

Higher-Order Thinking Skills in Shaping the Future of Students

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ABSTRACT

Higher-Order Thinking Skills (HOTS) is gaining tremendous recognition with the paradigmatic change in the light of 21st-century concerns faced by the teacher education institutions. This paper is a journey of conceptual understanding of understandings that starts from thinking to higher-order thinking via thinking skills and teaching thinking skills in the academic landscape. This paper also highlighted the particularities of some well-known structured thinking skills programs. In the present scenario, nation needs a pool of skilled human capital through which it can become a leader in the emerging knowledge-based societies. The value of this paper is to provide novel insights and draw a comprehensive picture of the development of HOTS for students.

Keywords

Higher-order thinking skills, thinking, thinking skills, teaching thinking skills

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Introduction

Disciplinary knowledge, epistemic knowledge and procedural knowledge are interlinked and needed higher-order thinking skills among students to further disseminate it in unknown and evolving circumstances (Organization for Economic Co-operation and Development, 2018). These competencies are required for the future-ready students to transform the society and shape the future in a broader perspective. Students' active participation in framing their lessons reflects higher-order competencies, such as a higher level of analysis and communication skills and creativity (OECD, 2019).

It was sometimes heatedly debated that education's crucial role in teaching-learning is to transmit content knowledge or facilitate HOTS among students. Indeed, both are equally important in the holistic development of the student. Content knowledge is needed for the foundational establishment of students while students with HOTS can adjust themselves in knowledge societies. In this information age, students necessitated applying existing knowledge to construct fructified knowledge as knowledge is a driving force of the sustainable progressive life. OECD (2019) showed its concern over the type of framework or mechanism of the education system to secure the nation in the light of cyber-attack threats and biological warfare which requires

highly-skilled and flexible human resources equipped with necessary higher-order thinking skills. With the support of a strategic team of the National Education Institute, the school development teams of Slovenia started renovation for upper secondary school teachers by empowering them to develop higher-order thinking and competences (OECD, 2015). Singapore began to a project *Thinking Schools, Learning Nation* in 1997 emphasizing developing thinking skills in schools and subsequently revised the national examinations substantially in conjunction to signify the assessment of the HOTS (OECD, 2014). How can we establish standards for our education systems that make them high-performing? The OECD started Programme for International Student Assessment (PISA), an international instrument that focused on acquiring the HOTS. It provided a global platform for teachers, researchers, and policy communities to substantially transform education policies and practices (Schleicher, 2018).

To mobilize stakeholders in transitioning secondary education to be on a par with World Economic Forum Education 4.0 framework, policy-makers of the new proposed National Curriculum Framework for school education need to carefully guide the National Council of Educational Research and Training (NCERT) who is responsible for preparing it under the purview of New Education Policy 2020. The higher-order

competencies can also supplement digital competencies considered a sine qua non for success in the fourth industrial revolution (4IR). More than 90% of job opportunities required threshold amount of digital skills (Van Dam, 2017). Students should be encouraged to think differently in their curricular disciplines and in day-to-day life to become a thoughtful global citizen.

Before inducting the new National Education Policy (NEP) in 2020, after thirty-four years of long-awaited period, the Indian education system was working on the guiding principles of National Policy on Education (1986) that was too old to deal with the socio-educational challenges emerged in the era of knowledge-driven economies. The NEP 2020 emphasized the need for cognitive skills among students in its document. Besides, India is a signatory of SDG4 in 2015 that focused on quality education which can be achieved through enabling HOTS.

This paper aimed to introduce a systematic view of HOTS in students' academic career and its paramount importance in shaping their future. The objective of the study was to provide insight into the following research questions:

- How thinking, thinking skills, teaching thinking skills and higher-order thinking skills imply in education?
- How can we develop HOTS among students?

Methodology

This study contributes to the more extensive discussion on thinking, thinking skills, teaching thinking skills, and higher-order thinking skills in exploring these questions. This study provides the knowledge-based need to promote HOTS to produce skilled human resources. The present study is based on document analysis of secondary data obtained from government documents, journals of international repute in the field of education and educational psychology along with relevant books on HOTS.

Result related to RQ 1

Thinking

Thinking is a form of information processing that consists of the cognitive rearrangement or manipulation of both the environment and the symbols stored in the long-term memory. Thinking allows humans to interpret and represent the world they experience, and to make predictions about the world.

Therefore, thinking is helpful for a human being with needs and desires to frame objectives and design plans to accomplish the goals. "Thinking is the systematic transformation of mental representations of knowledge to characterize actual or possible states of the world, often in service of goals" (Holyoak & Morrison, 2005, p. 2). Thinking is considered a subset of cognitive processes that create thoughts by associating sensory information in an unstructured mental background. It includes non-explicit, intuitive, and associative processes of linking mental content. Solso (2004) defined thinking as a "process by which a new mental representation is formed through the transformation of information by a complex interaction of mental attributes of judging transformation, reasoning, imagining, and problem-solving".

Thinking skills

The concept of thinking skills in education is nothing new, teaching students how to think had been advocated from Socrates' time till now. Students' thinking which consists of knowledge, skills, and attitudes, should be an integral part of our pedagogy so; the teachers need the pedagogical competence to teach thinking effectively. Thinking skills programs have been developed to foster higher-order thinking skills at various educational levels (Nickerson, Perkins, & Smith, 1985) from primary to tertiary. It is a questionable issue for a long while whether thinking is cognitive or behavioural. The word thinking is a construct, a multifaceted process, not a singular one that can be observed implicitly through actions (Orlich, Harder, Callahan, Trevisan & Brown, 2010). "Thinking is a sequence of internal symbolic activities that leads to novel, productive ideas or conclusions" (Ericsson & Hastie, 1994, p. 37). "Thinking is a complex act comprising attitudes, knowledge, and skills that allows the individual to shape his or her environment more effectively than by intuition alone" (Orlich et al., 2010, p.286). The psychology of thinking has been profoundly affected by the emergence of information and communication technology, especially after the predominance of computers in our life (Dominowski & Bourne, Jr., 1994). Thinking skills provide shared understandings that purportedly enhance the quality of instructional design, course and lesson planning, learning and assessment techniques.

Generally, researches on thinking and teaching thinking have been done in classroom settings. Therefore, Galotti (1989) showed his concerns over the methodological complications involved in everyday cognitive performance and studying thinking outside the classroom. Further, if the student with higher-order cognitive functioning able to show competence in the classroom performance but cannot apply them effectively in tackling day-to-day problems of life, it shows lacking in the transfer of knowledge. Frederiksen (1986) recognized one of the reasons behind this lacking is the way of defining problems, i.e. classroom problems are presented clearly with all the needed information to solve. In contrast, in real-life situations, issues emerge randomly, and students could not find the best possible solution without having the necessary information (Glass et al., 1979). It is a further debatable question as raised by Sternberg and Wagner (1986) that due to the distinct characteristics of academic and practical intelligence, person's capability varies in thought process; however, Nickerson (1988) regarded it as an unjustified comparison. More scientific and rigorous research work can provide a unanimous consensus over the thought process in solving problems in academic and non-academic contexts.

Teaching Thinking Skills

Thinking skills need practice to be nurtured and developed to become HOTS (Fisher, 1999; Marzano, 1993). Thus, students can reach their highest potential through exercising HOTS activities regularly in learning tasks. Teaching thinking skills to students have always been the fundamental aim of education (Zohar & Schwartz, 2005) and prime objective of teachers (Nickerson, 1994) and for this reason, multiple thinking programs have been developed at varied educational levels (Chance, 1986; Resnick, 1987) to suffice effective curriculum transaction. Nickerson (1987) proposed the substantial and inarguable assent over teaching thinking skills concerning its viability in educational advancement, job opportunities, respect and recognition. Evidential support confirmed that few aspects of thinking could be a taught-that individual can learn to be better thinkers in specific references, and it becomes effective through instruction (Nickerson, Perkins, & Smith, 1985). One question can be raised over the viability of the HOTS taught in course on

thinking. Are the knowledge, skills and attitude that students learn in thinking skills programs applied effectively in cognitively demanding tasks encountered in an everyday situation? It is a matter of feasibility of a thinking skills program. On this take, it is argued by the psychologists and educators that teaching thinking skills (or HOTS) should be delivered explicitly or implicitly. In other words, whether direct teaching of thinking skills separately would be fructified or it should be embedded in the curriculum with respective subjects.

There are several concepts and programs of HOTS for the educational development of students that have been used by the teachers in the teaching-learning process resulting in gainful achievement and valued learning outcomes (Fischer et al., 2011; Magno, 2011; Rajendran, 2001). Some structured programs are widely known and used as representative of the kinds of thinking skills programs to teach thinking skills and thinking dispositions. Ashman and Conway (1997) described metacognition, critical thinking, creative thinking, cognitive processes, core thinking skills and subject-specific knowledge as determinants of thinking skills programs. "Critical thinking skills are best acquired in relation to topics with which students are familiar" (Slavin, 2012, p. 242). Successful approaches to teaching thinking skills include cognitive acceleration and brain-based approaches, which can help escalate the standards of achievement and create thinking-students, thinking-classrooms, thinking curriculum and thinking-schools.

Higher-Order Thinking Skills

Quality education will only come through quality teaching at all levels, including infusion of positivity and openness to innovations. The quality of thinking has always been the ultimate aim of education because quality thinking will not only enable students to become more successful in academics but also equipping them to realize their potential and to contribute to the development of society and nation. The teacher needs to systematically and continually instruct students to encourage them to think differently and constructively. The HOTS must be taught across all subjects and grade levels.

In the present scenario, collecting information and pass it to the students is not relevant anymore instead of making students active learner to find out the source of information

and review them with creative thinking for sustained support. HOTS is complex and effortful thinking that produces valued outcomes and can be recognized through intuitive understanding (Resnick, 1987). Whitley (2006) opined that learning HOTS is difficult as it required reasoned thinking to gain the insight needed to deal with the educational or real-world situation.

Generally, HOTS is considered as the top three intellectual levels of Bloom's taxonomy: analysis, synthesis, and evaluation in the old version while analyzing, evaluating and creating in the revised version. Some researchers dissented on the division of HOTS and LOTS because nature of thinking is regarded as holistic rather than hierarchical., critical thinking is considered as the higher-order thinking skill (OECD, 2013) so, to a great extent, higher-order thinking skills synonymously used with critical thinking and also in a combination of critical thinking and problem-solving skills. The HOTS are the competencies that enable students to identify, analyze and evaluate situations with the ideation to formulate responses and solutions.

Till sometimes ago, it was a common conception that at the elementary level, lower-order thinking skills appropriately managed the cognitive needs of children and HOTS were needed at secondary and tertiary level education. At present, cognitive scientists argued in their dissent that HOTS could be developed at any age of learning. Pogrow (2005) distinctively designed HOTS based program for elementary students and students with learning disabilities which works on metacognition, making inferences, synthesizing information and generalizing ideas throughout contexts.

Table 1 represents sample questions that can elicit HOTS from the students:

<i>"Why do you think we see the sun only in the daytime?"</i>	Targeted thinking skills
<i>"Why do you think the archaeologists need to dig out the earth very slowly?"</i>	Constructing of theories
<i>"So, what happened if there is no tree around us?"</i>	Forming hypothesis
<i>"Why traffic signal lights always red to</i>	Reasoning

<i>stop us?"</i>	
<i>"What do you think is the better way to grow mushrooms? Are they following the same process?"</i>	Analyzing/Evaluating
<i>"Can you tell me more about the COVID-19?" "A scramjet? What is a scramjet engine?"</i>	Elaborating
<i>"What else do you think scientists can do...besides vaccines...to eradicate coronavirus?"</i>	Problem-solving

The higher-order thinking skills are necessitated in addressing the critical emerging needs of secondary education and implementing an agile mechanism to deal with the World Economic Forum Education 4.0 Framework's realized vision.

Result related to RQ 2

Beyer (2008) advised that if the teacher is concerned about improving the quality of their students' thinking and learning, then teachers need to teach thinking skills explicitly to apply it better what students' need to use well in the classroom learning. The teachers' role is increasingly become broadened as an expert of transacting knowledge and as the mentor who widens students' profound understanding and facilitates the acquisition of HOTS-essential for the growth of an innovative culture for tomorrow. The higher-order thinking skills are the most demanding skills and students need to invest focused effort to develop. Tishman et al. (1993) highlighted some of the peculiarities of students reflecting HOTS are fact-finding nature, think differently, open-mindedness for risk-taking, inquisitiveness, self-monitoring and rational thinking using evidence.

Though, teaching HOTS and learning HOTS both are equally difficult, and teachers' competence must be ensured whether they can manage HOTS-bound activities in curriculum transaction or not. With rigorous efforts and practice, it can be achieved. With the help of in-service professional

development training programs, teachers can enhance their understanding about how to effectively use HOTS activities in the classroom. There are several ways to develop HOTS among students like conducting brainstorming sessions, encourage questioning, emphasizing on project-based and activity-based learning. Teachers also need to teach students to give detailed answer and motivate them to draw conclusion.

Standards-based assessments can also help foster HOTS as these assessments include open-ended items instead of close-ended questions. However, these assessments are criticized because slow learners and academically unsound students found difficulty responding to such tests. Yet, teachers can tackle this issue with their academic acumen concerning individual differences of students.

There are some structured thinking skills programmes which widely known for teaching thinking skills and thinking dispositions such as Instrumental Enrichment, Somerset Thinking Skills course, Cognitive Research Trust Thinking Lessons, Thinking Through Philosophy, Let's Think, Six Thinking Hats, Cognitive Acceleration Through Science & Mathematics Education, Odyssey, Visible Thinking, Structure-Of-Intellect, Philosophy for Children, Habits of Mind Art, Talents Unlimited and many more.

Discussion

Teacher education programs in India must begin systematically by incorporating the dimension of teaching thinking into curricula and framing courses, aiming to develop the students' HOTS. However, success of these programs depend on the competence of teachers as thinking skill programs do not prepare the facilitators for teaching thinking. Keeping in view the equal importance of critical and creative thinking skills; both should have been embedded carefully in curricula for school education and teacher education. To keep up the pace of teachers' professionalism for learning new concepts and updating the existing one, some measures need to be taken care such as ample autonomy in the classroom, a reasonable time for lesson planning, sufficient pay with job security, plentiful classroom resources and liberal opportunities to get feedback on teaching HOTS (The New Teacher Project, 2013).

Conclusion

Educational institutions need to gravely think on how to systematically incorporate the dimensions of HOTS into the curriculum by framing syllabus aimed to develop higher-level cognitive functions. Bearing in the mind of HOTS, critical and creative, both thinking must be emphasized equally because, in the broader sense, critical thinking promotes reasoning and creative thinking stimulate curiosity. Therefore, the syllabus must cover the activities based on convergent and divergent orientation. HOTS enrich experience of life as it involves transferable skills that is essential in a wide variety of contexts.

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