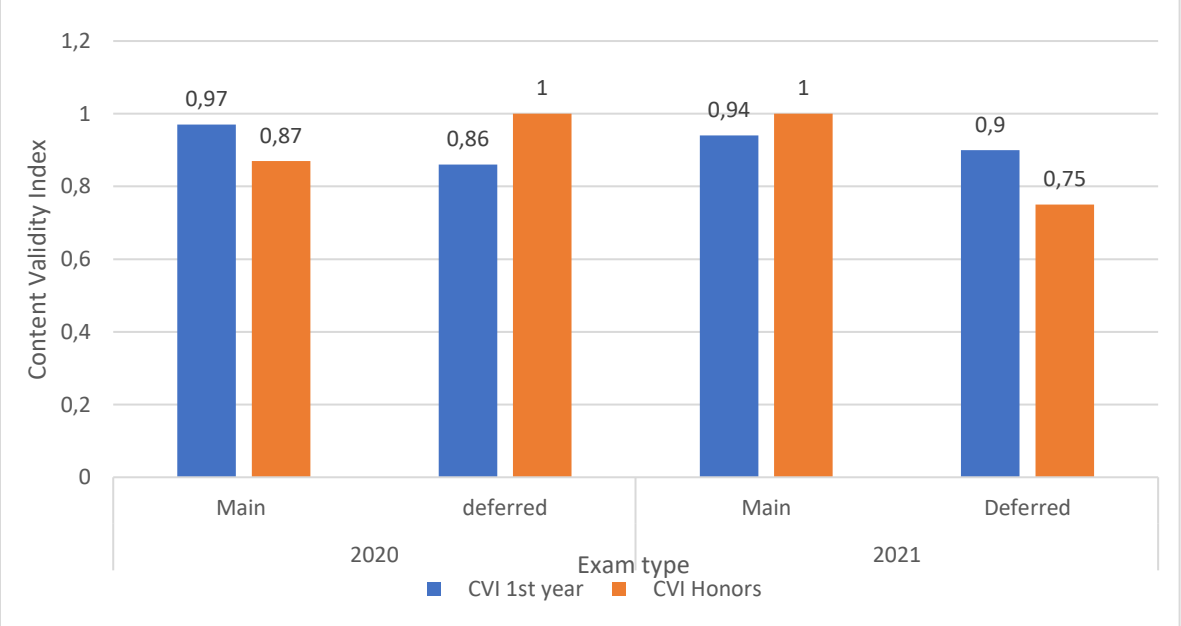
*CVI represents Content Validity Index

Table 4.2 shows the content coverage in percentages and the content validity indices of the online summative assessments under the biodiversity unit, for first year and Honours level of study. The column 'not aligned' represents items from the summative assessments, which were not based on any of the specified topics' content. Results for the first year's summative assessments show that both the main and deferred examination items administered in 2020 and 2021 were distributed across the two prescribed topics, with only a few items that were not related to the prescribed topics. For example, the 2020 main examination had 49% items based on topic 1, 48% items on topic 2, and 3% of items were not aligned to any of the two topics' content. On the contrary, the

Honours summative assessments seem to be predominantly based on topic 1, with a few items on topic 3, 4, or 'not aligned'. For example, in the 2020 Honours' main examination, 87% of the items were based on topic 1, while the remaining 13% of the items did not align to any of the four specified topics, leading to a CVI of 0.87. As explained in the methodology section, a CVI of 0.7 and above indicates that the paper is valid. This examination paper is therefore considered to be content valid, even though, the assessment items were not evenly related to all the prescribed content of the course. Another outstanding finding relates to the 2020 Honours' deferred examination which had a 100% of the items based on topic 1, with a CVI of 1. This also shows that even though the examinations were content valid, there was however, an uneven distribution of items across topics.

The following figure (4.1) shows the content validity indices of the first year and Honours online biodiversity summative assessments.

Figure 4.1 A bar graph showing the content validity of first year and Honours' online biodiversity summative assessments.



According to the data on Figure 4.1, all the online biodiversity summative assessments administered to first year and Honours students in 2020 and 2021were valid, as they had a CVI that is above 0.7. It can also be noted that the two Honours examinations for 2020 and 2021 had a CVI of 1, which is an indication that all the items in the summative assessments were based on the prescribed content of the biodiversity construct.

The following sub-section reviews the alignment of the first year and Honours online biodiversity summative assessments with course objectives, as stipulated in the course outlines that guided the 2020 and 2021 academic years.

4.1.2 Alignment of online biodiversity summative assessments with course objectives

This sub-section shows data on the alignment of the online biodiversity summative assessments with course objectives. The 2020 and 2021 biodiversity course outlines for both first year and Honours were used as frameworks to review each summative assessment item and to categorize it according to the objectives stipulated in the outlines. Firstly, I present on Table 4.3 the objectives of first year and Honours Biodiversity courses as specified by the respective 2020 and 2021 course outlines. This will be followed by Tables 4.4 and 4.5 which present the alignment of first year and Honours summative assessments with the course objectives respectively. Lastly, a Bar graph (4.2) that compares the total percentages of the alignment of first year and Honours summative assessments with course objectives is displayed.

The following table 4.3 displays the biodiversity course objectives for first year and Honours levels of study.

Table 4.3 First year and Honours biodiversity Course objectives for the years 2020 and 2021.

Objectives	First year: *by the end of the course students should be able to:*	Honours: *By the end of the course students should be able to*:
1.	Build a framework of knowledge based on reading, observation, experience, and reflection.	Describe the concept of biodiversity and its key component concepts
2.	Question the knowledge they have acquired in the light of new knowledge.	Explain why biological diversity is important
3.	Apply this knowledge in several ways.	Describe the threats to biological diversity
4.	Students are expected to develop a variety of science related and other skills such as the ability to record, observe accurately, communicate information in various ways.	Suggest appropriate actions needed to protect and restore biological diversity in the South African contexts
5.	Appreciate and acknowledge the role of science in our everyday lives and economy.	Describe the notion of Climate Change, adaptation, and mitigation
6.	Show respect and acknowledge natural resources.	Relate the notions of biodiversity and climate change
7.	Treat all living things humanely and value science as human activity.	Suggest effective ways to teach biodiversity and climate change in the South African context.

Source: B.Ed. first year and Honours. LS, Course Outline (2020-2021)

Coincidently, both first year and Honours courses have the same number of course objectives, even though the focus is different. To determine the alignment of assessments items to the course objectives, each item from each summative assessment was reviewed discretely against a set of objectives from the biodiversity course outline. Every examination item was categorized under the objective, to which it was aligned, on a grid table using ticks to represent the alignment of each item. The total number of ticks per objective were then added and divided by the total number of items from the assessment, and lastly multiplied by a 100 to get the percentage of the items that aligned to each objective. Items that did not align to any prescribed objectives were recorded under the 'Not Aligned' column.

The following excerpt is an example of test items from one of the first-year examinations, which were aligned to the objectives of the Biodiversity course.

Excerpt C

Answer ALL questions in this section by choosing the most correct option. E.g. 1.1 A
(2)

1.1 The following are classes of phylum Annelida except for …

A. Polychaete and Oligochaeta
B. Turbellaria and Cestode
C. Trematoda and Oligochaeta
D. Polychaeta and Trematoda (2)

1.2 Phyla Mollusca, Annelida, Arthropoda, Echinodermata, and Nemertea are organisms with complete body cavity, and they are known as …

A. Acoelomates
B. Coelomate
C. Pseudocoelomate
D. Flatworms (2)

1.3 Organisms in the phylum Mollusca are usually found in _____ habitat.

A. Brackish water
B. Ocean and ponds
C. Lakes and Marine
D. Marine and Fresh water (2)

1.4 Which ONE of the following protozoans are responsible for causing malaria?

A. Euglena
B. Plasmodium
C. Paramecium
D. Amoeba (2)

1.5 In the phylum Mollusc, the structure that helps in the removal of nitrogenous waste is known as the …

A. Radula
B. Shell
C. Nephridium
D. Antenna (2)

The items shown on excerpt C were under question 1, which was a multiple-choice question. Items 1.1 to 1.5, were aligned to objective one of the stated course objectives, which stated that, *"students should be able to build a framework of knowledge based on reading, observation, experience, and reflection"*. The items were classified under this objective because for students to respond to this question effectively, they had to read the question and options provided, observe their relationships and reflect on the observed patterns and meanings of these relationships, then decide on the most suitable answer for the question asked. To do this, students would have to reflect using their framework of knowledge based on what they were taught.

An example of an item which is not aligned to the course objectives is given in excerpt D, which was taken from an Honours summative assessment.

Excerpt D

Question 2.2

After graduation, you and 19 of your closest friends (let's say 10 males and 10 females) charter a plane to go on a round-the-world tour. Unfortunately, you all crash land safely, on a deserted island. No one finds you and you start a new population, totally isolated from the rest of the world. Two of your friends carry (i.e. are heterozygous for) the recessive cystic fibrosis allele (c). Assuming frequency of this allele does not change as the population grows, what will be the incidence of cystic fibrosis on your island? (5)

In the above example, item 2.2 required students to understand the scenario presents and answer the question that follow. Although this is a very good question, which tests students' higher thinking ability and it touches on some aspects of Biodiversity, the scenario and question are not directly related to any of the Biodiversity objectives provided in Table 4.4 above. The item is more aligned to genetics and evolution rather than Biodiversity because it requires students to understand the inheritance of genetic diseases and the subsequent formation of populations with different traits. This item was classified as not aligned to any of the stated course objectives, as it does not require students to explain key concepts of biodiversity, explain or identify threats to biodiversity, explain importance of biodiversity, describe the notion of Climate Change, adaptation, and mitigation, relate the notions of biodiversity and climate change or suggest effective ways to teach biodiversity and climate change in the South African context.

The following table (4.4) shows data retrieved from the first year 2020 and 2021 online biodiversity summative assessments, regarding their alignment with course objectives, using the same method explained above.

Table 4.4 Alignment of first year's online biodiversity summative assessments with course objectives.

Year	Examination Type	Objective 1 (%)	Objective 2 (%)	Objective 3 (%)	Objective 4 (%)	Objective 5 (%)	Objective 6 (%)	Objective 7 (%)	Not Aligned (%)	Total Alignment (%)
2020	Main	60	20	20	0	0	0	0	0	100
	Deferred	60	20	20	0	0	0	0	0	100
2021	Main	80	16	2	2	0	0	0	0	100
	Deferred	83	24	0	0	0	0	0	0	100

According to the data on table 4.4, in the 2020 main examination, 60% of the items aligned with objective 1, while 20% aligned with objective 2, and the remaining 20% aligned with objective 3. None of the examination items aligned to objective 4, 5, 6 nor 7. It can also be noted that100% of the assessment items in all the examination papers were aligned with course objectives. The succeeding Table 4.5 shows the alignment of Honour's online biodiversity summative assessments with course objectives for the 2020 and 2021 academic years.

Table 4.5 Alignment of Honours online biodiversity summative assessments with course objectives for the 2020 and 2021 academic years**.**

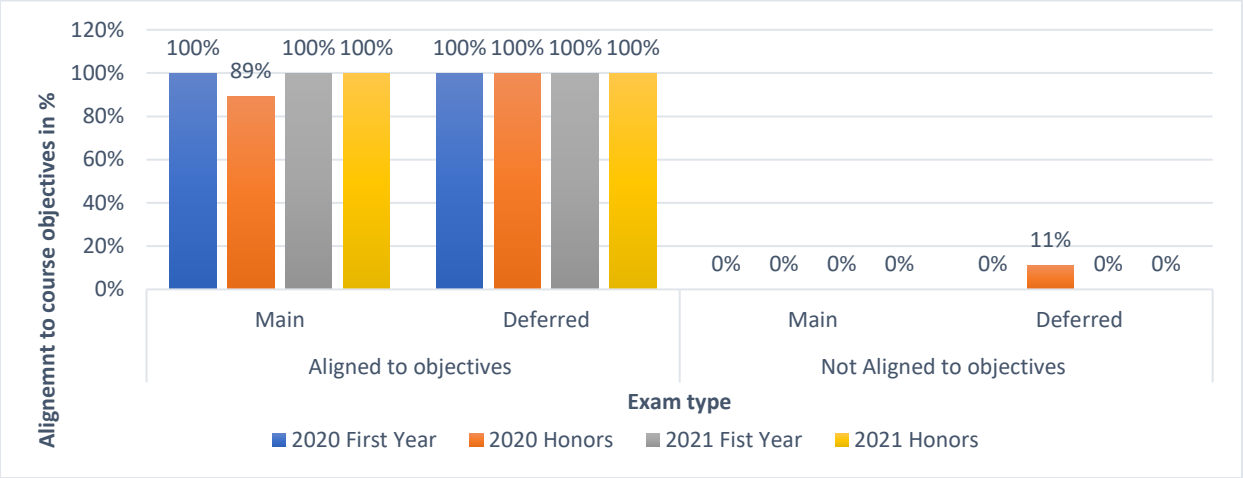
Year	Examination Type	Objective 1 (%)	Objective 2 (%)	Objective 3 (%)	Objective 4 (%)	Objective 5 (%)	Objective 6 (%)	Objective 7 (%)	Not Aligned (%)	Total Alignment (%)
2020	Main	56	33	0	0	0	0	0	11	89
	Deferred	63	25	12	0	0	0	0	0	100
2021	Main	50	17	0	17	0	8	8	0	100
	Deferred	25	0	0	50	0	25	0	0	100

According to data presented in Table 4.5, in 2020, 56 % of the main examination items aligned to objective 1 and 33% of the items were in correspondence with objective 2, while the remaining

11% of the items did not align to any of the specified objectives. This led to the total of 89% items aligning with the specified course objectives. The 2020 deferred examination had 63% items aligning to objective 1, 25% aligning to objective 2 and 12% corresponding to objective 3, which made the examination to have a total of 100% of the items aligning with course objectives.

Figure 4.2 below compares the alignment of first year and Honours online biodiversity summative assessments with course objectives for the years 2020 and 2021.

Figure 4.2 Bar graph of comparison of first year to Honours online biodiversity summative assessments' alignment with course objectives.



The results from Figure 4.2 show that 4 out of 4 first year summative assessments and 3 out of 4 Honours summative assessments had 100% alignment with course objectives. The 2020 Honours' main examination had a total of 89% of items aligning to course objectives, with 11% of the assessment items not aligned to the identified course objectives.

4.1.3 *Cognitive levels of online biodiversity summative assessments*

This sub-section presents data on the cognitive levels at which the first year and Honours online Biodiversity summative assessments were pitched. I start with a presentation of the revised Bloom's taxonomy (Figure 4.3), which was used as a framework to categorize the cognitive levels of the biodiversity summative assessment items. This will be followed by Tables 4.6 and 4.7 presenting the cognitive levels of first year and Honours' summative assessment items respectively. Finally, a bar graph (Figure 4.4) that compares the cognitive levels of items in the

first year and Honours' summative assessments is displayed. Bloom's revised taxonomy is presented in Figure 4.3 below

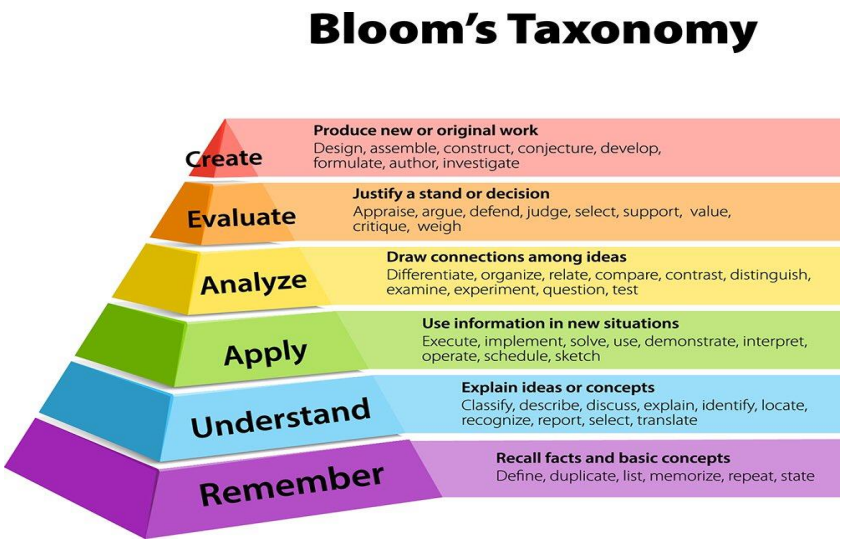


Figure 4.3 Blooms' taxonomy (Anderson & Krathwohl, 2001)

For determining the cognitive levels at which the summative assessments were pitched, items from the summative assessments were each reviewed and indicated using a tick (√) under a column of the relevant cognitive level of Bloom's revised taxonomy. The identification of the cognitive levels to which each item belonged was done using the demonstrative verbs suggested for each cognitive level (Anderson & Krathwohl, 2001). The total number of ticks per cognitive level was added, then divided by the total number of items in the assessment paper, and multiplied by 100 to get the percentage of items representing each cognitive level in the summative assessment. Excerpt E below shows an item from a first-year examination, followed by an explanation of how it was classified into the appropriate cognitive level.

Excerpt E

SECTION B
Answer ALL the questions in this section
Question 2
Match the following definitions to their appropriate terminology. E.g., 2.1 A

Column A		Column B
2.1 Gastro-vascular cavity	A	Body covered with spines
2.2 Golgi apparatus	B	Extends from the mouth and terminates at the anus.
2.3 Lysosome	C	Contains sacs of sex organs loaded with fertilized eggs after reproduction
2.4 Complete gut	D	Free living flatworms found in moist terrestrial & aquatic habitats
2.5 Proglottids	E	Gut undergoes torsion to bring anus to front part of the body
2.6 Echinoderms	F	Responsible for modification and sorting of proteins and lipids
2.7 Platyhelminthes	G	Grouping organisms using their inherited characteristics
2.8 Gastropod	H	Site of breakdown and digestion
2.9 Malpighian Tubules	I	Found in cnidarians
2.10 Phylogenetic	J	Excretory organ in some arthropods

The above except E shows question 2 of a first-year biodiversity examination paper, which required students to match the terms from column A with statements from column B. This question was classified under cognitive level 1 of Bloom's revised taxonomy as the verb "match" is reasoned to promote the remembering skill, according to the Anderson and Krathwohl's table of verbs representing the various cognitive levels.

To show the allocation of assessment items to other cognitive levels, the next except F, taken from one of the Honours examination papers, is used as an example.

Excerpt F

SECTION A: Biodiversity. [50 Marks]

Question 1: (25 marks).

1.1 Distinguish between shared and derived characteristics. (2)

1.2 Demonstrated using a table the shared and derived characteristics in echinoderms (4)

Shared characteristics	**Derived characteristics**

1.3 Giving examples, show how arthropods are important to human life. (19)

a) Food: (8)
b) Disease (4
c) Ecologically (7)

In the above except F, item 1.1 required students to distinguish between shared and derived characteristics. According to the suggested verbs for levels of Bloom's revised taxonomy, the verb 'distinguish' is used to test students' understanding of the knowledge taught. Item 1.2 and 1.3 would also be classified under the 'remembering' skill as the verbs 'demonstrate' and 'show' promote the remembering skill.

The following Table 4.6 shows the cognitive levels, in percentages, at which first year online biodiversity summative assessment items were pitched.

Table 4.6 Cognitive levels of first year's biodiversity summative assessment items.

Year	Examination type	Remember	Understand	Apply	Analyse	Evaluate	Create
2020	**Main**	**57**	**43**	**0**	**0**	**0**	**0**
	Deferred	**29**	**57**	**0**	**14**	**0**	**0**
2021	**Main**	**61**	**31**	**0**	**8**	**0**	**0**
	Deferred	**75**	**25**	**0**	**0**	**0**	**0**

On Table 4.6, all first-year examinations seem to be mainly based on the 'Remember' and 'Understand' levels of Bloom's taxonomy, with only a few or no items requiring students to apply, analyse, evaluate, or create knowledge. The 2020 deferred examination and the 2021 main examination slightly went beyond the lower order thinking skills as they had a few items, 14% and 8% respectively, representing the 'analyse skill. The following Table 4.7 presents the cognitive levels of Honours online biodiversity summative assessment items.

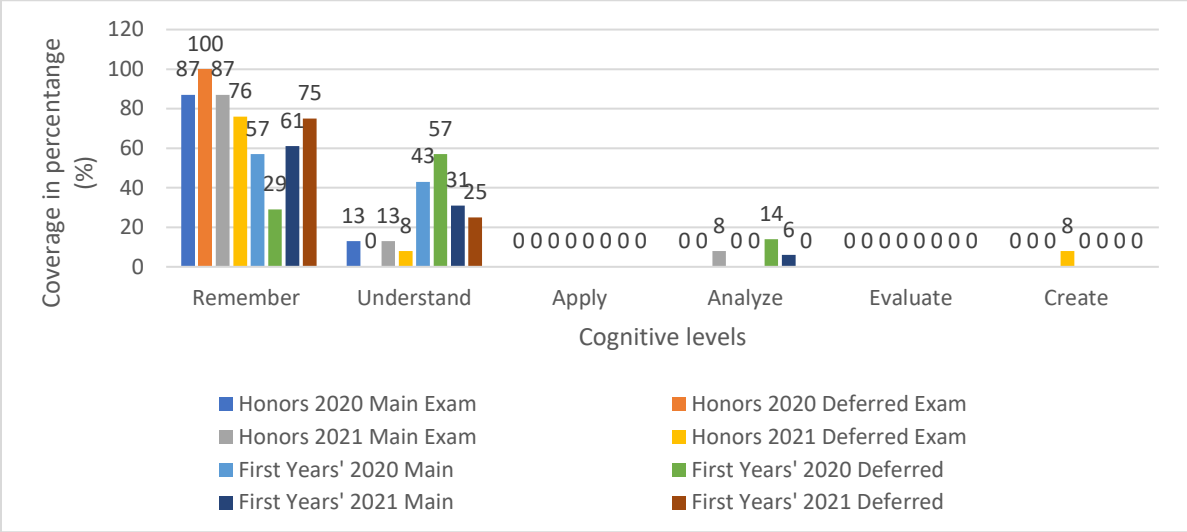
Table 4.7 Cognitive levels of Honours' biodiversity summative assessments items according to Bloom's taxonomy.

Year	Examination type	Remember (%)	Understand (%)	Apply (%)	Analyse (%)	Evaluate (%)	Create (%)
2020	**Main**	**87**	**13**	**0**	**0**	**0**	**0**
	Deferred	**100**	**0**	**0**	**0**	**0**	**0**
2021	**Main**	**87**	**13**	**0**	**0**	**0**	**0**
	Deferred	**76**	**8**	**0**	**8**	**0**	**8**

Table 4.7 above presents the cognitive levels of the online biodiversity examinations items administered to Honours' students in 2020 and 2021. The results of the analysis show that 87% of the 2020 Honours main examination required students to remember content. The remaining 13% of the items were based on skill two of Bloom's revised taxonomy, which is the 'understand' skill. Out of the four examinations, three were predominantly based on cognitive level one and two,

while only one examination had items based on the 'analyse' and 'create' skills, with the latter considered as a higher order thinking skill. The following Figure 4.4 presents the comparison of the cognitive levels of the first year and Honours online biodiversity summative assessments.

Figure 4.4 Bar graph showing a comparison of cognitive levels of first year and Honours' online biodiversity summative assessments according to Bloom's taxonomy.



Data presented in Figure 4.4 shows an almost consistent pattern of questioning of the lower order thinking skills in both first year and Honours levels of study. The major difference in the two levels of study can be noted with the first year 2020 deferred examination, which unlike all the other examinations had 8% of assessment items that tested the 'create' skill. The questioning of the lower order thinking in summative assessments reduces their quality as they do not test students on critical thinking and other higher order thinking ability. Data on the Authenticity of Biodiversity summative assessments of first year and honours courses are presented in the texts below.

4.1.4 Authenticity of online biodiversity summative assessments

This segment presents results of the authenticity of the first year and Honours online biodiversity summative assessments administered in 2020 and 2021. Wiggin's framework was used to categorize the assessment items as either authentic or unauthentic. The results are presented in the following order: Table 4.8 displays Wiggins' framework for authentic assessments, which guided the analysis of assessment items. Table 4.9 shows the authenticity of first year and Honours' online

biodiversity summative assessments, and the bar graph 4.7 compares the authenticity of first year and Honours' online biodiversity summative assessments.

Table 4.8 below shows Wiggin's framework for authentic assessments which was used in this study to classify biodiversity summative assessments as either authentic or unauthentic.

Table 4.8 Wiggin's framework for authentic assessments (1998).

Unauthentic assessments	Authentic assessments	Indicators of authenticity
Require correct responses	Require a high-quality product or performance, and a justification of the solutions to problems encountered	Correctness is not the only criterion; students must be able to justify their answers.
Must be unknown to the student in advance to be valid	Should be known in advance to students as much as possible	The tasks and standards for judgment should be known or predictable.
Are disconnected from real-world contexts and constraints	Are tied to real-world contexts and constraints; require the student to "do" the subject.	Practitioners in the discipline, like those encountered in the context and constraints of the task.
Contain items that isolate skills or facts	Are integrated challenges in which a range of skills and knowledge must be used in coordination	The task is multifaceted and complex, even if there is a right answer.
Include easily scored items	Involve complex tasks that for which there may be no right answer, and that may not be easily scored	The validity of the assessment is not sacrificed in favor of reliable scoring.
Are "one shot"; students get one chance to show their learning	Are iterative; contain recurring tasks	Students may use knowledge or skills in several different ways or contexts.
Provide a score	Provide usable diagnostic information about students' skills and knowledge	The assessment is designed to improve future performance, and students are important "consumers" of such information.

Source: (Wiggins, 1998)

The authenticity of the biodiversity summative assessments was determined by reviewing and analysing their items using Wiggin's framework for authentic assessments (Wiggins, 1998), shown on Table 4.8 above. Each examination question was reviewed and categorized as either authentic or unauthentic. For an assessment to be classified as authentic, it had to have authenticity percentage of above 50 % according to the indicators on Wiggin's framework. The following excerpt is an item from a first year assessment and the method used to categorize its authenticity is explained after the excerpt.

Excerpt G

Question 3
Write down the correct biological term for each of the following descriptions. Write only the term next to the question number.
3.1 The process by which organisms e.g., sea stars replace lost parts is _____.
3.2 The science of describing, naming, and classifying organisms is _____.
3.3 _____ are organisms which get energy by consuming organic matter composed of dead trees, plants, and animals.
3.4 A theory of cellular development where a primordial prokaryote is believed to have ingested plastids to form the current mitochondrion and chloroplast_____.
3.5 A group of organisms that share characteristics inherited from a common ancestor is a _____.
3.6 Internal cellular structures including those that are specialized to carry out metabolic activities such as converting energy to usable forms are collectively called _____.
3.7 _____ are short extra cellular structures found outside human cells, which are used to move substances.
3.8 The _____ describes fluid nature of a lipid bilayer with proteins.
3.9 Some invertebrates have a fluid-filled body cavity called the _____.
3.10_____ is the shedding off the old, hardened exoskeleton by an arthropod.

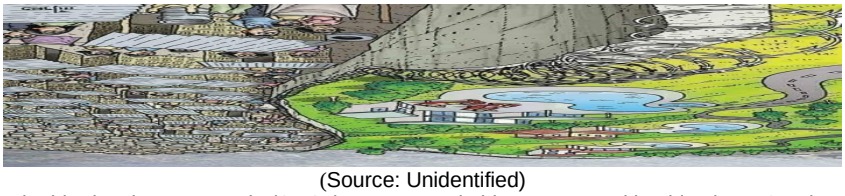
The above question in except G, required students to provide the correct terminology for the given descriptions. All items under this question are unauthentic according to the indicators of unauthentic items suggested by Wiggins's framework (1998). They do not require students to justify their answers as there is only one single correct answer, they can be easily graded, are isolated from real life experiences, and do not promote complex cognitive functions (Wiggins, 1998). The excerpt below (H) from one of the summative assessments is an example of an authentic item.

Excerpt H

SECTION A: Biodiversity [50 marks]

This section consists of one question.

Question 1: (50 marks): SDGs, Climate Change and Biodiversity
Study the picture below and answer questions that follow.



(Source: Unidentified)

1.1 Which sustainable development goals (SDGs) are most suitably represented by this picture? Using the picture, justify the relevance of each suggested SDG. (20)
1.2 Describe with reasons, what you could advise the municipality to do to turn around the condition shown in this picture, so that it shows sustainability. In your advice, suggest and justify the starting point and a step-by-step process of developing a sustainable society. (16)
1.3 How is biodiversity related to ecosystem services in the picture? (8)
1.4 Which of the two communities shown in the picture is likely to be affected adversely by climate change and in what ways? (6)

Question 1 in excerpt H above required students to provide answers to items 1.1 to 1.4 based on the picture provided. In accordance with Wiggin's framework, all the four items are authentic, as they are related to real life situations, are difficult to grade because students' responses may differ. Furthermore, students are required to justify their responses, which is a complex task that requires justification. This method of analysis was used to analyse and classify the authenticity of all items from the collected summative assessments. The succeeding table (4.9) displays the authenticity of first year and Honours online biodiversity summative assessments, displayed as percentages of authentic items in the analysed assessments.

Table 4. 9 Authenticity of first year and Honours online biodiversity summative assessments

Year	**Examination type**	**Authentic (%)**		**Unauthentic (%)**	
		1st year	**Honours**	**1st year**	**Honours**
2020	**Main**	6	88	94	12
	Deferred	0	71	100	29
2021	**Main**	0	75	100	25
	Deferred	0	75	100	25

For an assessment to be classified as authentic, it had to have authenticity percentage of above 50 % according to the indicators on Wiggin's framework. For example, according to the results on Table 4.9, the authenticity percentage of the 2020 first year biodiversity main examination was 6 %, whereas the remaining 94% of the examination items were unauthentic. On the other hand, the authenticity of the 2020 Honours' biodiversity examination was 88% with 12% of the items classified as unauthentic. Looking at the general trends, all first-year biodiversity summative assessments had low authenticity as three of them were 100% unauthentic. This could mean that they were of poor-quality in terms of their applicability to real-life situations, while all the Honours' biodiversity summative assessments had authenticity of 71% and above, which means that they were of satisfactory quality in terms of the alignment to real life issues. The following figure compares the authenticity of first year and Honours online biodiversity summative assessments.

Figure 4.5 Authenticity of first year and Honours online biodiversity summative assessments

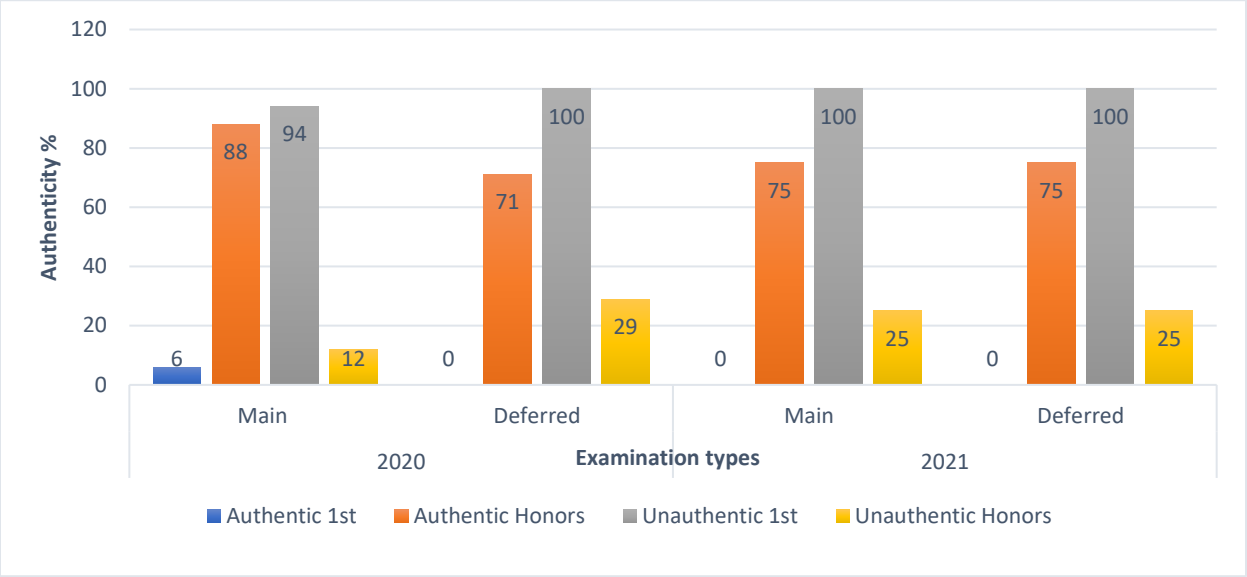


Figure 4.5 is a representation of the authenticity of different biodiversity summative assessments designed for first year and Honours at the institution of study. As can be seen on Figure 4.5, three out of four first year examinations had 0% authenticity, which means none of the examination items were related to real-life situations or problems. There is however, one main examination administered in 2020 that had an authenticity of 6%, which is still very low for the assessment to be considered authentic. These results significantly differ from the Honours biodiversity summative assessments' authenticity, which weighed more in percentages than the first year' summative assessments. Unlike the first years' summative assessments, all Honours' summative assessments had authentic items ranging from 71% and above, which increases their quality.

The analysis of summative assessments was followed by an interview with the lecturer who designed and implemented the analysed summative assessments. The following sub-section shows the interview results.

4.2. Semi-structured Interview results

Interviews were utilized to collect data about the study subject's perceptions about the quality of summative assessments in response to research question 5. In this respect, the lecturers of the biodiversity topic at first year and Honours educational levels were the target participants who

were presumed to possess the information required in the study. At the selected university, the topic of biodiversity is taught by the same lecturer at both first year and Honours levels. Therefore, only one participant was interviewed using Teams' meetings. The research question was divided into three themes, which were:

1. Lecturer's knowledge, understanding and usage of assessment terminologies.
2. Lecturer's experiences of developing online summative assessments
3. Factors that impact on the development of online summative assessments.

Below is a presentation of the participant's responses to questions asked under the stated themes. Each response was coded according to the theme number and the question asked. For example, the participant's response to question 1 of Theme 1 was coded as ***'T1, Q1, and Response'***.

4.2.1 Theme 1: Lecturer's understanding and usage of assessments terminologies.

In this theme, the participant was asked questions relating to his perceptions about the quality of summative assessments. The questions asked in this theme included the following:

1) What is your understanding of summative assessments?
2) What is your understanding of quality assessment?
3) Do you think online summative assessment sufficiently assess students' competence?

Regarding question 1: What is your understanding of summative assessments?, the lecturer's response indicated an understanding of summative assessments as he mentioned that they come at the end of a teaching cycle and that they assess what students have learnt, which is evident in this quotation; *"…summative assessments are assessments that come at the end of a teaching period, usually their purpose is to assess whether students have learnt, so it is assessment of learning*."

His understanding of summative assessment is in line with the definition provided by the great Schools Partnership (2013), which also explained summative assessments as assessments that take place at the end of a certain learning period and used to judge the level of competency and achievement of learning outcomes by students, against a benchmark.

In response to question 2, which is "What is your understanding of an online quality assessment?" He explained the concept of quality assessment as one that enables the educator to establish

whether the course objectives have been met or not, in his response he said, *"A quality assessment should uhm, achieve the intentions of the course. it should enable the educator to establish the way that the objectives of the course were achieved. So, for me that is what constitutes the quality of an assessment".* His response focused on the achievement of course objectives, without considering other quality assessment measures. He also did not include a description of online administration of assessments in his response.

Lastly, his response to question 3: Do you think online summative assessments sufficiently assess students' competence?, indicated that he believes that online summative assessments are useful but do not cover all necessary grounds as they are based only on what is valuable to the educator. See response below:

***T1, Q3. Response**: "Yes and no, the yes is that uhm these assessments are supposed to provide students with an opportunity to express themselves on what they should have understood. So, eh, in that sense, they are useful, and they are appropriate, however summative assessments do not cover uh all then ground that student are supposed to cover. They are based on what the assessor sees as valuable, in that case what may be valuable to the teacher might not have been valuable for the learner and in the end the learner is assessed on those aspects that are not useful to them and in another way, summative assessments are timed, in the end at times it's not about what learners have understood, but it's about what learners can answer or bring back in a specified period of time. So, in the end it is more like how fast one can work with knowledge over a period".*

Like his previous response, the lecturer did not relate his answer to the online mode of assessment. He simply spoke about summative assessment in general terms, explaining how summative assessments do not sufficiently assess students' competencies.

4.2.2 Theme 2: Lecturer's experience in designing online biodiversity summative assessments

This theme explored insights into how the lecturer ensures quality in his online summative assessments. The questions asked were as follows:

1) How do you ensure quality in your online summative assessments?
2) Would you consider the online biodiversity summative assessments administered at your institution to be of high quality, why?

Question 1 of this theme explored how the lecturer ensures quality in his online summative assessments. His response to this question was that when designing the assessments, he looks at

the levels of questioning in reference to Bloom's revised taxonomy. According to his understanding, this is what constitutes a quality assessment. The participant did not mention any other attributes for quality assessment assurance, such as validity, authenticity, and alignment with course objectives, as evident from his response below.

T2, Q1, Response "*When I look at quality, I look at the level of questioning. For me, I look at the bloom's taxonomy. That is what I consider as the quality so when I am preparing to give my learners a task, I look at how are they going to engage with that task and at what levels are they going to engage with the task. So, I always have low order questions. That helps the learners because my intention is not to fail my learners but to ensure that I assess my students so that they show whether they understood or achieved the intentions of that module."*

Question 2 under this theme sought to determine the lecturer's opinion regarding the quality of online summative assessments administered at the institution of study, where he works. The question asked in this regard was "Would you consider the online biodiversity summative assessments administered at your institution to be of high quality, why?" The lecturer responded that he believes that the online biodiversity summative assessments designed at the University of Study are of good quality as they undergo external moderation and peer judgement. See response below:

T2, Q2 *"when we set our summative assessment, once I have set the exam I share it with my colleagues who make input with that exam and then we have what we call external examiners, and they look at what we have set and if they have any input into how we have set the exams they make them and some of the inputs include what I have just told you about so that if you just have low order thinking they actually ask why one has just put low order question and at times they suggest how the questioned can be rephrased to cover higher order thinking. So, we have checks and balances that help us to produce good quality summative questions so yes, my institution produces good quality summative questions."*

4.2.3 Theme 3: Factors that impact the development of quality online biodiversity summative assessments.

Theme 3 sought to find out the factors that impact the development of quality biodiversity online summative assessments. The questions asked included the following:

1) What challenges do you experience when developing online biodiversity summative assessments?
2) What works well for you when developing online biodiversity summative assessments?

In response to the first question, under this theme, which was "What challenges do you experience when developing online biodiversity summative assessments?", the participant explained that one of the challenges he faces that could compromise the quality of the assessments he administers online has to do with the selection of items relevant and steeped at higher cognitive levels to assess what he intends to assess. Furthermore, he expressed that how he phrases the items matters as he wants learners to engage with some form of thinking. In this regard he said that expressing himself in a way that challenges students to go beyond the content taught is quite difficult.

T3, Q1, Response*: "well, the challenge is usually thinking about the items, linking what you taught and what you need to ask and how you ask it especially in the online platforms…because the answers must not be on a silver platter. The student must engage with critical thinking, they should use the content that they were taught but they should think beyond uhm that content, so I think as an assessor I think one finds it difficult to express themselves in the biodiversity unit in ways that challenge students rather than just give off the responses. I think that is my take."*

Furthermore, the lecturer explained that in order to overcome such a challenge, he takes time when designing his summative assessments and he repeatedly goes through them to ensure that they are of a satisfactory standard and that they engage students on higher mental functions.

Question 2 of this theme asked, "What works well when developing online biodiversity summative assessments?" The participant emphasized the importance of taking time to develop summative assessments as an effective way of enhancing their quality. See the following quotation:

T3, Q2, Response: *"I think the solution is taking time when developing summative assessments, so that asking questions is not a rushed process, designing tasks and items is not rushed, so one must take their time to include as much knowledge covered and as much of skill levels as possible. So, one must take time his time to go through it repeatedly to ensure that the questions are satisfactory."*

From the lecturer's responses, it appears that he did not adapt his face-to-face Biodiversity summative assessments to the online assessment mode, as he kept on referring to summative assessments in general terms without specifically referring to online assessments.

With respect to the two levels of attainment suggested by the LINQED quality Assurance framework for student assessment, namely, basic standards, and quality development, the study

results show that most of the reviewed biodiversity summative assessments from the selected institution of study did not only fail to meet the quality development criteria but also the basic standard requirement. As suggested by the quality assurance framework, the analysed assessments were aligned with the educational objectives and the content taught, as required to achieve the basic standards of quality Assurance. However, the first-year summative assessments were not authentic as they were not a representation of real-life problems of the assessed construct.

Moreover, all assessments from first year and Honours' level of study were commonly based on lower order thinking skills of Bloom's revised taxonomy. According to the LINQED framework these are the basic requirements for the assessments. Regarding the quality development aspect of the LINQED framework, the analysed biodiversity summative assessments did not meet most of the stipulated requirements, which included that 'assessments should be as realistic as possible' and that 'assessment should provoke the thinking process required to solve complex problems as within the workspace.'

It could be argued that the analysed summative assessments partially met the basic standards level of attainment suggested by the LINQED quality Assurance framework for student assessment, but failed to meet the quality development level.

4.3 Main study findings

As stated earlier, this study was guided by three criteria adopted from the LINQED quality Assurance framework for Student assessment. which are (1) 'Fitness for purpose' which speaks to content validity and alignment of assessments with course objectives (2) 'Authenticity' and (3) 'Cognitive complexity' (Jiang, 2011). These criteria are evaluated at two levels of attainment namely, basic standards, and quality Development (Jiang, 2011).

The study findings based on the above stated criteria and related to the five research questions are explained in detail in the narratives above, and the main findings are enumerated below.

- With regards to content validity, the online biodiversity summative assessments administered to first year and Honours in 2020 and 2021 are of high content valid as all

had a CVI of above 0.7, which is considered an indication of high validity. However, they were commonly based on one topic, 'Principles of classification and 'The notions of biodiversity and climate change' for first year and Honours respectively.

- In relation to alignment of assessments with course objectives, the reviewed online biodiversity summative assessments for both first year and Honours were aligned to course objectives even though items were mostly aligned with objective one, which for first year was, 'students should be able to build a framework of knowledge based on reading, observation, experience, and reflection', and for Honours it was "students should be able to Describe the concept of biodiversity and its key component concepts'.
- Findings regarding the cognitive levels at which assessments were itched revealed that most online biodiversity summative assessments items required lower order thinking skills, mainly at the levels of 'remembering' and 'understanding'.
- In response to the authenticity of the assessments, findings exposed varying trends in the authenticity of first year and the Honours summative assessments, in that the first-year summative assessments had 0 to very low authenticity percentages, whereas the Honours summative assessments had strong authenticity ranging between 71% and 78%.
- Regarding the perceptions of the lecturer about the quality of online biodiversity summative assessments, the participant seemed to understand the meaning and role of summative assessments. However, he had limited knowledge of what constitutes a quality assessment. He also expressed that within the biodiversity topic, it is difficult to design items steeped at higher cognitive levels. Therefore, he takes his time when developing summative assessments, but he did not speak about the different measures of assessment quality, and he often did not refer to online administration of assessments in his responses.

Conclusion

This chapter presents the results obtained from documents analysis and semi-structured interviews conducted to respond to research questions 1 to 5. Descriptive paragraphs, tables and graphs were used to present the data obtained from the study. Based on the findings presented, it can be suggested that online biodiversity summative assessments at the university of study are of poor quality as they lacked authenticity, were mostly aligned to objective one of the seven specified

objectives, and were pitched at lower cognitive levels. Furthermore, the lecturer at the institution of study seems to lack knowledge on how to set high quality summative assessments.

The next chapter discusses the results presented in chapter four.

Chapter five: DISCUSSION OF RESULTS

Introduction

This chapter presents the summary of study, discussion of results, the limitations of the study, conclusions, as well as the implications of the findings and recommendations.

5.1 Summary of study

This was a qualitative study that took place at a South African teacher training institution to investigate the quality of online biodiversity summative assessments administered during Covid-19 lockdown. To achieve the purpose of the study, five objectives were established, which are to; determine the content validity of the online biodiversity summative assessments, establish the alignment of the online biodiversity summative assessments with course objectives, identify the cognitive levels at which the online biodiversity summative assessments are pitched, determine the authenticity of the online biodiversity summative assessments, as well as to determine a lecturer's perceptions regarding the quality of online biodiversity summative assessments. Data collection instruments involved documents analysis and a semi- structured interview.

For document analysis, a total of eight online biodiversity summative assessments; four from first year, and four from Honours' level of study were collected. The summative assessments consisted of main and deferred examinations administered in the 2020 and 2021 academic years. A semi-structured interview of the lecturer who planned and administered the online biodiversity assessments to both first year and Honours students was conducted. This interview was purposed at obtaining data that could address objective five, which sought to determine the perspective of the lecturer regarding the quality of online biodiversity summative assessments.

The LINQED's framework for quality assurance of assessments was used as the main lens through which the quality of the online biodiversity summative assessments was to be determined (Jiang, 2011). In addition, other frameworks and criteria were substantially used to identify the attributes suggested by the LINQED's framework for quality assurance of assessments. Course outlines and readers were used to determine the content validity and the alignment of the online biodiversity summative assessments with course objectives. Bloom's taxonomy assisted in identifying the cognitive levels of the online biodiversity summative assessments items (Anderson & Krathwohl,

2001), while Wiggins' framework was used to determine the authenticity of the online biodiversity summative assessments (1998).

Both the semi-structured interview and documents analysis worked well to collect objective data under the covid-19 circumstances. However, the interview was costly as it took place online using Microsoft teams, which required internet data. Summative assessments were also retrieved online through email communication between the researcher and the participant. The data collected was useful in that it contained information needed to respond to the primary research question. Moreover, no problems were encountered during analysis of the summative assessments as the frameworks and criteria used to determine the quality of the summative assessments provided a clear foundation for item analysis. The results of the study are discussed in the following sub-section.

5.2 Discussion of study results

This section involves a discussion of results presented in chapter four of this dissertation. The discussion will be presented according to the explored themes, which are based on the study's sub-research questions. Furthermore, the discussion of documents analysis and semi-structured interviews will be done separately to provide a clearer and meaningful insight into the quality of online biodiversity summative assessments at the institution of study. The following narratives discuss the results of the documents analysis.

5.2.1 Discussion of document Analysis results

This sub-section discusses what the results obtained through document analysis entail. The discussion will address the identified themes which also respond to questions one to four of the study. The order of the discussion will be as follows:

- Content validity of first year and Honours online biodiversity summative assessments.
- Alignment of first year and Honours' online biodiversity summative assessments with specified course objectives.

- Cognitive levels at which the first year and Honours online biodiversity summative assessments are pitched.
- The authenticity of first year and Honours online biodiversity summative assessments.

The next section discusses the results of the content validity of first year and Honours' online biodiversity summative assessments.

5.2.1.1 Content validity of first year and Honours' online biodiversity summative assessments.

This theme involves a discussion of findings from the data collected and analysed in response to research question one, which was, "what is the content validity of first year and Honours' online biodiversity summative assessments administered at the institution of study?"

The findings related to this question as presented in Table 4.2 and Figure 4.1 of chapter four, suggest that all the online biodiversity summative assessments administered to first year and honours students in 2020 and 2021 had a content validity index of above 0.7. This implies that they were valid, as Sireci and Geisinger (1998) mentioned that a CVI of 0.7 and above indicates a content valid assessment. However, it is worth noting that even though valid, most of the assessment items were commonly based on topic 1 of both first year and Honours levels of study. The topics included 'Principles of classification for first year, and 'The notions of biodiversity and climate change' for Honours.

This finding is not different from findings of a study conducted by Gareis and Grant (2015), to determine the content validity of educator made assessments in three Malaysian primary schools. The results from this study showed the assessments to be content valid. However, most assessment items were not evenly distributed amongst the topics of the assessed constructs. Similarly, even though the online biodiversity summative assessments administered at the selected institution of study were valid in terms of their content, items were commonly based on topic 1, with a few items based on the other prescribed topics.

The concern in this regard as argued by Black et al (2011), Harlen (2005) and Stimpson (2006), is that educators and lecturers often teach for the test because of time constraints and complex curriculum demands. As a result, educators and lecturers end up neglecting other important topics

of the subject, which then makes them assess only those topics they taught, despite the curriculum specifications, in terms of the topics to be assessed. This could explain why most of the analysed assessment items were commonly based on one or two of the stipulated topics.

The concern thereof is, if students are not given a chance to show their abilities in different aspects of the tested unit, how then can we know for sure that they have mastered the subject and should progress to the next level? The implication of this finding is that students could progress to the next level or graduate, even though they do not possess sufficient knowledge and skills in the aspects of the subject that were not assessed.

Webb, Katz, and Decker (2005) explained that what causes discrepancies in the content validity of assessments is that educators lack training on how to adequately assess all aspects of the content taught. This problem could also be compounded by educators' inability to recognize the parts of the content taught or prescribed that are more important and that should be assessed. This implies that educators use their own judgement in terms of which content should be included in the assessments without some form of validation of this content. Furthermore, studies show that most educators and lecturers do not know how to interpret the curriculum, which leads to confusion about how to teach and assess some constructs, especially constructs like biodiversity which are complex (Sadler et al, 2013).

To mitigate the discrepancies, training of assessment administrators is crucial to ensure that their assessments are not only content valid as they relate to topics being taught, but that they also assess all important aspects of the content.

Another reason for unevenly distributed summative assessments items amongst prescribed topics is lack of time for planning assessments by educators (Webb, Katz & Decker, 2005). As a result, lecturers use assessment items from past papers, which might not be aligned to the current curriculum. In reference to the findings of the study, it is important to note that the curriculum for the biodiversity course might have been amended to align it with the Covid-19 circumstances, which forced assessments to be administered online. The lecturer who administered the online biodiversity summative assessments could have continued using assessment items from past papers that were used under normal circumstances, without validating them with the covid-19 amended curriculum for online learning. This could explain the results which show insufficient

distribution of items amongst the topics even though the assessments were content valid. To mitigate this problem, Webb, Katz & Decker (2005) suggests that lecturers should dedicate enough time to planning and designing assessments, as well as validating them to ensure that they address all important elements of the course. The next sub-section discusses the findings of the alignment of online biodiversity summative assessments with course objectives.

5.2.1.2 Alignment of first year and Honours' online biodiversity summative assessments with course objectives.

Under this sub-section, I discuss the results obtained from analysis of online biodiversity summative assessments administered to first year and Honours levels of study regarding their alignment with course objectives. This is in response to question two of the study; "how aligned are online biodiversity summative assessments with course objectives?"

Based on the results presented on Table 4.4 under chapter four of this report, all first-year online biodiversity summative assessments had 100% of the items aligned to the stipulated course objectives. On the other hand, Table 4.5 shows that three out four Honours online biodiversity summative assessments also had 100% of the items aligning with the course objectives. This is an indication of high quality of the summative assessments administered online at the South African teacher institution of study. However, it should be noted that out of the seven course objectives for both first year and Honours, most items were based on objective one with a few items based on other objectives. For first year, objective one called for students to be able to build a framework of knowledge based on reading, observation, experience, and reflection. Objective one for Honours was that students should be able to describe the concept of biodiversity and its key component concepts. It should also be considered that these are the same summative assessments whose items were mostly based on topic one of the prescribed course contents.

The results of the analysis of the alignment of online biodiversity summative assessments from the institution of study reveal findings which are both contradictory and analogous to findings from existing similar studies. For instance, the findings are different from studies by Smith (2012) who found that most online assessments are not aligned to course objectives. The summative assessments reviewed in the current study were aligned to the biodiversity course objectives.

However, like results obtained by Khoza (2015), the biodiversity summative assessment items were either not aligned to course objectives, or only aligned to one of the predetermined objectives.

Literature suggests that the reason for the lack of alignment of assessments with course objectives could be that some objectives require items to be steeped at higher order thinking levels, which makes it difficult for assessment administrators to design items at those thinking levels (Rise Insight note, 2020). Instead, they design assessments based on the objective(s) which can be achieved by items that require single correct answers and are easy to grade (Rise Insight note, 2020). Moreover, some findings reveal that some assessment administrators completely ignore the objectives when designing their assessments because it takes time to relate assessment tasks to courses objectives (Rise Insight note, 2020). These might be some of the underlying issues that led to the findings of the study.

There are currently not enough studies conducted to determine the alignment of online biodiversity summative assessments with course objectives. Hence, this finding from the current study provides insights of how online biodiversity summative assessments administered in South African teacher training institutions could be related to course objectives. This finding might also encourage assessment designers in higher institution to ensure that they align assessment items with the course objectives. Higher institutions could also consider organizing workshops aimed at training lecturers on how to base assessment items on all predetermined course objectives.

The following segment explains the results of the study with regards to the cognitive levels at which the online biodiversity summative assessments were pitched.

5.2.1.3 Cognitive levels of first year and Honours' online biodiversity summative assessments.

This sub-theme presents a discussion of results obtained from first year and Honours' online biodiversity summative assessments regarding the cognitive levels at which they were pitched, in response to research question three of the study, which asked, "At which cognitive levels are the online biodiversity summative assessments pitched?"

Findings from figure 4.6 in chapter 4, reveal that the online biodiversity summative assessments administered at the selected institution were mostly pitched at lower cognitive levels of blooms'

taxonomy; mainly the 'remembering' and 'understanding' levels (Anderson & Krathwohl, 2001). A few items from the summative assessments had small percentages of items pitched at the 'analysing' and 'creating' cognitive levels, which are considered higher order thinking skills (HOTS), (Anderson & Krathwohl, 2001). It was also discovered that items from the summative assessments mostly consisted of multiple-choice questions, 'match column A with B', 'Label the diagram', as well as 'fill in the missing words, which required single correct answers. One of the first year's summative assessments had a 100% of the items based on the remembering skill, which is the lowest cognitive skill according to Bloom's revised taxonomy (Anderson & Krathwohl, 2001).

This finding from the current study validates findings from other studies, which also looked at the cognitive levels of summative assessments at various educational levels and learning areas. These studies seem to suggest that most summative assessments are designed in a manner that only caters for lower order thinking skills of Bloom's taxonomy, with a few or no items of the summative assessments based on higher order thinking levels necessary for individuals to operate successfully in the revolving world (Msila, 2014; Shukla & Dungsungnoen, 2016; Kabombwe et al, 2021). For example, a study by Kabombwe, Machila and Sakayomya (2021) carried out to investigate the cognitive levels of grade 12 history examinations in a Zambian secondary, revealed a similar trend of assessment items that are pitched mostly at the 'remembering', 'understanding' and 'applying' cognitive levels (Anderson & Krathwohl, 2001). Another study by Motlhabane (2017) also found physical science summative assessments from a South African secondary school to be dominated by the lower order thinking skills with few items pitched at higher order thinking skills.

Studies claim that these findings show how summative assessments administered to students in most learning institutions are compromised in terms of their quality (Anees, 2017). Furthermore, they explain why most students could achieve high scores from summative assessments administered online, as they are not steeped at levels complex enough to limit responses to an individual's capabilities (Junus, et al., 2021). Such results show a negative assessment trend in learning institutions, including higher learning institutions. This has adverse effects on the country's functionality as it could result in employees who lack higher mental functions and who fail to solve problems, as they do not possess critical thinking skills (Msila, 2014). These are

probably individuals who were progressed from higher learning institutions without credible assessment of their readiness for professional practices that require higher mental functions.

Since the element of HOTS within most of the biodiversity summative assessments was absent, it can also be claimed that lecturers are not intentionally teaching for the development of critical thinking in their students because if they consistently integrated this element within their teaching, it would also be evident in the assessments they design (Barak & Dori, 2009; Suleiman et al, 2017). Failure to set credible summative assessments pitched at various levels of Bloom's taxonomy could also create complications for students being assessed, as the results from the summative assessments are used to make important life decisions about them (Kibble, 2017).

Possible explanations for the poor-quality summative assessments in terms of their cognitive levels worldwide include the argument that lecturers might not have any clue about what Bloom's taxonomy implies, and that they might not know how to intentionally assess the various cognitive skills as suggested by Bloom's taxonomy (Kabombwe et al, 2021). Studies suggest that even though most lecturers acknowledge the importance of HOTS, they are confused about what HOTS entail (Shukla & Dungsungnoen, 2016; Anees, 2017; Fangfang & Chun, 2020; Wilson & Narasuman, 2020). Furthermore, it may also be argued that lecturers lack necessary training on how to develop HOTS integrated items that validly assess students' ability to think at higher levels in relation to the unit being assessed (Fangfang & Chun, 2016).

To mitigate this shortfall, department of education needs to provide workshops that educate teachers about various cognitive levels and the importance of integrating them in assessments. Additionally, educators should always validate their assessments items using frameworks such as Bloom's taxonomy for learning objectives, to ensure a sufficient distribution of the assessment items across various cognitive levels. The following theme discusses the authenticity of first year and Honours' biodiversity summative assessments administered in 2020 and 2021.

5.2.1.4 Authenticity of first year and Honours online biodiversity summative assessments.

The fourth research question sought to determine the authenticity of first year and Honours' online biodiversity summative assessments. The finding related to this question is that all first-year summative assessments were mostly unauthentic as 3 out of 4 summative assessments had 0%

authenticity, while only one paper had 6% of items relating to real life situations. In contrast, all 4 Honours' online biodiversity were authentic as they had over 50% of authentic items.

This finding implies that online biodiversity summative assessments administered to first year did not prompt students to apply knowledge to real-life situations and to demonstrate skills they developed through the learning process. In this regard, Koh (2014) argued that such assessments do not promote long life learning, as learner's abilities and competencies necessary for the 21st century are not known. Furthermore, it seems that there was no deliberate plan and consistency in designing authentic items in the online biodiversity summative assessments. This can be explained by the differences in the authenticity of first year and Honours' summative assessments. While the authenticity of first year' summative assessments was extremely low, that of Honours' summative assessments was quite high. This could be a result of lecturers' lack of understanding of what an authentic assessment involves (Frey et al, 2012). Additionally, authentic assessment items are usually open-ended and require items to be set at higher cognitive levels, which literature suggests most lecturers struggle to design (Koh, 2014).

This finding supports results from studies of Frey et al (2012) and Rawlusyk (2018) who determined that most assessment administrators do not consistently plan for authentic assessments. Consequently, most school assessments lack realistic items. Moreover, these researchers reasoned that because of time constraints, assessment administrators simply design closed-ended theory-based questions, which they can easily grade to meet academic deadlines (Valli & Chambliss, 2007). These could be some of the reasons related to the finding of low authenticity of the online biodiversity summative assessments at the institution of study.

Another possible underlying reason for low authenticity of first year's online biodiversity summative assessments could be that the biodiversity unit is taught at an entry level. Therefore, the lecturer could have planned to only test basic theory to determine students' fundamental understanding of the unit with the goal of increasing the level of complexity in assessment items as the academic levels progress. This could also explain why the Honours online biodiversity summative assessments were more authentic, as the content might have been in more depth, which could have enabled the lecturer to design various questions from theory to practice.

It is important for online biodiversity summative assessments to have authenticity to expose students to the various realistic situations, as Mueller (2005) explained that assessments should

reflect the workspace and should enable students to see the connection between theory and practice, which could enable them to be active citizens. Moreover, assessments should "tell whether students can apply what they have learned in authentic situations" (Mueller, 2005). Lecturers are therefore expected to be intentional about ensuring that this attribute is incorporated into assessments as it could increase the quality of the summative assessments and the outcomes obtained from them. Sub-section 5.2.2 below presents a discussion of the lecturer's perceptions of the quality of online biodiversity summative assessments administered at the institution of study.

5.2.2 Semi- structured interview: Lecturer's perceptions of the quality of online biodiversity summative assessments

Under this sub-theme, I discuss the results obtained from the semi-structured interviews that took place between the researcher and the biodiversity lecturer from the institution of study, regarding his general thinking and knowledge in relation to the quality of online summative assessments.

5.2.2.1 Lecturer's knowledge, understanding and usage of assessments terminologies.

Theme one of the interviews sought to determine the lecturer's understanding, knowledge, and usage of summative assessments and what constitutes a quality assessment. When asked what he understood about the phrase 'summative assessment', he explained that it is an assessment that takes place at the end of a learning cycle and that it is used to measure in grades, learner's achievements. His explanation of summative assessments is like that of other scholars who also explained that summative assessments are used to gather information about students' learning competencies, are graded and used to make high stakes decisions (The great Schools Partnership, 2013; States Detrich & Keyworth, 2018; Taras, 2005; Bhat & Bhat, 2019 & Nel & Hugo, 2012).

He further explained that a quality summative assessment is one that achieves the intentions of the course and should enable the educator to establish whether course objectives were achieved. It can be said that the lecturer had a limited knowledge of what a good assessment is. This is because his response only addressed the quality attribute of alignment of assessments with course objectives, as suggested by the LINQED's framework (Jiang, 2011). While it may be justified that

at least the lecturer had an idea of what constitutes a quality summative assessment, it should be considered that his response neglects the role played by other attributes that ensure high-quality assessment (Siddiek, 2018). Alignment of assessments with course objectives alone does not guarantee a quality assessment.

A quality assessment involves an integration of more than one quality attribute as each one plays a different role. While an assessment aligns with course objectives, it should also be content valid, authentic and must have cognitive complexity (The great Schools Partnership, 2013; States Detrich & Keyworth, 2018).

This finding from the current study supports findings from studies carried out by Siddiek (2018) and Msila (2014), who also found that most lecturers are confused about quality assessment attributes, such as authenticity, cognitive levels, and validity. They found that even though some of these attributes were integrated in some of the lecturers' assessments, the lecturers were not intentional about them. This could explain why some online biodiversity summative assessments reviewed were found to lack some quality assessment attributes while others had some of the attributes, even though they were all planned by the same lecturer. This is particularly in reference to the attribute of authenticity, which was evident in the Honours' summative assessments while absent in the first year's summative assessments.

It is particularly important for lecturers at the teacher training institution of the institution of study to have knowledge of important attributes that contribute to quality learning and assessment. This is because, student teachers leaving the institution have an obligation to carry out the same task of designing and administering quality assessments. Therefore, lecturers must model to their students what will ensure successful teaching, learning and assessment for future generations. Msila (2014) argued that when teacher trainers are confused about learning concepts, it is most likely that even their trainees will be confused about the same concepts and fail to implement successful teaching or assessments of those concepts when they take up their roles as educators in future.

5.2.2.2 Lecturer's experience in developing online biodiversity summative assessments

This theme explores the lecturer's experience in designing and administering online summative assessments. The first question asked in this theme was, "How do you ensure quality in your online summative assessments?"

The lecturer responded that when designing summative assessment items, he engages students in activities pitched at various cognitive levels of Bloom's taxonomy. This speaks to the attribute of cognitive levels as a necessity for quality assessments. The lecturer seemed to know that an inclusion of items based on various cognitive levels of Bloom's taxonomy contributed to the quality of assessment, even though he was unable to mention other necessary quality attributes. This could possibly show he has limited, or no knowledge of other trade-offs involved in ensuring that assessments are of a satisfactory standard.

It is also important to note that even though the lecturer explained that he ensures assessment quality by designing items that are based on Blooms' various cognitive levels, all his online biodiversity summative assessments administered to first year and Honours level of study were mostly pitched at lower levels of Bloom's taxonomy. This is contrary to what he claimed in his response to how he ensures quality assessments. The implication of this could be that he either does not know how to design summative assessment items that are pitched at higher cognitive levels, or he had challenges in developing assessments items pitched at these levels, even though he is aware of their importance.

This finding relates to existing studies, as Msila (2014) and (Shukla & Dungsungnoen, 2016) explained in their studies that most educators are not well trained in assessments of higher mental functions even though they are aware of the importance of doing so. This implies that summative assessments administered by some educators do not gather reliable evidence of skills and knowledge acquisition of students, where higher cognitive operations are concerned. Students are simply graded on the ability to reproduce what was taught within the classroom as the assessments do not probe them to use their higher cognitive skills. Again, as explained in under theme 5.2.1.3, students grow to become ineffective employees who do not meet their employer's needs as they might have been progressed while their readiness in terms of cognitive functionality was not sufficiently assessed.

This finding calls for intervention from relevant stakeholders to train lecturers in assessments design and quality assurance. This is to help mitigate the current state of assessments, which are gauged at poor standards due to lack of knowledge and training by lecturers.

Another observation from the interviews was that the lecturer did not seem to have adapted his summative assessment to suit the online environment. He spoke about assessment design in general without specifically referring to online assessments. The lecturer could have taken advantage of the benefit of online assessments, such as multiple test takers completing the assessment at the same time, quality and immediate feedback to the educator to enhance the quality of his assessments (Alruwais, Wills & Wald, 2018). Conversely, online assessments have several challenges, such as, easiness of cheating, the unreliability of technology, lack of online devices and computer skills, and connectivity problems (Alruwais, Wills & Wald, 2018). The lecturers could have identified these challenges and worked out ways of mitigating them to enhance the quality of his online assessments. Given the responses of the interviewed lecturer regarding online assessments, it could be assumed that he simply transferred his sit-down assessments to the online mode of assessment without considering their benefits and mitigating their adverse effects.

The second question under this theme required the lecturer to provide his opinion regarding the quality of online summative assessments administered at the institution of study. The finding in this regard was that, at the University of Study, the only forms of moderation that take place, to validate summative assessments are peer judgement and external moderation. It is important to note that the decision to ask for peer judgement is left at the discretion of the lecturer, as some lecturers may not offer their work to colleagues for scrutiny. This means that the only effective form of checking whether the assessments are of a quality standard is the external moderations, which are mostly done by one expert outside of the institution.

Even though the lecturer interviewed expressed his conviction in the sufficiency of the peer judgment and external moderations, to ensure that summative assessments are of high quality, it cannot be ignored that the extent to which these moderations, especially when done by one individual, are sufficient has not been established. This implies that if the individual moderating the assessments fails to identify weaknesses in the summative assessments, students will most likely write these assessments with such faults. In addition, it is compelling to mention that the analysed biodiversity summative assessments, were found to have many spelling and grammatical

errors, even though moderated externally. One of the importance of validating assessments is to ensure that assessments items are clear and unambiguous, so that they can successfully achieve their intentions (Kibble, 2017). It can be claimed that there are no effective valid measures put in place at the institution of study, to ensure that the summative assessments administered online are of high quality and can capture students' true learning achievements.

It is highly recommended for the institution of study to establish other measures of ensuring the quality of online summative assessments, apart from single external moderations, in order to thoroughly evaluate summative assessments before they are administered to students. This will ensure high quality assessments that can produce true evidence of learning.

The factors that affect the development of quality online Biodiversity summative assessments are discussed in the following section.

5.2.2.3 Factors that affect the quality online biodiversity summative assessments.

Regarding the challenges experienced by the lecturer when developing online summative assessments, the lecturer explained that one of the biggest constraints to developing quality online summative assessments is the selection of appropriate items. He responded that, the items should be able to engage students in critical thinking where the answers are not easily attainable. It appears that the lecturer struggles to design items that assess students not only on basic theory level but also on complex and practical forms of knowledge. This can be related to Saddler, et al (2013)'s idea, who reasoned that lecturer find the biodiversity construct difficult to assess and thus only base assessments items on simple and basic theory. Even though the lecturer at the institution of study explained that to overcome such a challenge, he takes time when planning the assessments, it was still evident from the assessment papers reviewed that, he struggled with the designing of high-quality items, as indeed some of the items were not at the appropriate levels in terms of their authenticity and cognitive levels to engage students on higher thinking. This could again be a consequence of the confusion and lack of knowledge of quality assessment attributes and how to ensure their inclusion in online assessments (Siddiek, 2018).

Training in the knowledge and usage of important quality assessment attributes is recommended as it is important for lecturers to understand what they are assessing and how they should go about

it, especially in online summative assessments. This could also assist in overcoming the challenges experienced by a lot of lecturers when designing assessments and it could further assist in the administration of summative assessments that can provide true accounts of students' competencies in the subject matter. (Kibble, 2017; Harlen, 2005; Stimpson, 2006). The next section reviews the limitations and delimitations of the study.

5.3 Delimitations and Limitations of the study

The study described in this report involved the review of only eight Biodiversity summative examination papers administered at one university in 2020 and 2021. The biodiversity examination papers were administered to life sciences education students at the university. In addition, only one lecturer was interviewed because he is the only one who taught Biodiversity at first year and Honours levels, in 2020 and 2021. The topic of Biodiversity was not taught at other levels of study in the life sciences section of the university where the study took place. Therefore, the findings from study should only be interpreted and understood in the context of the study and in institutions with similar contexts.

The limitations experienced in the study include that the study took place during the Covid-19 pandemic where schools and higher institutions operated remotely online. This was challenging as data collection had to be done online, which required funds for both the researcher and the participant. To minimize the costs, most communication between the researcher and the lecturer took place through emails, and only one teams meeting was set up for the semi-structured interview.

Another challenge faced by the researcher was the choice of the research tradition and design that would help achieve the purpose of the study. The study required both quantitative and qualitative computations as it dealt with both subjects and document analyses, where the former needed qualitative data collection and analysis, while the latter required numerical computations. However, the quantitative aspect of a mixed methods approach could not be accommodated because the sample size was too small, as only eight assessment papers were analysed in the study. Therefore, the researcher used a qualitative design with numerical computations.

Moreover, since the sample size consisted only of one lecturer, who taught biodiversity at both first year and Honours level of study and eight summative assessments papers, the results cannot be generalized to all online biodiversity summative assessments administered in south African teacher training institutions. The researcher acknowledges the fact that results from similar studies from other institutions could differ.

Even though the study might have been conducted on a smaller scale, it should be noted that the data collected were extensively analysed using valid techniques. The findings have a significant implication in the education and research field, as they can provide a foundation from which more similar studies regarding the quality of online summative assessment could be conducted. The finding might also encourage lecturers to validate their summative assessments against criteria for quality assessments before administering them, as a way of ensuring that they produce authentic and valid results for making high stake decision about students.

5.4 Conclusions

The purpose of this study was to investigate the quality of first year and Honours 'online biodiversity summative administered at a South African teacher training institution, during Covid-19 lockdown It was necessary to conduct the study as there is limited research that reports on the quality of online biodiversity summative assessments administered at teacher training institutions. The few studies found suggested that there are discrepancies in the quality of educator designed summative assessments in the biodiversity unit. These discrepancies could be attributed to difficulty of understanding and assessing Biodiversity concepts (Sadler et al, 2013).

With respect to this study, the first research question sought to determine the quality of the first year and Honours online biodiversity summative assessments' quality in terms of their content validity. In response to this question, it was found that the online summative assessments administered were high in content validity even though most items of the assessments were based on 'topic one' of the biodiversity unit in both first and Honours levels of study.

Regarding research question two, which was purposed at investigating the alignment of the first year and Honours' online biodiversity summative assessments with course objectives, findings

revealed that the online biodiversity summative assessments aligned to mostly objective one of the seven stipulated objectives for each level of study.

The third research question investigated the cognitive levels at which the first year and Honours' online biodiversity summative assessments were pitched. The finding related to this question was that all summative assessments administered did not assess HOTS as they were commonly based on the 'remembering' and the 'comprehension' cognitive levels, with none or a few items based on the 'analyses and the 'creation' levels.

In relation to research question four of the study whose aim was to establish the authenticity of the first year and Honours' online biodiversity summative assessments, the findings showed inconsistencies in the authenticity of the summative assessments, as all first-year summative assessments were unauthentic, while most of the Honours assessments were authentic.

The fifth research question of the study investigated the perception of the lecturer who designed and administered the online biodiversity summative assessments, regarding their quality. The findings revealed that he has limited knowledge on what constitutes quality online summative assessments, and that even though he acknowledges few of the quality attributes, he is not sure of how to incorporate them within his summative assessments.

Regarding the overall quality of the reviewed summative assessments, the study found that even though the first year and Honours online biodiversity summative assessments had some quality attributes, their quality was still low in terms of authenticity and cognitive complexity. These are attributes that would ensure that students apply learnt knowledge to real-life situations and solve real-life problems, as they promote critical thinking and creativity.

In addition, findings from interviews suggest that the responding lecturer did not adapt sit-down summative assessments to the online environment, as he did not explain how he re-designed his assessments to suit the online environment. This assumption was alluded to by Junus et al, (2021), who explained that some assessors are not accustomed to online administration of assessments. Therefore, they simply continue using the same summative assessments designed for use in invigilated venues, without adapting them to the online environment. It could therefore be said that there is a need for improvement in the planning, designing and administration of online

biodiversity summative assessments at the University of Study, to ensure that are of satisfactory quality and can provide credible results.

The following sections discusses the implications and recommendations put forth following the study's findings.

5.5 Implications and recommendations

This study explored the quality of online biodiversity summative assessments with the aim of filling in existing literature gaps, especially since only a few scholars have investigated the quality of online summative assessments, without necessarily looking at the biodiversity unit. Following the findings of this study, we recommend the following.

Firstly, semi-structured interviews' results indicated that the lecturer at the selected institution might be having a limited knowledge and understanding of the attributes that are important to ensuring a quality assessment. Literature suggests that most lecturers are not intentional about their assessments due to the inability to fully understand terminologies involved in assessments and how they should be integrated, which leads to the design of poor-quality assessments that do not provide true reports of students' achievements (Siddiek, 2018 & Kibble, 2017).

This finding calls for lecturers in higher learning institutions to revisit their assessments designing methodologies to ensure that they fully understand what they are assessing and that their summative assessments sufficiently cover important aspects of quality assessments. Furthermore, the science division could plan training sessions to educate lecturers about the different elements which are important in designing quality assessments, as well as how to ensure the incorporation of those elements in summative assessments. This will assist in minimizing the deficiencies found within online summative assessments.

Regarding the integration of various cognitive levels according to Bloom's taxonomy, it was found that all online biodiversity summative assessments were mostly pitched at lower cognitive levels with negligence of HOTS. This supports arguments in literature that most lecturers understand the importance of HOTS, but they do not know what they entail or how to integrate them in both formative and summative assessments (Shukla & Dungsungnoen, 2016; Msila, 2014). In the online

learning mode, this creates opportunities for students to cheat and exchange answers as questions are not set at higher cognitive levels that require individual engagement with the questions (Junus, et al., 2021).

To mitigate the issue of lecturers' lack of understanding of cognitive levels and their inability to design assessments steeped at higher cognitive levels, the Life sciences curriculum could be revised to explicitly prescribe guidelines on how various cognitive levels could be integrated within online summative assessments to ensure their reliability and validity. Moreover, workshops could be held to train lecturers on how to increase the complexity of test items according to Bloom's taxonomy. This is necessary to increase the quality of online summative assessments.

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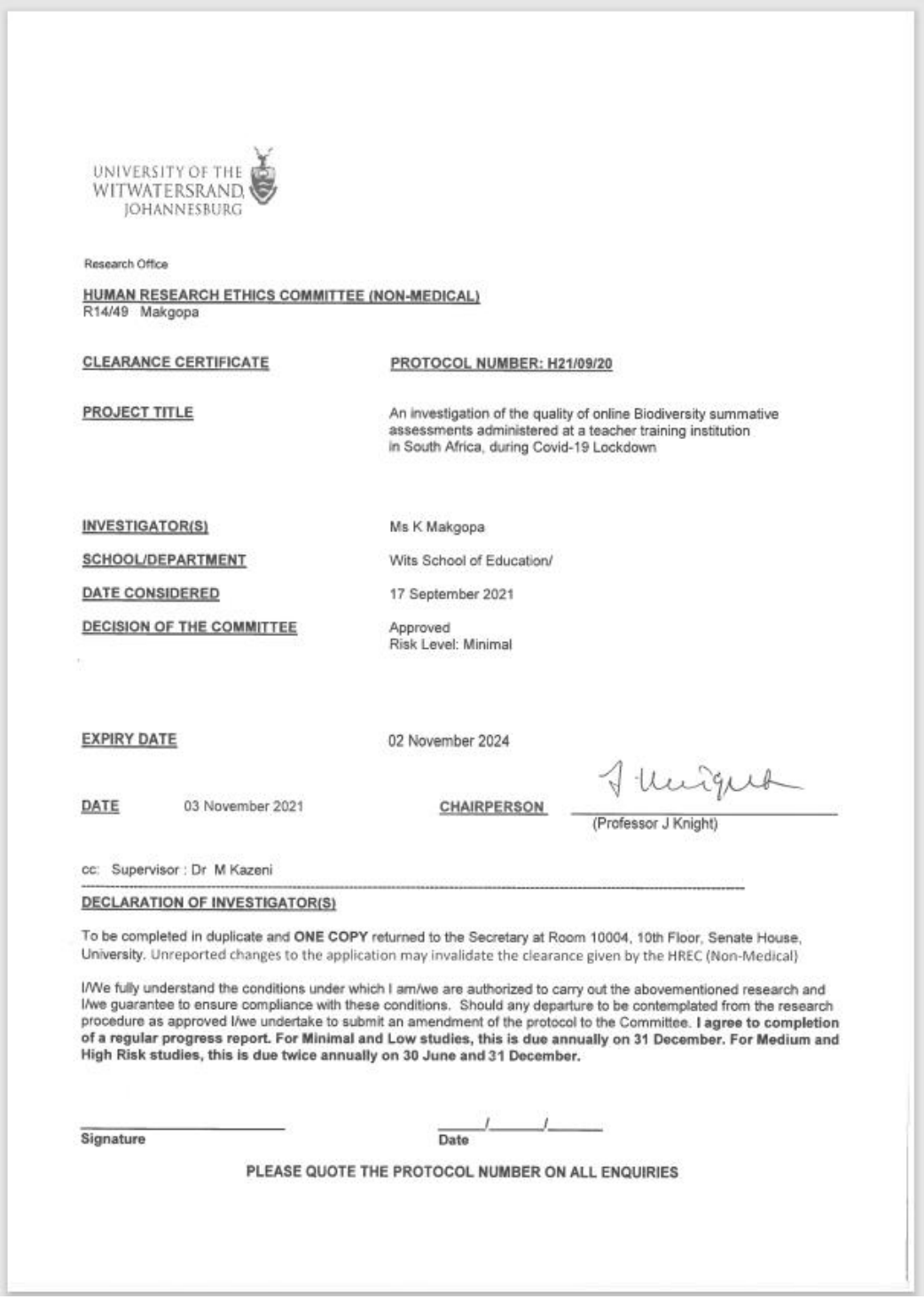
7.0 APPENDICES

Appendix 7.1: Ethics clearance certificate



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R14/49 Makgopa

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H21/09/20**
PROJECT TITLE	An investigation of the quality of online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown
INVESTIGATOR(S)	Ms K Makgopa
SCHOOL/DEPARTMENT	Wits School of Education/
DATE CONSIDERED	17 September 2021
DECISION OF THE COMMITTEE	Approved Risk Level: Minimal
EXPIRY DATE	02 November 2024

DATE 03 November 2021 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Dr M Kazeni

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I agree to completion of a regular progress report. For Minimal and Low studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

Appendix 7.2: Head of school's permission letter

Ms. Kholofelo Makgopa
University of the Witwatersrand,
Faculty of Humanities, School of Education, Science Division,
Education Campus,
School of Education,
Science Education Division,
27 St Andrews Road,
Parktown.

The Head of School of Education,
University of the Witwatersrand,
Education Campus,
School of Education,
27 St. Andrews Road,
Parktown.

Date: 22 August 2021

Dear Sir/Madam,

Re: Permission to conduct research at the University of the Witwatersrand.

My name is Kholofelo Makgopa (1420746).

I am studying for MEd Dissertation at the WITS School of Education. I am seeking permission to do research in the Science Education Division. I am investigating the quality of online Biodiversity summative assessments administered during Covid-19 in the Science Division at Wits School of Education. Quality in the proposed study is used to denote an assessment's validity, reliability, alignment with learning outcomes, authenticity, and the cognitive levels it is pitched at (Assessment Reform Group, 2009; Gardner, 2006; Bezuidenhout & Alt, 2011; DBoE, 2012-2014). These measures are considered important when developing summative online and can help

increase the quality of the assessments and further provide true reflection of what students have learnt.

Following the Covid-19 protocol, many education institutions have had to quickly change from contact to online pedagogy to save the academic year. Some institutions, lecturers, and students were not ready for this sudden change (Junus et al, 2021). It seems that even though most lecturers have managed to acquaint themselves with conducting lessons online, they are particularly struggling with planning, administering, and monitoring assessments online (Junus et al, 2021). This could particularly be true in the administration of Life sciences summative assessments, which are considered to be in disarray due to the subjects' objectivity (Sadler, 2013). The sudden transition from contact to online assessments could have further affected the quality-of-life sciences summative assessments due to their factual nature, which makes them vulnerable to cheating by students since online assessments are not invigilated. For this reason, the study is purposed at determining the quality of Biodiversity summative assessments administered online at the stated institution.

The University of the Witwatersrand was selected for the study because of its academic excellence, which makes it necessary to ensure the development of quality online summative assessments. Furthermore, the researcher studies at the University of the Witwatersrand and she has easy access to the prospective research participants.

I request your permission to invite life science lecturers from the science education division to participate in this study. These lecturers are responsible for developing and rendering online Biodiversity summative assessments. They are therefore considered to be receptacles for the information sought for in the proposed study. If they agree to participate in the study, they will be requested to provide their summative assessments for analysis and to participate in a 30- minute telephonic interviews, to determine their perceptions about the quality of their summative assessments.

Participants will be requested to provide a written consent before they participate in the study. Their responses will be treated confidentially, and identities of their names and the name of the institution will be anonymous. Individual anonymity and confidentiality of data will be maintained

in all published reports. The research participants will not be advantaged or disadvantaged in any way. They will be reassured that they can withdraw their permission at any time during this project without any penalty. There are no foreseeable risks in participating in this study.

All research data will be stored in a password protected electronic document, for five years, after which it will be deleted. The research results will be communicated in a research report, and possibly presented at a conference or published in a journal.

I therefore request permission in writing to conduct my research in your school. The permission letter should be on your institution headed paper, signed, and dated, and specifically referring to myself by name and the title of my study:

Title: An investigation of the quality of first year and Honours 'online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19.

Please let me know if you require any further information. I look forward to your response as soon as is convenient.

Yours sincerely,

Kholofelo Makgopa
Signature:
Contact number: 0827312049
Wits email address: 1420746@students.wits.ac.za

Supervisor's name: Dr. Monde Kazeni
Signature:
Wits contact number: 011 717 3973
Wits email address: monde.kazeni@wits.ac.za

Appendix 7.3: Plagiarism/ Turnitin report

Turnitin Originality Report

Processed on: 15-Mar-2022 9:47 PM SAST
ID: 1785081917
Word Count: 23901
Submitted: 1

TURN IT IN.docx By Kholofelo Makgopa

Similarity Index	Similarity by Source	
7%	Internet Sources:	5%
	Publications:	2%
	Student Papers:	4%

1% match (student papers from 05-Nov-2020)
Submitted to University of Witwatersrand on 2020-11-05

1% match (student papers from 29-Nov-2021)
Submitted to University of Witwatersrand on 2021-11-29

1% match (Internet from 10-Dec-2020)
https://citl.indiana.edu/teaching-resources/assessing-student-learning/authentic-assessment/index.html

1% match (Internet from 07-Nov-2021)
https://www.chemedx.org/blog/incorporating-authentic-assessments-chemistry

< 1% match (student papers from 22-Nov-2021)
Submitted to University of Witwatersrand on 2021-11-22

< 1% match (student papers from 11-Nov-2021)
Submitted to University of Witwatersrand on 2021-11-11

< 1% match (Internet from 16-Nov-2021)
https://www.researchgate.net/publication/333633265_Formative_and_Summative_Evaluation_Techniques_for_Improvement_of_Learning_Process

Appendix 7.4: Participant Information sheet

Title: **An investigation of the quality of first year and Honours' online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown**

Dear Sir/Madam,

My name is Kholofelo Makgopa, and I am a M.Ed. Dissertation student at the WITS School of Education, Johannesburg. I must carry out a research project as part of my studies. My study investigates the quality of online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown, under the supervision of Dr M.M.M. Kazeni. The reason for such an investigation is that, given the huge impact of summative assessments on both students and instructors, (Kibble, 2017; States & Keyworth, 2018), instructors have a great responsibility to develop summative assessments that are unambiguous, have a good educational impact and can be proven valid, reliable, and authentic (Examsoft, 2019). In addition, the American Psychological Association, and National Council on Measurement in Education (NRC, 1999) argued that when stakes are high, it is predominantly significant that the inferences drawn from an assessment are steady. The proposed study aims to provide clarity of the quality of online Biodiversity summative assessments administered at a South African teacher training institution.

To carry out the study successfully, I must conduct semi-online interviews and would therefore like to invite you to participate in these interviews. During the interview, you will be required to answer some questions related to; your views about the quality of online Biodiversity summative assessments, your experiences developing online Biodiversity summative assessments and the factors that impact on the development of quality Biodiversity summative assessments. The interview will probably take 30 minutes and it will be conducted online via Teams or Zoom meeting platforms. I would also like to record the interview process using a digital device. In addition, I request you to kindly allow me to review Biodiversity summative assessments you have developed and rendered online since 2019 up to date. These summative assessments are necessary to corroborate the data collected from the interviews. Please note that only the researcher and her supervisor will have access to your assessments as they will be encrypted and protected, furthermore the interpretations made from the resources and information you provide will not be used to judge you in a way that will demoralize or infringe your dignity.

Participating in this study will be free of charge and there will not be direct remuneration for participation. You will not be disadvantaged or penalized should you choose not to participate or

withdraw from the study. Information you give to me will be held securely and not disclosed to anyone else. I will be using codes to represent your participation in my final research report.

If you have any questions about this research, during or afterwards data collection, feel free to contact me or my supervisor on the details provided below. If you have any concerns or complaints regarding the ethical procedures of this study, you are welcome to contact the University Human Research Ethics Committee (Non-Medical), telephone +27(0)11 717 1408, email hrecnon-medical@wits.ac.za

Yours sincerely,
Kholofelo Makgopa

CONTACT DETAILS

Researcher:
Name: Kholofelo Makgopa
Wits email: 1420746@students.wits.ac.za
Phone number: 0827312049

Supervisor:
Name: Dr. M.M.M. Kazeni
E-mail: monde.kazeni@wits.ac.za
Phone number: 011 717 3073

Appendix 7.5: Consent forms

7.5.1 Consent Form for documents analysis

Dear prospective participant,

Kindly complete this form to indicate your willingness to participate in this research project by providing your planned online Biodiversity summative assessments which will be reviewed to help realize the goal of the research project.

Title of project: An investigation of the quality of first year and Honours 'online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown.

Name of researcher: Kholofelo Makgopa

I, ……xxxxxxxx……., agree to participate in this research project by providing my planned Biodiversity summative assessments rendered online during Covid-19 Lockdown. The research has been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous	✓ YES NO
I agree that my assessments documents may be interpreted and used as part of findings	✓ YES NO
I agree that the information provided by the assessment documents may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	✓ YES NO

……xxxxxxxxxxxx……(Participant's signature)

……xxxxxxxxxxx…… (name of participant)

…28-10-2021……..(date)


…… …… (Researcher's signature)
… Kholofelo Carol Makgopa ……(name of researcher)
…28-10-2021……..(date)

Consent Form for Participation in a semi-structured interview

Name of researcher: Kholofelo Makgopa

Title: **An investigation of the quality of online first year and Honours biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown**

Dear prospective participant, kindly complete this form to indicate your willingness to participate in this study by participating in an interview which will be recorded and by providing your Biodiversity summative assessments for a review as part of the research.

I,xxxxxxxxxx., agree to be participate in this research project. The research, the interview and the documents review processes have been explained to me and I understand what my participation will involve. I agree to the following:

(Please circle the relevant options below).

I agree that my participation will remain anonymous	✓	YES	NO
I agree that the researcher may use anonymous quotes in his / her research report	✓	YES	NO
I agree that my summative assessments may be reviewed to make judgements about their quality	✓	YES NO	
I agree that the interview may be audio recorded	✓	YES	NO
I agree that the information I provide may be used anonymously after this project has ended, for academic purposes by other researchers, subject to their own ethics clearance being obtained.	✓	YES	NO

…… (Participant's signature)

……xxxxxxxxxxxxx……..(name of participant)

……28- 10-2021……(date)

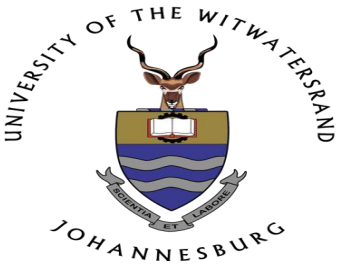
…… (Researcher's signature)

……Kholofelo Makgopa…… (name of researcher)

……28-10-2021…….. (date)

Appendix 7.6: Document analysis tools

7.6.1 Documents analysis schedule for collecting data on the authenticity of online biodiversity summative assessments



Researcher	Kholofelo Makgopa
Academic Level	Honours

Table 1 Wiggin's framework (1998)

Typical tests	**Authentic tasks**	**Indicators of authenticity**
Require correct responses	Require a high-quality product or performance, and a justification of the solutions to problems encountered	Correctness is not the only criterion; students must be able to justify their answers.
Must be unknown to the student in advance to be valid	Should be known in advance to students as much as possible	The tasks and standards for judgment should be known or predictable.
Are disconnected from real-world contexts and constraints	Are tied to real-world contexts and constraints; require the student to "do" the subject.	Practitioners in the discipline, like those encountered in the context and constraints of the task.
Contain items that isolate particular skills or facts	Are integrated challenges in which a range of skills and knowledge must be used in coordination	The task is multifaceted and complex, even if there is a right answer.
Include easily scored items	Involve complex tasks that for which there may be no right answer, and that may not be easily scored	The validity of the assessment is not sacrificed in favor of reliable scoring.
Are "one shot"; students get one chance to show their learning	Are iterative; contain recurring tasks	Students may use knowledge or skills in several different ways or contexts.
Provide a score	Provide usable diagnostic information about students' skills and knowledge	The assessment is designed to improve future performance, and students are important "consumers" of such information.

Table 2 Tool for displaying the Authenticity of summative assessment items

Question number	2020 Honours main exam	
	Unauthentic	Authentic
1.1		✓
1.2		✓
1.3		✓
1.4		✓
1.5		✓
1.6		✓
2.2.1	✓	
2.2.2		✓
Total/9	1	8
Total (%)	6	88

Table 3 Tool for displaying the Authenticity of summative assessment items

Question number	2020 Honours deferred exam	
	unauthentic	Authentic
1.1	✓	
1.2		✓
1.3		✓
2.1	✓	
2.2		✓
2.3		✓
2.4		✓
Total (%)	29	71

Table 4 Tool for displaying the Authenticity of summative assessment items

Question number	2021 Honours main exam	
	unauthentic	Authentic
1.1	✓	
1.2	✓	
1.3	✓	
1.4		✓
1.5		✓
1.6		✓
1.7		✓

1.8		✓
1.9		✓
1.10		✓
1.11		✓
1.2		✓
Total (%)	25	75

Table 5 Tool for displaying the Authenticity of summative assessment items

Question number	2021 Honours deferred exam	
	Unauthentic	Authentic
1.1		✓
1.2		✓
1.3	✓	
1.4		✓
Total (%)	25	75

Table 2 Tool for displaying the Authenticity of summative assessment items

Question number	2021 first year main exam	
	Unauthentic	Authentic
1	✓	
2	✓	
3.1	✓	
3.2	✓	
3.3	✓	
4	✓	
Total (%)	100	0

Table 3 Tool for displaying the Authenticity of summative assessment items

Question number	2021 first years deferred exam	
	Unauthentic	Authentic
1-20	✓	
2.1-2.10	✓	
3.1-3.10	✓	
4.1-4.10	✓	
Total (%)	100	0

Table 4 Tool for displaying the Authenticity of summative assessment items

Question number	2020 first year's main exam	
	Unauthentic	Authentic
1	✓	
2	✓	
3	✓	
4	✓	
5		✓
6	✓	
7	✓	
8		✓
9	✓	
10	✓	
11		✓
12	✓	
12	✓	
14	✓	
15	✓	
16	✓	
17	✓	
18	✓	
19	✓	
20	✓	
2.1	✓	
2.2	✓	
2.3	✓	
2.4	✓	
2.5	✓	
2.6	✓	
2.7	✓	
2.8	✓	
2.9	✓	
2.10	✓	
3.1-3.10	✓	
4.1-4.10	✓	
Total	47	3
Total (%)	94	6

Table 5 Tool for displaying the Authenticity of summative assessment items

Question number	2020 first years deferred exam	
	Unauthentic	Authentic
1-20	✓	
2.1-2.10	✓	
3.1-3.10	✓	
4.1-4.10	✓	
50	50	0
Total (%)	100	0

Document review schedule for collecting data on the content validity of Honours biodiversity summative assessments.

Researcher: Kholofelo Makgopa

Academic level (year): Honours

Table 1: Prescribes topics

Topic number	Honours topics
1	The notions of biodiversity and climate change
2	Biodiversity in the caps
3	Teaching for biodiversity and climate change
4	Assessment for biodiversity and climate change

Table 2: 2020 Main examination

Question no.	Topic 1	Topic 2	Topic 3	Topic 4	Not Aligned
1.1					✓
1.2	✓				
1.3	✓				
1.4	✓				
1.5	✓				
1.6	✓				
2.2.1	✓				
2.2.2	✓				
Total (%)	87	0	0	0	13

Table 3: 2020 Deferred examination Honours

Question no.	Topic 1	Topic 2	Topic 3	Topic 4	Not Aligned
1.1	✓				
1.2	✓				
1.3	✓				
2.1	✓				
2.2	✓				
2.3	✓				

2.4	✓				
Total (%)	100	0	0	0	0

Table 4: 2021 Main examination Honours

Question no.	Topic 1	Topic 2	Topic 3	Topic 4	Not Aligned
1.1.1	✓				
1.1.2	✓				
1.1.3	✓				
1.1.4	✓				
1.1.5	✓				
1.1.6	✓				
1.1.7	✓				
1.1.8	✓				
1.1.9	✓				
1.1.10		✓			
1.1.11		✓			
1.2					✓
Total (%)	75	17	0	0	8

Table 5: 2021 Deferred examination Honours

Question no.	Topic 1	Topic 2	Topic 3	Topic 4	Not Aligned
1.1					✓
1.2	✓				
1.3	✓				
1.4					
Total (%)	75	0	0	0	25

Document review schedule for collecting data on cognitive levels Honours biodiversity summative assessments are pitched at

Researcher's name: **Kholofelo Makgopa**

Academic level (year): **Honours**

Table:1 Cognitive levels for Bloom's taxonomy

Remembering	Understanding	Applying	Analysing		Evaluating	Creating
Define	Explain	Solve	Analyse		Criticize	Design
Identify	Describe	Apply	Compare		Evaluate	Compose
Describe	Interpret	Illustrate	Classify		Order	Create
Label	Paraphrase	Modify	Contrast		Appraise	Plan
List	Summarize	Use	Distinguish		Judge	Formulate
Name	Classify	Calculate	Infer		Support	Invent
State	Compare	Change	Separate		Decide	Hypothesize
Match	Discuss	Demonstrate	Categorize		Discriminate	Write
Select	Distinguish	Experiment	Differentiate		Recommend	Compile
Locate	Predict	Relate	Discriminate		Assess	Construct
Memorize	Associate	Complete	Divide		Convince	Develop
Quote	Convert	Construct	Order		Defend	Integrate
Recall	Demonstrate	Dramatize	Subdivide		Find errors	Modify
Reproduce	Estimate	Interpret	Survey		Measure	Organize
Tabulate	Express	Manipulate	Advertise		Grade	Prepare
Tell	Indicate	Paint	Conclude		Rank	Produce
Copy	Infer	Prepare	Correlate		Score	Rearrange
Duplicate	Relate	Produce	Deduce		Select	Rewrite
Enumerate	Restate	Report	Devise		Test	Adapt
Omit	Select	Teach	Diagram		Argue	Arrange
Recite	Translate	Act	Dissect		Conclude	Assemble
Record	Cite	Administer	Estimate		Consider	Collaborate
Repeat	Generalize	Articulate	Illustrate		Critique	Devise
Retell	Give examples	Chart	Organize		Debate	Express
	Group	Collect	Outline		Distinguish	Facilitate
	Illustrate	Compute	Plan		Editorialize	Make
	Order	Determine	Question		Justify	Negotiate
	Report	Develop	Test		Persuade	Originate
	Represent	Employ			Rate	Propose
	Rewrite	Explain			Weigh	Reorganize
	Show	Interview			Validate	Simulate
	Trace	List				Structure
	Transform	Operate				
		Practice				
		Predict				
		Simulate				

Source: (Anderson & Krathwohl, 2001)

Table 2: 2020 Honours main examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1 – 1.2		✓				
1.3 – 1.5	✓					
2.2.1	✓					
2.2.2		✓				
Total	57	43				

Table 3: 2020 Honours deferred examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1				✓		
1.2 – 1.3		✓				
2.1 – 2.2	✓					
2.3 – 2.4		✓				
Total	29	57	0	14	0	0

Table 4: 2021 Honours main examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1.1 – 1.1.3	✓					
1.1.4	✓			✓		
1.1.5 – 1.1.8	✓					
1.1.9		✓				
1.1.10	✓					
1.1.11-1.1.12		✓				
1.2 – 1.3		✓				
Total	62	31		7		

Table 5: 2021 Honours deferred examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1	✓					
1.2		✓				
13 – 1.4	✓					
Total	75	25	0	0	0	0

Document review schedule for collecting data on cognitive levels first year biodiversity summative assessments are pitched at

Researcher's name: **Kholofelo Makgopa**

Academic level (year): **First year**

Table 2: 2020 first year main examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1 – 4	✓					
Total (%)	100	0	0	0	0	0

Table 3: 2020 first year deferred examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1 – 1.8	✓					
2						✓
3.1				✓		
3.2	✓					
3.3		✓				
Total (%)	75	8	0	8	0	8

Table 4: 2021 first year main examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1 – 1.4	✓					
2.1 – 2.3	✓					
2.4.1 – 2.4.5	✓					
2.4.6		✓				
2.5	✓					
2.6		✓				
Total	87	13	0	0	0	0

Table 5: 2021 first year deferred examination

Question no	Remember	Understand	Apply	Analyse	Evaluate	Create
1.1	✓					
1.2		✓				
1.3 – 1.4	✓					
Total (%)	75	25	0	0	0	0

Document review schedule for collecting data on the Alignment of first year biodiversity summative assessments with course objectives.

Researcher: Kholofelo Makgopa

Academic level (year): First year

Table 4.3 First year biodiversity Course objectives for the years 2020 and 2021.

Objectives	First year: *by the end of the course students should be able to:*
1.	Build a framework of knowledge based on reading, observation, experience, and reflection.
2.	Question the knowledge they have acquired in the light of new knowledge.
3.	Apply this knowledge in several ways.
4.	Students are expected to develop a variety of science related and other skills such as the ability to record, observe accurately, communicate information in various ways.
5.	Appreciate and acknowledge the role of science in our everyday lives and economy.
6.	Show respect and acknowledge natural resources.
7.	Treat all living things humanely and value science as human activity.

Source: B.Ed. first year Course Outline (2020-2021)

Table1: Alignment of biodiversity summative assessments with course objectives

MAIN FIRST YEAR 2021								
QUESTION NO	Objective1	Objective2	Objective3	Objective4	Objective5	Objective6	Objective7	N/A
1-30	✓							
2.1-2.10	✓							
3.1			✓					
3.2				✓				
3.4.1-3.4.6	✓							
3.7	✓							
3.8-3.10	✓							
4.1-4.10		✓						
Total (%)	80	16	2	2	0	0	0	0

Table 2: Alignment of biodiversity summative assessments with course objectives

DEFERRED FIRST YEAR 2021								
QUESTION NO	Objective1	Objective2	Objective3	Objective4	Objective5	Objective6	Objective7	N/A
1-30	✓							
2.1-2.10	✓							
3.1-3.17	✓							
4.1-4.12		✓						
Total (%)	83	17	0	0	0	0	0	0

Table 3: Alignment of biodiversity summative assessments with course objectives

MAIN FIRST YEARS 2020								
QUESTION NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1-1.20	✓							
2.1-2.10			✓					
3.1-3.10	✓							
4.1-4.10		✓						
Total (%)	60	20	20	0	0	0	0	0

Table 4: Alignment of biodiversity summative assessments with course objectives

DEFERRED FIRST YEARS 2020								
QUESTION NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1-1.20	✓							
2.1-2.10			✓					
3.1-3.10	✓							
4.1-4.10		✓						
Total (%)	60	20	20	0	0	0	0	0

Document review schedule for collecting data on the Alignment of Honours biodiversity summative assessments with course objectives.

Researcher: Kholofelo Makgopa

Academic level (year): Honours

Table 4.3 Honours biodiversity Course objectives for the years 2020 and 2021.

Objectives	Honours: *By the end of the course students should be able to*:
7	Describe the concept of biodiversity and its key component concepts
8	Explain why biological diversity is important
9	Describe the threats to biological diversity
10	Suggest appropriate actions needed to protect and restore biological diversity in the South African contexts
11	Describe the notion of Climate Change, adaptation, and mitigation
12	Relate the notions of biodiversity and climate change
13	Suggest effective ways to teach biodiversity and climate change in the South African context.

Source: B.Ed. Honours. LS, Course Outline (2020-2021)

Table 2: 2020 Honours deferred exam

Q.NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1	✓							
1.2	✓							
1.3			✓					
1.4	✓							
2.1	✓							
2.2	✓							
2.3		✓						
2.4		✓						
Total (%)	63	25	12	0	0	0	0	0

Table 3: 2020 Honours Main exam

Q.NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1								✓
1.2	✓							
1.3	✓							
1.4		✓						
1.5	✓	✓						
1.6		✓						
2.2.1	✓							
2.2.2	✓							
Total (%)	56	33	0	0	0	0	0	11

Table 4: 2021 main exam Honours

Q.NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1.1	✓							
1.1.2	✓							
1.1.3	✓							
1.1.4	✓							
1.1.5		✓						
1.1.6	✓							
1.1.7	✓							
1.1.8		✓						
1.1.9						✓		
1.1.10				✓				
1.1.11				✓				
1.2							✓	
Total (%)	**50**	**17**		**17**		**8**	**8**	**0**

Table 5: 2021 Honours home deferred

Q.NO	Objective 1	Objective 2	Objective 3	Objective 4	Objective 5	Objective 6	Objective 7	N/A
1.1				✓				
1.2				✓				
1.3	✓							
1.4						✓		
Total	**25**	**0**	**0**	**50**	**0**	**25**		**0**

APPENDIX 7.7: SEMI-STRUCTURED INTERVIEW SCHEDULE

Title: **An investigation of the quality of first year and Honours' online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown**

Researcher: Kholofelo Makgopa.

Interviewee code **L1**

INTRODUCTION.

Thank you for agreeing to participate in this discussion about the quality of online Biodiversity summative assessments administered at a teacher training institution in South Africa, during Covid-19 Lockdown.

My name is Kholofelo Makgopa, and I am Med. Dissertation student at the University of the Witwatersrand. The MEd. (Diss) course requires me to conduct research, and I would like to ask you some questions related to my research. In this interview, we shall discuss your perceptions of the quality of online Biodiversity summative assessments and the factors that affect the quality of these assessments. The interview items will be divided into themes of, (1) lecturers' knowledge, understanding and usage of assessment terminologies (2) lecturers' experiences of developing online summative assessments, and (3) factors that impact on the development of quality online summative assessments.

There are no wrong or right answers in this discussion, but the information you provide will be valuable to my study and to the field of science education. The interview will approximately last for 30 minutes, and it consists of a biography section and the main interview section. I will audio record the interview, so that I can listen to our discussion at a later stage, to capture your views correctly. All information gathered from this interview will be kept confidential, and your identity and that of the university will not be disclosed to the public. Furthermore, your responses to the interview questions will not be used against you in any way. You are therefore requested to feel free to say what you really think and how you real feel.

Please feel free to stop the interview at any point if you feel uncomfortable. Do you have any questions or comments before we start?

…… …… (Researcher's signature)
… Kholofelo Carol Makgopa ……(name of researcher)
…28-10-2021……..(date)

Appendix 7.8: Interview transcripts

SECTION 1. BIOGRAPHICAL DATA

1. Gender

Male

2. What is your nationality

xxxxxxxxxxx

3. In which range does your age fall?

20 to 25 years	
25 to 30 years	
30 to 35 years	
Above 35 years	✓

4. What is your highest qualification?

B.Ed.	
B.Ed. Hons	
Masters	
PhD	✓

5. In which range does your teaching experience fall?

0-2 years	
3-5 years	
6-10 years	
Above 10 years	✓

SECTION 2. INTERVIEW ITEMS

Theme 1: Lecturers' knowledge, understanding and usage of assessments terminologies

Q1: What is your understanding summative assessments?

L1, Response:

"These are assessments that come at the end of a teaching model, usually their purpose is to assess whether students have learnt so it is assessment of learning."

Q2: What is your understanding of 'quality assessment?

L1, Response:

"It should uhm achieve the intentions of the course it should enable the teacher to establish the way that the objectives of the course were achieved so for me that is what constitutes the quality of an assessment".

Q3: What are your thoughts about the necessity of evaluating students using summative assessments?

L1, Response:

"The excuse me, the system that we use needs a grade at the end, uhm students' performance is evaluated in terms of their achievement and that achievement is judged through some form of assessment. So, it is a way of judging of a student has achieved the intensions of that course and it a necessary activity in the end."

Q4: Do you think summative assessments sufficiently assess students' progress in learning?

L1, Response:

"Yes and no, the yes is that uhm these assessments are supposed to provide students with an opportunity to express themselves on what they should have understood. So, eh, in that sense, they are useful, and they are appropriate, however summative assessments do not cover uh all then ground that student are supposed to cover. They are based on what the assessor sees as valuable, in that case what may be valuable to the teacher might not have been valuable for the learner and in the end the learner is assessed on those aspects that are not useful to them and in another way, summative assessments are timed, in the end at times it's not about what learners have understood, but it's about what earners can answer or bring back in a specified period of time. So, in the end it is more like how fast one can work with knowledge over a period".

Theme 2: Lecturers' experiences of developing online summative assessments

Q1: How do you ensure quality in your online summative assessments?

L1, Response:

"*When I look at quality, I look at the level of questioning. For me, I look at the bloom's taxonomy. That is what I consider as the quality so when I am preparing to give my learners a task, I look at how are they going to engage with that task and at what levels are they going to engage with the task. So, I always have low order questions. That helps the learners because my intention is not to fail my learners but to ensure that I assess my students so that they show whether they understood or achieved the intentions of that module."*

Q2: Can biodiversity summative assessments administered at your institution be considered of good quality, why?

L1, Response:

"when we set our summative assessment, once I have set the exam I share it with my colleagues who make input with that exam and ten we have what we call external examiners, and they look at what we have set and if they have any input into how we have set the exams they make them and some of the inputs include what I have just told you about so that if you just have low order thinking they actually ask why one has just put low order question and at times they suggest how the questioned can be rephrased to cover higher order thinking. So, we have checks and

balances that help us to produce good quality summative questions so yes, my institution produces good quality summative questions."

Theme 3: factors that impact on the development of summative assessments.

Q1: What comes as challenging when developing biodiversity assessments?

L1, Response:

"Well, the challenge is usually thinking about the items, linking what you taught and what you need to ask and how you ask it because the questions must not necessarily be on a silver platter. The answers must not be on a silver platter. The student must engage with a bit of thinking, they should use the content that they were taught but they should think beyond uhm that content, so I think as an assessor I think one is challenged by how to express themselves in ways that challenge students rather than just give off the responses. I think that is my take."

Q2: What works well for you when developing online biodiversity assessments?

L1, Response:

"*I think the solution is taking time so that asking questions is not a rushed process, designing tasks and items is not rushed so one must take their time to include as much knowledge covered and as much of skill levels as possible. So, one must take time their time to go through repeatedly to ensure that the questions are satisfactory."*

Is there anything else that you would like to add or ask?

L1, Response:

"*No, thank you"*

It has been a pleasure talking to you. Thank you very much for your participation, patience, and help. Your contribution is highly appreciated. I will provide you with the transcribed data before I use it in my research report.

Thank you!

NOTE: The following appendices 7.9, include samples from the analysed documents. It should be noted that biodiversity was taught along with other topics therefore, the summative assessments consist of a combination of the biodiversity and other topics that were taught within the first semester at the institution of study. However, only the biodiversity items were analysed for the purposes of this study.

Appendix 7.9: Samples of analysed assessment papers

Sample 1

SECTION A: Biodiversity [50 marks]

Question 1: (25 marks)

Extinction of threatened marine megafauna would lead to huge loss in functional diversity

Date: April 17, 2020

Source: Swansea University

Defined as the largest animals in the oceans, with a body mass that exceeds 45kg, examples include sharks, whales, seals, dugong and sea turtles. These species serve key roles in ecosystems, including the consumption of large amounts of biomass, transporting nutrients across habitats, connecting ocean ecosystems, and physically modifying habitats.

Traits, such as how large they are, what they eat, and how far they move, determine species' ecological functions. As a result, measuring the diversity of traits allows scientists to quantify the contributions of marine megafauna to ecosystems and assess the potential consequences of their extinction. The team of researchers -- led by Swansea University's Dr Catalina Pimiento -- first compiled a species-level trait dataset for all known marina megafauna to understand the extent of ecological functions they perform in marine systems.

Then, after simulating future extinction scenarios and quantifying the potential impact of species loss on functional diversity, they introduced a new index (FUSE) to inform conservation priorities.

https://www.sciencedaily.com/releases/2020/04/200417212930.htm

1.1 Identify the large animals found in the oceans. (5)

1.2 Make a classification of each of these animals to class level. (10)

1.3. What is meant by functional biodiversity, which is raised in this article excerpt? (2)

1.4. Why would functional biodiversity be a good concept for looking at biodiversity in South Africa? (2)

1.5 Why is South Africa considered as a biological hotspot? (4)

1.6 Suggest two ways that biodiversity is important for South Africa. (2)

Question 2: (25 marks)

2.2. Arthropods are said to be the most "successful" group of animals.

2.2.1 Define "success" in biodiversity terms. (2)

2.2.2 Describe how each of the following contribute to making arthropods a successful evolutionary group of animals.

- Body form, plan, and morphology. (3)
- Excretory system. (4)
- Reproduction. (4)
- Nervous and sensory system. (4)
- Feeding and digestion. (4)
- Gaseous exchange and circulatory system. (4)

Sample 2:

SECTION A: Biodiversity [50 marks]

This section consists of one question.

Question 1: (50 marks): SDGs, Climate Change and Biodiversity

Study the picture below and answer questions that follow. ‘

(Source: Unidentified)

1.1 Which sustainable development goals (SDGs) are most suitably represented by this picture? Using the picture, justify the relevance of each suggested SDG. (20)

1.2 Describe with reasons, what you could advise the municipality to do to turn around the condition shown in this picture, so that it shows sustainability. In your advice, suggest and justify the starting point and a step-by-step process of developing sustainable society. (16)

1.3 How is biodiversity related to ecosystem services in the picture? (8)

1.4 Which of the two communities shown in the picture is likely to be affected adversely by climate change and in what ways? (6)

SCTION B: Evolution. [50 marks]

Question 2: [25 marks]

2.1 Why do scientists consider vestigial structures evidence for evolution? (5)

2.2 After graduation, you and 19 of your closest friends (let's say 10 males and 10 females) charter a plane to go on a round-the-world tour. Unfortunately, you all crash land safely, on a deserted island. No one finds you and you start a new population, totally isolated from the rest of the world. Two of your friends carry (i.e. are heterozygous for) the recessive cystic fibrosis allele (c). Assuming frequency of this allele does not change as the population grows, what will be the incidence of cystic fibrosis on your island? (5)

2.3 Explain why the statement that a monkey is more evolved than a mouse is incorrect. (5)

2.4 Extinction is a natural part of life's process, which is a way of clearing the way for new kinds of life, that are potentially more advanced. Extinction through time is very common, and, in fact, nearly 90 percent of all species that ever lived on Earth are now extinct.

2.4.1 State two natural and two man-made factors that could contribute to the extinction of species, and for each stated factor, explain how it could lead to the extinction of species.

2.4.1.1 Natural could contribute to the extinction of a species. (4)
2.4.1.2 Made-made factors could contribute to the extinction of a species. (4)

2.4.2 Which type of factors could lead to background extinction? Explain your answer.

Sample 3:

SECTION A: Biodiversity [50 marks]

There is one question in this section.

Question 1: (50 marks)

Read the following excerpt and find the full article to answer questions that follow:

A botanist watches evolution and extinction play out in Richtersveld.

By Janine Stephen• 4 February 2021

In January and February, the mountainsides of Helskloof usually blaze yellow-orange-red as thousands of Pearson's Aloes flower. It's an astonishing display of plant life in the desiccated expanses of the |Ai-|Ais/Richtersveld Transfrontier Park. But nowadays, all is not well.

The aloe occupies only about 52km² in the Richtersveld, and just over the Orange River in Namibia. Livestock feeds on it when under pressure; mining and drought are other threats. But some kind of tipping point has struck. In late November 2020, the park's nursery curator, Pieter van Wyk, mapped out a 50m by 50m square transect in Helskloof, and counted the number of dead and living aloes within it. All too many had turned to lifeless, grey-brown husks. The characteristic reddish leaves atop the survivors, too, were unnervingly sparse, despite recent good rains. "None of them is healthy," Van Wyk says. "This population is likely to [become] extinct."

Average temperatures in the Richtersveld rose by a formidable 2.9°C between 2012 and 2019, and for much of this time the region was battered by drought. (The Paris Agreement committed countries to make changes to prevent global warming above 2°C.) Studies are under way, but anecdotally it appears that up to 85% of the populations of many plants – not just the unlucky Pearson's Aloes – have died. Conditions have become too extreme, too quickly. Even the otherworldly floristic symbol of this area, the Pachypodium namaquanum, or halfmens, has been devastated: it's not that easy to spot their strange, spiny bodies in Halfmens Pass any more. Skeletons of quiver trees dot Kokerboomkloof. Elsewhere, masses of the region's vygies or Aizoaceae have died back, leaving soils vulnerable to erosion.

The Richtersveld, a mountainous desert, often appears barren to newcomers. Yet its flora is astonishing, wildly unique – and richer in species than any comparable arid area on Earth. A single 3km-long valley on the park's tallest peak, Vandersterrberg, has a species count of 782: more than 10 of South Africa's national parks. There are more than 40 species of carrion flowers and a vast variety of vygies. As much as 30% of the region's flora is endemic. Species are finely attuned to the harsh conditions, sometimes to exceptional degrees.

As is Van Wyk. If this amateur botanist were a plant, he'd be a new species. Intense, hyperfocused and blessed with a brain to rival a supercomputer, Van Wyk, 32, is as much a product of his environment as the Richtersveld flora. His mother says he was made in Alexander Bay, at the mouth of the Orange River, and born in Port Nolloth, as there wasn't a doctor in town back then. His Richtersveld roots run deep, as his family have lived and farmed here since the 1830s. "We were big hunters, and destructive," he says. "My great-grandma's brother shot the last hippo in 1925; another relative shot the last free-roaming cheetah in the 1960s."

Excerpt from the Daily Maverick: https://www.dailymaverick.co.za/article/2021-02-04-a-botanist-watches-evolution-and-extinction-play-out-in-richtersveld/

1.1.1 Define the term 'biodiversity'. (3)

1.1.2 What is meant by the term "species rich area"? (2)

1.1.3 What is a 'tipping point' as used in this article? (1)

1.1.4 Classify the aloe to the genus level. (1)

Domain: Kingdom; Division; Subdivision; Family; Class; Order; Genus.

1.1.5 What is the most probable reason why plants in this area are dying? (1)

1.1.6 What is meant by the term 'indicator species' and how can plants mentioned in this excerpt be used as indicator species? (4)

1.1.7 What are the effects of Biodiversity loss? (3)

1.1.8 State and describe five threats to Biodiversity? (10)

1.1.9 Explain how Climate Change could reduce the species diversity the area described in the article (state and describe). (6)

1.1.10 Which Sustainable Development Goals (SDGs) are directly related to the issues raised in this article? (3)

1.1.11. Explain how addressing one SDG could affect the other SDGs among those raised in question 10 above. (6)

1.2. Read the full article and describe in detail how you can use this article to teach a biodiversity and climate change concepts in the CAPS Life Sciences FET curriculum document, using the Active Learning Framework (O'Donoghue model). (10)

The lesson must illustrate how the following will be achieved:

- The focus/ concept
- Information seeking (researching information)
- Reporting ideas (presentations and discussions)
- Enquiry encounters (practical activities or videos)
- Taking action (helping learners to take action)

Sample 4:

Section A

Question 1

Answer ALL questions in this section by choosing the most correct option. E.g. 1.1 A

1.1 The cell theory is one of the unifying themes of biology. Which ONE of the following statements best describes the cell theory?

A. All life is made of cells.

B. Cells are the smallest unit of life.
C. Cells come from preexisting cells.
D. All of the above. (2)

1.2 The functions of the central vacuole of plant cells include …

A. storing pigments that will help attract pollinating insects.
B. storing products of metabolism (e.g. sugar in sugar beet root cell vacuoles)
C. helping increase the size of cells by absorbing water and producing pressure (turgor) against the wall.
E. All of the choices are correct. (2)

1.3 The type of digestion found in sponges …

A. Extracellular
B. Intercellular
C. Intracellular
D. Both A and C (2)

1.4 You are told that the cells on a microscope slide are possibly plant, animal, or bacterial. You look at them through a microscope and see cell walls and membrane-bound organelles. You conclude that the cells …

A. are plant cells.
B. could be either plant or bacterial.
C. are bacteria
D. could be plant, animal, or bacterial. (2)

1.5 The following are classes of phylum Annelida except for …

A. Polychaete and Oligochaeta
B. Turbellaria and Cestoda
C. Trematoda and Oligochaeta
D. Polychaeta and Trematoda (2)

1.6 Phyla Mollusca, Annelida, Arthropoda, Echinodermata and Nemertea are organisms with complete body cavity, and they are known as …

A. Acoelomates
B. Coelomate
C. Pseudocoelomate
D. Flatworms (2)

1.7 Organisms in the phylum Mollusca are usually found in _____ habitat.

A. Brackish water
B. Ocean and ponds
C. Lakes and Marine

D. Marine and Fresh water (2)

1.8 Which ONE of the following protozoans are responsible for causing malaria?

A. Euglena
B. Plasmodium
C. Paramecium
D. Amoeba (2)

1.9 In the phylum Mollusc, the structure that helps in the removal of nitrogenous waste is known as the …

A. Radula
B. Shell
C. Nephridium
D. Antenna (2)

1.10 Octopuses, squids and nautiluses are all members of the class …

A. Bivalvia
B. Gastropoda
C. Polyplacophora
D. Cephalopoda (2)

1.11 The process of shedding and replacing the rigid exoskeleton in arthropods is known as …

A. Moulting
B. Growing
C. Conjugation
D. Paralysis. (2)

1.12 In terrestrial arthropods, the function of the trachea is …

A. Waste removal
B. Feeding
C. Copulation
D. Respiration (2)

1.13 The structure, book lungs is found in which ONE of the following organisms?

A. Octopuses

B. Bees
C. Spiders
D. Crabs (2)

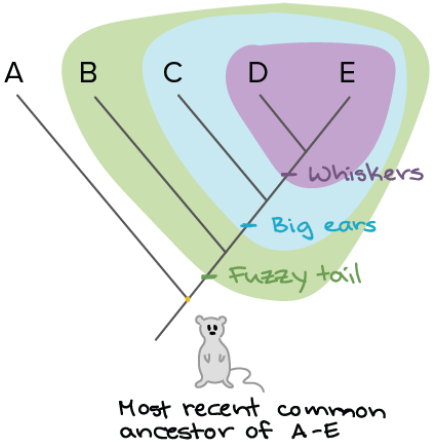
1.14 Which ONE of the sequences below shows complete metamorphosis in insects?

A. Egg, larva, pupa and adult
B. Egg, pupa, larva and adult
C. Pupa, egg, larva and adult
D. Adult, pupa, larva and egg (2)

1.15 Which of ONE of the sequences below is an incomplete metamorphosis?

A. Egg, nymph, larva and adult
B. Larva, egg, nymph and adult
C. Egg, larva, nymph and adult
D. Nymph, egg, larva and adult (2)

1.16 Which ONE of the following features will be found in organisms B-E?



A. Whiskers
B. Big ears
C. Fuzzy tail
D. Ribbon tail (2)

1.17 Which of the following statements is NOT an ecological importance of Arthropods.

A. Some are important decomposers.
B. They are pollinators of flowering plants.
C. They play an important role in soil aeration and water infiltration
D. They are used to manufacture fabrics in industry. (2)

1.18 Which of the following organisms is known as a protozoan?

A. Cnidaria
B. Porifera
C. Acidaria
D. None of the above (2)

1.19 Leeches secrete hirudin into body of host. What is the function of hirudin?

A. It thins the blood and changes the proteins in the cell.
B. It thins the blood to prevent blood clotting.
C. It thickens the blood causing the blood to clot.
D. It thickens the blood to prevent blood clotting. (2)

1.20 Which ONE of the following types of reproduction is found in sponges?

A. binary fission
B. budding
C. multiple fission
D. sexual reproduction (2)

[40]

SECTION B

Answer ALL the questions in this section

Question 2

Match the following definitions to their appropriate terminology. E.g. 2.1 A

2.1 Gastrovascular cavity	A	Body covered with spines
2.2 Golgi apparatus	B	Extends from the mouth and terminates at the anus.
2.3 Lysosome	C	Contains sacs of sex organs loaded with fertilized eggs after reproduction
2.4 Complete gut	D	Free living flatworms found in moist terrestrial & aquatic habitats
2.5 Proglottids	E	Gut undergoes torsion to bring anus to front part of the body
2.6 Echinoderms	F	Responsible for modification and sorting of proteins and lipids

2.7 Platyhelminthes	G	Grouping organisms using their inherited characteristics
2.8 Gastropod	H	Site of breakdown and digestion
2.9 Malpighian Tubules	I	Found in cnidarians
2.10 Phylogenetic classification	J	Excretory organ in some arthropods

[10]

Question 3

Write down the correct biological term for each of the following descriptions. Write only the term next to the question number.

3.1 A _____ character is one that two lineages have in common

3.2 _____ are organisms which get energy by consuming ready-made organic substances.

3.3 The process by which organisms such as sea stars replace their lost parts is _____

3.4 Organisms that form three germ layers during the process called _____, are called 3.5 _____

3.6 The process of shedding off the old hardened exoskeleton by an arthropod is known as _____.

3.7 In Deuterostomes, the _____ develops into the anal end of the animal first.

3.8 Some invertebrates have a fluid-filled body cavity called the _____

3.9 _____ is a whip-like structure with a 9+2 arrangement of microtubules which aids movements in some protozoans

3.10 _____ is the sorting and grouping of things/organisms with similar features.

[10]

Question 4

State whether the following statements are True or False

4.1 A distinguishing characteristic is a feature or features that are only present in a particular group.

4.2 In arachnids, air passes into trachea through openings in the exoskeleton called spiracles.

4.3 There are five main types of classification used in classifying organisms.

4.4 Both plant and animal cells are made up of cellulose cell wall.

4.5 In binomial system of classification, both the general and specie name is important.

4.6 The mesoderm gives rise to several tissues and structures including bone, muscle and connective tissues.

4.7 Echinoderms have canals branching into extensions called tube feet which are used for locomotion and feeding.

4.8 Gaseous exchange in Cnidarians takes place through diffusion.

4.9 A derived character is one that evolved in the lineage leading up to a clade and that sets members of that clade apart from other individuals.

4.10 A glycoprotein is a type of protein molecule that acts in cell-cell recognition and binding of other molecules.

[10]

TOTAL: 70

Sample 5

Section A

Answer ALL questions in this section by choosing the most correct option, E.g. 1. A

1. Cells are small because as cell size increases, the …

A. volume and surface area decrease.
B. volume increases faster than the surface area.
C. surface area and volume increase at the same rate.
D. surface area increases faster than the volume. (2)

2. Which ONE of the following is NOT a characteristic of prokaryotes?

A. DNA
B. Cell Membrane
C. Cell wall
D. Endoplasmic Reticulum (2)

3. Which ONE of the following best describes the pathway of proteins destined to be secreted?

A. Rough ER→ Golgi Transport vesicle→ Golgi Cisternae → secretory vesicle→cell surface
B. Smooth ER → rough ER → ER transport vesicle → Golgi cisternae → cell surface
C. Rough ER → ER transport vesicle → Golgi cisternae → Golgi transport vesicle → cell surface
D. Smooth ER → ER transport vesicles → Golgi cisternae → Golgi transport vesicle → cell surface (2)

4. Which ONE of the following reinforce cell walls of fungi?

A. Chitin
B. Cellulose
C. Lignin
D. Microtubules (2)

5. Knowing what you know about phospholipid bilayers; if you wanted to build your own membrane protein, what would your amino acids need to have in order to stay in the membrane?

A. negatively charged groups
B. hydrophilic groups
C. hydrophobic groups
D. amphipathic groups (2)

6. The cell theory is one of the unifying themes of biology. Which ONE of the following statement/s would best describe the cell theory?

F. All life is made of cells.
G. Cells are the smallest unit of life.
H. Cells come from pre-existing cells.
I. All of the above. (2)

7. The functions of the central vacuole of plant cells include …

D. Storing pigments that will help attract pollinating insects.
E. Storing products of metabolism (e.g. sugar in sugar beet root cell vacuoles)
F. Helping increase the size of cells by absorbing water and producing pressure (turgor) against the wall.
G. All of the choices are correct. (2)

8. A researcher made an interesting observation about a protein that was translocated into the rough Endoplasmic Reticulum (ER) during its synthesis and eventually ending up in the plasma membrane. Significantly, the protein in the plasma membrane was found to be slightly larger than the cognate protein in the ER. The protein was probably changed in the …

A. Golgi apparatus
B. Smooth endoplasmic reticulum
C. Mitochondrion
D. Nucleus (2)

9. A group of organisms that includes a recent common ancestor and all its descendants is …

A. Polyphyletic
B. Paraphyletic
C. Monophyletic
D. An example of horizontal gene transfer (2)

10. Lysosomes can be expected to be present in large numbers in cells which …
A. secrete peptide hormones
B. are migrating
C. are actively dividing
D. carry out phagocytosis (2)

11. Echinoderms are deuterostomes. How is the mouth and the anus formed in deuterostomes?

A. The blastopore develops into the anus and mouth forms at the second opening.
B. The endoderm forms the anus and the mouth forms the second opening.
C. The coelom develops into the mouth and the second opening forms the anus.
D. The blastopore develops into the mouth and the second opening forms the anus. (2)

12. The type of digestion found in sponges is …

E. Extracellular
F. Intercellular
G. Intracellular
H. Both A and C (2)

13. To which domain are you, a human, a member of?

A. Eubacteria

B. Eukaryote
C. Animalia
D. Mammalia (2)

14. Protostomes that have a closed circulatory system and obvious segmentation are part of which phylum?

A. Cnidaria
B. Annelida
C. Echinodermata
D. Mollusca (2)

15. In an open circulatory system, blood is pushed …

A. Only through the animal's head.
B. Into a series of veins and arteries.
C. Out into the body cavity.
D. Through the heart into a tube. (2)

16. Leeches secrete hirudin into body of host. What is the function of hirudin?

E. It thins the blood and changes the proteins in the cell.
F. It thins the blood to prevent blood clotting.
G. It thickens the blood causing the blood to clot.
H. It thickens the blood to prevent blood clotting. (2)

17. Generally, which members of flatworm class/es are non-parasitic?

A. Turbellaria
B. Trematoda
C. Cestoda
D. Monogenea (2)

18. Crayfish, crabs and shrimp are …

A. Copepods
B. Isopods
C. Decapods
D. Ropepods (2)

19. Which of the following characteristics do flatworms share with Cnidarians?

A. Sessile

B. Organ systems
C. Single opening
D. Radial symmetry (2)

20. A shared derived feature in a group of species which is NOT found outside that group of species is …

A. Analogous
B. Homologous
C. Phenotypic
D. Recessive (2)

[40]

Section B

Answer ALL Questions in this section

Question 2

Match the structure to the correct function.

Term Bank:

A. Complete gut
B. Proglottids
C. Nucleus
D. Golgi apparatus
E. Gastrovascular cavity
F. Nematocysts
G. Smooth endoplasmic reticulum
H. Lysosome
I. Radula
J. Mitochondrial Cristae

2.1._____ extends from the mouth and terminates at the anus.

2.2_____ location of oxidative phosphorylation.

2.3_____ device for feeding, scraps up food.

2.4_____ contains and protects genetic material.

2.5_____ responsible for modification and sorting of proteins and lipids.

2.6_____ responsible for both the digestion of food and the transport of nutrients.

2.7_____ contains sacs of sex organs loaded with fertilized eggs after reproduction.

2.8_____ site of breakdown and digestion.

2.9_____ specialized cnidae.

2.10_____ site of lipid synthesis.

[10]

Question 3

Write down the correct biological term for each of the following descriptions. Write only the term next to the question number.

3.1 The process by which by which organisms e.g. sea stars replace lost parts is _____.

3.2 The science of describing, naming and classifying organisms is _____.

3.3 _____ are organisms which get energy by consuming organic matter composed of dead trees, plants and animals.

3.4 A theory of cellular development where a primordial prokaryote is believed to have ingested plastids to form the current mitochondrion and chloroplast_____.

3.5 A group of organisms that share characteristics inherited from a common ancestor is a _____.

3.6 Internal cellular structures including those that are specialized to carry out metabolic activities such as converting energy to usable forms are collectively called _____ .

3.7 _____ are short extra cellular structures found outside human cells, which are used to moved substances.

3.8 The _____ describes fluid nature of a lipid bilayer with proteins.

3.9 Some invertebrates have a fluid-filled body cavity called the _____.

3.10 _____ is the shedding off the old hardened exoskeleton by an arthropod.

[10]

Question 4

State whether the following statements are TRUE or FALSE.

4.1 The mesoderm gives rise to a number of tissues and structures including bone, muscle and connective tissues.

4.2 The protein collagen found in Nematoda is also found in humans.

4.3 Animal and fungal cells contain chloroplasts.

4.4 The overall shape of a bacterial cell is determined by the cell membrane.

4.5 When classifying humans, *Homo* is the species name whilst *sapiens* is the genus name.

4.6 A child can contract an Ascaris infection when she plays with sand and uses unwashed hands to eat.

4.7 In arachnids, air passes into trachea through openings in the exoskeleton called spiracles

4.8 When using natural classification to classify organisms, almost all the characteristics are considered.

4.9 A glycoprotein is a type of protein molecule that acts in cell-cell recognition and binding of other molecules.

4.10 Echinoderms have canals branching into extensions called tube feet which are used for locomotion and feeding.

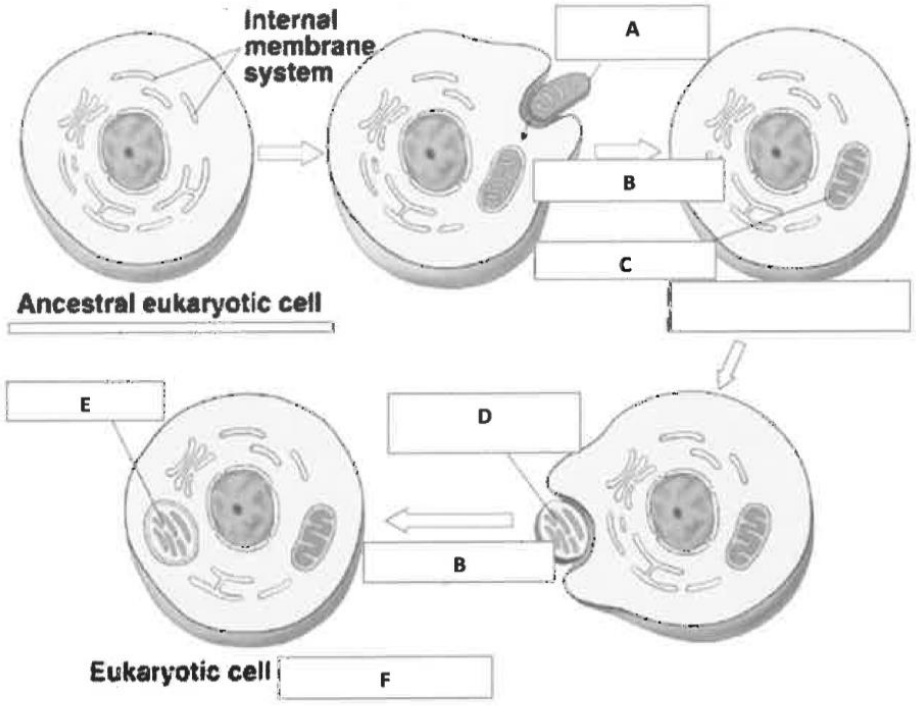
[10]

Total: 70

Sample 6

Section A
Question 1

Use the diagram below to answer the questions that follow.



1.1 Name the organism labelled A. (1)

1.2 Identify the process labelled B. (1)

1.3 Name the structure labelled C and state its function. (2)

1.4 Describe the depiction in the above diagram. (1)

[5]

Question 2

Figures A and B represent organisms that belong to the same Phylum.

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Figure A

Figure B

2.1 Identify the Phylum to which Figures A and B belong. (1)

2.2 What are the visible similarities between organisms A and B? (2)

2.3 What are the visible differences between them? (2)

2.4 The organisms in figures A and B are said to be triploblastic, coelomates, protostomes, showing evident metameric segmentation and bilateral symmetry.

2.4.1 Define “triploblastic”. (2)

2.4.2 List six (6) animal phyla that are triploblastic. (6)

2.4.3 What is a coelomate? (1)

2.4.4 Why is this animal phylum classified as protostomes? (1)

2.4.5 Give three (3) examples of animal phyla that can be characterized as protostomes. (3)

2.4.6. State two (2) ecological roles of organisms in this phylum to which A and B belong. (2)

2.5. Name three animal phyla that are deuterostomes. (3)

2.6 Vertebrates are deuterostomes. Discuss how the vertebrates are structurally adapted to survive in the *aquatic environment*. (2)

Sample 7

SECTION A: Biodiversity. [50 Marks]

Question 1: (25 marks).

1.1 Distinguish between shared and derived characteristics. (2)

1.2 Demonstrated using a table the shared and derived characteristics in echinoderms (4)

Shared characteristics	**Derived characteristics**

1.3 Giving examples, show how arthropods are important to human life. (19)

a) Food: (8)
b) Disease (4
c) Ecologically (7)

Question 2: (25 marks)

2.1 State and describe the different definitions of the term "biodiversity"? (6)

2.2 What is a "biodiversity hotspot" and why is SA regarded as a "biodiversity hotspot"? (4)

2.3 Using ONE specific example of human activities, describe in detail how it can affect biodiversity in South Africa. (5)

2.4 Discuss this statement: When considering development options, should we prioritize the needs of nonhuman organisms or should we prioritize the needs human beings? Substantiate your argument. (10)

SECTION B: Evolution. [50 marks].

Section B consists of six (6) questions worth 25 marks each. **Answer any two** of the six questions.

***Please NOTE**: You are required to do your own research in order to answer the questions. Please reference any ideas and examples that you include from published literature. You can use references located on google scholar, or any reputable website.*

Question 3: [25 marks]

Dawkins (2009) in his book "The Greatest Show on Earth" presents a huge amount of evidence for natural selection. Write an essay explaining, in your own words, how natural selection works. Your answer must:

3.1 Explain using one example for each of the following concepts where the variation that natural selection works on originates from. In your explanation, you will need to differentiate among the following. **Please provide references for your answers:**

3.1.1 Origin of new alleles through mutation (except transposons). [5]

i. What **are mutations** and what **causes them** (1)
ii. Give **3 examples of mutations at DNA level**. A frame shift mutation would be one example. You must give others (3)
iii. **Give an example of how a mutation** has affected a phenotypic character (e.g. Cystic fibrosis is apparently cause by a frame shift mutation). (1)

3.1.2 Origin of new alleles due to the action of transposons. [5]

i. What is a transposon? (1)
ii. How do transposons effect gene functioning? (2)
iii. Give two examples of how a transposon has affected gene functioning? (Example the dark coloured wings of a pepper moth is an example of the action of transposon) (2)

3.1.3. Role of the recombination in Natural Selection. [5]

i. What is the role of recombination in Natural Selection? (2)
ii. How do the roles of mutation and recombination differ with regards to Natural Selection? (3)

3.1.4. Role of epigenetics) [5]

i. What are epigenetic effects? (2)
ii. Give one example of an epigenetic way of gene regulation. (1)
iii. Give an example of inherited epigenetic effects in humans which could be acted on by natural selection. (2)

3.2 Once you have genetic variation, you need to have differential survival of the different variants. Give an example of selection from Dawkins **USING ONE** of the following: [5]

3.2.1. Artificial selection
3.2.2. Sexual selection
3.2.3 Natural section

In your answer you need to:
Choose an appropriate example from Dawkins (1). You also need to describe what the variation is in the population (1). Then they need to explain why there is differential reproductive success (1) and who is doing the choosing (1). Next, you need to explain how that differential reproductive success leads to a change in frequency of a trait or gene (1).

Question 4: [25 marks]

Allopatric speciation is the most well substantiated model for speciation in evolutionary theory and requires populations separated on islands. In a well-planned essay, address the following:

4.1 Describe biological species. [3]

4.2 Give two examples of allopatric speciation taken from your own research (you can take examples from Dawkins). One of your examples should be organisms on a traditional island in the sea, and your second example should be a non-traditional island (e.g. organisms isolated in a patch of forest, or a small land locked lake). For each example provided, explain the following: [20]

4.2.1 Parent population (why is it a population) (2 examples, 2 marks each)
4.2.2 Barrier to dispersal and gene flow (2 examples, 2 marks each)
4.2.3 Dispersal event that forms a daughter population (2 examples, 2 marks each)
4.2.4 Causes of change in the daughter population (2 examples, 2 marks each)
4.2.5 At which point a new species is formed. (2 examples, 2 marks each)

4.3 In general, how would you determine in the case of allopatric speciation whether a new species had formed? [2]

Question 5: [25 marks]

Reconstructions of early hominins (from a scientific point of view) are normally shown as hairy, dark coloured and with some resemblance to chimpanzees. An example of such a reconstruction (*Ardipithecus ramidus*) is given here (Figure 1). Some people have taken offense to these reconstructions saying that they are racist and prejudicial towards people of recent African ancestry.

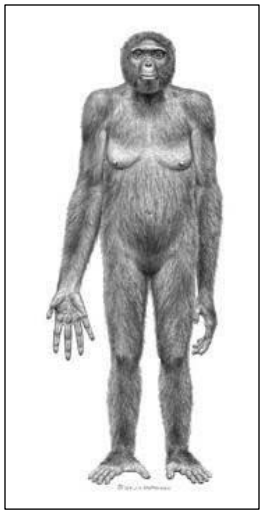

Figure 1

5.1 Based on your understanding of human evolution, re-draw and label the cladogram below (Figure 2) which shows the evolutionary relationships between some of the major species/genera of hominins and modern non-human apes (like the one we used in the lecture).[7]

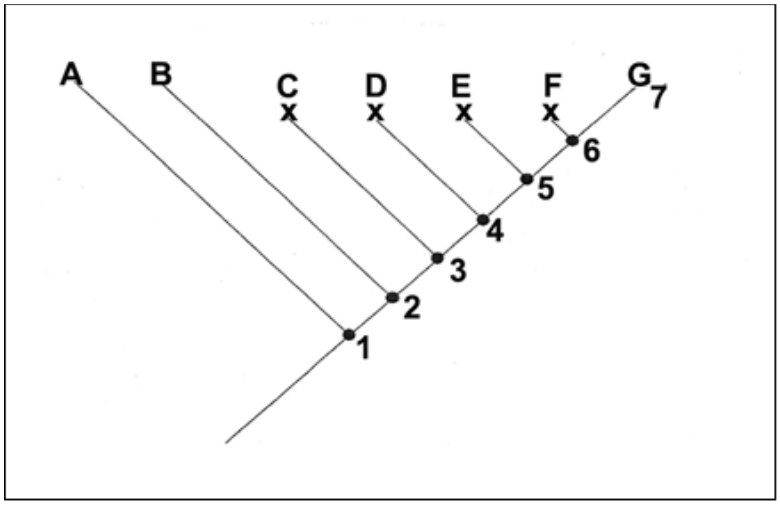

Figure 2: Cladogram showing the evolutionary relationships between selected hominins and non- human apes.

5.2 Explain how reconstructions like Figure 1 can be misinterpreted to support racist views of evolution. [5]

5.3 Use the cladogram to explain why these prejudicial people are mistaken. [4]

5.4 Explains why people of African Origin have dark skin. [1]

5.5 Explain the common mistakes people make when interpreting cladograms of human evolution. [4]

5.6 Finally, explain how teaching about human evolution can be used to argue that there is no biological support for the concept of race. [4]

How you will be marked
• Correct labelling of cladogram- 7 • Explanation of why people feel the reconstructions are prejudiced – 5 • Uses the cladogram to explain why these prejudicial people are mistaken– 4 • Explains why people of African Origin have dark skins- 1 • Explains common mistakes people make when interpreting cladograms of human evolution – 4 • Explains how modern science is deconstructing race – 4
Total = 25 marks

Question 6: [25 marks]

Evolution can be a tricky subject to teach because the different religious backgrounds of learners may result in a negative attitude towards the subject. Describe the different beliefs and attitudes which learners may have towards evolution (e.g. Literalist Creationist, Literalist- Intelligent Designer, Theistic Creationist etc.) and the ways in which science and religion may relate to one another (e.g. conflict, independence, congruence, etc.). Explain the ways **you** think science and religion should best be related, and how you would teach evolution to a class of learners with diverse beliefs, or possibly a group of learners with one particular set of beliefs, which generally oppose the idea of evolution. REMEMBER TO REFERENCE ANY SOURCES YOU CITE.

Marking guide
Description different attitudes to evolution (5)
Description of different relationships between science and evolution (4)
Opinion given on how the student thinks science and evolution should be related (6)
Methodology for how you might teach evolution to a class of learners (10)
Total = 25
You are expected to reference all your sources of information.

Question 7: [25 marks]

Use your own research to describe the "Out of Africa" hypothesis for the origin of modern humans. Please give approximate times for when major events in the "Out of Africa" hypothesis. In addition, describe the multi-regional hypothesis for the origin of modern humans. Explain why, using mitochondrial DNA, the "Out of Africa" hypothesis is the generally accepted one today.

Finally, why is the "Out of Africa" hypothesis so important, in general, for African pride and nation building? Mention findings that have been made in South African archaeological sites such as the Blombos cave that have contributed so much to our knowledge "Out of Africa" hypothesis

and the evolution of modern behaviour. REMEMBER TO REFERENCE ANY SOURCES YOU CITE.

Marking guide
Out of Africa Hypothesis (5)
Multiregional Hypothesis (5)
Mitochondrial DNA evidence in support of the "Out of Africa Hypothesis" (6)
Explaining why "Out of Africa" hypothesis is important for African pride (7)
References (2)
Total = 25

Question 8: [25 marks]

In a survey involving 57 practicing Life Science teachers, Kyriacou et al. (2015) administered a questionnaire of simple questions about evolution. Questions similar to the ones they used include:

a) Can one kind of plant or animal change into another kind, and if so, how long does it take for this to happen?
b) Why do animals and plants generally survive and reproduce successfully in the environment that they live in?
c) Has evolution happened in people, and if it has, are we the most evolved animal?
d) What is the difference between evolution and natural selection (if any)?
e) Has evolution taken place and has the process been guided?

The authors discovered that many of the responses by teachers reflected a naïve understanding of biology, which reflected reasoning that was essentialist, teleological, and intentional. In a well-structured essay, address the following:

8.1 Explain in your own words, with an example, what each of these errors of reasoning are. [5]

8.2 Give short answers to the 5 questions (a- e) listed above and provide a brief reflection on your answer. Your answer should include an account of the following: [15]

- Your answer (1)
- Explain if it essentialist, teleological or intentional and why (2)

8.3 Explain the significance of the study for teaching. [5]

- What language should evolution teachers avoid? (1)
- Illustrate, using two examples (not already used), of what language they should avoid? (2*2)

Marking guide
8.1 Explanation of each of the errors of reasoning: [5] • Teleological (2) • Intentional (2) • Essentialist (1) 8.2 Answers to questions: [15] • Short answer each question (1 x 5) • Analyse the answer is it teleological, intentional or essentialist and why, - (2 x 5). 8.3 Explain significance for teachers of evolution. [5] • What should teachers avoid (1) • Give two examples of the type of thing they should avoid (2 * 2)
Total = 25

THE END