

Analysis of Domain Addressed and Subdivisions of Anatomy Emphasized in Spotting Stations in Anatomy Part of First Professional MBBS Examination

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DOI: <https://doi.org/10.3329/jafmc.v19i1.70289>

Abstract

Introduction: Assessment of any educational program should implement purpose of the learning objectives. Learning objectives are prepared with the help of several models such as SOLO (Structure of Observed Learning Outcomes) taxonomy, Bloom's Taxonomy etc. The most commonly used classification system is "Bloom's taxonomy to develop learning objectives" which describes the domains of educational objectives and divides the domains into three categories a) cognitive domain b) psychomotor domain c) affective domain.

Objectives: To observe the domains of the questions of soft part portion of Spotting stations to fulfill the learning objectives set by the curriculum in Anatomy professional examination in the background of Bloom's Taxonomy. The research also tries to find out the subdivisions of Anatomy preferred more and regions of Gross Anatomy more emphasized in soft part portion of Spotting stations.

Methods: This cross sectional study held in the department of Anatomy in Armed Forces Medical College (AFMC) from August 2015 to December 2018. Data (questions of soft part portion of Spotting stations and 'answer key's) are collected from seven different medical colleges affiliated under Dhaka University. A total fifty-two day's questions with 'answer key's are taken for the study from the first professional examination held on May 2013 and May 2014. For the purpose of the study each question is divided into 'Item', 'Part's and 'Segment's. Moreover verbs of the segments are then analyzed in the form of 'statement', 'list' and 'single name' and Anatomy is subdivided into Gross Anatomy, Histology and Developmental Anatomy.

Results: A total 774 items, 1571 parts, 2048 segments are analyzed. The verbs used to address the levels of cognitive domain in the questions reveals that 'identification' is mostly (76.62%) used in supplied figure followed by radiology (52.05%) model (41.89%) viscera (38.82%) and dissection (24.95%) stations. Statement' mostly used as verb by dissection (37.28%) and minimum in supplied

figure (11.6%) stations. Similarly 'list' is mostly used in viscera (23.14%) and 'single name' is mostly used verb in dissection stations. Maximum (89.2%, 92.47%, 90.54% and 81.82%) questions are asked from Gross Anatomy subdivision in viscera, radiology, model and in supplied figure stations respectively. In case of viscera stations about one third (34.62%) and one fourth (25.62%) questions are from the abdomen proper and thorax respectively and around 10.54% questions cover pelvis, head neck 12.34% and brain 16.88%. Nearly half (46%) of the figure station use supplied figures as a 'tool'. Maximum (39%) figures are used from brain where supplied figures are used as a 'tool' and no figure used from lower limb. When instructed to 'draw and label', 50% are from region of brain and less than 20% from other regions.

Conclusion: From the findings it can be easily perceived that though Spotting examination is part of practical examination but in our country but it mainly involves in assessing factual knowledge of Anatomy which can hardly meet the demand of the objectives set by the curriculum.

Key words: Anatomy, Spotting, Structure of Observed Learning Outcomes (SOLO) taxonomy, Bloom's taxonomy, Cognitive domain, Psychomotor domain, Affective domain.

Introduction

A new curriculum¹ was introduced 2002 in Bangladesh for undergraduate MBBS course where Anatomy was kept as a separate discipline, like a traditional curriculum². Like other subjects of the curriculum Anatomy as a subject formulates departmental objectives, course contents for different subdivisions of the subject and selects approaches to be taken in teaching and assessment system so that the graduates can obtain the required competencies to cater the ongoing health needs of Bangladesh¹.

Objectives set for Anatomy in the curriculum¹ are as follows: students after end of the course not only have to equip themselves with adequate knowledge for understanding

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the structural components of the body also have to use the knowledge to understand and appreciate other subjects taught in the pre-clinical, para-clinical and clinical courses and also use the knowledge to understand the basis of common clinical conditions.¹

All components of assessment system of a curriculum should be in line with that of the objectives.⁵ This is true for Spotting examination usually held before oral examination in soft part portion of summative (professional) examination in Anatomy as recommended in the module.⁶ The module also specify the 'tool's to be used in soft-part Spotting examination as follows: eight viscera, four bodies, one model, one x-ray plate and one figure station where the examiners have to select an 'understanding type' figure to be drawn by the students.⁶ At each station students are asked to identify a structure with relevant question/questions on that structure which follow the format of any traditional curriculum in Anatomy Spotting examination.^{6,16} The objective of this research is to observe the addressed domains of the questions of Spotting stations to meet the demand of the objectives set by the curriculum.¹

Learning objectives of any educational program are prepared following several models such as SOLO (Structure of Observed Learning Outcomes) taxonomy, Bloom's Taxonomy^{3,4} etc. The most commonly used classification system is Bloom's taxonomy which describes the domains of educational objectives and divides the domains into three categories a) cognitive domain b) psychomotor domain c) affective domain. Each three broad domains are further classified into a hierarchical pattern known as 'level's.⁴ Bloom's taxonomy subcategories the cognitive domain into following six levels: knowledge, comprehension, application, analysis, synthesis and evaluation.⁴

The preliminary levels in cognitive domain are simple knowledge acquisition and utilization of memory which lead to understanding and comprehension of the meaning of newly acquired information.⁴ Next level is application of gained new knowledge. Higher levels require increasingly more complex mental processes include analysis, synthesis and evaluation.⁴

Psychomotor domain is demonstrated by physical skills.⁴ Affective learning is demonstrated by behaviors that indicate attitude of awareness, interest, attention, concern, responsibility and ability to listen and respond during interactions with others.⁴

Aim of this study is to observe the domain addressed in the Spotting stations to have an insight whether the students are able to apply their gained Anatomy knowledge in other subjects of pre-clinical, para-clinical

and clinical courses as well as in common clinical conditions as narrated in the curriculum.¹ Other aims of the study are to find out the subdivisions of Anatomy are more encountered and the regions of Gross Anatomy are more highlighted in this part of practical examination.

Materials and Methods

This cross sectional study held in the department of Anatomy in AFMC from August 2015 to December 2018. Spotting questions with 'answer key's of soft part portion of Anatomy are collected from seven different medical colleges reside in Dhaka and are affiliated under Dhaka University. Present researcher explains the research procedure to the head of the departments of Anatomy of the respective medical colleges and after taking their permission the research materials (questions with 'answer key's of the Spotting stations of first professional examination held in May 2013 and May 2014) are collected from the department. If any station has no 'answer key' that question is discarded from the research. A total fifty two day's questions with 'answer key's are analyzed for the study.

Collected 'Question's with 'answer key's have following format as per module⁶:

Question: "Identify the tied structure. Write its nerve supply and action."
Answer key: Deltoid, nerve supply and action

Figure-1: Format of question

For the purpose of study, the whole question of the Spotting station is termed as an 'item' and in the figure is indicted by two bold sentences. Every individual sentence in italic is termed as a 'part' and each component of a part that deals an issue which is underlined in the figure is regarded as individual "segment".⁷ In figure station supplied figure is also analyzed by above-mentioned method. But if in the figure station students are instructed to draw and label any structure-the whole question is considered as having a *single 'item'*, a *single 'part'* and a *single 'segment'*.⁸

After carefully reading the collected 'question's and 'answer key's of Spotting stations, it is found that the 'answer key' of the identification (which is present in the first 'part' of the 'Item') of any issue is present, but 'answer key' of relevant question/questions (present in second 'part' of the 'item') are absent. To overcome the above-mentioned problems, present researcher analyzes the recommended books⁹⁻¹⁵ of the curriculum¹ carefully to find out the answer/answers. At the same time the researcher observes the form (identification of a structure, single name, list of structures, sentence/sentences) of answer/answers to have an insight about the recommended verbs that are used to assess the levels of cognitive domain

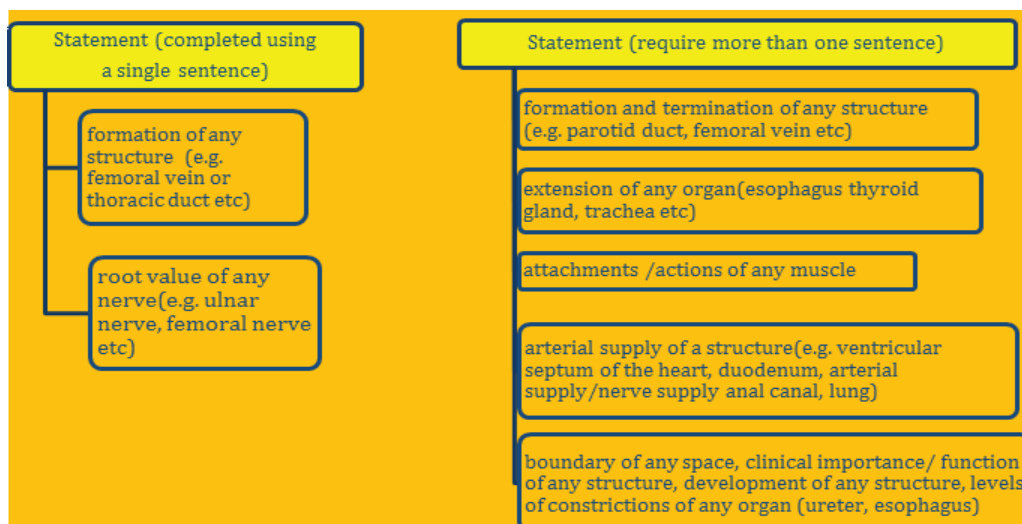
addressed in Spotting stations of soft part portion in Anatomy professional examination as per Bloom's taxonomy.⁴ Researcher also notices that the verbs used in the questions besides 'identification' are 'mention', 'give', 'write' but most of the time ask answer in the form of name of structure/structures (Figure-1: Deltoid) or answer in the form of sentence/sentences (Figure-1: Action of deltoid). For the purpose of the study if the question requires an answer in the name of a single structure is denoted as 'single name' and if the question needs names of multiple structures tagged as 'list'. Moreover, if the question demands answer/answers in the form of 'one sentence'/'more than one sentence'- is noted as 'statement'. It is noticed that 'Identification' most of the time calls for name of a single structure (Figure-1: Deltoid) but sometimes for multiple structures (List). Several examples 'single name', 'list' and 'statement' are given below:

Single name				
Artery supply of an organ (e.g. spleen, kidney etc)	Nerve supply of a muscle (e.g. deltoid, trapezius etc)	Types of an organ (e.g. pancreas, parotid gland etc)	Lining epithelium of an organ (e.g. trachea, duodenum etc)	Type of an artery/ a vein (e.g. abdominal aorta, femoral artery, inferior vena cava)

Flowchart-1: Some examples of single name

List				
Blood supply of an organ (artery supply and venous drainage)	Artery supply of an organ (e.g. stomach, midbrain),	Any relations of any organ/ or part of an organ (ureter, base of the urinary bladder, uterus, brainstem)	Formation of borders of a structure (radiological right/left border of the heart etc)	Contents of any structure (falx cerebri, the mesentery, interpeduncular fossa, middle ear cavity etc.)

Flowchart-2: Some examples of list



Flowchart-3: Some examples of statement

Besides above mentioned verbs of the Flowchart (1, 2 and 3), 'Draw and label' is another verb which is used in the figure stations and indicates a competency test of an examinee to draw and label a figure and regarded as 'skill' test but according to Bloom's taxonomy this verb cannot be categorized under any domain and any level by definition.⁴

For the purpose of the study Anatomy is again subdivided into Gross Anatomy, Histology and Developmental Anatomy.⁷ There are three main approaches in studying Gross (macroscopic) Anatomy: regional, systemic, and clinical (or applied).¹⁰ In our country mainly region-based approach is taken for studying Gross Anatomy and recommended textbooks contain regional description of different topics where relevant clinical procedures and relevant clinical conditions are also discussed briefly.^{9,10} On the other hand clinical anatomy books lay emphasis on the application of anatomical knowledge in clinical practice.¹¹⁻¹³ Recommended textbooks for other divisions of Anatomy (Histology, Developmental Anatomy) discussing general topics of the respective subjects initially then system-based approach are taken for other topics.^{13,14} This study also observes the subdivisions of Anatomy are more emphasized as well as the regions (under the subdivision Gross Anatomy) are addressed more in different Spotting stations in soft part portion of Anatomy professional examination.

Results

Table-I: Distributions of items, parts and segments of soft part Spotting questions in Anatomy professional examination

Stations	Items	Parts	Segments (n)
Viscera	450	939	1167
Dissection	194	398	558
Radiology	52	109	146
Model	30	60	74
Figure	Supplied figure	22	77
	Draw and label	26	26
Total	774	1571	2048

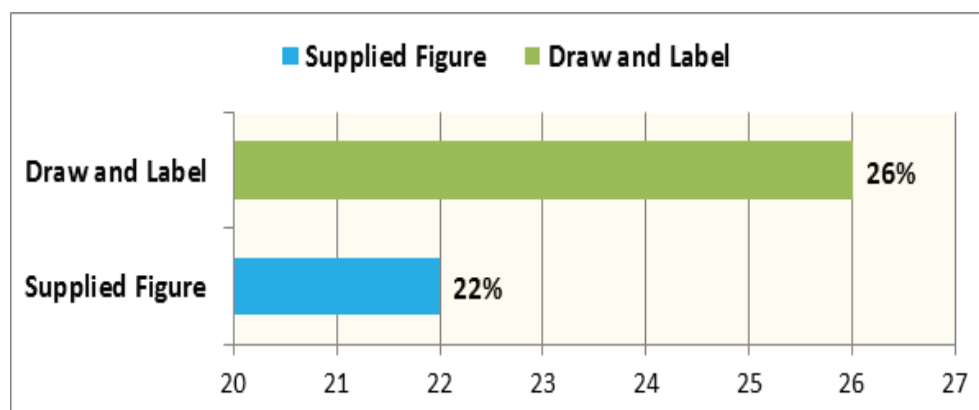


Figure-2: Percentage frequency distribution of the 'supplied figure' and instructed to 'draw and label' the figure in soft part portion of Spotting in Anatomy professional examination.

Table-II: Distributions of the verbs used to address the levels of cognitive domain in the questions of soft part-portion of different spotting stations in Anatomy professional examination

Stations	n	Verbs used to test cognitive domain				
		Identification	Statement	List	Single name	
Viscera	1167	453(38.82%)	262(22.45%)	270(23.14%)	182(15.60%)	
Dissection	558	195(24.95%)	208(37.28%)	53(9.50%)	102(18.28%)	
Radiology	146	76(52.05%)	18(12.33%)	27(18.49%)	25(17.12%)	
Model	74	31(41.89%)	20(27.03%)	13(17.57%)	10(13.51%)	
*Figure	Supplied figure	77	59(76.62%)	9(11.69%)	1(1.30%)	8(10.39%)
Total	2048	840	517	364	327	

n: Number of segments

*Only supplied figures are considered in this table although twenty six (26) figure stations instruct examinee to 'Draw and label' a figure. 'Draw and label' is a competency test to observe the drawing skill of the examinee but it is kept as a separate entity as this verb cannot be labeled under any domains of Bloom's taxonomy.

Table-III: Distribution of different subdivisions of Anatomy addressed in the questions of soft part portion of different Spotting stations in Anatomy professional examination

Stations	n	Subdivisions of Anatomy		
		Gross Anatomy	Histology	Developmental Anatomy
Viscera	1167	1041(89.20%)	80(6.86%)	46(3.94%)
Dissection	558	558(100%)	-	-
Radiology	146	135(92.47%)	11(7.53%)	-
Model	74	67(90.54%)	5(6.76%)	2(2.7%)
Figure	Supplied figure	77	63(81.82%)	14(18.18%)
	Draw and label	26	26(100%)	-
Total	2048	1890	110	48

n: Number of segments

Table-IV: Regional distribution of Gross Anatomy questions of in soft part portion of Spotting stations in Anatomy professional examination

Stations	n	Regions of Gross Anatomy						
		Thorax	Abdomen	Pelvis	Head & Neck	Brain	Upper limb	Lower limb
Viscera	1167	299(25.62%)	404(34.62%)	123(10.54%)	144(12.34%)	197(16.88%)	--	--
Dissection	558	6(1.08%)	6(1.08%)	--	58(10.4%)	--	205(36.7%)	283(50.7%)
Radiology	146	33(22.6%)	4(2.74%)	5(3.4%)	53(36.3%)	--	31(21.2%)	20(13.7%)
Model	74	--	--	--	36(48.65%)	38(51.35)	--	--
Figure	Supplied figure	77	14(18.2%)	12(15.6%)	9(11.7%)	8(10.4%)	30(39%)	4(5.2%)
	Draw and label	26	2(7.7%)	5(19.2%)	--	1(3.85%)	13(50%)	4(15.4%)
Total	2048	354	431	137	300	274	244	304

n: Number of segments

A total 774 items, 1571 parts, 2048 segments are analyzed. Table-I shows detailed of the items, parts, and segments of different Spotting stations in soft part portion of Anatomy professional examination. Table-II caters that 'identification' is the mostly (76.62%) used verb in supplied figure followed by about half (52.05%) in radiology, two fifth (41.89%) in model, nearly two fifth (38.82%) in viscera and one fourth (24.95%) in dissection stations. This table also depicted that 'statement' mostly used verb by dissection (37.28%) station followed by model (27.03%), viscera (22.45%), radiology (12.33%) respectively and minimum in supplied figure (11.6%) stations. Similarly 'list' is mostly used in viscera (23.14%) and 'single name' is mostly (18.28%) used as verb in dissection stations. All the verbs used in this table usually confined mainly to cognitive domain and address knowledge level of Bloom's taxonomy. Although both knowledge comprehensive level of cognitive domain use 'identification' as verb.

Figure-2 shows the 'type' of figure used in Spotting stations and it reveals that in nearly half (46%) of the stations use supplied figures as a 'tool'. Table-III discloses that maximum (89.2%, 92.47%, 90.54%, 81.82%) questions are from Gross Anatomy in viscera, radiology, model and in 'supplied figure' stations respectively. Same table also notices that less than 10% questions are from Histology and Developmental Anatomy in other stations except in supplied figure station where nearly one fifth (18.18%) questions are from Histology. It is also found that no questions from Developmental Anatomy in x-ray and supplied figure stations and all the questions are from Gross Anatomy in dissection stations.

Table-IV also figures out that in case of viscera stations about one third (34.62%) and one fourth (25.62%) questions are from abdomen proper and thorax respectively and less than 20% questions cover brain (16.88%), head neck (12.34%) and pelvis (10.54%) respectively. In dissection stations maximum (87%) questions covering limbs (lower limb 50.7%, upper limb 36.7%) and nearly 1% questions covers thorax and abdomen. Moreover in x-ray stations maximum (36.34%) questions are from head neck regions followed by thorax (22.6%), upper limb (21.23%), lower limb (13.7%) and less than 5% questions are from abdomen proper (2.74%) and pelvis (3.42%) regions respectively. All the questions are confined to head neck (48.65%) and brain (51.35%) regions in model stations. It is also noticed from the table that half (50%) of the figures are selected from brain and less than one fifth from other regions when students are instructed to 'draw and label' figure. The station using supplied figure as a 'tool' used to select maximum (39%) figures from brain and less than one fifth questions from other regions. No figures are selected from limb when supplied figure is used as a 'tool' and no figure is selected from pelvis region when instruction is given to 'draw and label' figure.

Discussion

Any educational program has a definite curriculum which is always kept under evaluation and is changed time to time according to the societal needs. MBBS curriculum¹ of Bangladesh also follow the similar process and as a subject of MBBS course, Anatomy also continuously evolved its teaching and assessment system to maintain the congruency of the ever changing MBBS course. Teaching as well as every component of assessment is time to time redesigned to meet the

change, hence number of 'tool's in Spotting stations and number breakdown is reorganized in the module⁶ of Anatomy for the approved curriculum of 2002.¹

Characteristic findings of this research are that Spotting stations (Table-II) inquire for 'identification' of the structure whose blood supply or nerve supply is asked for. It is also noted that questions of viscera stations mainly confined in abdomen proper and thorax regions and dissections are mainly on limbs (Table-III). Similarly x-ray and figures are emphasized on head-neck and brain as regions (Table-III). As a region head-neck and brain equally are emphasized in model station (Table-III). So except 'identification' other questions unable to assess the practical oriented knowledge of Anatomy.^{16,17} Not only that all above mentioned questions assess knowledge level of cognitive domain mainly and 'identification' covers both knowledge and comprehension levels of cognitive domain according to Bloom's taxonomy.⁴ This research also finds that the questions (e.g. asking about blood supply/nerve supply of a structure which are also assessed in written Anatomy professional examination) of Spotting stations (Table-II) in soft part may involved in repetition of questions hence may decrease the area of content coverage.

From above discussion it is manifested that although different types of 'tool's are used in soft part portion of Spotting stations in first professional examination but all are occupied in assessing factual information of different regions as well as different subdivisions of Anatomy and these knowledge level questions are least difficult⁵ and these type of questions encourage rote memorization which engaged students in superficial learning.⁴ So in their para-clinical and clinical part of the MBBS course students face difficulty to correlate¹⁷ gained anatomical knowledge in different clinical conditions. So objectives set by the MBBS curriculum¹ or objectives set by the department of Anatomy are not fulfilled by current practice of using Spotting stations in assessing anatomical knowledge as this format is unable to judge the practically applicable knowledge of Anatomy.

Format of Spotting stations can be changed in such a way that it can test practical aspects of Anatomy to meet the demands of the objectives set by the curriculum.¹ As for example, student can show a demonstration of palpating brachial artery in his/her own body which directly tests practical knowledge of Anatomy or student may asked for testing any muscle (e.g. biceps, latissimus dorsi, gluteus medius etc) testing a nerve (any cranial or spinal nerve) and can be regarded as a procedure station. In case of viscera station besides using individual viscera, figures of the recommended books⁹⁻¹⁵ can be used where single/multiple structures may be tagged for identification and relevant

practical questions can be formulated to test the anatomical knowledge from practical point of view as tested by Yaqinuddin.^{2,5}

In model station besides mere identification we can use dummy so that student can demonstrate anatomically applicable procedures (e.g. intramuscular injection, venesection, iv infusion, bronchoscopy or endoscopy) so the model station can be used as procedure station. In figure station there is instruction in the module⁶ that student will be engaged in drawing and labeling an 'understanding type' figure but no selection criteria is instructed in choosing the figure and no examples are given. Present researcher finds that most of the time a neuron, dermatome of palm/sole are given for drawing and labeling which does not match with the instruction ('understanding type' figure) of the module.⁶ Moreover in 46% cases supplied figure is used in the figure station which mainly calls for identification of different structures. In this regard present researcher feels that figure station should be used more judiciously so that practical knowledge of Anatomy can be tested by using figure and decision should be made whether drawing skill is necessary to be tested or not in spotting examination as it is already tested in written part of Anatomy professional examination. If figure station is continued as a separate station the module/manual should clarify following points: i. which subdivision of Anatomy to be addressed, ii. region of Anatomy to be selected iii. criteria of the figure to be used and if possible should provide a list of figures as example. Regarding subdivision and regional distribution of Anatomy manual/module should provide a clear cut instruction how both aspects of Anatomy will be distributed in the Spotting stations and the way to deal both the aspect in the spotting stations. Present module⁶ lacks the guideline about above-mentioned problems.

Conclusion

In summary from the findings it can easily understood that though Spotting examination is part of practical examination in professional examination in Anatomy but in our country it mainly involves in assessing factual knowledge of Anatomy which fails to meet the demand of the objectives of the curriculum as well as the objectives set by Anatomy department. So Spotting examination of soft part portion of the Anatomy examination should be redesigned and restructured in a way which will be able to test the practical knowledge of Anatomy in professional examination. Further study is needed involving more number of medical colleges all over the country whether their Spotting questions is able to test the practical knowledge of anatomy in professional examination. If the results are similar to this study then necessary changes may be incorporated in Spotting stations so that Spotting station can correctly assess practical knowledge of anatomy.

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