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Bloom's taxonomy of cognitive learning objectives

Dr.U.Srineetha
Assistant professor in zoology, Govt.Degree College for Women, Pulivendla

Ummadisrineetha64200@gmail.com

Abstract-

This investigation intends to Bloom's Hierarchy of Cognitive Learning Goals is a widely recognized framework that categorizes educational objectives into progressive levels of thinking, ranging from simple recall of knowledge to complex processes such as analysis, evaluation, and creation. Information professionals engaged in training or instruction can utilize Bloom's taxonomy to formulate learning objectives that articulate the skills and competencies they wish their learners to acquire and exhibit. Bloom's taxonomy distinguishes among various levels of cognitive skills and emphasizes learning objectives that necessitate advanced cognitive abilities, thereby facilitating deeper learning and the application of knowledge and skills across a broader range of tasks and contexts. Finally, some implications are proposed for those who tend to apply Bloom's taxonomy in their investigations.

Keywords: Cognition, Classification, Teaching, Bloom's Taxonomy Learning Objectives

Introduction

Learning is an activity that is made to facilitate a systematic learning process and can be carried out with certain procedures to achieve the learning objectives that have been set.[1]

Bloom's taxonomy serves as a framework designed to classify the objectives of any curriculum based on both explicit and implicit cognitive skills and abilities. This taxonomy is considered one of the essential models that aid in curriculum development in the 21st century. In this context, a search engine yields over 817,000 results for the term "Bloom's taxonomy." Bloom's taxonomy endures and remains relevant over time. It has been expanded, detailed, and interpreted in numerous ways, and its scope has been elaborated upon. Consequently, as a result of research and inquiries into the original taxonomy, various comments and implementations that differ in certain aspects have emerged, ranging from drafting work to enhanced instructional methods. Despite these variations, only one revision is recognized.[1]

Education aims not only to transfer knowledge but also to develop higher levels of thinking and problem-solving skills. In this context, Bloom's Taxonomy of Cognitive Learning Goals, first developed by Benjamin Bloom and colleagues in 1956 and later revised in 2001, provides a structured framework for classifying educational objectives. The taxonomy divides cognitive learning into hierarchical levels, ranging from basic knowledge acquisition to complex processes such as evaluation and creation.

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At its foundation, Bloom's hierarchy emphasizes that learning progresses step by step—from remembering facts to applying, analyzing, and ultimately generating new ideas. Teachers, curriculum designers, and learners can use this model to set clear learning objectives, design effective instructional strategies, and assess outcomes more systematically(Fig:1).

By focusing on different levels of cognition, Bloom's taxonomy not only supports academic achievement but also promotes critical thinking, creativity, and lifelong learning. Would you like me to expand this into a detailed introduction with historical background and modern applications, or keep it short and academic?

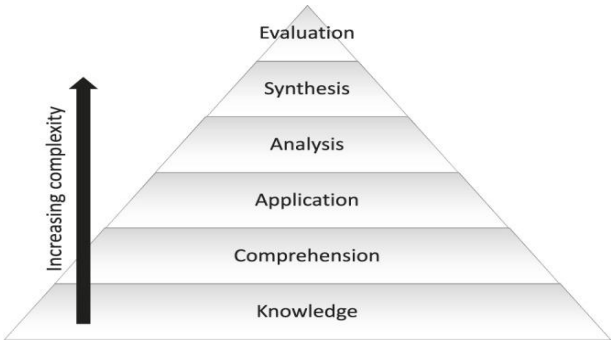

Fig: 1 Blooms taxonomy

1. Methodology

Literature Review (Secondary Research)

Purpose: To understand how Bloom's taxonomy has been applied in education and cognitive psychology.

Method: Collect and analyze peer-reviewed articles, books, and reports. Categorize how different levels of Bloom's taxonomy (Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation/Creation) are used in curriculum design, assessment, and pedagogy.

Tools: Databases like Google Scholar, JSTOR, and Scopus

2. Blooms revised taxonomy

Changes from Original Bloom's Taxonomy

Original (1956): Knowledge → Comprehension → Application → Analysis → Synthesis → Evaluation

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Revised (2001): Category names were changed to **verbs** (action-oriented).The order of the top two levels was switched (now *Create* is the highest, not *Evaluate*) (Fig:2)[2]

1. Taxonomy of Cognitive Objectives.2.1950s-developed by Benjamin Bloom.3.Means of expressing qualitatively different kinds of thinking.4.Been adapted for classroom use as a planning tool.5.Continues to be one of the most universally applied models.6.

Provides a way to organize thinking skills into six levels, from the most basic to the more complex levels of thinking.7.1990s-Lorin Anderson (former student of Bloom) revisited the taxonomy8.As a result, a number of changes were made[3]

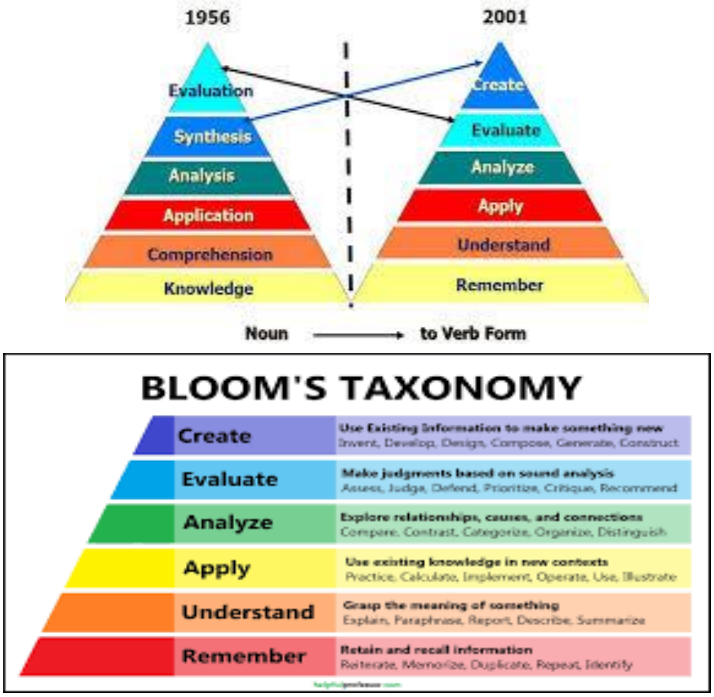

Fig:2 Blooms revised taxonomy(4,5,6)

3. Change in terms

1.The names of six major categories were changed from *no u*nto *verb*forms.2.As the taxonomy reflects different forms of thinking and thinking is an *active* process verbs were used rather than nouns.3.The subcategories of the six major categories were also replaced by verbs and some subcategories were reorganized.4.

The knowledge category was renamed. Knowledge is an outcome or product of thinking not a form of thinking *per se*.

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Consequently, the word knowledge was inappropriate to describe a category of thinking and was replaced with the word *remembering* instead.5.Comprehension and synthesis were retiled to *understanding* and *creating* respectively, in order to better reflect the nature of the thinking defined in each category,[5].

Table:1 The Cognitive Dimension Process
Level 1 - C1

Categories & Cognitive Processes	Alternative Names	Definition
Remember		**Retrieve knowledge from long-term memory**
Recognizing	Identifying	Locating knowledge in long-term memory that is consistent with presented material
Recalling	Retrieving	Retrieving relevant knowledge from long-term memory

Table:2 Level 2 – C2 (7)

Categories & Cognitive Processes	Alternative Names	Definition
Understand		Construct meaning from instructional messages including oral Written and graphic communication
Interpreting	Clarifying Paraphrasing Representing Translating	Changing from one form of representation to another
Exemplifying	Illustrating Instantiating	Finding a specific example or illustration of a concept or principle
Classifying	Categorizing Subsuming	Determining that something belongs to a category
Summarizing	Abstracting Generalizing	Abstracting a general theme or major point(s)
Inferring	Concluding Extrapolating Interpolating Predicting	Drawing a logical conclusion from presented information

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Comparing	Contrasting Mapping Matching	Detecting correspondences between two ideas, objects, and the like
Explaining	Constructing models	Constructing a cause and effect model of a system

Table:3 Level 3 – C3 (7)

Categories & Cognitive Processes	Alternative Names	Definition
Apply		Applying a procedure to a familiar task
Executing	Carrying out	Applying a procedure to a familiar task
Implementing	Using	Applying a procedure to an unfamiliar task

Analyze		Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose
Differentiating	Discriminating Distinguishing Focusing Selecting	Distinguishing relevant from irrelevant parts or important from unimportant parts of presented material
Organizing	Finding coherence Integrating Outlining Parsing Structuring	Determining how elements fit or function within a structure
Attributing	Deconstructing	Determine a point of view, bias, values, or intent underlying presented material

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Evaluate		Make judgments based on criteria and standards
Checking	Coordinating Detecting Monitoring Testing	Detecting inconsistencies or fallacies within a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented
Critiquing	Judging	Detecting inconsistencies between a product and external criteria; determining whether a product has external consistency; detecting the appropriateness of a procedure for a given problem

Table:4 The Knowledge Dimension (7)

Dimension	Definition
Factual Knowledge	The basic elements students must know to be acquainted with a discipline or solve problems in it
Conceptual Knowledge	The interrelationships among the basic elements within a larger structure that enable them to function together
Procedural Knowledge	How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods
Metacognitive Knowledge	Knowledge of cognition in general as well as awareness and knowledge of one's own cognition

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4. Revised Bloom's Taxonomy Action Verbs (Revised by Anderson)

Benjamin Bloom created taxonomy of measurable verbs to help us describe and classify observable knowledge, skills, attitudes, behaviors and abilities. The theory is based upon the idea that there are levels of observable actions that indicate something is happening in the brain (cognitive activity.) By creating learning objectives using measurable verbs, you indicate explicitly what the student must do in order to demonstrate learning.

The action verbs in the Revised Bloom's Taxonomy (7). These verbs are used to write learning objectives
and outcomes, showing what learners should be able to *do* at each level.

Table:5 Revised Bloom's Taxonomy Action Verbs (Revised by Anderson)

Definitions	Remember	Understand	Apply	Analyze	Evaluate	Create
Bloom's Definition	Remember previously learned information	Demonstrate an understanding of the facts.	Apply knowledge to actual situations	Break down objects or ideas into simpler parts and find evidence to support generalizations	Make and defend judgments based on internal evidence or external criteria	Compile component ideas into a new whole or propose alternative solutions
Verbs	•Arrange • Define • Describe • Duplicate • Identify • Label • List • Match • Memorize • Name • Order • Outline	• Classify • Convert • Defend • Describe • Discuss • Distinguish • Estimate • Explain • Express • Extend • Generalized • Give example(s)	• Apply • Change • Choose • Compute • Demonstrate • Discover • Dramatize • Employ • Illustrate • Interpret • Manipulate	• Analyze • Appraise • Breakdown • Calculate • Categorize • Compare • Contrast • Criticize • Diagram • Differentiate • Discriminate • Distinguish • Examine	• Appraise • Argue • Assess • Attach • Choose • Compare • Conclude • Contrast • Defend • Describe • Discriminate • Estimate • Evaluate	• Arrange • Assemble • Categorize • Collect • Combine • Comply • Compose • Construct • Create • Design

	• Recognize • Relate • Recall • Repeat • Reproduce • Select • State	• Identify • Indicate • Infer • Locate • Paraphrase • Predict • Recognize • Rewrite • Review • Select • Summarize • Translate	• Modify • Operate • Practice • Predict • Prepare • Produce • Relate • Schedule • Show • Sketch • Solve • Use • Write	• Experiment • Identify • Illustrate • Infer • Model • Outline • Point out • Question • Relate • Select • Separate • Subdivide • Test	• Explain • Judge • Justify • Interpret • Relate • Predict • Rate • Select • Summarize • Support • Value	• Develop • Devise • Explain • Formulate • Generate • Plan • Prepare • Rearrange • Reconstruct • Relate • Reorganize • Revise • Rewrite • Set up • Summarize • Synthesize • Tell • Write

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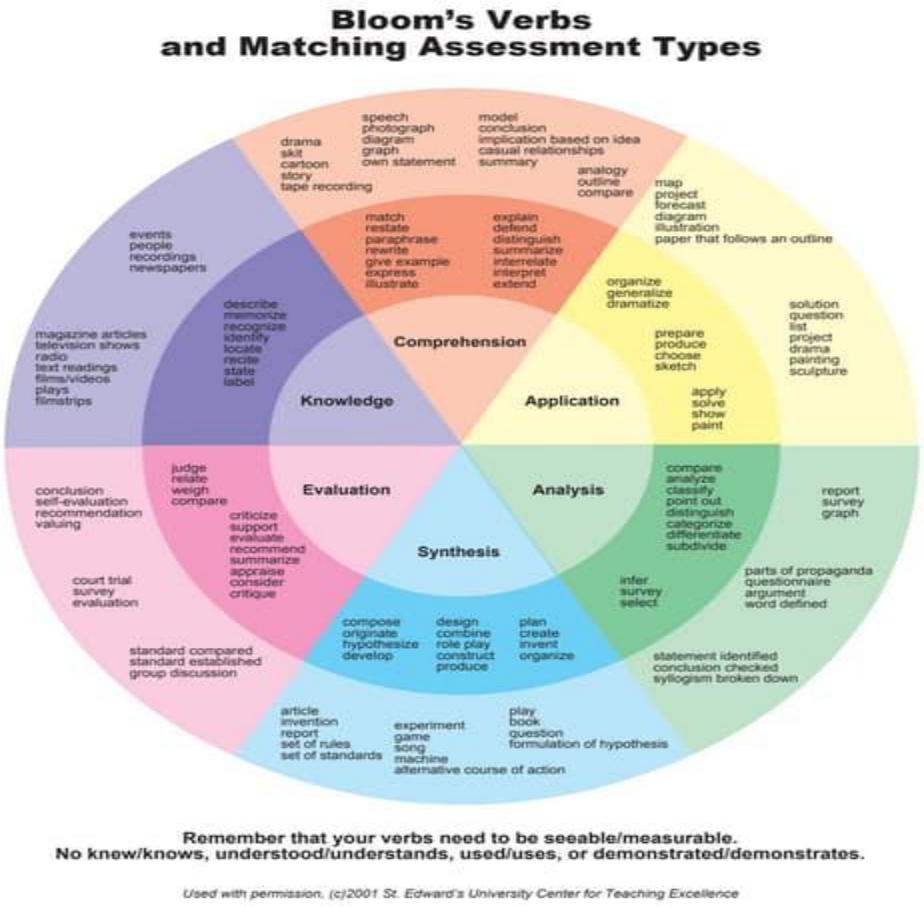

Fig:3 Bloom's Verbs And Matching Assessment Types(8)

5. Changes in bloom's taxonomy

Based on findings of cognitive science following the original publication, a later revision of the taxonomy changes the nomenclature and order of the cognitive processes in the original version. In this later version, the levels are *remember, understand, apply, analyze, evaluate,* and *create.* This reorganization places the skill of synthesis rather than evaluation at the highest level of the hierarchy [7]. Furthermore, this revision adds a new dimension across all six cognitive processes. It specifies the four types of knowledge that might be addressed by a learning activity: *factual* (terminology and discrete facts)*; conceptual* (categories, theories, principles, and models)*; procedural* (knowledge of a technique,

process, or methodology); and *meta cognitive* (including self-assessment ability and knowledge of various learning skills and techniques).

5.1. Remembering: Potential Activities and Products

1.Make a list of the main events of the story.2.Make a time line of events.3.Make a facts chart.4.Write a list of any pieces of information you can remember.5.What animals were in the story?6.Make a chart showing…7.Make an acrostic.8.Recite a poem Understanding:

5.2. Remembering: Potential Activities and Products

1. Cut out, or draw pictures to show a particular event.2.Illustrate what you think the main idea may have been.3.Make a cartoon strip showing the sequence of events.4.Write and perform a play based on the story.5.Retell the story in your own words.6.Write a summary report of the event.7.Prepare a flow chart to illustrate the sequence of events.8.Make a coloringbook.9.Cut out, or draw pictures to show a particular event. Illustrate what you think the main idea was.10.Make a cartoon strip showing the sequence of events.11.Write and perform a play based on the story.12.Retell the story in your own words.13.Write a summary report of the event.14.Prepare a flow chart to illustrate the sequence of events.15.Cut out, or draw pictures to show a particular event..Illustrate what you think the main idea was.16.Make a cartoon strip showing the sequence of events.17.Write and perform a play based on the story.

5.3.Applying: Remembering: Potential Activities and Products

1.Construct a model to demonstrate how it works.2.Make a diorama to illustrate an event.3.Make a scrapbook about the areas of study.4.Make a papier-mâché map / clay model to include relevant information about an event.5.Take a collection of photographs to demonstrate a particular point.6.Make up a puzzle or a game about the topic.7.Write a textbook about this topic for others.8.Dress a doll in national costume.9.Make a clay model.10.Paint a mural using the same materials.11.Design a marketing strategy for your product using a known strategy as a model.

5.4. Analyzing: Remembering: Potential Activities and Products

1. Design a questionnaire to gather information.2.Write a commercial to sell a new product.3.Make a flow chart to show the critical stages.4.Construct a graph to illustrate selected information.5.Make a family tree showing relationships.6.Devise a play about the study area.7.Write a biography of a person studied.8.Prepare a report about the area of study.9.Conduct an investigation to produce information to support a

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view.10.Review a work of art in terms of form, color and texture.

5.5. Evaluating: Remembering: Potential Activities and Products

1. Prepare a list of criteria to judge…2.Conduct a debate about an issue of special interest.3.Make a booklet about five rules you see as important. Convince others.4.Form a panel to discuss views.5.Write a letter to... advising on changes needed.6.Write a half-yearly report.7.Prepare a case to present your view about...

5.6. Creating: Remembering: Potential Activities and Products

1. Invent a machine to do a specific task.2.Design a building to house your study.3.Create a new product. Give it a name and plan a marketing campaign.4.Write about your feelings in relation to...5.Write a TV show play, puppet show, role play, song ***or*** pantomime about..6. Design a record, book or magazine cover for...7.Sell an idea.8.Devise a way to...9.Make up a new language and use it in an example.

6. Assessment of blooms taxonomy

Bloom's Taxonomy is a framework that categorizes learning objectives into different levels of cognitive skills, ranging from basic knowledge recall to higher-order critical thinking and creativity. It is widely used in education, training, and curriculum design to structure both teaching and assessment.

6.1. Questions for remembering

Recall facts, definitions, and basic concepts. *Assessment:* Multiple-choice, true/false, fill-in-the-blank.1. What happened after...? 2. How many...? 3.What is...?4.Who was it that...?5.Can you name ...?6.Find the meaning of…7.Describe what happened after…8.Who spoke to...?9.Which is true or false...?

6.2. Questions for understanding

Explain ideas or concepts in one's own words. *Assessment:* Summaries, concept maps, short-answer questions
1. Can you write in your own words? 2. How would you explain…?3.Can you write a brief outline...?4.What do you think could have happened next...?5.Who do you think...?6.What was the main idea...?7.Can you clarify…?8.Can you illustrate…?9.Does everyone act in the way that …….. Does?

6.3. Questions for applying

Use knowledge in new situations. *Assessment:* Problem-solving exercises, case studies, lab tasks.1.Do you know of another instance where…?2.Can you group by characteristics such as…?3.Which factors would you change if…?4.What questions would you ask of…?5.From the information given, can you develop a set of instructions about…?

6.4.Questions for analyzing

Break down information into parts and understand relationships. *Assessment:*

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Compare/contrast, categorize, identify assumptions, data interpretation.1. Which events could not have happened? 2.If. ..happened, what might the ending have been?3.How is...similar to...?4.What do you see as other possible outcomes?5.Why did...changes occur?6.Can you explain what must have happened when...?7.What are some or the problems of...?8.Can you distinguish between...?9.What were some of the motives behind..?10. What was the turning point? 11.What was the problem with...?

6.5. Questions for evaluating

Make judgments based on criteria and standards. *Assessment:* Essays, debates, critiques, peer reviews, decision-making tasks.1. Is there a better solution to...?2.Judge the value of... What do you think about...?3.Can you defend your position about...?4.Do you think...is a good or bad thing?5.How would you have handled...?6.What changes to.. would you recommend?7.Do you believe...? How would you feel if. ..?8.How effective are. ..?9.What are the consequences..?10.What influence will....have on our lives?11.What are the pros and cons of....?12.Why is ....of value? 14.What are the alternatives?•Who will gain & who will loose?[11]

6.6. Questions for creating

Produce new or original work. *Assessment:* Research projects, designs, creative writing, models, presentations.1.Can you design a...to...?2.Can you see a possible solution to...?3.If you had access to all resources, how would you deal with...?4.Why don't you devise your own way to...?5.What would happen if ...?6.How many ways can you...?7.Can you create new and unusual uses for...?8.Can you develop a proposal which would...?[11]

Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**
Result: Students can recall, recognize, or retrieve facts and basic concepts.	**Result:** Students can explain ideas, interpret information, and show comprehension.	**Result:** Students can use information, methods, or procedures in new situations.	**Result:** Students can break material into parts, identify relationships, and detect patterns.	**Result:** Students can justify a decision, critique, or make judgments using criteria and standards.	**Result:** Students can generate new ideas, products, or perspectives by combining knowledge and skills.

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Example outcome: *List the steps of photosynthesis.*	Example outcome: *Summarize the main idea of a story.*	Example outcome: *Use a math formula to solve a real-world problem.*	Example outcome: *Compare and contrast two theories of learning.*	Example outcome: *Assess the reliability of a scientific source.*	Example outcome: *Design an experiment to test a hypothesis.*

Overall result

1. Encourages higher-order thinking skills (critical thinking, problem-solving, creativity).2.Guides assessment design (teachers can measure specific levels of learning).3.Supports curriculum development (moving from simple recall → complex creation).4.Improves student learning outcomes by making objectives clear and measurable.

8. Discussion

Bloom's taxonomy of cognitive learning objectives provides a hierarchical framework for classifying levels of thinking, ranging from lower-order to higher-order skills. The revised taxonomy outlines six stages: remembering, understanding, applying, analyzing, evaluating, and creating. These levels guide learners from basic recall of information to complex processes such as critical evaluation and innovation. The framework is widely used in education to design curricula, set learning objectives, and develop assessment methods, ensuring that teaching goes beyond memorization to foster deeper comprehension, critical thinking, and creativity. By progressing through these levels, learners achieve meaningful and measurable outcomes that prepare them to solve problems and adapt to real-world challenges[13]. It is essential to recognize that the predominant application of Bloom's taxonomy emphasizes cognitive learning skills, as opposed to psychomotor or affective skills, both of which are vital for the effectiveness of health professionals. For instance, psychomotor skills include knot tying in surgical procedures, while affective skills pertain to demonstrating empathy towards patients. Information professionals engaged in training or instructing others can leverage Bloom's taxonomy to formulate learning objectives that articulate the skills and competencies they wish their learners to acquire and exhibit.

The taxonomy serves two significant purposes. Firstly, employing the taxonomy prompts instructors to conceptualize learning objectives in behavioral terms, focusing on what learners can achieve as a result of the

instruction. A learning objective articulated with action verbs will provide insight into the most effective means of evaluating the skills and knowledge imparted. Numerous lists of action verbs suitable for learning objectives at each tier of Bloom's taxonomy are readily accessible online [10]. Secondly, evaluating learning objectives through the lens of Bloom's taxonomy underscores the importance of incorporating objectives that necessitate higher-order cognitive skills, which facilitate deeper learning and the application of knowledge and skills across a broader range of tasks and contexts. Health professions educators' today aim to cultivate learners' abilities at the advanced tiers of Bloom's taxonomy, which necessitate the exhibition of more profound cognitive processing, including critical thinking and evaluative judgments. However, research indicates that the learning objectives in numerous training programs and curricula predominantly emphasize the lower levels of the taxonomy, specifically knowledge and comprehension [9, 11]. Educators must address this deficiency if health professionals are to attain higher levels of skill and functionality. Today's health professions educators wish to develop learners' skills at the higher levels of Bloom's taxonomy that require demonstration of deeper cognitive processing such as critical thinking and evaluative judgments, but studies have shown that learning objectives in many training programs and curricula focus overwhelmingly on the lower levels of the taxonomy, knowledge and comprehension [9, 11]. This shortcoming must be considered by educators if health professionals are to achieve increasing levels of skill and function.

9. Conclusion

In conclusion, Bloom's taxonomy of cognitive objectives serves as a valuable framework for organizing and assessing learning outcomes. It emphasizes the progression from basic knowledge recall to higher-order skills such as analysis, evaluation, and creation, thereby promoting deeper learning and critical thinking. By guiding educators in designing objectives, instructional strategies, and assessments, the taxonomy ensures that students not only acquire information but also develop the ability to apply, analyze, and innovate. Thus, it remains an essential tool for fostering meaningful learning and preparing learners to meet the intellectual demands of real-life situations.

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