


**Research Article**

# Advanced Cognitive Skills: HOTS A Strategy for Boosting Student Intelligence in New India

**Dr. Anju Bharti <sup>1\*</sup>, Dr. Neeru Gupta <sup>2</sup>, Dr. Rajiv Jain <sup>3</sup>**

<sup>1-3</sup> Assistant Professor, Department of Management, MBA, Maharaja Agrasen Institute of Technology, Delhi, India

**Corresponding Author:** \*Dr. Anju Bharti

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**Abstract**

There is a need to review the curriculum specifically made for higher education for the benefit of all students. Higher Order Thinking Skills (HOTS) should be developed by mentors and higher authorities. The purpose of HOTS is to ensure that students are able to produce, analyse, and assess their own knowledge. Students who possess higher-order thinking abilities can think more creatively and independently, as well as in a more sophisticated manner. Students who possess the ability to think critically and creatively are better equipped to handle situations in the real world. The teachers' tactics will help the pupils plan their thoughts in accordance with the current circumstances. Students should be able to alter the information and transform it into something fresh and significant rather than merely knowing it. Higher-order thinking skills, or "HOTS" for short, take thinking to higher levels than restating the facts. HOTS requires doing something with the facts. We must understand them, infer from them, connect them to other facts and concepts, categorise them, manipulate them, put them together in new or novel ways, and apply them as we seek new solutions to new problems. Like most talents, higher-order thinking can be learnt and practised. HOTS fosters vital abilities like critical thinking and problem-solving while facilitating a deeper understanding of literature and the arts, enhancing our enjoyment and life experience. Employers greatly value it, and demand for it is only expected to grow in the future. The tools and techniques applied for HOTS will help students to feel inspired to learn and comprehend the value and purpose of education. Students will be more likely to learn as they comprehend the importance and purpose of education. It will enable students to study and use what they have learnt to address challenges outside of the classroom and in real-world situations. Employers greatly appreciate and seek these out. Additionally, it is anticipated to become more and more popular in the near future. Additionally, it will include transferable abilities that are required in a wide range of contexts. Using thought-provoking statements, questions, or scenarios to spark conversation is one strategy the mentors might employ in their lectures to promote higher-order thinking. It will encourage the pupils to develop their talents and aid in their knowledge expansion. This paper will discuss different tools and techniques for HOTS to inculcate values-oriented skills in students. The paper will also discuss about various strategies to reduce the gap between employer expectations and university curriculum using HOTS. For the benefit of all students, the curriculum designed especially for higher education has to be re-examined. Higher Order Thinking Skills (HOTS) should be developed by mentors and higher authorities. The objective is to ensure that students are capable of creating, analysing, and assessing their own knowledge. Thinking beyond just restating the facts is possible with higher-order thinking abilities, or "HOTS" for short. HOTS demands that the facts be used in some way. The resources and methods used for HOTS will encourage students to study while also assisting them in understanding the value and purpose of education. It will increase the likelihood of learning as students understand the value and intent of learning. These are highly valued and in demand by employers. It is also forecasted to be increasingly in demand in the near future. It will help the students broaden their knowledge and motivate them to expand their skills.

**KEYWORDS:** HOTS, Motivation, Creativity, Tools & Techniques, Learning

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## INTRODUCTION

Globalisation brings numerous opportunities to India with being vast demographic and economic potential to turn various opportunities into advantages. Over 50% of India's population is of working age, and projections indicate that by 2020, Indians will account for 25% of the global labour force. For the government, creating jobs is crucial since, in the future, they may serve as the catalyst for economic growth. But since the only thing that is needed in the Age of Information is a professional, well-educated workforce, education is crucial. The largest nation on the subcontinent makes an effort to adapt its educational system to the difficulties, but change is unquestionably necessary.

The administrations of India have made a concerted effort in recent years to address the shortcomings of the previous system, embrace innovations, and create a knowledge-based society that values originality and creativity. By increasing the number of students enrolled in school, government changes in the past primarily addressed the advancement of basic education. The quality gap between Indian and international universities is evident, as seen by the 256% rise in higher education students studying abroad between 2000 and 2009, according to a poll. Furthermore, just a little over 5% of them return or look for work in India as a result of brain drain (Peter, 2017) <sup>[10]</sup>.

The New Education policy approved by the Union Cabinet, chaired by Prime Minister Narendra Modi, on July 29, 2020, is focused on the development of a holistic education environment in the country. The goal of the new educational system is to create decent people with strong ethical foundations and beliefs who can think and act rationally, have empathy and compassion, courage and resilience, a scientific temper, and a creative imagination. It seeks to create citizens who are involved, productive, and contribute in order to create the plural, inclusive, and egalitarian society that our constitution envisions (Wani 2022).

NEP 2020 aims at making "India a global knowledge superpower", and it can be achieved when high-order technical skills are developed among students. NEP will provide a space for critical thinking, more holistic, inquiry-based, discovery-based, discussion-based and analysis-based learning.

The corporate world is full of complexities. High-order thinking skills are required to solve these complex problems. Generally, employer complains that the fresher they are hiring from higher education institutes have inadequate skills to solve these problems. The traditional teaching learning program is capable of transferring knowledge according to pre pre-designed curriculum. Traditional Classroom set-up teaching and learning can impart only lower-level cognitive skills through the transfer of knowledge. To solve the large & complex industry problem, high-order technical skills are required where students can relate their learned knowledge and skills with the prevailing context. Our happiness and experience of life are enhanced by higher-order thinking, which makes it possible to appreciate

literature and the arts more. It fosters vital abilities like problem-solving and critical thinking, which are highly sought after by companies and are expected to become more so in the future.

High Order Thinking Skills (HOTS) takes thinking to higher levels than restating the facts. HOTS requires doing something with the facts. It requires understanding the existing concept and fact, drawing inferences from them, connecting them to other facts and concepts, categorising them, manipulating them, putting them together in new or novel ways, and then applying them to find solutions to the critical and new problems. Thinking at a higher level than just memorising facts or repeating information verbatim is known as higher-order thinking. Students who memorise information are indeed acting like robots, and they do it without thinking. It does what it's programmed to do, but it doesn't think for itself. High-order thinking involves creativity and innovation. It is like thinking beyond set boundaries and procedure, it is the higher level in cognitive process where people try to relate things based on their intuition, perception, knowledge and judgment and come out with a novel idea.

Many smart and new technologies are embedded in organisations. Robots, Artificial Intelligence, cloud computing, and quantum computing are making the processes faster and easier. But technology is the means, not the end. Human beings are responsible for implementing and guiding the change. It requires top-down management support and capacity-building throughout teams for successful transformation. Higher-order thinking skills are required to excel in resourceful collaboration between Higher education institutes and Industry.

Here are a few skills where students and institutions can work upon and develop to get innovative results:

- Analytical Ability
- Critical Thinking
- Effective Problem Solving
- Ideation
- Innovation
- Creativity and originality

## Components of HOTS

High-order thinking skills comprise adopting the following components for the overall development of students (Fleming, L. (2015) <sup>[7]</sup>:

- Through demonstrating things
- Connecting concepts
- Encouraging students to question their mentors
- Using mind maps
- Solving Problems
- Creative thinking
- Using analogies
- Teaching question and answer relationships

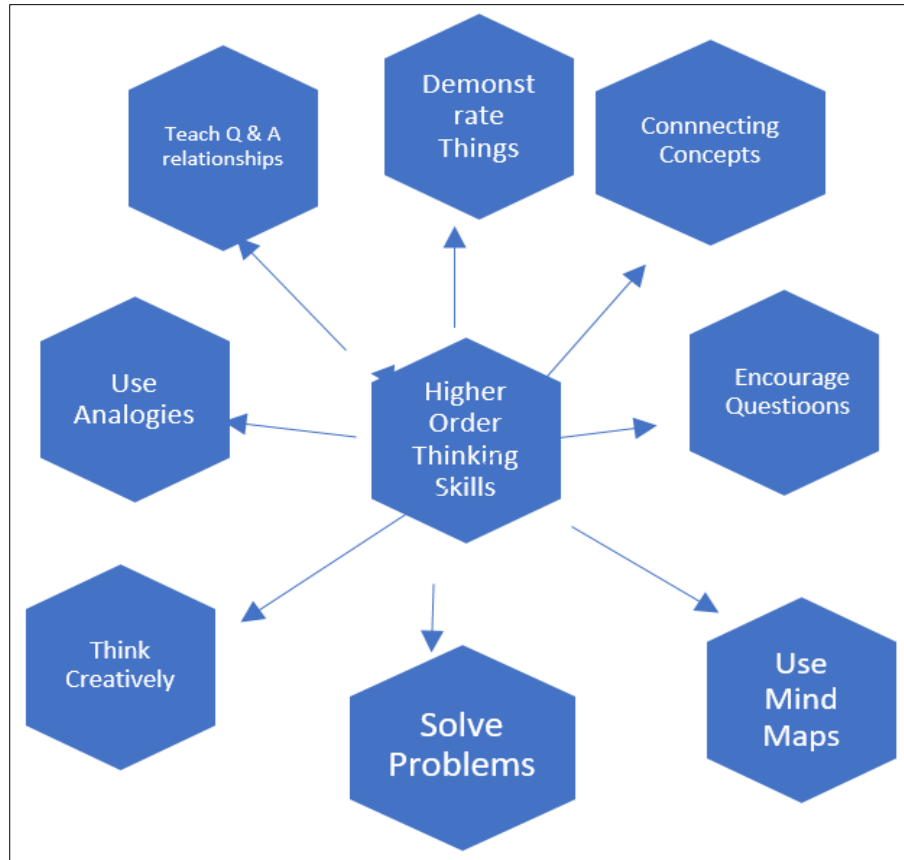


Fig 1: Components of High Order Thinking Skills (Source: learnpanda.school/blog,2021)

### Teacher Role in Developing HOTS

There is always a dilemma whether high-order thinking skills can be learned or not. Like any other skill, HOTS can also be learned through regular practice. Kalra *et al.* (2020) [9] in their study 'Developing Industry-Relevant Higher Order Thinking Skills in Computing Students' demonstrate that analysis and application-level quizzes can help to develop higher-order technical skills.

Teachers should work to enhance students' "transfer," "critical thinking," and "problem solving" skills if they intend to educate and extend their higher-order thinking abilities. These are characterised as:

- Critical thinking: the capacity to reason, consider, and determine what to believe or do next;
- Transfer: the capacity to apply knowledge and skills to new contexts (for instance, a fifth-grade student studying fractions applied her knowledge to a real-world scenario);
- Problem solving: achieving an objective that cannot be achieved with a memorised solution (Brookhart, 2010, 2011) [6].

### Tools and Techniques that can assist teachers in encouraging HOTS among students

According to Rajendran (1999), most Malaysian instructors

lack knowledge of pedagogical skills and are merely equipped to ask HOTS questions. The greatest approach to guarantee that students can apply HOTS in their daily lives is for teachers to incorporate this information into regular classes so that it is simpler to observe how the students' thinking abilities have changed (Rajendran, 1999).

There are two ways in which teachers can encourage HOTS

- Using Models
- Strategies for HOTS

### Models for HOTS

#### Bloom's Taxonomy

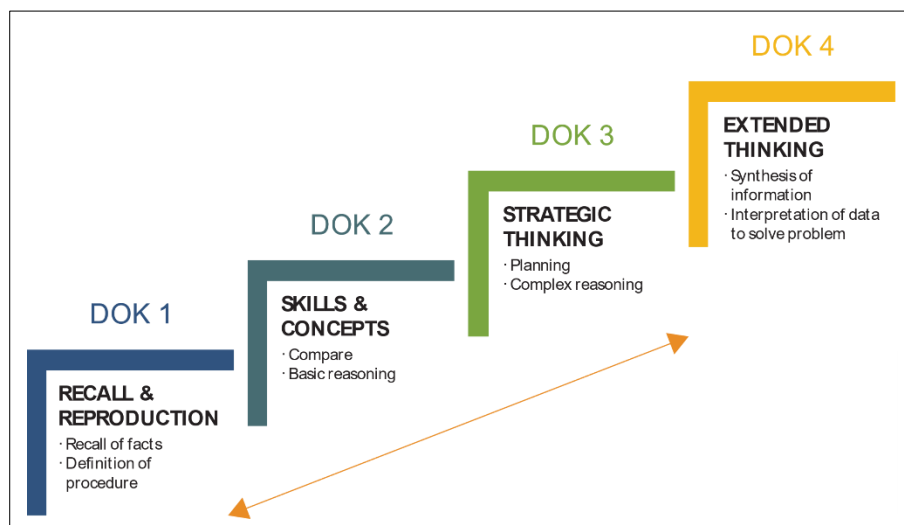
Some taxonomy of thinking skills may be used by educators. (Anderson & Krathwohl, 2001) [4-5] One example of this would be Bloom's Revised Taxonomy (remember, comprehend, apply, analyse, evaluate, create). Bloom's taxonomy primarily provides instructors with a focus for developing their course learning outcomes. There are fruitful reasons for a teacher to use Bloom's taxonomy. It consists of various levels. Initially, it can be used to increase one's understanding of the educational process, and later, the teachers can see and understand complex cognitive development and can build lower-level skills into higher-order thinking.

### Webb's Depth of Knowledge

Instructors can also make use of Webb's Depth of Knowledge, which includes extended thinking, skill application, memory and replication, and strategic thinking (Webb, 2002). Another kind of framework for determining the degree of rigour for an examination is called Depth of Knowledge, or DoK. Dr Norman Webb created the DoK in 1997 to group tasks based on the degree of mental complexity. Depth of Knowledge breaks down and classifies the many

problem-solving thought processes, which aid in our conceptualisation of cognitive rigour. Teachers and mentors can further identify student understanding by dissecting and differentiating the DoK (level of thinking) necessary for each question. Establishing the context—such as the scenario, location, or circumstance—in which students demonstrate the breadth and depth of their learning is the aim of DoK (Francis, 2017) [8].

Fig 2: Webb's Depth of Knowledge (Francis, 2017) [8].



### Design Thinking

A modification of Bloom's (1965) taxonomy of educational objectives, which defines learning, teaching, and assessment outcomes, serves as the foundation for the design thinking framework (Anderson *et al.* 2001) [4-5]. Affective, Knowledge, Cognitive, Sensorimotor, and Social Learning were therefore defined as the five areas of Design Thinking competency.

Design Thinking can be defined as a meta-disciplinary, human-centred framework for innovation (Lindberg 2010). Design Thinking constitutes an array of principles, perspectives and practices that can be used to design solutions to ill-defined and complex problems. Every company has a different flavour of it. Additionally, design thinking is not limited to design; it can be

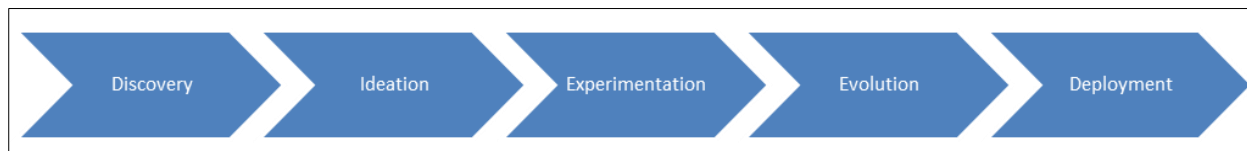
used in any profession (Tim Brown, 2009) [15]. Design thinking is the technique of rapidly identifying issues, ranking the most important ones that may be used to organisational change, addressing the work that needs to be done, and coming up with solutions (Lymari Castro and Ben Linders, 2021) [11].

The Design thinking Multi stage model:

To integrate a multi-stage model into course activities, there are many practical variants, which are as follows:

1. Discovery (Empathy, Research, and Problem Definition)
2. Ideation (Interpret, Create, and Make)
3. Experimentation (Prototype, Test and Evaluate)
4. Evolution (Re-Think, Re-Make, Repeat)
5. Deployment (Socialise, Pilot, and Integrate)

Fig 3: Design Thinking Process, Source: Iowa State University, 2022



The design thinking technique may be used for curriculum development by conceiving and creating lesson plans. Learning objectives, organised lesson plans, project briefs, learning activities, evaluation standards, and deliverables are all included in design thinking models. A high degree of student-teacher contact and discussion can take place throughout

learning activities of all kinds, including autonomous, self-directed, semi-structured, and organised activities. Students can use the models to guide their planning of higher-order thinking exercises. It will also assist in concentrating on the best possible information and abilities.

### System thinking

The systems thinking approach can be used along with design thinking. Design thinking is all about creating and building, while systems thinking is about breaking a system down into parts to understand their relationships. A teacher or a mentor can use systems thinking in analysing the problems faced by students. They will be able to analyse the problem if it is due to

the administration of the school, or due to infrastructure, or supporting staff, or due to teachers and staff, etc. Following is a systems thinking model that can be used by teachers to inculcate high-order thinking skills among students.

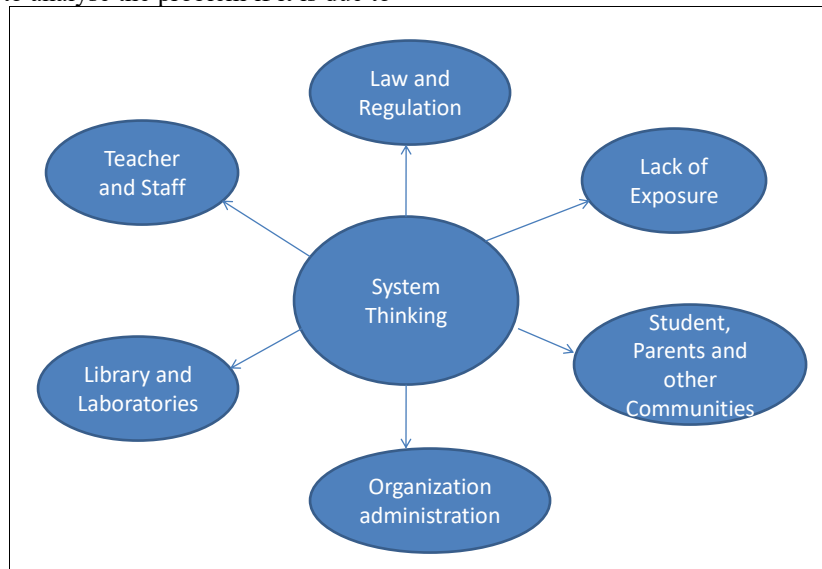


Fig 4: Components of System Thinking (Source: Created by authors)

### Strategies for HOTS

Low and high cognitive questions can also be used to tailor exercises to certain skill levels (Anderson, L. W., Krathwohl, D. R., & Bloom, B. S., 2001) [4-5]. Teachers can employ the following tactics in their lessons to promote higher-order thinking:

- Presenting pupils with thought-provoking ideas, questions, or scenarios to spark conversation (e.g., 'what if' enquiries)
- Students should be able to explain concepts using analogies, similes and metaphors
- posing problems that have multiple pathways to a solution
- Establishing a makerspace in your classroom to promote creativity, critical thinking, and design thinking; modelling a variety of problem-solving techniques; and using concept mapping to help students draw connections between and within concepts
- In a World War I study, for instance, students would be given the following paradox to think about: "War nurses saved lives, but they also contributed to deaths."
- Establishing a "I wonder" wall in your office

### Students HOTS Development

"Learning is an active process that promotes the development of high-order thinking and problem-solving in education," according to Vygotskian theory (1962). According to Vygotsky, new information would be learnt if circumstances were created that let pupils apply their critical thinking abilities. "Learning is an essential phase of developing high-order thinking," he said. The following are the components of the updated Bloom's taxonomy: recall, comprehend, apply, analyse, evaluate, and create. Knowledge—the knowledge that can be acquired, and cognitive processes—the act of acquiring knowledge, are its two main focuses. According to these two theories, students may cultivate their critical thinking abilities to come up with fresh concepts from many perspectives in order to assess issues and make wise decisions in the future.

By starting with lower-level cognitive abilities, Bloom's taxonomy helps pupils develop higher-order thinking capabilities. To demonstrate how Bloom's taxonomy may be integrated into more comprehensive educational objectives or recommendations, behavioural and cognitive learning outcomes are provided.



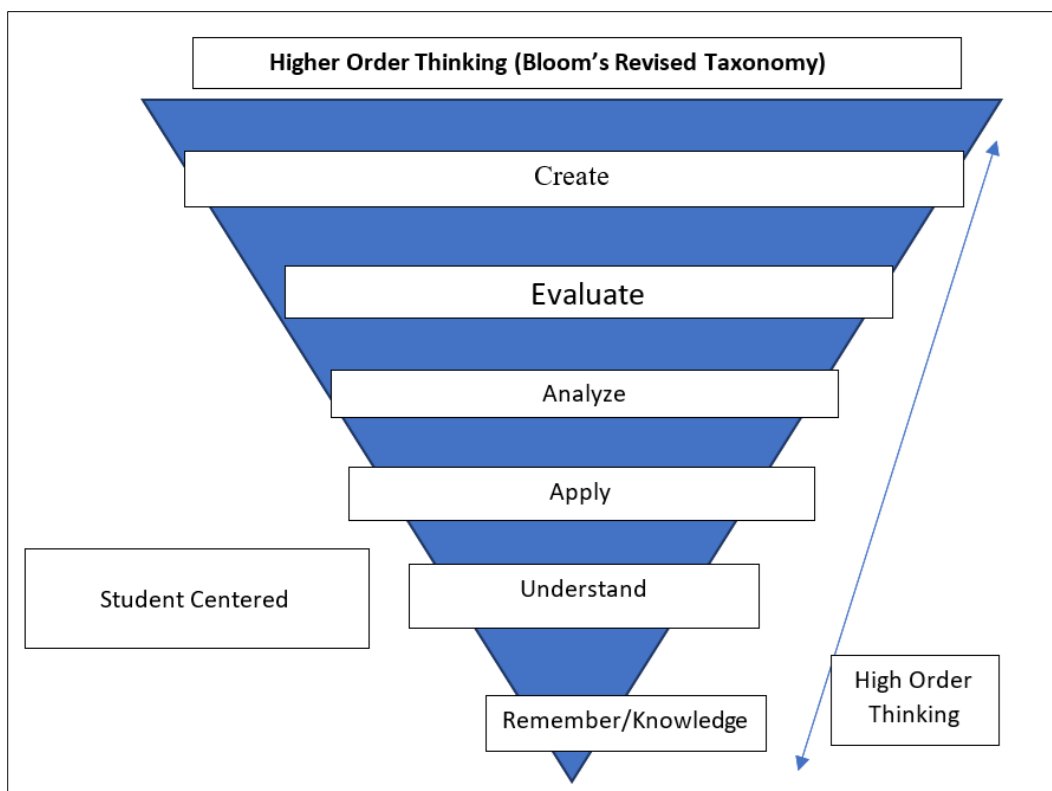


Fig 5: Bloom's Taxonomy High Order Thinking (Armstrong, 2010) <sup>[1]</sup>

Bloom's Taxonomy High Order Thinking (Armstrong, 2010) <sup>[1]</sup>

#### Knowledge

The first level of Bloom's taxonomy focuses on universal axioms and/or abstractions that are accepted by the field or discipline (principles and generalisations, theories and structures), as well as rote factual knowledge of particular terminology, ways and means (i.e., conventions, trends, classifications and categories, criteria, methodology). In this level, the Behavioural learning outcome will be the Ability to recall appropriate, learned information on command. This is the lowest level of learning outcomes.

#### Comprehension

The second level is understanding the meaning of information and materials. The behavioural learning outcome is being able to translate materials from one form or format to another by explaining or summarising and predicting consequences or effects. It represents the lowest level of understanding and interpretation of rote factual information.

#### Application

The third level of Bloom's taxonomy deals with applying knowledge and resources to address novel issues or specific circumstances for which there is only one best solution. Applying learnt content, including laws, ideas, concepts, norms, and procedures, is the behavioural output. Learning outcomes show a deeper degree of comprehension than comprehension when it comes to the mechanics of using information for a

purpose.

#### Examination

Breaking down things into their constituent elements for analysis and comprehension is the fourth stage. Here, the learner can draw several conclusions about the causes, reasons, inferences, and generalisations that can be drawn from the structure and constituent elements of the material. Understanding and comprehension of the material's structure and substance are key components of learning outcomes.

#### Synthesis

The fifth level involves using past knowledge and abilities in novel and imaginative ways.

The capacity of the learner to create a novel or unique final product. A unique message, a research proposal's operational design, or abstract relations (a technique for classifying information) are a few examples. Learning objectives place a strong emphasis on originality and the development of distinctive structures or patterns.

#### Evaluation

The sixth level is all about evaluating the materials' worth according to certain standards or one's own beliefs and opinions. Concerned with assessing the content to see if it serves the intended goal. Criteria might be external (related to the goal; given to the student) or internal (organisation; determined by the student). In this case, the learner can create a

final product that serves a certain function rather than being correct or incorrect. Because it encompasses all other categories and incorporates value judgements based on well-specified criteria, learning results are at their maximum.

## CONCLUSION

By foreseeing the links between various concepts, higher-order thinking abilities can aid in the effective solution of difficulties. Some cognitive researchers use taxonomies to arrange their theories about how people think.

### Higher-order thinking:

- Enables a more inclusive appreciation of art and literature, enriching the enjoyment and experience of life
- Promotes critical thinking, problem-solving skills and creativity
- Boosts the likelihood of learning as students comprehend the value and intent of learning;
- Enables students to acquire knowledge and apply their learning to solve problems in real-life scenarios and outside of the classroom;
- Helps students understand the purpose and usefulness of learning and motivates them to learn.
- Is highly valued and in demand by employers. It also entails transferable abilities that are required for a wide range of contexts and are anticipated to become more and more in demand in the near future.

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