Chapter #6

ASSESSING COMPLIANCE WITH BLOOM'S TAXONOMY: AN EXAMINATION OF SUMMATIVE ASSESSMENT PAPERS FOR FINAL YEAR B-ED STUDENTS

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ABSTRACT
Summative assessment papers must be compiled in accordance with Bloom's taxonomy of the cognitive domain. For final year student teachers, the recommendation is that eighty percent of the question paper must be pitched at Bloom's taxonomy's upper cognitive levels and only twenty percent of the question paper must be pitched at Bloom's lower cognitive levels. This distribution is designed to assess higher order thinking and thus instill, promote, and reinforce independent and critical thinking, as well as problem-solving skills in final year students. To determine whether examiners comply with this recommendation, I analyzed ten question papers from the faculty of humanities through document analysis. The study found that some examiners pitch their question papers for final year student teachers entirely at Bloom's lower cognitive levels and only a few distribute the questions close to the required recommendations. Of concern was that some examiners inappropriately used action verbs belonging to Bloom's higher levels. It is recommended that examiners be re-trained in setting question papers in line with the revised Bloom's taxonomy protocol and the correct use of action verbs. It is recommended also, that main assessment papers must be quality-assured in terms of the levels of questioning before they are administered.

Keywords: assessment, bloom's taxonomy, lower order thinking, problem solving skills, higher order thinking.

1. INTRODUCTION

Undergraduate final year students are at a very critical stage of their journey to becoming qualified school teachers. Their summative assessment must therefore be of a very high standard that prepares them for the eventual world of work and their careers. This essentially means that the quality of their summative assessment papers must be very good, i.e., the questions should mostly be pitched at Bloom taxonomy's high cognitive levels, namely, analysing, evaluating, and creating (Anderson & Krathwohl, 2001).

At the Central University of Technology (CUT), summative assessments for fourth year Bachelor of Education (B-Ed) students, are conducted twice per annum; in the periods between May and June, as well as November and December. The Central University of Technology (CUT), in its assessment manual, prescribes that fourth-year summative assessment papers be pitched eighty percent at Bloom's high cognitive levels, and only twenty percent at Bloom's lover cognitive levels (Hay et.al. 2004).

It has been noted by the assessment quality assurance committee that most summative assessment papers do not meet the expected standards in terms of the cognitive levels of questioning. Senior management at the CUT has in recent times reiterated the importance of setting summative assessment papers at the correct levels in terms of Bloom's taxonomy of the cognitive domain. For this reason, this study sought to investigate whether examiners, when setting summative assessment papers, comply with the recommendations as outlined in the CUT's assessment manual.

2. BLOOM'S TAXONOMY OF THE COGNITIVE DOMAIN

Granello (2001) asserts that Bloom's taxonomy is one of the first models created to provide teachers with a systematic classification of cognitive operations. Bloom's taxonomy of the cognitive domain is a six-level approach to the intellectual expectations of the classroom and classroom assessment (Booker, 2007).

This taxonomy indicates six hierarchical levels of cognitive complexity that are ordered from the least to the most complex level as follows: knowledge, comprehension, application, analysis, synthesis, and evaluation (Granello 2001).

A revision of these levels has been conducted to suit the demands of the modern-day assessment needs.

2.1. Revised Bloom's Taxonomy

Bloom's taxonomy was revised and slightly modified to suit the needs of the constantly changing dynamics of teaching and learning around assessment, as follows:

The lowest level was changed from **knowledge** to **remembering**, **comprehension** was changed to **understanding**, **application** to **applying**, and **analysis** to **analyzing**. **Evaluation** was moved a level down and renamed **evaluating**, and finally **synthesis** was moved to the top of the structure and changed to **creating** (Wilson, 2016. Below is a diagrammatical representation of the revised Bloom's taxonomy adopted from (Schultz, 2005).

Figure 1.
Rearrangement of Bloom's taxonomy from the old version to the revised version.

In this structure, the lower levels, remembering, understanding, and applying, are representative of lower-order thinking and according to the CUT's assessment recommendations, must constitute twenty percent of the B-Ed fourth year summative assessment paper. The upper levels, analyzing, evaluating, and creating are representative of higher-order thinking, which is where eighty percent of the questions in a fourth-year B-Ed summative assessment paper should be pitched.

Table 1 below illustrates so commonly used action verbs that characterize each of Bloom's cognitive levels as described above:

Table 1.
Action verbs across Bloom taxonomy levels in the cognitive domain.

REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
Choose	Distinguish	Act	Analyze	Assess	Create
Mention	Defend	Apply	Appraise	Arrange	Design
List	Classify	Experiment	Divide	Attach	Develop
Outline	Associate	Interview	Dissect	Critique	Collect
Identify	Demonstrate	Develop	Break down	Defend	Combine
Arrange	Describe	Identify	Deduce	Grade	Compile
Define	Illustrate	Generalize	Group	Prepare	Generate
Lable	Give examples	Modify	Examine	Manage	Invent
Memorize	Identify	Explain	Differentiate	Invent	Improve
Locate	Contrast	Implement	Inspect	Judge	Formulate
Name	Match	Employ	Conclude	Mediate	Facilitate
Match	Locate	Debate	Criticize	Estimate	Categorize
Indicate	Extend	Calculate	Correlate	Probe	Choose
Tell	Estimate	Complete	Diagnose	Reconcile	Collect
Select	Inteprete	Modify	Debate	Rate	Make
Memorize	Observe	Back up	Compare	Decide	Modify
Duplicate	Compare	Adapt	Attach	Explain	Originate
Reproduce	Extrapolate	Dramatize		Evaluate	Organise
Quote	Differentiate	Discover			Plan
Copy	Convert	Compute			predict
State		Interview			

Adapted from Stanny (2016)

2.2. Lower Order Thinking (LOT)

The recall or remembering of facts as well as the application of knowledge to situations and contexts that are recognizable to learners or students, is what defines lower order thinking (Thompson, 2008). This alludes to learners, in their attempt to answer questions, reproducing the memorized concepts and mentioning facts word for word. This kind of thinking cannot be applied in unfamiliar situations or to solve unrecognizable problems.

Qasrawi and Abdelrahman (2020) opine that modern day education must take students far beyond memorizing and reproducing the content but bring them to a place where they are able to solve unfamiliar problems using the knowledge and insight that they have gained. Abosalem (2016) reiterates the notion that the assessment of lower order thinking entails asking learners questions that prompts simple applications and routine steps to arrive at the answer.

According to Khan and Inamullah (2011), lower order questions in a question paper seem to always take the shape of closed questions for which the response or answer is already known. A typical example could be, "who is the president of South Africa?". Such a question does not require learners to think deeply about the answer, but to go into their memory banks to try and recall the answer. Such questions do not require students to think critically as they do not pose a problem to be solved.

2.3. Higher Order Thinking (HOT)

Assessing higher order thinking involves posing questions that allow students to express their opinions and explore their experiences on the content in a manner that demonstrates understanding of the content (Stayanchi, 2017). Abosalem (2016) asserts that higher order questions request students to interpret, analyze, manipulate information as well as substantiate facts. All these action verbs prohibit students from following routine steps to get to the answer as they must think deeply and critically to provide answers that convince the teacher that they have a deeper understanding of the content.

Thompson (2008) is of the perception that assessing for higher order thinking in a summative assessment paper insinuates that the questions may have information that is similar to what students dealt with during teaching and learning but present an element of newness and unfamiliarity for them. Sagala and Andriani (2019) classify HOT into four main categories, namely, problem-solving, critical thinking, creative thinking and decision making. To assess students' competence in applying these categories, teachers must challenge students to tackle questions that are contextual but unfamiliar and do not require routing steps to answer. According to Bosica, Pyper, and MacGregor (2021) problem-solving and critical thinking skills are usually associated with higher-order thinking.

2.4. Problem-Based Learning (PBL) for Problem-Based Assessment (PBA)

McPhee (2002: 60) has an assertion that it is much more beneficial for students to learn through discovery rather than being fed information by instructors or lecturers. Students should therefore be presented with problematic scenarios to resolve by applying certain principles of even formulae and be encouraged to work in groups to try and come up with solutions, with the lecturer facilitating discussions. The concept of PBL emphasizes the premise that students must work in small groups and be able to identify critical issues in a problematic situation, be self-directed and self-disciplined, as well as be able to incorporate information or knowledge from other disciplines to solve problems (Filipenko, Naslund, & Siegel, 2016:2). Even though PBL puts most emphasis on group interactions and experiential work to solve presented problems, the type of questions given to students in their groups for experiential work may be used in summative assessment as they stimulate critical thinking. According to Savin-Baden (2004: 224), given that PBL is a learning approach characterized by experiential learning, other forms of assessment including summative assessment must reflect some principles of PBL.

2.5. Critical thinking (CT)

Critical thinking is understood to be referring to "pondering on thinking in a systematic manner", which has an ultimate purpose of achieving a particular goal or solving a specific problem, as well as making decisions about what to do (Franco et al., 2018: 132). Lai (2011: 2) argues that the assessment of students' critical thinking skills must be characterized by open-ended questions that are related to real-world situations and are not confined to one correct answer or argument. These are the type of questions that do not require students to

only remember or recall previously learned content but apply deep thinking to get solutions. According to Bloom's taxonomy, the action verbs associated with the demands of critical thinking are for example, analyze, debate, distinguish, argue, criticize, arrange, assemble, design, develop, defend, construct, etc. (Stanny 2016: 5). Typically, these are some of the action verbs that must characterize open-ended questions meant to assess students' critical thinking.

3. PURPOSE OF THE STUDY

Senior management at the CUT has in recent times reiterated the importance of setting summative assessment papers at appropriate levels in terms of Bloom's taxonomy of the cognitive domain. For this reason, this study sought to investigate whether examiners, when setting summative assessment papers for final year B-Ed students, comply with the recommendations as outlined in the CUT's assessment manual. This study sought to judge the overall quality of main assessment papers in terms of Bloom's taxonomy and suggest ways to help lecturers comply with the basic rules of test/examination construction in terms of Bloom's taxonomy when setting main assessment papers.

4. METHODOLOGY

The aim of this study was to investigate whether examiners for B-Ed final year students comply with the CUTs stipulations (80% higher order thinking and 20% lower order thinking) when they compile summative assessment papers. To carry out this investigation I analyzed ten B-Ed fourth year summative assessment papers set by ten lecturers at the Central University of Technology.

A qualitative intrinsic case study research design used in this study was intended to address the aim of this study. Suresh (2015:1) reports that a case study involves a thorough observation of any social phenomenon, be it an individual, a family unit, an ethnic group, or an institution. This study is a case study conducted at the University of Technology, which is an institution of higher education. A case study is a research approach that makes the investigation of a phenomenon within its context easy, using different sources of data.

4.1. Data Collection

Document study was used in this study to investigate the compliance of examiners to Bloom's taxonomy. Karppinen and Moe (2012) describe documents as sources of information that can divulge the intentions and interests of their authors, and also reveal facts about the processes they describe.

There are documents in companies and institutions, such as minutes of meetings, agendas and newspapers, which are never compiled for the purpose of research (Strydom & Delport 2005:315). As soon as these documents are collected and evaluated or analyzed for the purpose of research, then the method of document study comes to the fore. The main data gathering strategy that the researcher chose was the collection of documents, specifically summative assessment instruments in the form of examination papers.

In this study, the documents in question are ten summative assessment papers, and the information they are meant to provide is the extent to which they assess higher order thinking and lower order thinking. I collected ten 2022 summative assessment papers from ten lecturers in the faculty of humanities at the CUT for analysis and named the papers A, B, C, D, E, F, G, H, I and J.

5. FINDINGS

After completing the analysis of all ten summative assessment papers was completed, the results presented in Table 2 were obtained:

Table 2.
Distribution of questions across Bloom's cognitive levels with totals for LOT and HOT.

PAPER	Remembering	Understanding	Applying	Total: LOT	Analysing	Evaluating	Creating	Total: HOT
A	52%	30%	7%	89%	7%	4%		11%
B	20%	17%	47%	84%	16%			16%
C	12%	70%		82%	8%	10%		18%
D	30%	11%	49%	90%	10%			10%
E	10%	19%	30%	59%	21%	20%		41%
F	11%	20%	10%	41%	34%	25%		59%
G	17%	63%		80%	20%			20%
H	8%	74%		82%	18%			18%
I	10%	8%	10%	28%	40%	32%		72%
J	21%		79%	100%				0%

It was discovered that all ten question papers addressed the lowest cognitive level (remembering) and none addressed the highest level (creating). All ten question papers required students to mention, name, state, or outline, which are, according to Bloom's taxonomy, used to test students' ability to recall information. Eight out of ten question papers that were analyzed (highlighted in yellow) had the highest weights in the lower band.

A typical example was question 2.1 of paper B in which students were required to "Mention two other factors on which a force on a current-carrying conductor depends".

Paper A addressed remembering, understanding, applying, analyzing, and evaluating were addressed. The highest level, namely, creating, was not addressed in this paper.

Below is an example of a "Remembering" question from paper A, together with its memorandum:

List *and* ***discuss*** *two (2) ways in which curriculum can be thought about (6).*

Memorandum:

Narrowly: √ as the pieces of paper on which curriculum content, objectives, and so on are written for teachers to use in their teaching.√√

Broadly: √ as the sum of the plan and all that happens in schools, including the experience and consequences of teaching and learning.√√

"List" is an action verb used to test students' memory.

"Discuss" is an action verb used to test students' ability to apply their understanding of the content, but the memorandum shows that this action verd was used inappropriately because the answer appears in the textbook exactly as it is on the memorandum, proving that this is another "Remembering" task.

Out of the ten papers that were analyzed, only one paper (I) had over seventy percent of the whole paper pitched at one of the higher levels, namely evaluating.
Below is a typical "Evaluating" question together with its memorandum from paper I:

One of the most important trends and forces that shape educational policies and have an impact on South African Schools is "New technologies, especially information technology."

Justify this trend with the aid of two practical examples in a school setting. (10)

Memorandum:

> *Students may make any two practical examples that demonstrate the importance of teachers and other personnel equipping themselves with the knowledge and skills to use or apply IT in the classroom or elsewhere within the school. Any two practical examples along these lines! (5 marks each)*

The action verb "Justify" is used to test the students' competence in "Evaluating" any process, circumstance, decision, assertion, etc.

Paper F came close with 59% in the higher band and 41% in the lower band. Paper J was the only paper that was pitched only in the lower band. It addressed only "Remembering" and "Applying" and none of the higher order thinking levels.

The overall average percentage of questions pitched at Bloom's lower cognitive levels, assessing lower order thinking for all ten papers was **73.5%**, while that of the higher levels was only **26.5%**.

5.1. Discussion of the Findings

The findings of this study resonate with the results reached by Mahroof and Saeed (2021:93) that most examiners place maximum focus on Bloom's lower order thinking skills when setting examination question papers. This study found that examiners place much emphasis on lower order thinking skills when they compile summative assessment papers for B-Ed fourth year students, and neglect higher order thinking skills. There were papers that were pitched as high as 80% and 100% at Bloom's lower cognitive levels. This evidence shows that most examiners tend to ask lower order thinking questions that outweigh higher order thinking questions. This has the challenge that students are not assessed on their critical thinking skills, and neither are they assessed on their ability to solve unfamiliar and unprepared problems. Some examiners tend to use certain action verbs incorrectly or inappropriately when phrasing their questions. This was evident in one of the questions where students were asked to "discuss" a certain aspect, and the memorandum revealed that students were expected to recall and reproduce previously learned content.

6. CONCLUSION AND RECOMMENDATIONS

Kumara, Brahmana, and Paik (2019) asserts that the quality-assurance of assessment papers in the teaching and learning process is an essential exercise. This study aimed at judging the quality of summative assessment papers for final year B.Ed. student teachers I alignment with Bloom's taxonomy of the cognitive domain. As a result of the findings of

this study, which point out the non-compliance of examiners to Bloom's taxonomy when setting assessment papers, the following recommendations have been made:

- The study highlighted the need for examiners to constantly and consistently consult and comply with the recommendations of the CUT regarding the distribution of questions when compiling summative assessment papers.
- More questions that assess higher order thinking such as evaluate and create must be included in main assessment papers, especially for final year students to develop their critical thinking and problem-solving skills.
- Main assessment papers must be quality-assured in terms of the level of questioning before they are administered.
- Examiners must be trained on striking the correct balance between lower-order questions and higher-order questions for different level student groups.

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