PEDAGOGICAL SCIENCES

TOOLS AND TECHNIQUES TO DEVELOP HIGHER ORDER THINKING SKILLS IN STUDENTS OF NON-LINGUISTIC TECHNICAL UNIVERSITIES OF UKRAINE DURING ONLINE LEARNING

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Abstract

This article presents a comprehensive exploration of tools and techniques designed to motivate and develop Higher Order Thinking Skills (HOTS) in students of non-linguistic technical universities of Ukraine engaged in online learning. As critical and creative thinking have become indispensable for academic and professional success, fostering HOTS in this context is paramount. The article addresses the unique challenges faced by students and educators in the virtual learning environment and offers innovative strategies to engage students and promote active learning. We discuss various digital tools, platforms, and approaches that facilitate collaboration and encourage learners to analyse, evaluate, and create while mastering the English language. Drawing on best practices, real-life examples, and recent research, this article provides practical insights and actionable recommendations to help educators enhance the learning experience and equip students with the necessary skills to excel in an increasingly interconnected and competitive world.

Keywords: Higher Order Thinking Skills (HOTS), non-linguistic technical universities, online learning, English language teaching, critical thinking, problem-based learning, innovative strategies.

In today's rapidly evolving global landscape, the ability to think critically and creatively has become an essential skill for success in various fields, particularly in technical disciplines. As educational institutions increasingly shift toward online learning, fostering Higher Order Thinking Skills (HOTS) in students of non-linguistic technical universities has become a pressing concern. This article aims to provide educators with a comprehensive overview of tools and techniques that can be employed to motivate and cultivate HOTS in these students as they navigate the virtual learning environment. By integrating HOTS into their pedagogical practices, educators can better prepare learners to tackle complex challenges, enhance their language proficiency, and ultimately excel in their academic and professional pursuits.

The development of HOTS not only strengthens problem-solving and decision-making abilities but also elevates the overall learning experience, enabling students to apply critical and creative thinking to both their language studies and technical subjects. In this article, we will delve into the challenges and opportunities presented by online learning and explore innovative strategies for engaging students and fostering HOTS within this context. In our article we will discuss various digital tools, platforms, and approaches that facilitate collaboration, promote active learning, and encourage students to analyse, evaluate, and create while mastering the English language. By examining best practices, real-life examples, and the latest research in the field, this article aims to equip educators with practical insights and actionable recommendations to help students of non-linguistic technical universities thrive in an increasingly interconnected and competitive world.

The formulation of the problem in this context revolves around the need to effectively cultivate Higher Order Thinking Skills among students of non-linguistic technical universities who are engaged in online learning. This issue carries significant relevance for both the scientific and practical domains.

General problem statement

In the digital age, as education increasingly transitions to online platforms, students pursuing technical degrees in non-linguistic fields face a critical challenge: the development of Higher Order Thinking Skills (HOTS) in a virtual learning environment. HOTS encompass essential cognitive abilities such as critical analysis, creative problem-solving, and in-depth evaluation, which are indispensable for academic success and future professional competence.

Connection with important scientific tasks

1. Educational psychology and pedagogy. The problem aligns with ongoing research in educational psychology and pedagogy, where scholars strive to understand how learners can effectively develop HOTS in diverse learning settings. Investigating strategies and tools for nurturing these skills in an online context is a pressing scientific task.

2. Technology-enhanced learning. As technology plays an increasingly central role in education, it is imperative to explore how digital tools and platforms can be harnessed to facilitate the growth of HOTS. This problem bridges the gap between educational theory and technology application.

3. Assessment and evaluation. The development of HOTS calls for innovative assessment methods that accurately measure these skills. Researchers are engaged in creating valid and reliable evaluation techniques, a challenge directly related to the problem at hand.

Connection with important practical tasks

1. Educator professional development. Addressing this problem directly benefits educators who seek effective strategies to engage students and promote HOTS in virtual classrooms. Practical solutions can guide teacher training and development programs.

2. Student success and employability. Equipping students with HOTS is not only essential for academic achievement but also for their future employability. Tackling this problem contributes to a well-prepared, competitive workforce.

3. Online curriculum design. Educational institutions and instructional designers are tasked with creating online curricula that foster HOTS. Identifying practical techniques and tools helps shape the design and delivery of digital courses.

In summary, the problem revolves around nurturing HOTS in students of non-linguistic technical universities engaged in online learning, which is of paramount importance both in scientific research and practical education, impacting educators, students, and the future workforce.

Higher Order Thinking Skills are cognitive skills that involve complex, critical, and creative thinking processes that go beyond the basic recall and understanding of facts. [1] HOTS enable learners to analyse, synthesize, evaluate, and apply information in new and meaningful ways. These skills are essential for problem-solving, decision-making, and independent learning.

The purpose of this article is to provide a comprehensive guide to tools and techniques aimed at fostering HOTS in students of non-linguistic technical universities who are engaged in online learning. In recognition of the critical importance of HOTS for academic and professional success, this article addresses the specific challenges posed by virtual learning environments. It offers innovative strategies to engage students and promote active learning, emphasizing the development of critical and creative thinking skills. By exploring a range of digital tools, platforms, and teaching approaches, this article seeks to empower educators with practical insights and actionable recommendations. Ultimately, the goal is to enhance the online learning experience for students, equipping them with the skills necessary to thrive in today's interconnected and competitive world.

Various researchers and psychologists have contributed to the understanding and development of HOTS. Some prominent figures include: an American educational psychologist, Bloom is best known for creating Bloom's Taxonomy, a hierarchical classification of cognitive skills. [2] This taxonomy, first published in 1956 and later revised, has been influential in understanding and promoting higher-order thinking skills in education. The higher levels of the taxonomy – analysing, evaluating, and creating – encompass HOTS.

An educational researcher and author, Marzano has contributed significantly to the understanding of teaching and assessment strategies that promote higher-order thinking skills. His research and publications focus on effective instructional practices, including the use of questioning techniques, student engagement, and assessment methods that foster HOTS. [3]

An educational researcher and author, Arthur Costa developed the concept of "Habits of Mind," which are dispositions or patterns of intellectual behaviour that promote critical and creative thinking. [4] Costa's work emphasizes the importance of nurturing these habits in students to foster higher-order thinking skills and lifelong learning.

A cognitive psychologist and educator, David Perkins has researched the development of intelligence, creativity, and HOTS. [5] He has contributed to the understanding of how individuals think and learn and has developed several teaching strategies, such as "Teaching for Understanding" and "Visible Thinking," to promote higher-order thinking in the classroom.

A psychologist, philosopher, and author, Edward de Bono is best known for his work on creative thinking and the development of the "Six Thinking Hats" technique. [6] This method encourages structured and parallel thinking, helping individuals and groups develop higher-order thinking skills by exploring problems and solutions from different perspectives.

An American philosopher, psychologist, and educational reformer, John Dewey was an early advocate of progressive education and experiential learning. He believed that learning should be grounded in real-life experiences and problem-solving, which are essential for developing higher-order thinking skills. [7]

These researchers, among others, have significantly contributed to our understanding of Higher Order Thinking Skills and the methods and strategies that can be used to cultivate these skills in learners. Their work has helped shape educational practices, emphasizing the importance of critical and creative thinking in academic and professional success.

HOTS are grounded in the revised version of Bloom's Taxonomy, a hierarchical classification of cognitive skills. The taxonomy is divided into six levels, with the higher levels indicating more complex thinking processes:

Remembering. Recalling or recognizing information without necessarily understanding it.

Understanding. Grasping the meaning of information and being able to interpret, summarize, or explain it.

Applying. Using knowledge or skills in new situations or solving problems.

Analysing. Breaking information down into its constituent parts to understand relationships, patterns, and underlying structures.

Evaluating. Assessing the quality, credibility, or effectiveness of information, ideas, or arguments.

Creating. Generating new ideas, products, or ways of understanding by combining or reorganizing existing knowledge.

Higher Order Thinking Skills generally refer to the top three levels of Bloom's Taxonomy: analysing, evaluating, and creating. Developing HOTS involves practicing these cognitive processes, encouraging learners to think critically and creatively about the information they encounter. This approach to learning fosters deeper understanding, innovation, and lifelong learning.

To promote HOTS, educators should incorporate activities and assessments that require students to think critically and creatively. [8] Examples include:

- ✓ encouraging discussions and debates on complex topics;
- ✓ asking open-ended questions that require thoughtful responses;
- ✓ assigning projects that require problem-solving, analysis, and synthesis of information;
- ✓ encouraging students to create new solutions, products, or ideas;
- ✓ teaching students to evaluate sources and information for credibility and relevance.

By nurturing higher-order thinking skills, educators help students become more effective learners, problem solvers, and decision-makers, better preparing them for success in the future.

There are several digital tools and resources that can be employed to develop Higher Order Thinking Skills (HOTS) in students of technical universities during English lessons. [9] Here are some popular options:

Collaboration platforms. Tools like Zoom, Microsoft Teams, or Google Meet can be used for real-time discussions, group work, and debates, encouraging students to analyse, evaluate, and synthesize information.

Online discussion boards. Platforms such as Padlet, Edmodo, or Google Classroom can be used to create asynchronous discussion boards or forums, providing opportunities for reflection, analysis, and evaluation of different perspectives.

Interactive quizzes and polls. Tools like Kahoot, Quizlet, or Google Forms can be used to create quizzes, polls, or surveys that require higher-order thinking, such as analysing scenarios, evaluating options, or making predictions.

Digital whiteboards and mind mapping tools. Digital whiteboards (e.g., Miro or Mural) or mind mapping tools (e.g., MindMeister or XMind) can be used to encourage brainstorming, visualizing complex relationships, or organizing ideas during group work or individual tasks.

Multimedia content creation tools. Encourage students to create digital stories, presentations, or videos using tools like Adobe Spark, Canva, or Prezi to practice organizing, synthesizing, and communicating complex ideas.

Reflective blogging or e-portfolios.: Have students maintain reflective blogs or e-portfolios using platforms like WordPress or Google Sites, where they can document their learning journey, self-assess their progress, and showcase their achievements.

Peer review and feedback tools. Platforms like Google Docs or peer review tools (e.g., Peergrade) can be used to facilitate the sharing and evaluation of student work, promoting evaluation and communication skills.

Educational games and simulations. Utilize games and simulations, such as those available on BrainPOP or iCivics, to engage students in interactive learning experiences that promote higher-order thinking.

Learning management systems (LMS). Platforms like Canvas, Blackboard, or Moodle can be used to organize course content, assignments, and assessments that emphasize HOTS, providing a structured and integrated learning environment.

Content control and research tools. Encourage students to explore topics of interest, gather resources, and develop their own learning goals using content control tools like Diigo, Scoop.it, or Feedly.

By incorporating these digital tools into English lessons, educators can effectively develop Higher Order Thinking Skills in students of technical universities, preparing them for academic and professional success. [10]

Generating Higher Order Thinking Skills in students at technical universities involves designing and implementing learning experiences that encourage critical and creative thinking. Here are some strategies to promote HOTS in technical university students.

1. Integrate real-world problems. Design courses and assignments that present students with authentic, complex problems relevant to their field of study. This encourages them to apply their knowledge and skills to practical situations, fostering problem-solving and critical thinking.
2. Encourage project-based learning. Implement project-based learning where students work in teams to design, build, or develop solutions to technical challenges. This approach requires students to analyse, synthesize, and evaluate information while also promoting collaboration and communication skills.
3. Use inquiry-based learning. Foster curiosity by presenting students with open-ended questions or scenarios and encouraging them to investigate, research, and analyse information to reach a conclusion. This method promotes critical thinking, analytical skills, and self-directed learning.
4. Promote reflection and self-assessment. Encourage students to reflect on their learning experiences, identify areas for improvement, and evaluate their progress. This process helps develop metacognitive skills and a growth mindset, which are crucial for lifelong learning and continuous improvement.
5. Facilitate peer review and collaboration. Encourage students to review and critique each other's work, providing constructive feedback and suggestions for improvement. This collaborative process helps develop evaluation and communication skills while fostering a deeper understanding of the subject matter.
6. Teach critical evaluation of sources. Instruct students on how to evaluate the credibility, reliability, and relevance of information sources, especially in the context of research and problem-solving. This skill is

essential for HOTS and helps students make informed decisions based on evidence.

7. Offer interdisciplinary courses. Create opportunities for students to explore connections between disciplines by offering interdisciplinary courses or encouraging collaboration between departments. This approach fosters creative thinking and exposes students to diverse perspectives.

8. Organize workshops and seminars. Offer workshops, seminars, or guest lectures that focus on critical and creative thinking skills, problem-solving strategies, or emerging technologies and trends. These events can inspire and motivate students to engage in higher-order thinking.

9. Support extracurricular activities. Encourage students to participate in clubs, organizations, or competitions related to their field of study, as these experiences often involve problem-solving, collaboration, and creative thinking.

10. Model HOTS and provide feedback. Educators should model higher-order thinking skills in their teaching and interactions with students. Offer constructive feedback on students' work, highlighting areas where they demonstrated HOTS and suggesting ways to improve.

By implementing these strategies, technical university educators can foster an environment where students develop and practice higher-order thinking skills, better preparing them for success in their careers and as lifelong learners. [11]

When students at technical universities who are just beginning to learn English try to generate Higher Order Thinking Skills (HOTS), they may face several challenges.

Limited vocabulary. A limited English vocabulary can make it difficult for students to express complex ideas, analyse information, or engage in higher-order thinking tasks. They might struggle to understand and use subject-specific terminology, which can hinder their ability to analyse, evaluate, and create.

Language comprehension. Students with limited English proficiency may struggle to understand complex texts, lectures, or instructions. This can make it difficult for them to grasp essential concepts, analyse relationships between ideas, or evaluate arguments and evidence.

Communication barriers. Students may face difficulties in participating in class discussions, debates, or group projects due to language barriers. This can limit their opportunities to practice critical and creative thinking, as well as hinder their ability to collaborate and learn from their peers.

Cognitive load. Learning a new language while simultaneously trying to develop higher-order thinking skills can impose a significant cognitive load on students. This added mental effort may cause fatigue, reduced motivation, or slower progress in both language acquisition and HOTS development.

Cultural differences. Students may experience challenges in understanding cultural references, idioms, or context-specific information, which can affect their ability to analyse, evaluate, or create within an English-speaking academic environment.

Inaccurate self-assessment. Students may struggle to accurately assess their own understanding of concepts or their progress in developing HOTS due to language barriers, which can lead to misconceptions or overconfidence.

To address these challenges and support students in generating HOTS while learning English, educators can consider the following strategies.

1. Provide language support. Offer additional language classes, tutoring, or resources to help students improve their English proficiency, focusing on both general and subject-specific vocabulary.

2. Use visual aids and multimedia. Utilize visual aids, diagrams, videos, and other multimedia resources to help students better understand complex concepts and relationships, even if their language skills are limited.

3. Encourage collaboration. Pair or group students with varying levels of English proficiency to promote peer support and learning, allowing more proficient students to help those who are struggling.

4. Simplify language. Use clear, simple language and avoid unnecessary jargon when presenting information or giving instructions, while still maintaining the complexity of ideas and concepts.

5. Scaffold learning. Break down complex tasks into smaller, manageable steps, providing guidance and support as students' progress through the learning process.

6. Foster a supportive environment. Create a classroom culture that encourages students to ask questions, seek help, and share their thoughts without fear of judgment or ridicule.

7. Incorporate native language resources. Where possible, provide resources or allow students to access materials in their native language to support their understanding of complex concepts and ideas.

Generating Higher Order Thinking Skills in students at technical universities involves designing and implementing learning experiences that encourage critical and creative thinking. [13] Here are some strategies to promote HOTS in technical university students.

Interactive multimedia content. Develop or curate interactive multimedia content, such as simulations, virtual labs, or games that require students to analyse, evaluate, or create as they engage with the material.

Online project-based learning. Assign collaborative projects that require students to research, design, or develop solutions to real-world problems using online tools and resources. This promotes higher-order thinking skills, as well as communication and collaboration in a virtual environment.

Peer review and feedback. Use platforms like Google Docs or peer review tools (e.g., Peergrade) to facilitate the sharing and evaluation of student work. Encourage students to provide constructive feedback to their peers, fostering evaluation and communication skills.

Digital storytelling and presentations. Encourage students to create digital stories, presentations, or videos using tools like Adobe Spark, Canva, or Prezi to

practice organizing, synthesizing, and communicating complex ideas.

Reflective blogging or e-portfolios. Have students maintain reflective blogs or e-portfolios using platforms like WordPress or Google Sites, where they can document their learning journey, self-assess their progress, and showcase their achievements.

Synchronous and asynchronous coaching. Offer real-time (synchronous) or pre-recorded (asynchronous) coaching sessions, tutorials, or workshops focused on developing higher-order thinking skills and strategies, tailored to students' needs and interests.

By using these tools and techniques in the online learning environment, educators can support the development of Higher Order Thinking Skills among students at non-linguistic technical universities, preparing them for success in their academic and professional pursuits. [14]

Incorporating Higher Order Thinking Skills into online English teaching for students of non-linguistic technical universities can yield several positive outcomes.

✓ Enhanced language proficiency. HOTS encourage students to actively engage with complex ideas and concepts in English, resulting in improved vocabulary, grammar, reading, writing, listening, and speaking skills.

✓ Improved critical thinking. By practicing HOTS, students learn to analyse and evaluate information, arguments, and ideas in English. This enables them to make well-informed decisions and develop logical reasoning abilities.

✓ Better problem-solving skills. Integrating HOTS in online learning helps students develop the ability to identify, analyse, and solve real-world problems using their English language skills, preparing them for professional challenges in their field.

✓ Increased creativity. When HOTS are emphasized in English teaching, students learn to generate original ideas, innovate, and think outside the box. This creativity can be applied to their language learning as well as their technical subjects.

✓ Greater collaboration and communication. Online learning activities that promote HOTS often involve teamwork, discussion, and debate. Students develop their ability to communicate effectively, negotiate, and collaborate with others in English, enhancing their interpersonal skills.

✓ Higher engagement and motivation. HOTS-based learning activities tend to be more engaging and stimulating, motivating students to actively participate and invest in their English language learning.

✓ Deeper understanding of subject matter. Incorporating HOTS allows students to better comprehend complex concepts related to their technical subjects, as they learn to analyse, synthesize, and evaluate information in English.

✓ Development of metacognitive skills. HOTS encourage students to reflect on their learning process, assess their progress, and develop strategies for improvement. This self-awareness and metacognition promote lifelong learning and adaptability.

✓ Improved academic performance. Students who develop HOTS typically demonstrate better academic performance, as they can apply their critical thinking, problem-solving, and creativity to both their English language studies and their technical subjects.

✓ Enhanced career prospects. Possessing strong HOTS and English language skills can increase students' employability and career opportunities, as these skills are highly valued in the global job market.

By integrating Higher Order Thinking Skills into online English teaching for students of non-linguistic technical universities, educators can help learners maximize their potential, excel academically, and prepare for successful careers in their chosen fields. [15]

Implementing Higher Order Thinking Skills (HOTS) in online English teaching for students of non-linguistic technical universities can be a rewarding endeavour, but it comes with its own set of challenges. Here are some of the key problems associated with this implementation.

1. **Limited Language Proficiency**. Many students in non-linguistic technical universities may have basic English language proficiency, making it challenging to engage in HOTS activities that require complex language comprehension and expression. Bridging this gap is a significant hurdle.

2. **Technical Competence**. Online learning often requires students to navigate digital tools and platforms effectively. Some students, particularly those in technical fields, may lack the necessary technical skills to fully engage in online HOTS activities.

3. **Lack of Motivation**. Keeping students motivated in an online environment can be challenging. Engaging in HOTS activities often requires sustained effort and critical thinking, which may be difficult to maintain without face-to-face interactions and immediate feedback.

4. **Time Management**. Balancing HOTS activities with technical coursework and other commitments can be a time-consuming task for students. Many may struggle to allocate sufficient time for in-depth analysis and creative thinking.

5. **Assessment and Feedback**. Assessing HOTS in an online setting can be complex. Educators may face difficulties in designing assessments that authentically measure higher-order thinking skills, and providing timely, constructive feedback can be challenging. [16]

6. **Digital Divide**. Not all students have equal access to technology and the internet. Some may lack the necessary devices or a stable internet connection, which can hinder their participation in online HOTS activities.

7. **Isolation and Engagement**. Online learning can be isolating, making it harder for students to engage in collaborative HOTS activities. Building a sense of community and encouraging active participation can be challenging in virtual classrooms.

8. **Adaptation of Teaching Strategies**. Educators may need to adapt their teaching methods and materials to effectively promote HOTS online. Traditional pedagogical approaches may not always translate seamlessly to the digital environment. [17]

9. **Cultural and Linguistic Diversity**. Non-linguistic technical universities often have diverse student populations with varying language backgrounds and cultural contexts. Adapting HOTS activities to accommodate this diversity can be complex.

10. **Teacher Professional Development**. Preparing educators to effectively facilitate HOTS in an online English teaching context is crucial but requires ongoing professional development. Many instructors may need training to master online HOTS strategies.

11. **Resource Constraints**. Developing and implementing HOTS activities can require additional resources, such as specialized software, content, or support staff. Budget constraints can limit the scope of these initiatives.

Addressing these challenges requires a thoughtful approach that considers the specific needs and context of non-linguistic technical universities. It may involve a combination of pedagogical innovation, technological support, teacher training, and ongoing evaluation to ensure the successful integration of HOTS into online English teaching.

In conclusion, fostering Higher Order Thinking Skills in students of non-linguistic technical universities of Ukraine is essential for their academic and professional success in an increasingly interconnected and competitive world. As online learning becomes more prevalent, it is imperative for educators to harness the potential of various digital tools and techniques to motivate and cultivate HOTS in their students. This article has outlined numerous strategies, tools, and platforms that can be integrated into English lessons to facilitate collaboration, active learning, and critical and creative thinking. By employing these approaches, educators can not only enhance students' language proficiency but also equip them with the vital skills needed to excel in their technical disciplines and future careers.

It is important to recognize that each learning environment and student population is unique, and educators should adapt and customize these tools and techniques to best suit their specific context. By continually reflecting on their teaching practices and staying informed of the latest developments in educational technology and pedagogy, educators can ensure that their students are well-prepared to tackle the complex challenges they will face in the 21st century.

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