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## Analysis of Examination Papers using Bloom's Taxonomy. A Case of the Faculty of Agriculture, University of Ruhuna

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### Abstract

The extent to which students have reached the cognitive levels set out by the teacher reflects the effectiveness of the teaching-learning process. Six level Bloom's taxonomy is a widely accepted tool in setting question papers. Objective of this study was to determine to what extent the evaluation process of the BSc (Agriculture) degree program of the Faculty of Agriculture, University of Ruhuna (FAUR) follows the revised Bloom's taxonomy in setting the end semester question papers. 772 questions appeared in second semester examination papers representing all four years of the BSc (Agriculture) examinations were scrutinized and grouped into one of the six cognitive domains as identified by Revised Bloom's taxonomy. The mean number of questions of an examination paper was 25.3 (range 5-7). Around 45% of the questions aimed at knowledge level while only 1.3% aimed at creativity. All the examination papers had knowledge and understanding testing components. However, a substantial percentage of examination papers had not tried to test creativity (80%), analysis (40%), evaluation (36%) and application (23%) domains. Knowledge level questions dominated the examination papers of all four years and across all six departments. The highest number of knowledge level questions appeared in 3<sup>rd</sup> year papers (54%) and in the papers of the Department of Animal Science (79%). It was concluded that attention should be paid in setting the question papers to test higher order of cognitive levels.

**Key word:** Bloom's taxonomy, Examinations, Questions, Paper setting

### Introduction

Assessments are an important component of an effective teaching-learning process. Assessments aim to make judgments and decisions about students and teachers effectiveness. From teacher's point of view, assessments are set to test to what extent students have met the course objectives which in turn is influenced by the cognitive level the teacher wish to impart. Revised Bloom's taxonomy of cognitive levels (Anderson and Krathwohl, 2001) is an improvement to the original version proposed by Bloom (1956). This classification suggests that six cognitive levels to be tested in order to assess the students.

The initial levels test superficial knowledge (shallow processing), and understanding (translating, interpreting, extrapolating). Applying relates to when to apply knowledge, why to apply knowledge, recognizing patterns of transfer that are new and/or unfamiliar. Analyze relates to breaking down into parts and forms. At evaluation level students should be able

to state why. At the highest level; creative student should be able to combine knowledge into pattern not clearly there before. It is widely accepted that a good teaching-learning process should attempt to impart higher cognitive levels of the Bloom's taxonomy. Therefore, ideally a good question paper should test across all the cognitive levels.

The BSc (Agriculture) degree offered by the FAUR is a four year program conducted over eight semesters. Even though, the main objective of the program is to produce high quality agriculture professions, recent studies have shown that agriculture graduates are employed in a diverse range of executive positions. In these circumstances, recent curriculum revisions emphasized to impart higher cognitive levels in teaching learning process. However, no scientific studies has been done to test to what extent the assessment process follows the cognitive level taxonomy. The objective of this study was to ascertain to what extent the evaluation process of the BSc

(Agriculture) degree program of the FAUR follows the revised Bloom's taxonomy in setting the end semester question papers.

of questions are asked, students' thinking is not challenged at higher cognitive level. When higher number of question sections are appear in a paper, evaluators will have a better opportunity to test across a higher number of cognitive levels.

**Table 1: Cognitive domains and key words used to categorize the questions of the BSc (Agriculture) degree programme**

Cognitive domain	Question words
Knowledge	list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where
Understanding	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
Applying	apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
Analysis	analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer
Evaluation	assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize
Creating	Combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if, compose, formulate, prepare, generalize, rewrite

### Methodology

Second semester examination papers (n=30) representing all six Departments and all four years of the BSc (Agriculture) were used for the analysis. There were 772 different question sections in all 30 examination papers. Papers differ in the format (essay-type, structured-type, but no MCQ) and duration. Papers were related to the subjects offered by six Departmental studies. Each question was scrutinized and grouped into one of the six cognitive domains as identified by Revised Bloom's taxonomy (Anderson and Krathwohl, 2001). The question words used to identify the cognitive domain to which the respective question was grouped are given in Table 1. Percentages and ranges of questions aimed at different cognitive domains were determined for different departments and year of the degree programme.

### Results and Discussion

The mean number of question of a paper was 25.3 (range of 5-7). The examination paper which had the highest number of questions contained 75, 11, 5, 0, 9 and 0%, of knowledge, understanding, applications, analysis, evaluation and creative level questions. In contrast the examination paper having lowest number of questions had tested only knowledge, understanding and evaluation domains only (5, 17 and 25% questions, respectively). This observation supports that thesis of Blooser (2000) that when only a few types

Use of various cognitive levels of questions is normally recommended for greater development of the cognitive levels (Eiwin, 2007). However, results of this study revealed that, that was not the case in FAUR. Around 45% of the questions aimed at knowledge level while only 1.3% aimed at

creativity. All the papers had knowledge and understanding components. However, a substantial percentage of papers had not tried to test creativity (80%), analysis (40%), evaluation (36%) and application (23.3%) components. Knowledge level questions dominated the question papers of all four years and the highest number of knowledge level questions appeared in 3<sup>rd</sup> year papers.

Understanding, applications, analysis, evaluation and creative level questions were highest in fourth, first, fourth, third and second year examination papers, respectively. The third year second semester of the FAUR is mainly a practical on-farm training program. However, it was the third year in which knowledge level questions was highest and analysis and application level questions were lowest. Furthermore those question papers contained as low as 8% evaluation and 2% creativity level questions.

Ideally the question papers of the initial years of the program should aim at lower cognitive levels while

**Table 2: Percentage and range of questions appeared in the end semester theory examination papers of BSc Agriculture Degree**

	Knowledge		Understanding		Cognitive domain				Evaluation		Creativity	
	mean	range	mean	range	Application mean	Application range	Analysis mean	Analysis range	mean	range	Mean	range
Year-wise												
1 <sup>st</sup>	36.8	67.6-17.3	23.0	42.8-10.5	21.1	56.5-0.0	12.3	28.5-0.0	6.5	23.0-0.0	0.0	0.0-0.0
2 <sup>nd</sup>	48.92	78.9-20.0	25.9	47.3-10.5	10.4	28.9-5.2	6.3	20.0-0.0	5.5	33.3-0.0	2.8	6.6-0.0
3 <sup>rd</sup>	54.23	75.0-30.0	26.8	55.0-10.7	3.3	10.0-0.0	4.5	32.5-0.0	8.8	28.5-0.0	2.2	15.0-0.0
4 <sup>th</sup>	38.61	62.5-18.6	30.6	46.5-12.5	10.4	23.2-0.0	14.6	23.5-0.0	5.6	11.6-0.0	0.0	0.000
Department-wise												
AS	78.95	78.9-35.2	18.4	33.3-10.5	10.4	28.9-0.0	10.2	32.5-0.0	3.3	8.9-0.0	0.6	5.410.0
CC	35.10	57.9-17.4	34.7	35.0-17.4	20.6	56.5-0.0	0.0	0.00-0.0	2.9	8.7-0.0	6.7	15.0-0.0
CS	38.22	63.6-21.4	35.6	47.3-24.1	1.4	5.26-0.0	14.6	28.5-0.0	9.1	23.0-0.0	0.8	5.260.0
EC	32.60	57.1-20.0	24.8	40.9-10.7	17.6	50.0-0.0	5.20	13.6-0.0	18.1	33.3-0.0	1.6	6.67-0.0
EN	46.30	60.0-32.6	23.9	27.9-20.0	21.3	32.6-10.0	3.49	6.9-0.0	5.0	10.0-0.0	0.0	0.0-0.0
FS	28.90	39.3-18.6	39.3	46.5-32.1	13.4	23.2-3.5	10.7	21.4-0.0	7.6	11.6-3.5	0.0	0.0-0.0
Overall	45.17	78.9-17.3	26.1	55.0-10.5	11.5	56.5-0.0	8.6	32.50-0.00	6.8	33.0-0.0	1.3	15.0-0.0
% of papers having for components	0	0			23.3		40.0		36.6		80	

advanced stages of the program should focus higher cognitive level questions. Such a trend could also not be seen.

The highest percentage of knowledge, understanding, applications, analysis, evaluation and creative level questions appeared in the question papers of the Department of Animal Science, Food Science, Agric Engineering, Crop Science, Economic and those came as common course, respectively (Table 2). Meanwhile, the lowest percentage of knowledge, understanding, applications and analysis questions appeared in the question papers of the Department of Food Science, Animal Science, Crop Science and course came as coming courses. The question papers of the Department of Food Science and technology and the Department of Agric Engineering had no creativity level questions at all.

It was concluded that attention should be paid in setting the question papers to test higher order of cognitive levels.

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