Assessing the Higher Order Thinking Skills of Revised Blooms Taxonomy

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Abstract:

The success and failure of nations, to a great extent depend upon their education. Honour, prestige and freedom of the nations deprived of quality education are always at stake. Dominated and successful societies in the world promote their effective and well-versed education system in line with the latest techniques developed worldwide through the strength of factors involved to ensure quality education. The experience of this process is not limited to one specific subject but should be applied to all subjects jointly for the betterment of the education system. Educational leadership of counties developed and reformed their education system following role models of advanced learning skills, assessment and evaluation techniques. Within the range of this study, the focus will remain on the modulation and modernization of learning skills and discuss their vitality in getting higher education.

Introduction:

Education is the backbone to run the system of life. Behind the wall, a strong mechanism not only ensures the smooth running of every walk of life but also stands responsible for improvisation in the system. Teachers are key agents to change the nation. They can only play their pivotal role when they are aware of the national ideology, educational phenomena, educational aspirations, historical developments, future desires and national goals. Although many researchers have investigated higher-order thinking skills and training objectives, some rightly argue that higher-order thinking skills are widely misunderstood. Although researchers and educators in developed countries are considered advanced thinkers who are always striving for the betterment of educational institutions.

One of the common weaknesses facing the education system of most countries in the world is a weak learning process. The main reason for this is the lack of motivation of students to think practically and the non-provision of a thoughtful curriculum. In this context, the implementation of higher thinking skills education and practice from primary schools is considered important to improve assessment procedures. As the selection of the right teaching materials is an essential process in the education system, highly qualified staff also plays a pivotal role in influencing the learning process. Again, the availability of relevant resources or other factors remains insignificant unless effectively used or utilized for which an able, sound and motivated educational leadership is required.

Today the nations following the latest techniques devised by popular educational thinkers such as Benjamin Bloom, inventor of Bloom's Taxonomy for learning skills, are dominating other nations due to success in the field of education. These nations followed the lower and

higher-order thinking skills and modulated their educational and technical curriculum to explore the creations in this universe (Shane, 1981). In the present era, one more change reinforcing the already intact advancement in every walk of life and blooming up with a sudden revolution is the fourth education i. e. Education 4.0. This change brings a new dimension to the field due sudden appearance of a pandemic disease and lockdown situation.

Research Question:

Can modern educational theories be found helpful for the improvisation of the education system in Pakistan?

Objectives of the Study:

To analyze the modern educational theories for effective implementation in, Teaching methodology, Arrangement of the curriculum and Evaluation system.

Research Methodology:

During the research work, a Literature review, and analytical and descriptive methods will be used. Secondary data sources like books, journal articles and web sources are more relied upon. As per requirement, quotations will be referred to.

Literature Review:

Learning to assess and identify the mental quality that individual students are capable of working on is very important. According to Savich (2009), "the main purpose of education is to develop our response to feedback and critical thinking skills to better understand the learning environment and implement actions that help to maintain it." Therefore, it is important to ask questions of students and at the same time clarify instructions that aim to improve students' critical thinking behaviour. Teachers and researchers are utilizing modern educational theories in learning techniques and assessment methodologies.

In the 1940s, Benjamin Bloom with his colleagues identified the learning skills and arranged a framework for the categorization of educational aims. The same was revised by Bloom and his team after reform and published its final version in 1956 as the Taxonomy of Educational Objectives. This framework initially proved helpful for student assessment and was quickly used by teachers to design their curriculum, learn and teach, outline clear learning objectives and design group activities (Shane, 1981). Bloom's Taxonomy since then has paved the arcstone of many education philosophies.

Learning Theories:

"Bloom's Taxonomy comprises three learning domains: the *cognitive, affective*, and *psychomotor*, and assigns to each of these domains a hierarchy that corresponds to different levels of learning" (Simpson, 1966; Krathwohl, 2002). The table below presents a summary of the learning domains.
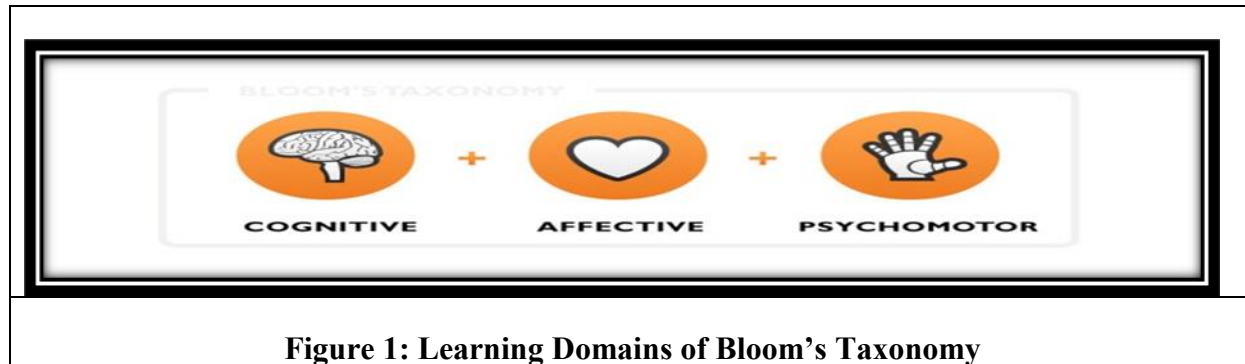
Figure 1: Learning Domains of Bloom's Taxonomy

Domains	Skills and Action	Description
Cognitive	Mental (How to think) Knowledge	• First domain was devised by Benjamin Bloom and presented in 1956 • Depicts learning that is predominantly related to mental (thinking) processes. It shows change in our knowledge as a result of an experience. • Has six hierarchal levels • Moves from easy to most complex level of knowledge.
Affective	Emotional (How to feel) Attitude or self	• Second domain was devised by Krathwohl presented in 1964 • Includes manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitude. • Has five hierarchal levels • Moves from easy to most complex level of attitude.
Psychomotor	Physical (How to do some task) Skills	• Third domain was presented in 1970s • Devised by three people; R.H. Dave (1970), Elizabeth Simpson (1972) and Anita Harrow (1972). • Includes physical movement, coordination, and use of the motor-skill areas.

Table 1: Learning Domains of Bloom's Taxonomy

Learning in the Cognitive Domain:

Many researchers believe that basic skills are important for grooming pupils which will be gradually enhanced towards a higher category which is categorized from simple to difficult. Therefore, out of these, memorization is adopted more frequently in educational settings. The cognitive domain primarily relates to mental/thinking processes and is divided into six further levels. Bloom had organized six levels with categorization starting from simple to comprehensive. This theory was devised by Bloom to prepare the students gradually toward higher goals of intellectual standards. Anderson et al. (2001) revisited the cognitive domain of learning taxonomy and made some changes, with the "two most prominent ones being 1) changing the names in the six categories from noun to verb forms, and 2) reshuffling the last two higher levels" Figures 2 & 3 below depict this change:
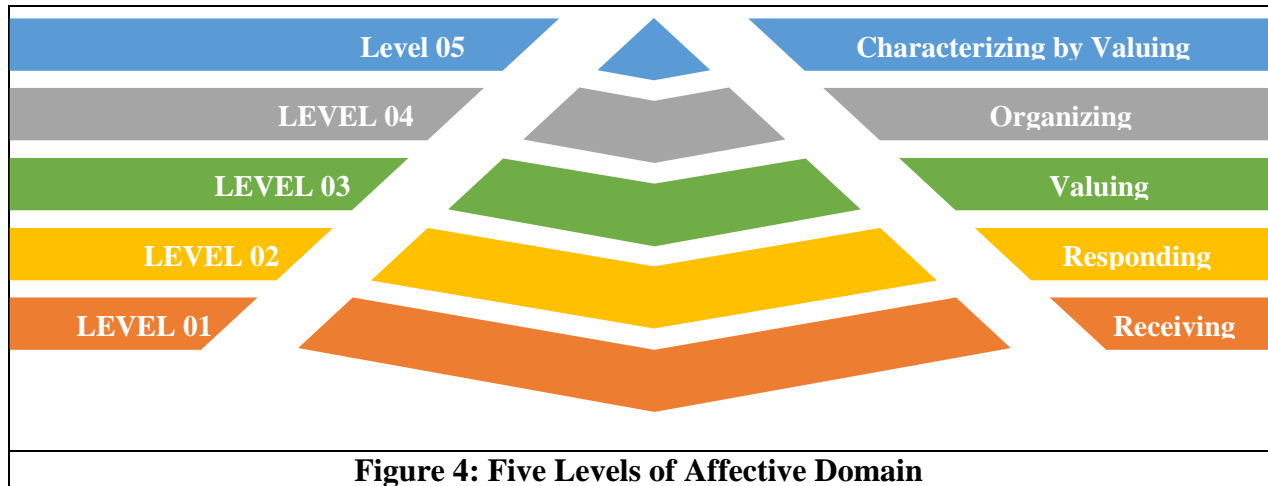
Figure 2: Old version-1956	Figure 3: Revised version
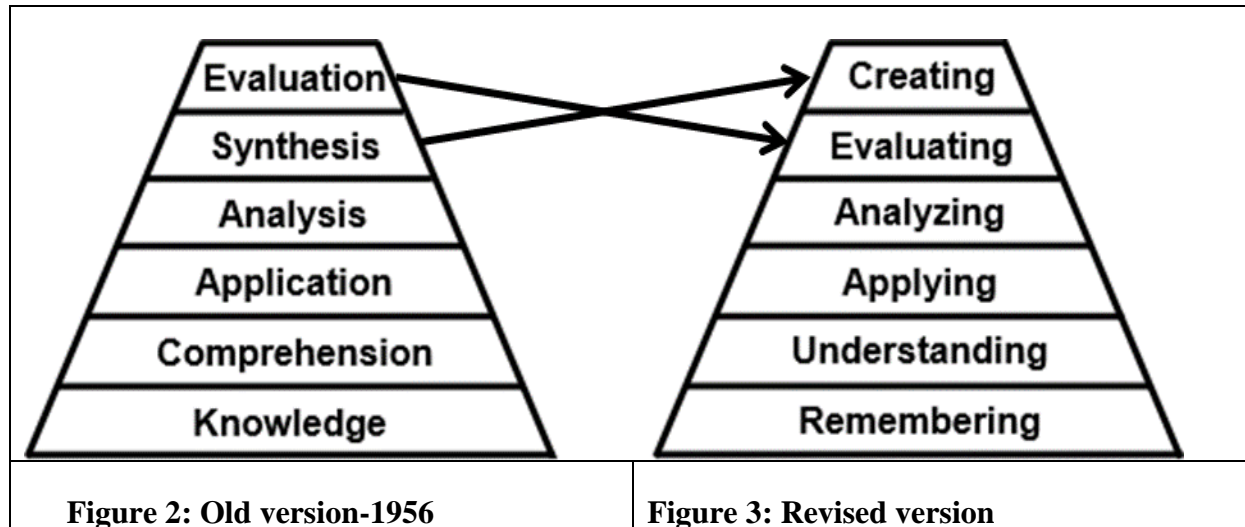
A brief explanation of cognitive levels:

i.   **Remembering.** A basic level of knowledge is achieved through this level. Students are encouraged to memorize the statements elaborated for later assessment. A memory-based assessment proved the ability of the student. The specific methodology used to recall the students' memory can be used.

ii.   **Understand.** Comprehension takes students a little further than reality in understanding the information presented. Within comprehension, facts of the problem are required to be described by students instead of producing a statement.

iii.   **Applying.** Students are required to generate the solution to the problem by applying already achieved skills. Requisite information about the problem is given to students to produce a workable solution.

iv.   **Analyzing.** At the analytical level, students are enabled to distinguish between different patterns by carefully observing a given problem and proving the ability to distinguish between the given information, which can be subjective and objective.

v.   **Evaluating.** The task is given to students in advance to generate new ideas by applying the facts. To perform this task, one has to resort to the synthesis of already existing information which is necessary to arrive at a particular conclusion.

vi.   **Creating.** Top-level in the hierarchy related to diagnosis. Learners' ability after comprehending some problem with modulated literature will be checked to invent a new one.
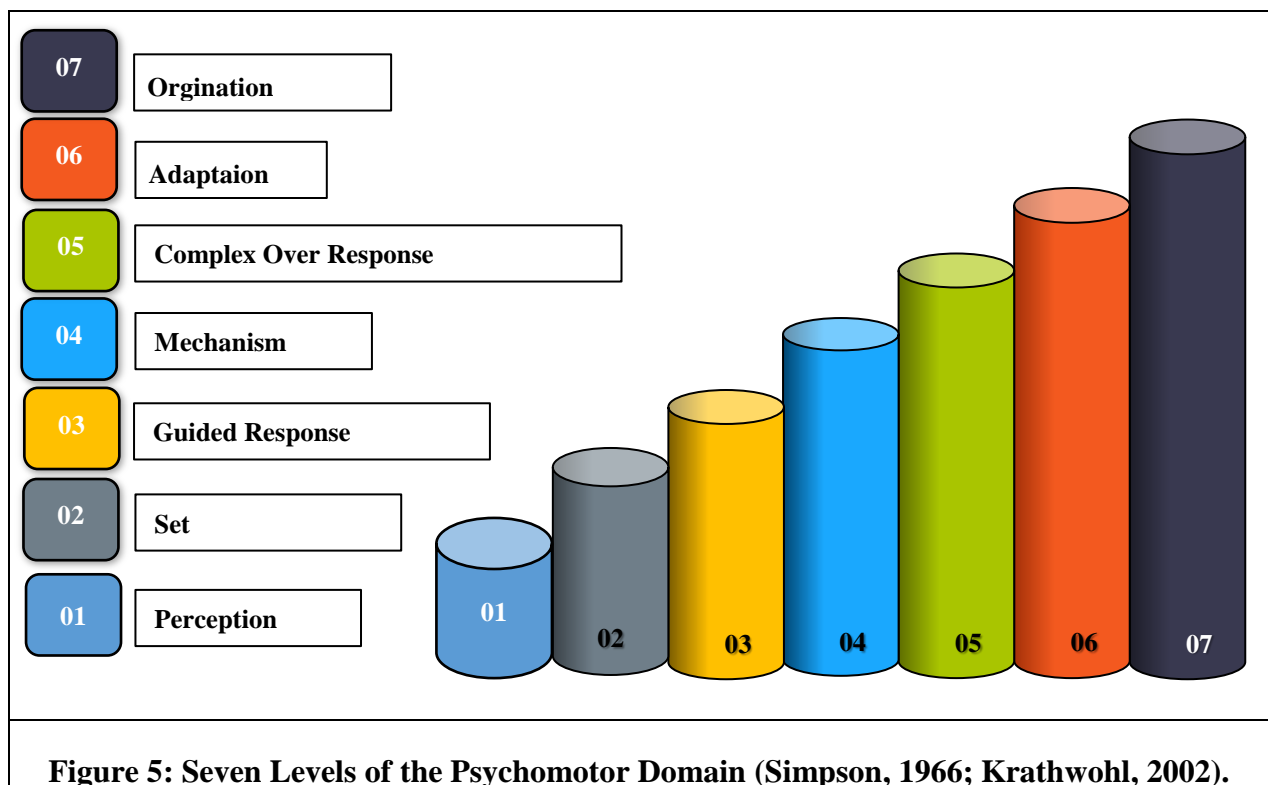
Affective Domain:

It deals with the emotional spirit and attitude of an individual. "The affective domain has five levels Receiving, Responding, Valuing, Organizing and Characterizing by Valuing" (Bloom, 1956). The figure below shows their detail:

Level 05	Characterizing by Valuing
LEVEL 04	Organizing
LEVEL 03	Valuing
LEVEL 02	Responding
LEVEL 01	Receiving

Figure 4: Five Levels of Affective Domain

Psychomotor Domain:

It deals with the physical abilities of individuals and is subdivided into seven levels (Harrow, 1972). The figure below shows their detail:

07	Orgination
06	Adaptaion
05	Complex Over Response
04	Mechanism
03	Guided Response
02	Set
01	Perception

Figure 5: Seven Levels of the Psychomotor Domain (Simpson, 1966; Krathwohl, 2002).

The Comprehensive Level of Thinking Skills:

It is difficult to assume the suitability of a tutor or teacher who is dealing with the modern theories of education, inculcating them in young pupils in this era.   However, a comprehensive level of thinking may be judged in the presence of solutions obtained through the effective

utilization of modern prospects of education. These prospects may revolve around critical and logical thinking.

Categories of Higher Order Thinking:

A general question arises in every human being about knowledge. Brookhart (2010) identifies definitions of higher-order thinking into three categories:

i.   Those who define it in terms of *transfer*,
ii.   Those who define it in terms of *critical thinking*, and
iii.   Those that define it in terms of *problem-solving"*.

Implementation of comprehensive learning skills:

i.   There are many arguments for adapting top-order learning skills in teaching and designing methodology. This is because a student and a teacher both require a framework during the learning process obtained through the setting of the appropriate learning goal.
ii.   This may be achieved through regular exercise by adapting the levels of thinking from simple to gradually building to a top comprehensive level. In this system, the student has been tasked to face the hard work by understanding and without bypassing any critical thinking level. As a systematic channel of guidance, intended goals are easy to access for students achieved with a little effort and guidance.
iii.   While Bloom's Taxonomy is a widely in-practice model of thinking. It is not only spotted as beneficial but also provides support throughout learning techniques. According to King et al., (2018), "Bloom aimed to promote higher forms of thinking in education, such as analysing and evaluating, rather than just teaching students to remember facts. Learning was divided into three domains of educational activity Cognitive, Affective and Psychomotor." Action verbs are devised against each level to develop effective thinking skills amongst students from lower to higher levels in the cognitive domain of learning (Simpson, 1966; Krathwohl, 2002). A list of action verbs is placed (Table 2).

Evaluating Methodology:

Designing and setting up of questionnaire is a more sacred task for a teacher. During the action of this job, the teacher is always on hard task to institutionalize his sound work of learning and set a base for students to easily conceptualize the phenomenon utilized (Jansen et al., 2009). Teachers may administer the latest techniques but remember that evaluation must be meaningful, comprehensive and unbiased. Such activity validated his course of action and favour encouraging the methodology announced from time to time by teachers and institutions.

Learning Objectives:

As depicted in the above in Figure 3 given above, the levels of cognitive learning remain the same with slight changes in the top two levels. Every level has its own identity and

configuration and is designed to achieve progress in learning step by step starting from simple to comprehensive. Both teacher and learner must pass through if requiring standards. As the student is directed to move up to achieve the next standards, he or she improves knowledge. The teacher-student relationship also has a pivotal role in this context (Fadul, 2009).

Level	Description	Action Verbs
Remembering	It is the most basic level of learning, requiring the least amount of cognitive rigor. This is about students recalling key information, for example, the meaning of a word.	define, identify, describe, label, list, name, state, match, recognize, select examine etc.
Understanding	At this level, the student who recalls the definition of a word, for example, would also be able to show understanding of the word by using it in the context of different sentences.	explain, describe, interpret, paraphrase, summarize, classify, compare, differentiate, discuss, distinguish etc.
Applying	It is concerned with how students can take their knowledge and understanding, applying it to different situations. This usually involves students answering questions or solving problems.	solve, construct, apply, illustrate, modify, use, calculate, change, choose, demonstrate, discover etc.
Analyzing	It is the high order thinking level and about students being able to draw connections between ideas, thinking critically, to break down information into the sum of its parts.	analyze, compare, classify, contrast, distinguish, infer, separate, explain, select, categorize etc.
Evaluating	It is also the high order thinking level where students can make accurate assessments or judgments about different concepts. They can make inferences, find effective solutions to problems and justify conclusions, while drawing on their knowledge and understanding	frame, criticize, evaluate, order, appraise, judge, support, compare, decide, discriminate, recommend etc.
Creating	It is the ultimate aim of students' learning journey. At this final level of Bloom's taxonomy, students demonstrate what they have learnt by creating something new, either tangible or conceptual. This might include, for example, writing a report, creating a computer program, or revising a process to improve its results.	design, compose, create, plan, combine, formulate, invent, hypothesize, substitute, write, compile, construct, develop, generalize, integrate etc.

Table 2: Action verbs devised in six levels of Cognitive domain of Bloom's Taxonomy

The ABCD model for writing objectives:

Before initiating a course outline in a learning procedure, the objective must be thoroughly investigated and marked as a goal to enhance the level of confidence of the student on the one hand and successfully pass through on the other hand. The student has the freedom to explain the lesson given to him or her at own choice, however, boundaries of rules such as selection of material, structural way out and the conclusion remain in place. Learning and research approaches may be simplified but not exempted from students' desires. Again, the role of the director or teacher is more pivotal and influential which is linked with his or her experience.   The study can be shortened in the presence of a basic formula: The ABCD approach. It consists of four key elements and the detail is as under (Figure 6):
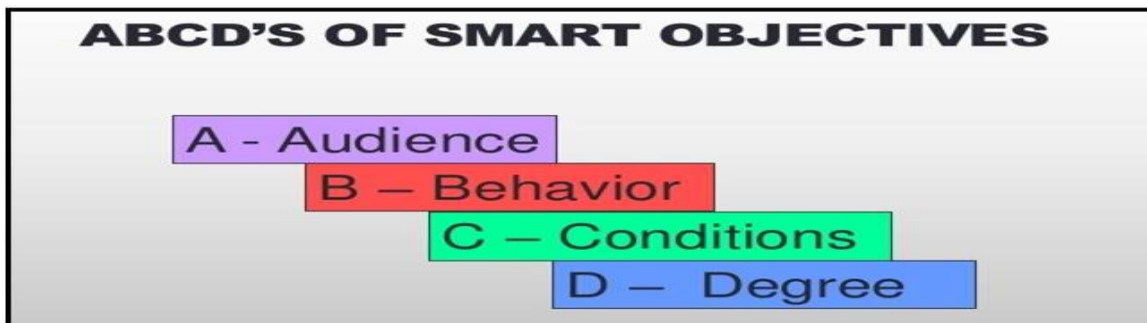
Figure 6: Key Elements of Smart Objectives

Key Element	Smart Objective
A-Audience	Determine who will achieve the objective.
B-Behavior	Use action verbs (Bloom's taxonomy) to write observable and measurable behavior that shows mastery of the objective.
C-Condition	If any, state the condition under which behavior is to be performed.
D-Degree	If possible, state the criterion for acceptable performance, speed, accuracy, quality, etc. (Optional)

Figure 7 : ABCD Smart Objectives

Thus, by creating learning objectives of lectures and practical work along the ABCD model, teachers can meet the requirement of Taxonomy. The table given below may help the reader to understand how an individual can frame the learning objectives of his lesson plans incorporated with different levels of learning along with the ABCD model of writing objectives:

Level of learning	Examples
Remembering	By the end of the lesson **students** will be able to: **define** at least **five organs** of the digestive system after **studying** the diagram of digestive system.
Understanding	By the end of the lesson **students** will be able to: **describe** the **process of digestion** after **teacher's explanation**
Applying	By the end of the lesson **students** will be able to: **demonstrate** any **five parts** of digestive system after **watching a video**
Analyzing	By the end of the lesson **students** will be able to: **explain** the function of any **five parts** of digestive system **after reading the text book.**
Evaluating	By the end of the lesson **students** will be able to: **judge** the importance of **each organ** of the digestive system after **reading the text book.**
Creating	By the end of the lesson **students** will be able to: **design** a **model of digestive system** in lab **after working in pairs**.

Table 3 : Examples of ABCD Model

HOTS-Based Assessment/ Evaluation:

The latest counselling techniques intensify the individual's sense of success in competitive examinations. The overall impact of the same prevails in society by regular monitoring of development momentum in every walk of life which is, however, designed to improve standards of the society. This concept of improvisation of course required to be ended with the establishment of a unique curriculum to run in the country. Based on the latest educational theories, an evaluation methodology should also be devised that is more practical towards the empowerment of the educational system of the country (Shane, 1981).

Successful implementation of unbiased evaluation methodology supports justice in society. In the present era where everything comes under practical situations, the old mechanism of assessment needs to be reformed to support both students and teachers. A few methods of assessment available are as:

     i.   Inter-student evaluation method.
     ii.   Self-examine method.
     iii.   External examination method.

Ways to promote student growth:

The interest of students can be achieved by promoting the following standards in their classroom:

     i.   Set an efficient environment for competition
     ii.   Enhance student's aptitudes towards performance
     iii.   Recognition of students' self-esteem by addressing their issues (Kress and Selander, 2012).
     iv.   Regards to latest educational theories

v.   Proposed effective instructional tools
vi.   Implement modern educational theories
vii.   Instrument the communication gap
viii.   Ensure repetition of comprehensive learning tasks
ix.   Utilize a cooperative learning environment
x.   Appreciate the willingness to accept the challenge by participants
xi.   Emphasize mentor valuation
xii.   Intensify the learning abilities in tutorial space

Educational Modernization:

Education 4.0 is a new dimension of purposeful approach to learning which is based and planned in line with the fourth industrial revolution, use of advanced technology, and automation in this model has a major role in changing the future of education. Creativity is the foundation of Education 4.0. It emphasizes the need to prepare students to cope with the challenges they face through the use of modern technology.

In the new era, existing and advanced technology began to penetrate every walk of life including education. This process modulated the mindset of both students and teachers to utilize technology in basic ways. This model was lastly known as Education 2.0. With time, technology advanced and mass changes and upgradation came into being through fast user-generated internet facilities. Such a model of education was known as Education 3.0. At present, students have achieved the level of advanced information in their access, due to which option to learn virtually favoured more to them. This advancement gave more freedom to students to gain learning in a personalized way as well as connection with a variety of information sources. This model is called Education 4.0.

Education systems worldwide are exercising the latest development in their learning, teaching and evaluating methodologies. In the late months of 2019, the pandemic nCOVID-19 also gave new concepts of learning worldwide due to home isolation or quarantine of students and teachers. Such restrictions to both guide and learner gave more options to explore sites on social media and the internet for the continuation of educational setups. On another hand, educational systems also allow the student to access such options for online schooling and examination etc. In this context, social media remains open and favourable for every individual to assign and achieve their goals. Few sites were famous to all after all assumption of their smaller formalities like registration process such as Adobe Connect, WhatsApp, Zoom etc.

Educational Advancement in Pakistan:

Education in Pakistan was also affected during the period of the pandemic disease. Although this dilemma has weakened and lost its severity, however, this institutionalized a way out and channel among the nation about the usage of the latest technology around the globe. In many educational institutions, methodologies have been reformed in line with the latest trends being implemented in the world. However, the pace of advancement is not up to mark due to financial crunch and lack of resources (Amir et al., 2000).

Even then, many universities or degree awarding institutes in Pakistan developed their students' facilitation modules in line with the latest trends in the world. Smooth and unbiased computerized systems in administration, student attendance and examinations brought the standards of not only the particular institution but also our nation to a remarkable position in the

world. OBE (Outcome Based Education) and SAT (Systematic Approach to Training) are the examples of usage of the latest technology.

The methodology of training during the pandemic restriction, in particular, was also modulated. Educational institutions abided by the rules enforced in the country by NCOC against preventive measures. During the said period, effective usage of the latest technology in terms of online conduct of classes and examinations minimized the loss of scheduled training and academic sessions organized for combatants and non-combatants. Moreover, following the latest schemes of Education 4.0, institutions introduced the latest methodologies in learning, assessment and evaluation domains in respective organizations. OBE (Outcome Based Education) and SAT (Systematic Approach to Training) are examples of the said revolution.

Conclusion:

The literature review of previous studies and other sources on the subject enables an analysis of the concept of general and specific assessment. Knowledge gained and reviewed through literature helps in gaining assessment about the importance of higher-order thinking and its effective implementation in leadership tasks in general and the education system in particular. These higher-order thinking as per the study may be denied at once by advancements in technology but cannot be ruled out due to their unique significance. It may be a bit difficult for early adaptation of these methodologies early in line with the latest modulation in technology, but in the long run, their unique fundamentals may irrigate stronger routes to our education system. Our education system, however, defined before independence and gifted in heritage needs reform to bring this nation in between developed countries. Such possibilities may only be conquered when as a whole accept the challenge of modernization in the education system. This is a need time to adopt the latest version of Education 4.0 in every discipline of education because every subject is equally important in the development of the country.

Recommendations:

Based on an assessment of the study it is found that improvisation in educational theories is an essential and unique element for the development of a nation. These reforms may only be obtained through effective planning of the national curriculum for each discipline, its implementation and a well-versed monitoring system. The latest model of education in developing countries such as Malaysia adopting Education 4.0 and UAE may be taken as torch light.

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