# TECNIA INSTITUTE OF ADVANCED STUDIES

## NAAC Accredited Grade 'A' Institute

### Internal Quality Assessment Cell
### IQAC

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### -: Improving Quality Structure:-
### (Bloom's Taxonomy Assessment)

For improving the structure and quality of assessment in various ICT programs following points need to be remembered:

1. In Indian ICT education system, written examinations play a major role in assessing the learning and awarding of grades to the student. Universities and colleges give highest weightage to the outcomes of the written examinations in overall grading. Questions raised in the examination/test papers play an important role in defining the level of learning the student is expected to achieve in the courses and hence in the program. Since assessment drives learning, the design of question papers needs to go beyond the mere test of memory recall. They also need to test higher-order abilities and skills.

2. Written examinations assess a very limited range of outcomes and cognitive levels. Particularly in the courses, where course outcomes (COs) cover a broad range of expectations, written examinations alone will not be sufficient to make valid judgments about student learning. A wide range of assessment methods (e.g., term papers, open-ended problem-solving assignments, course/lab project rubrics, portfolios etc.) need to be employed to ensure that assessment methods match with learning outcomes.

3. It is advisable to formulate assessment plans for each of the course in the program that brings clarity to the following:
   a) Alignment of assessment with learning outcome of the course
   b) Level of learning (cognitive) student is expected to achieve
   c) Assessment method to be adapted

The method to align examination questions/assessment to COs and hence POs was discussed in the section-1. The following sections discuss the application of Bloom's taxonomy framework to create the optimal structure of examination papers to test the different cognitive skills.

## 1. Bloom's Taxonomy for Assessment Design

Bloom's Taxonomy provides an important framework to not only design curriculum and teaching methodologies but also to design appropriate examination questions belonging to various cognitive levels. Bloom's Taxonomy of Educational Objectives developed in 1956 by Benjamin Bloom [6] was widely accepted by educators for curriculum design and assessment. In 2001, Anderson and Krathwohl modified Bloom's taxonomy [7] to make it relevant to the present-day requirements. It attempts to divide learning into three types of domains (cognitive, affective, and behavioral) and then defines the level of performance for each domain. Conscious efforts to map the curriculum and assessment to these levels can help the programs to aim for higher-level abilities which go beyond remembering or understanding, and require application, analysis, evaluation or creation.

Revised Bloom's taxonomy in the cognitive domain includes thinking, knowledge, and application of knowledge. It is a popular framework in ICT education to structure the assessment as it characterizes complexity and higher-order abilities. It identifies six levels of competencies within the cognitive domain (Fig. 2) which are appropriate for the purposes of ICT educators.
According to revised Bloom's taxonomy, the levels in the cognitive domain are as follows:

| Level | Descriptor | Level of attainment |
|---|---|---|
| 1 | Remembering | Recalling from the memory of the previously learned material |
| 2 | Understanding | Explaining ideas or concepts |
| 3 | Applying | Using the information in another familiar situation |
| 4 | Analysing | Breaking information into the part to explore understandings and relationships |
| 5 | Evaluating | Justifying a decision or course of action |
| 6 | Creating | Generating new ideas, products or new ways of viewing things |

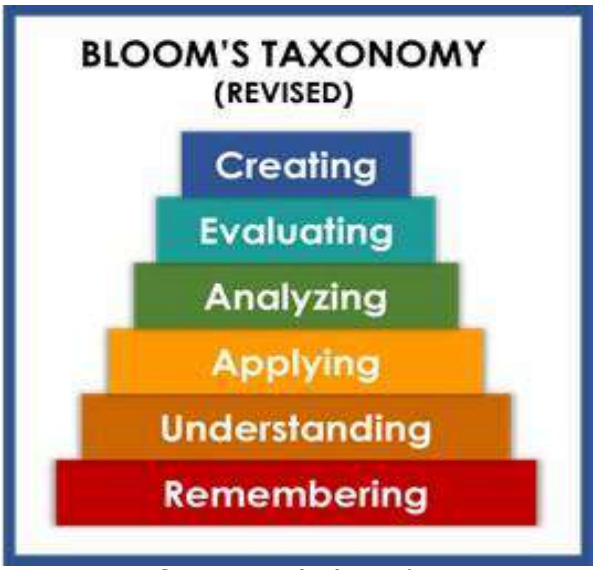

Fig. 2: Revised Bloom's Taxonomy

Bloom's taxonomy is hierarchical, meaning that learning at the higher level requires that skills at a lower level are attained.

## 2. Action Verbs for Assessment

Choice of action verbs in constructing assessment questions is important to consider. Quite often, the action verbs are indicators of the complexity (level) of the question. Over time, educators have come up with a taxonomy of measurable verbs corresponding to each of the Bloom's cognitive levels [8]. These verbs help us not only to describe and classify observable knowledge, skills and abilities but also to frame the examination or assignment questions that are appropriate to the level we are trying to assess.

Suggestive list of skills/ competencies to be demonstrated at each of the Bloom's level and corresponding cues/ verbs for the examination/ test questions is given below

| Level | Skill Demonstrated | Question cues / Verbs for tests |
|---|---|---|
| 1. Remember | • Ability to recall of information like facts, conventions, definitions, jargon, technical terms, classifications, categories, and criteria<br>• ability to recall methodology and procedures, abstractions, principles, and theories in the field<br>• knowledge of dates, events, places<br>• mastery of subject matter | list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where |
| 2. Understand | • understanding information<br>• grasp meaning<br>• translate knowledge into new context<br>• interpret facts, compare, contrast<br>• order, group, infer causes<br>• predict consequences | describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss |
| 3. Apply | • use information<br>• use methods, concepts, laws, theories in new situations<br>• solve problems using required skills or knowledge<br>• Demonstrating correct usage of a method or procedure | calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify |
| 4. Analyse | • break down a complex problem into parts<br>• Identify the relationships and interaction between the different parts of a complex problem<br>• identify the missing information, sometimes the redundant information and the contradictory information, if any | classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select |
| 5. Evaluate | • compare and discriminate between ideas<br>• assess value of theories, presentations<br>• make choices based on reasoned argument<br>• verify value of evidence<br>• recognize subjectivity<br>• use of definite criteria for judgments | assess, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate |
| 6. Create | • use old ideas to create new ones<br>• Combine parts to make (new) whole,<br>• generalize from given facts<br>• relate knowledge from several areas<br>• predict, draw conclusions | design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate |

It may be noted that some of the verbs in the above table are associated with multiple Bloom's Taxonomy levels. These verbs are actions that could apply to different activities. We need to keep in mind that it's the skill, action or activity we need students to demonstrate that will determine the contextual meaning of the verb used in the assessment question.

## 3. Assessment Planning

While using Bloom's taxonomy framework in planning and designing of assessment of student learning, following points need to be considered:

1. Normally the first three learning levels; remembering, understanding and applying and to some extent fourth level analysing are assessed in the Continuous Internal Evaluation (CIE) and Semester End

Examinations (SEE) where students are given a limited amount of time. And abilities; analysis, evaluation and creation can be assessed in extended course works or in a variety of student works like course projects, mini/ minor projects, internship experience and final year projects.

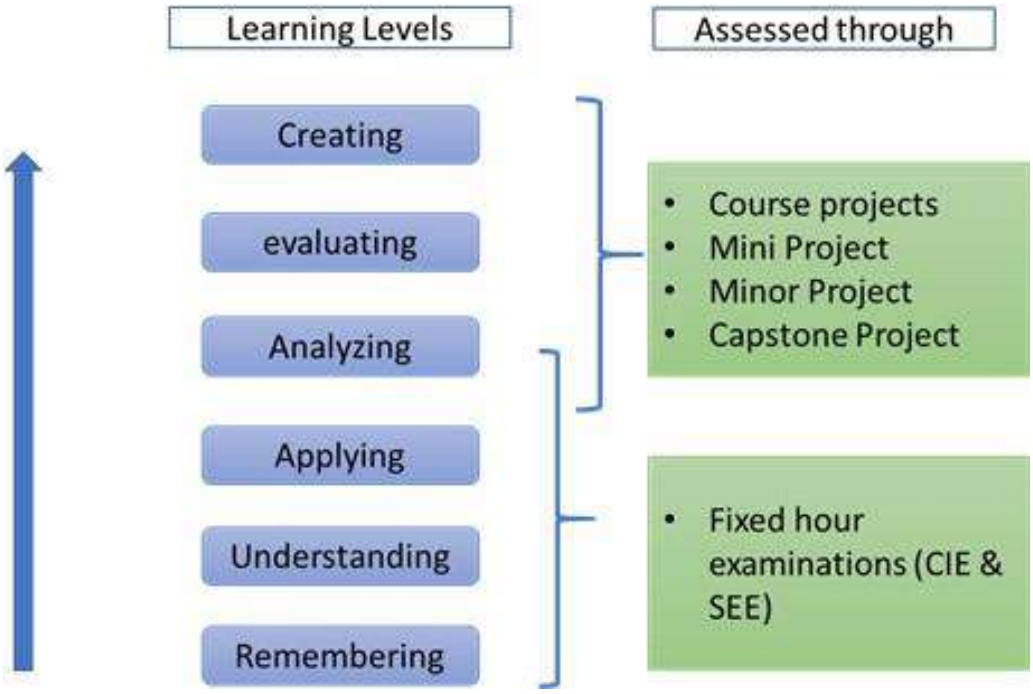


*Fig. 3: Assessment methods for different Bloom's cognitive levels*

2. Before adopting this framework for reforms in examination system of a University/Institution, it is worthwhile to study the present pattern of assessment in each of the course in the program to gain insight about:
   a) Alignment of assessment questions with course learning outcomes
   b) Whether all the learning outcomes are tested; sometimes some learning outcomes are over tested at the expense of others which may be not tested at all.
   c) Overall weightage in the assessment, to each of Bloom's learning levels
   d) Assessment methods used to adequately assess the content and desired learning outcomes

Based on the study, improvement priorities for each of the above factors need to be arrived at. The reform process needs to be well planned and implemented through institutional strategy and communicated to all stakeholders particularly to the students.

3. A good and reasonable examination paper must consist of various difficulty levels to accommodate the different capabilities of students. Bloom's taxonomy framework helps the faculty to set examination papers that are well balanced, testing the different cognitive skills without a tilt towards a tough or easy paper perception. If the present examination questions are more focused towards lower cognitive skills, conscious efforts need to be made to bring in application skills or higher cognitive skills in the assessment. It is recommended that at institution/ University level, upper limit need to be arrived for lower order skills (for example, no more than 40% weightage for knowledge-oriented questions). It is important to note that, as nature of every course is different, the weightage for different cognitive levels in the question papers can also vary from course to course.

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