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COMPARISON OF WRITTEN ASSESSMENT TOOLS OF BUSINESS MATHEMATICS IN THE FACULTY OF BUSINESS ADMINISTRATION BASED ON BLOOM'S TAXONOMY

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Abstract

The teaching learning is a continuous process by which the educators involving in this field are working to change the behavior of the students as the required human resources for the welfare of the society. Bloom's Taxonomy is the most important and widely used process that helps the educators to provide the students equipped with knowledge perfectly in the different domains of the learning skills as suggested by Benjamin Bloom. To assess the learning skills written test is the very important tools that are applying on the students from the beginning of the formal education. In this paper an attempt has been taken to evaluate the allocation pattern of the marks of the course Business Mathematics of the three departments Accounting and Information System, Management and Finance & Banking under business faculty according to the components of Bloom's Taxonomy. It is observed that there is a significant difference of the allocations of marks among the selected the three departments regarding the cognitive domain of the B.T. But no significant difference has been found in the allocation pattern of marks throughout the academic years under review. The marks allocation in LOCQ, IOCQ and HOCQ are found to be 43 percent 52 percent and 5 percent respectively which are not suited with the recommended marks allocation according to the recognized system. The suggestions and recommendation have been given to allocate the marks to prepare the written questions papers according to the cognitive domains of Bloom's Taxonomy

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1. Introduction

Educators involving in teaching learning operations have been being assessed the progress of the learners in different procedures from the beginning of formal education. Throughout the period of a certain academic program it is required to assess, to evaluate, to measure the learning progress, acquisition of skills, documentations of academic readiness and fitness of each of the learner to have a clear idea of acquired knowledge about the specific courses allotted. The set of procedures that helps to make clear idea about the academic achievement consists of different types of test, assessment, examination, evaluation, measurement is used frequently on the students changed behavior. Written examination is the most important tools to measure the changed behavior of the students with quantified scores by which the evaluations of achievement are to be done clearly for the individual depth of knowledge.

The depth of the knowledge of a student in a course is evaluated through using various types of procedures among which application of written test examination is a very important technique where questions paper is only the element to assess the students in quantitative manner of the acquired knowledge. How well the depth of the knowledge of a student is achieved depends on the students' performance in answer script of examination based on the questions paper quantifies in scores weight in a specific subject.

Since the question is the main parameter to measure the depth of the knowledge of a student, it is required to examine how well and standardly the questions paper has been prepared for a specific course to achieve educational goal and development. To attain at the target of the educational objectives and continuous advancement of education, the Bloom's Taxonomy has yet been used widely by the educators involving in teaching learning activities since it is created by Benjamin Bloom in the year 1956(Anderson, 2005). According to the Bloom's Taxonomy there are three Domains for learning namely cognitive domains, affective domain and psychomotor domain. Among which cognitive domain is completely on the basis of mental skills that are conventionally measured by the question papers used in the written examination. Under cognitive domain there are six parameters suggested as **Remembering, Understanding, Applying, Analyzing, Evaluating and creating** to have a standard questions paper to evaluate the student's mental skills in a specific subject with scores. In the Faculty of Business Administration of Islamic University, Kushtia, total marks allotted to a course with seven sets of different questions each of which containing 14with a grand total of 98 marks is allotted to consider the students with written examination by questions paper. Furthermore, 30 marks are allotted to evaluate the students known as internal evaluation completely based on the **Creating** parameter and some limitation to collect the scores in this concern is not considered to include in the analysis.

2. Statement of the Problems

Bloom's Taxonomy has proved its superiority and effectiveness over other methods after it was verified widely and successfully in the assessment of students learning performance of different domains of learning skills. A written test examination is conventional process to evaluate the achievement of the learning skills of knowledge for a certain program by the values of individual scores achieved. The questions paper is the main instrument of assessing the skills of knowledge of the students. The assessed scores do not indicate the uniform learning skills of the students because of the unstandardized test setting. It is proved that following the components of Bloom's

Taxonomy, the prepared questions paper will be the standard in evaluating the skills of knowledge of the students uniformly. In this regards the researchers have tried to explore variation of written test examinations to examine the question paper of Business Mathematics taking the study period (2011-2016) of three departments at Business Faculty under the Islamic University, Kushtia, Bangladesh.

3. Objective of the Study

To assess the written tests of the three departments of business faculty of the Islamic University, Kushtia, Bangladesh an attempt has been taken to complete the following specific objectives of the study:
1) To overview the concepts of Bloom's Taxonomy.
2) To make a comparison of tests of Business Mathematics on the basis of the components cognitive domain of Bloom's Taxonomy for the selected sample departments during the study period.
3) To identify the variations of the selected tests of the sample departments during the study period
4) To recommend suggestions for the improvement of the tests.

4. Hypothesis of the Study

The following hypotheses have been tested in the study:
H_0: There is no significant difference regarding each of the parameters of cognitive domain of Bloom's Taxonomy compare to the three departments as well as selected academic year under review.

5. Review of Related Literature

Nayef et al. (2013) Focus on an essential study entitle **"Taxonomies of Educational Objective Domain."** The author's studies in this paper taxonomy are used as a tool of educational objectives analysis, so that the studies have been done on Bloom's Taxonomy, Loran Andersons Taxonomy and Wilsons Taxonomy. After this study the writers make a comparison among these three taxonomies then the authors finding that the Bloom's Taxonomy is more suitable as a tool of analyzing educational objective domains.

Nancy (2015) expressed an idea entitled **"Bloom's taxonomy of cognitive learning objectives."** They mainly focused on how the cognitive domain of blooms taxonomy used for evaluating of learning objective and the authors viewed that those who are teach, instruct and train other in information professionals, They can use Bloom's taxonomy to write learning objectives that describe the skills and abilities that they desire from their learners to master and express.

Heather et al. (2014) highlight in the study **"Improving Outcomes with Bloom's Taxonomy: From Statistics Education to Research Partnerships."** The authors mainly focused on this paper improving learning outcome with the help of Bloom's Taxonomy in many statistics courses so that it could be contribute to the research partnerships or in research. To achieve this objective the researchers inquired that in recent year many statistical courses have been updated or restructured

to emphasis on concept and application so that students would be improve to prepared consumers and producers of statistical information and at the same time authors shift their attention on the gap which are still existing between students and instructor expectation, its means that the students what are able to actually to do after completing the courses.

Seyyed et al. (2016) wrote an article on **"A Critical Appraisal of Bloom's Taxonomy."** In this paper the researcher thoroughly look in to the both Original Bloom's Taxonomy and Revised Bloom's Taxonomy which has been utilized since in 1956 and revised in 2001 sequentially. Under this study the authors at the very beginning explaining about the Original Bloom's Taxonomy and Revised Bloom's Taxonomy, Then its explaining about the criticism about both Original Bloom's Taxonomy and Revised Bloom's Taxonomy and also discuss about the limitation and weakness of originals Taxonomies and how its overcome through revised Bloom's Taxonomy. Finally several implication are proposed for whom those who are interested to or tend to apply Bloom's taxonomy for their investigation and evaluation.

Anderson (2005) wrote an important article on "Objectives Evaluation, and the Improvement of Education." In this paper the authors has taken an attempt to show how the eight educators in Syracuse NY applied BT in the better assessment of the students learning skills. It is known from the paper that for the five years from 1995-2000 these eight educators meet twice annually to share their experiences for the better applications of B.T. regarding a suitable table known as taxonomy table with the combination of the demonstration of knowledge and the verb forms regarding remembering, understanding, applying, evaluating and creating.

Sivarman and Krishna (September 2015) conducted a study entitiled "Blooms Taxonomy-Applications in Exam Papers Assesment." In this paper the authors has taken an attempt to assess the examination papers on the basis of Bloom's Taxonomy and provide suggestion to set objectives of the learning outcomes according to cognitive domain of Bloom's Taxonomy for the different program of the selected institutions. The authors also identify the examination papers under three categories i.e. LO, IO and HO according to the applications of the cognitive domain of Bloom's Taxonomy.

Singun (November 3rd, 4th 2016) create an important works entitiled "Application-Based Test Bluprint For A Sammatative Classroom Assessment." In this paper a test blueprint has been prepared on the basis of cognitive domain of Bloom's Taxonomy.

This blueprint is a guideline for both of the summative classroom tests and precursor of the written test examinations.

Ghazali et. al (2011) wrote an valuable paper entitled **"**Allocation Marks Model for Examination Based on Bloom"s Taxonomy." In this paper the authors have taken an attempt to fit models to prepare the examination papers on the basis of cognitive domain of Bloom's Taxonomy for the course of engineering mathematics. They also provide suggestions to identify the HOT and LOT questions according to the cognitive domain of Bloom's Taxonomy.

It is observed from above literature review that there are no works on the basis of comparison of written assessment tools based on Bloom's Taxonomy with an empirical analysis. So the work has

been under with the topic "Comparison of Written Assessment Tools of Business Mathematics in the Faculty of Business Administration Based on Bloom's Taxonomy". This study will be helpful for the policy makers and researchers of education sector.

6. Concept of the Related Terms

Assessment
Assessment is what we do in order to identify strengths and weaknesses within a program. This is conducted by using student assignments to tell us if we are upholding our promise to develop the knowledge and skills we promised the students the program would deliver (California State University, 2016).

In education, the term **assessment** refers to the wide variety of methods or tools that educators use to evaluate, measure, and document the academic readiness, learning progress, skill acquisition, or educational needs of students (The glossary of education reform, 2015).

Assessment involves the use of empirical data on student learning to refine programs and improve student teaching (Allen, 2004). Assessment is the process of gathering and discussing information from multiple and diverse sources in order to develop a deep understanding of what students know, understand, and can do with their knowledge as a result of their educational experiences; the process culminates when assessment results are used to improve subsequent learning (Huba & Freed, 2000).

Assessment is the systematic basis for making inferences about the learning and development of students. It is the process of defining, selecting, designing, collecting, analyzing, interpreting, and using information to increase students' learning and development (Erwin.T.D, 1991).

7. Components Cognitive Domain

The features of cognitive domain of Bloom Taxonomy are furnished as below:

Components	Definitions	Key words
Remembering	Remembering define the ability to recall, restate, and remember learned information. **Invalid source specified.** Its means that the ability of the student to recall or remember information. **Invalid source specified.** According to The Peak Performance Center remembering mainly focus on the Retrieving, recognizing, and recalling relevant knowledge from long-term memory. This level is simply remembering or recalling previous learned information. (The Peak Performance Center, 2013)	Retrieving, Recognizing, Recalling Restate, Remember
Understanding	It's expressed that the ability to grasp the meaning of information by interpreting and	Interpreting, translating, Illustrating, Categorizing,

	translating what has been learned. **Invalid source specified.** It's expressed that the ability to explain ideas or concepts. **Invalid source specified.** The Peak Performance Center define the Understanding is from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining. This is essentially demonstrating understanding of information by explaining ideas or concepts. (The Peak Performance Center, 2013)	Summarizing, Inferring, Comparing and explain ideas or concepts
Applying	Applying means that the ability to make use of information in a context different from that in which it was learned. **Invalid source specified.** Applying means that the ability to use information in a new way. **Invalid source specified.** From the view point of The Peak Performance Center Applying constructing a procedure through executing, or implementing. Mainly, this is using the information in another familiar situation. (The Peak Performance Center, 2013)	Executing, Integrating, and implementing or Application,
Analyzing	Its means that the ability to break learned information into parts to understand said information. **Invalid source specified.** Its means that the ability to distinguish between the different parts. **Invalid source specified.** According to The Peak Performance Center Analyzing means it's Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing. (The Peak Performance Center, 2013)	Disintegrating, *Realizing or Perceiving, Organizing, Charactering and* Attributing
Evaluating	Evaluating means that the ability to make decisions based on in-depth reflections, criticisms, and assessments. **Invalid source specified.** Its focus that the ability to justify a stand or decision. **Invalid source specified.** The Peak Performance Center define the Evaluating is Making judgments based on criteria and standards through checking and critiquing and also it's includes justifying a	Examine or Checking, Investigating, criticisms, Justifying and Decision

	decision or course of action. (The Peak Performance Center, 2013)	
Creating	Its focus on the ability to create new ideas and information using what was previously learned. Invalid source specified. Creating define the ability to create new products or points of view. Invalid source specified. Creating define by The Peak Performance Center Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. This includes generating new ideas, products, or ways of viewing things. (The Peak Performance Center, 2013)	Originating idea, Planning Idea, and Producing new Idea

Sources: Compiled from Different Works as Cited above.

Order of Thinking: The order of thinking skills of knowledge according to cognitive domains of Bloom Taxonomy is of two types of which higher order thinking and lower order thinking.The lower order thinking (LOT) covers the skills in knowledge under the components Remembering and Understanding while higher order thinking (HOT) incudes Applying, Analyzing, Evaluating and Creating (Singun, 2016)

Order of Cognitive Questions: Lower Order Cognitive Questions (LOCQ) covers the questions for testing the Remembering and Understanding concepts of the students with percentage of marks for distribution recommended (20-30) percent. Intermediate Order Cognitive Questions (LOCQ) includes the questions for testing the Applying and Analyzing skills of students with recommended marks (40%-50%) of allocations. Higher Order Cognitive Questions (HOCQ) consists of the questions for testing the evaluating and creating abilities of students with recommended marks (30%-40%) percent of sharing (Sivarman & Krishna, 2015)

8. Research Methodology

The Researchers has selected three departments out of six from the Business Faculty of Islamic University, Kushtia on the basis of purposive sampling those are (i) Accounting and Information System (ii) Management and (iii) Finance & Banking. The study is covered with the period of six years from the year 2011 to 2016.

This study is based on secondary data which are obtained from allotted marks in each of the parameters of cognitive domain of Bloom's Taxonomy for each set of questions paper. Moreover, the journals, articles, reports and surveys have been discussed for the better understanding to conduct the study.

9. Analysis and Interpretation

Table 1: Comparative Measurements of Tests of Sample Departments Based on the components
of Blooms Taxonomy

Year	Remembering			Understanding			Applying			Analyzing			Evaluating		
	F&B	Mgt.	AIS	F&B	Mgt.	AIS	F&B	Mgt.	AIS	F&B	Mgt.	AIS	F&B	Mgt.	AIS
2011	10	20	31	30	26	17	31	34	33	22	16	10	4	3	7
2012	21	12	14	27	27	26	30	33	38	17	21	14	3	5	5
2013	9	17	9	26	26	26	31	35	43	24	16	14	7	4	7
2014	13	20	26	27	21	21	35	40	34	17	14	10	6	3	7
2015	10	20	21	31	21	20	38	38	39	16	16	13	3	4	5
2016	14	18	17	29	25	25	32	37	38	16	16	10	7	3	8
Mean	13	18	20	28	24	23	33	36	38	19	17	12	5	4	7
Min.	9	12	9	26	21	17	30	33	33	16	14	10	3	3	5
Max.	21	20	31	31	27	26	38	40	43	24	21	14	7	5	8
S.D	4	3	8	2	3	4	3	3	4	3	2	2	2	1	1
C.V	35	18	41	7	11	17	9	7	10	18	14	17	38	22	19

Source: Compiled the average scores from the written tests questions paperof the sample departments.

The Table 1 shows the allocations of scores in various aspects under the different components of the cognitive domains of Blooms Taxonomy for the selected department during the period of the study. The allocated scores vary from minimum to maximum by (9-21), (12-20) and (9-31) respectively of the three department F&B, Mgt., and AIS regarding the component **Remembering** of Blooms Taxonomy within the sleeted academic years. Similarly, the variations {(26-31), (21-27) and (17-26)} for **Understanding; {**(30-38), (33-40) and (33-43)} for **Appling; {**(16-24), (14-21) and (10-14)} for **Analyzing and {**(3-7) (3-5) and (5-8)} for **Evaluating** have been found for the three selected departments F&B, Mgt., and AIS respectively. The average scores for the departments F&B, Mgt., and AIS are found be {13, 18 and 20}; {28, 24 and23}; {33,36 and38}; {19, 17 and12} and {5, 4 and7} respectively regarding the components Remembering, Understanding, Applying, Analyzing and Evaluating. The lowest and better coefficient of variations is shown Mgt. under the components **remembering** (18), Appling **(7) and Analyzing (14)** having the more consistent among the selected departments in this regards. In the case of **Understanding (7)** and **evaluating** (19) the better and coefficient of variations is found to be in the departments F&B, and AIS respectively.

The comparisons of the average scores of selected three departments allocate under the different components of Blooms Taxonomy have been depicted in the following Bar-Diagram:
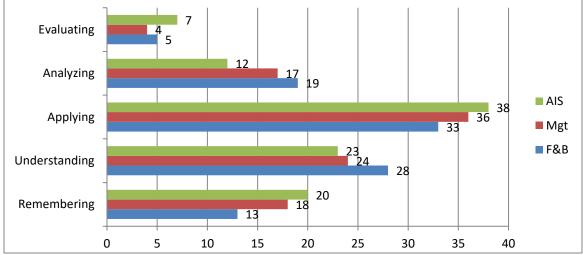
Chart 2: Bar Chart of Allotted Test Scores for the Sample Departments
Source: Table No.1, a comparison of average scores.

The comparisons of the average scores of selected three departments allocate under the different components of Blooms Taxonomy have been shown clearly in the multiple bar-chart No.2. Each of the departments allocate the highest average scores under components **applying** by the value of 33 (F&B), 36(Mgt.) and (38) AIS whereas the lowest allocations have been made in case of the factor **evaluating** for the same departments by 5, 4 and 7 respectively. The comparisons for the rest of the components are done similarly as shown in the figure:

Table 3: Measurements Allotted Test Scores Based on Cognitive Orders of the Sample Departments

Selected Academic Years	Percentage of scores allotted on cognitive orders		
	LOCQ (%)	IOCQ (%)	HOCQ (%)
2011	46	50	5
2012	43	52	4
2013	38	55	6
2014	44	51	5
2015	42	54	4
2016	43	51	6
Average (%)	43	52	5
Recommended (%)	20-30	40-50	30-40

Source: Compiled the Average Scores from the Written Tests Questions Paper of the Sample

Departments, LOCQ=Lower Order Cognitive Questions, IOCQ= Intermediate Order Cognitive

Questions, HOCQ=Higher Order Cognitive Questions.

This table shows the measures of the allotments of marks of the selected courses combined of three departments during the study period based on cognitive domain of Blooms Taxonomy. Written questions are required to classify three types of orders as LOCQ (Lower order cognitive questions), IOCQ (Intermediate order cognitive questions) and HOCQ (Higher order cognitive questions) with a specified percentage of marks in each order. It is noted that the average percentage of allocations of marks are 43 percent, 52 percent and 5 percent for LOCQ, IOCQ and HOCQ respectively which is not suited with the recommended percentage ranges (20-30), (40-50) and (30-40) in that order.

Table 4: ANOVA: Two-Factor without Replication

ANOVA: Regarding the Factor Remembering						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Selected academic Years	145.78	5	29.16	0.90	0.52	3.33
Selected Departments	150.11	2	75.06	2.31	0.15	4.10
Error	325.22	10	32.52			
Total	621.11	17				
ANOVA: Regarding the Factor Understanding						
Source of Variation	**SS**	**df**	**MS**	**F**	**P-value**	**F crit**
Selected academic Years	32.94	5	6.59	0.72	0.62	3.33
Selected Departments	106.78	2	53.39	5.85	0.02	4.10
Error	91.22	10	9.12			
Total	230.94	17				
ANOVA: Regarding the Applying						
Source of Variation	**SS**	**Df**	**MS**	**F**	**P-value**	**F crit**
Selected academic Years	62.50	5	12.50	1.48	0.28	3.33
Selected Departments	69.33	2	34.67	4.11	0.05	4.10
Error	84.67	10	8.47			
Total	216.50	17				
ANOVA: Regarding the Factor Analysing						
Source of Variation	**SS**	**Df**	**MS**	**F**	**P-value**	**F crit**
Selected academic Years	46.67	5	9.33	1.53	0.26	3.33
Selected Departments	146.33	2	73.17	11.99	0.00	4.10
Error	61.00	10	6.10			
Total	254.00	17				
ANOVA: Regarding the Factor Evaluating						
Source of Variation	**SS**	**Df**	**MS**	**F**	**P-value**	**F crit**
Selected academic Years	10.94	5	2.19	1.22	0.37	3.33
Selected Departments	24.11	2	12.06	6.74	0.01	4.10
Error	17.89	10	1.79			
Total	52.94	17				

Source: Table 1, Computed Using Microsoft Data Analysis Technique.

Table 4 measures the difference among the three departments regarding the components of Bloom's Taxonomy the under review period. It is found from ANOVA-two-factor without replication test, calculated value of F by source of variation in academic years, the calculated F statistics of Remembering, Understanding, Applying, Analyzing and Evaluating are found to be 0.90, 0.72, 1.48, 1.52 and 1.22 respectively with critical value each of F is 3.33. So, the null hypothesis is accepted for all of academic years included in the study. Thus we conclude that there is no significant difference among the departments regarding different academic years based on the cognitive domains of Bloom's Taxonomy. On the other hand the calculated value of F is greater than critical value of F in all cases source of variations except the factor **remembering** of the three departments and thus we reject the null hypothesis.

10. Conclusion

It is clear from the analysis and interpretation that the written question papers those are applied to assess the learning skills of the students of the business faculty are not prepared by following the cognitive domains properly of Bloom's Taxonomy during the review period. It is found that no change have been made throughout the selected academic year to allocate marks by each of the selected department but a significant different has been found among the department thus the authority should take necessary steps to follow principles of Bloom's Taxonomy for the preparation of the written test questions papers.

11. Suggestions and Recommendations

On the basis of analyses, interpretations and observations, the following suggestions and recommendations are provided to prepare a better written test questions paper to assess the skills of the students in acquired knowledge of the cognitive domain uniformly:

1) To have a clear idea of Bloom's Taxonomy for the faculty teachers, the authority should take necessary actions.
2) The applications of the principles of Bloom's Taxonomy should cover the learning outcomes of the courses of business mathematics.
3) The teachers should follow the codes of Bloom's Taxonomy both in the classroom teaching learning and in preparing the written questions papers of business mathematics.
4) It should be maintained the ratio of higher order thinking questions and lower order thinking questions and preference should be given to select the more in higher order thinking in the course of business mathematics.
5) Peer questions setters should be nominated based on skilled and experienced regarding the specific courses oriented.
6) The moderation activities to select the final questions papers must be done by the group of teachers of combinations of knowledge in each of the courses.

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