

## FOSTERING CRITICAL THINKING AMONG STUDENTS

## ФОРМУВАННЯ НАВИЧОК КРИТИЧНОГО МИСЛЕННЯ У СТУДЕНТІВ

*This paper will examine what critical thinking is, why it is important, what university teachers need to know about critical thinking, and identify ways in which university teachers can foster critical thinking skills in their classrooms.*

*Critical thinking, or the ability to objectively analyze information and solve meaningful problems, is an essential life skill for 21st century students, but one that is not being taught or practiced sufficiently in 21st century Ukrainian university classrooms. In the modern competitive job market the preference is given to those individuals who are able to objectively analyze data, facts, observable phenomenon, and research findings in order to arrive at reasoned judgments, make informed decisions, and solve meaningful problems. Learning these skills leads to becoming a critical thinker. Critical thinkers are those persons who can move beyond "typical" thinking models to an advanced way of thinking. They become more adept in their thinking by using a variety of probing techniques which enable them to discover new and often improved ideas. More specifically, critical thinkers tend to see the problem from many perspectives, to consider many different investigative approaches, and to produce many ideas before choosing a course of action. In addition, they are more willing to take intellectual risks, to be adventurous, to consider unusual ideas, and to use their imaginations while analyzing problems and issues. Critical thinkers test their first impressions, make important distinctions among choices, and base their conclusions on evidence rather than their own feelings, they double check the logic of their thinking and the workability of their solutions, identifying imperfections and complications, anticipating negative responses, and generally refining their ideas. Critical thinkers learn to focus. They acknowledge personal limitations, see problems as exciting challenges, have understanding as a goal, are interested in others' ideas, think before acting, keep an open mind and are engaged in active listening. Thus the skill which is of major importance for the future success of the present day students should be a core of modern university education. In order to address the needs of students, making them competitive enough for a modern job market Ukrainian university teachers must understand the difficulties in teaching and modeling critical thinking skills and be determined to follow this path throughout the whole teaching – learning process.*

**Key words:** *critical thinking; analyze; research; skills; findings; problem solving; critical thinker.*

*У статті розглянуто, що таке критичне мислення, чому воно важливе і що викладачі вузів повинні знати про критичне мислення, а також способи, якими викладачі можуть сприяти формуванню навичок критичного мислення на заняттях.*

*Критичне мислення або вміння об'єктивно аналізувати інформацію та вирішувати значущі проблеми – це важлива навичка для студентів 21 століття, така, якої, на жаль, недостатньо навчають і практикують в українських університетах 21 століття. На сучасному конкурентному ринку праці перевага надається тим індивідам, які здатні об'єктивно аналізувати дані, факти, явища та результати досліджень, а також приймати обґрунтовані рішення та вирішувати значущі проблеми. Навчання цих навичок призводить до появи поняття критично мислячого. Критично мислячі – це особи, які можуть вийти за межі типових моделей мислення до більш передового способу мислення. Вони більш досконалі і використовують у своєму методі мислення різноманітні методи зондування, які дозволяють продукувати нові вдосконалені ідеї. Вони зазвичай розглядають проблему з багатьох точок зору, розглядають багато різних дослідницьких підходів та генерують багато ідей перш ніж обирати хід дії. Вони готові ризикувати, розглядати нестандартні варіанти та використовувати уяву, аналізуючи проблему. Критично мислячі здатні знаходити важливі відмінності між варіантами, базуючи свої висновки на доказах. Вони перевіряють логіку своїх висновків та рішень, виявляючи недосконалість, передбачають ускладнення та попереджають негативні наслідки. Вони вчать зосереджуватись, усвідомлюють свої можливості, сприймають проблему як виклик, цікавляться ідеями інших, відкриті до нового і вміють активно слухати.*

*Таким чином, майстерність, яка має найважливіше значення для майбутнього успіху теперішніх студентів, повинна бути стрижнем сучасної університетської освіти. Для задоволення потреб студентів, їхньої подальшої конкурентноспроможності на ринку праці викладачі вузів повинні розуміти труднощі у викладанні критичного мислення та моделюванні навичок його викладання і неухильно дотримуватись цього курсу впродовж цілого процесу навчання.*

**Ключові слова:** *критичне мислення, аналізувати, досліджувати, навички, результати дослідження, вирішення проблем, критично мислячий.*

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**Problem statement in general.** The international education reformer, Sir Ken Robinson, argues that too often education fosters conformity and compliance to outdated standards. Though he was referring to the education system in the United States, the same can be said of university education in Ukraine. In a 2017 speech at a symposium in Philadelphia, the head of Ukraine's National Agency for Higher Education Quality Assurance, Serhiy Kvit, argued as much when he observed the majority of Ukraine's administrators

came of age in the Soviet Union, with little knowledge of foreign languages, and even less understanding of modern educational or practices [1]. Although Ukraine has made a commitment to reform education, good intentions have thus far resulted in few real changes for Ukrainian university students, who see no connection between what they study and their eventual career after university. Only about 14% of university students say they are "probably" or "most likely to" work in a field related to what they are studying [2].

**The purpose of the article** is research of fostering critical thinking among students.

**Presenting main material.** Robinson believes 21<sup>st</sup> education reform must begin by offering students a broad curriculum that encourages individualization of the learning process and fosters curiosity through creative teaching, including high quality teacher training, as well as focusing on awakening creativity. These ideas mirror reforms proposed for Ukrainian institutions of higher education.

As Robinson has pointed out, modern education institutions arose out of the industrial revolution of the 19<sup>th</sup> century, and are modeled on the factory system of that time. Both schools and universities separate subjects and specializations, in much the same way factories of the past separated processes. Students are organized into groups and must move through the system together, like an assembly line. (3) This production line mentality makes it easier for institutions to organize classes, arrange schedules, and maintain an orderly soviet-like control over the institution and students, but has almost nothing to do with the 21<sup>st</sup> century world in which these students will compete.

Like many universities and schools around the world, Ukraine is struggling to update its educational institutions technologically. However, more and better technology is not a panacea that will solve Ukraine's most pressing education challenges.

It is obvious students in the modern age require digital literacy, however computers, laptops, mobile phones, and various social media platforms are just tools. In the hands of a poor craftsman they are no more effective than a hammer-and-tongs in the hands of an amateur blacksmith. In order to use modern technological tools effectively, students must first learn to be critical thinkers.

Today's high-tech industries are looking for employees who are self-directed, curious, creative, problem solvers, effective communicators, and above all, have an ability to think critically. Factory-like schools of the 19<sup>th</sup> century prepared students for work in factories. However, tasks that require simple linear thinking and routine repetitive work are being outsourced or, increasingly, performed by automated systems. Today's students will need to be able to solve complex problems that do not even exist today, independent of higher supervision. They must organize and use data and information from a wide variety of dimensions, in order to see problems from a variety of angles. The skills of the 21<sup>st</sup> century do not involve repetitive work, rote learning, or conformity to outdated standards, but rather conceptualization, synthesis of knowledge, an ability to evaluate risks, make decisions, and organize information for effective problems solving.

These critical thinking skills do not come about naturally or easily, which means Ukrainian university

teacher must be trained to develop these essential skills in their students.

***What is Critical Thinking and Why is it Important?***

Critical thinking is an educational buzz phrase used in teacher training workshops from Los Angeles to New York, London to Helsinki, and from Lviv to Kyiv. Yet, when asked to identify what critical thinking actually is many educators seem to fall back on St. Augustine's puzzlement about the concept of time: "What is time? If no one asks me, I know what it is. If I wish to explain it to him who asks, I plainly do not know" [4].

In a study of 38 Public Universities and 28 Private Universities to determine faculty emphasis on critical thinking in instruction, Dr. Richard Paul, Dr. Linda Elder, and Dr. Ted Bartell found that though the overwhelming majority (89%) of professors claimed critical thinking to be a primary objective of their instruction, only a small minority (19%) could give a clear explanation of what critical thinking is [5].

In addition, the overwhelming majority (78%) claimed that their students lacked appropriate intellectual standards (to use in assessing their thinking), and 73% considered that students learning to assess their own work was of primary importance, only a very small minority (8%) could enumerate any intellectual criteria or standards they required of students or could give an intelligible explanation of what those criteria and standards were [5].

While 50% of those interviewed said that they explicitly distinguish critical thinking skills from traits, only 8% were able to provide a clear conception of the critical thinking skills they thought were most important for their students to develop [5].

Finally, although the vast majority (89%) stated that critical thinking was of primary importance to their instruction, only a very small minority could clearly explain the meanings of basic terms in critical thinking. For example, only 8% could clearly differentiate between an assumption and an inference, and only 4% could differentiate between an inference and an implication [5].

So, what is critical thinking?

Very simply, critical thinking is the ability to objectively analyze data, facts, observable phenomenon, and research findings in order to arrive at reasoned judgments, make informed decisions, and solve meaningful problems.

Critical thinking is an essential life skill and is used in a wide variety of professions. The triage nurse who must analyze a wide variety of symptoms and medical criteria to determine the order in which patients will be treated is using critical thinking. The attorney who reviews the evidence about a client to determine whether to settle out of court or to proceed to develop a strategy to win a case is using critical thinking skills. The plumber who reviews past experiences, repair

manuals, and observable conditions in a bathroom with leaky pipes and then analyzes what materials to use and how to proceed to fix the leak is using critical thinking.

Consider this real-life situation from the Second World War.

The U.S. Army Corps of engineers approached Abraham Wald, a mathematician working for America's Statistical Research Group (SRG), with an apparently simple problem. The Army SRG wish to reinforce the protective plating on its planes, but because of weight problems the protective armor had to be applied selectively. They asked Wald to analyze returning B-29 bombers by studying where most of the bullet holes were in order to reinforce those selective sections of the planes. The Army had already observed that many planes returned with the fuselage riddled with bullets, whereas the engine platforms had taken very little weapons fire.

Section of plane	Bullet holes per square foot
Engine	1.11
Fuselage	1.73
Fuel system	1.55
Rest of the plane	1.8

For the Army the solution seemed simple. Reinforce the fuselage. They wanted Wald to tell them how much reinforcement of the fuselage they needed.

Wald returned his report to the Army recommending they reinforce the engine casing, not the fuselage.

How did Wald reach the exact opposite conclusion of the Army's engineers? While the large number of bullet holes in the fuselage led the Army to conclude this was the area to reinforce, Wald's critical analysis of the problem led him to conclude that the reason the Army saw so few planes with bullet holes in the engine, was because those planes never returned from their bombing runs.

They had been shot down, and therefore never returned to have their bullet holes counted.

Wald identified this faulty analytical thinking as "survival bias." His recommendations concerning the reinforcement of bomber plane's engines are still used by the U.S. military today. [6]

Wald's thinking process was the same as that of the ancient Greek philosopher, Diogenes, who upon being shown a painting of ship-wreck survivors and asked, "Look, you who think the gods have no care of human things, what do you say to so many persons preserved from death by their especial favor?" to which Diogenes responded, "Why, I say that their pictures are not here who were cast away, who are by much the greater number" [7].

Like Diogenes, Wald objectively analyzed observable phenomenon (bullet holes in the planes), as well as research findings (the Army's erroneous conclusions), which allowed him to arrive at reasoned judgment (not all planes were counted in the report),

make an informed decision (planes shot down did not return to base), and solve a meaningful problem (save planes and the lives of their crews).

Critical thinking that saved lives.

### ***What Do University Teachers Need to Know About Critical Thinking?***

The first thing teachers need to know about critical thinking is that it is difficult.

Deanna Kuhn, in her book, *The Skills of Argument*, the first major study of how people reason in everyday life, found that most people cannot reliably exhibit general reasoning and critical thinking skills, even when prompted. [8] For instance, when asked why some children skip school or drop out, most people can give an opinion, such as, "Some kids stay away from school because their parents do not provide adequate discipline." However, when asked to justify their opinion, such as providing evidence or a reasoned argument, more than half of the study group was unable to. Often what they think is evidence is simply more opinions.

This is not to imply people are stupid, but rather that most people do not naturally use critical thinking skills. The reason for this is that humans have not evolved to think critically.

Critical thinking is a skill, like singing, which must be developed through practice. Humans have evolved to vocalize sounds to indicate danger, but not necessarily to sing Ukrainian folk songs, which require voice lessons and training. To become a world-class soprano opera singer requires years of advanced voice training.

No one ever stepped onto the stage of the Lviv Theater of Opera and Ballet to sing "Der Hölle Rache" from Mozart's *The Magic Flute* as an amateur.

So it is also with critical thinking.

If humans did not evolve natural critical thinking skills, then what type of thinking skills are more innate? According to Michael Shermer, in *Why people believe weird things: Pseudoscience, superstition, and other confusions of our time*, "Humans are pattern-seeking story-telling animals, and we are quite adept at telling stories about patterns, whether they exist or not." [9]

Humans look for patterns to fit the stories they tell. They have a tendency to make evidence subservient to belief and the patterns of the story rather than the other way around, a logic fallacy known as Belief Preservation. Yet, sometimes those patterns, and the assumptions made in the stories people tell, can lead to incorrect inferences. For the U.S. Army, the pattern was bullet holes in airplanes leading to the incorrect inference about what part of the plane needed to be reinforced.

In order to teach critical thinking skills, instructors must realize some basic facts about critical thinking.

1) Critical thinking is a higher order skill requiring a mastery of lower order knowledge and skills, but

can be taught in conjunction with even basic knowledge lessons.

Critical thinking requires students to objectively analyze data, facts, observable phenomenon, which presupposes a basic knowledge of the data, facts, and phenomenon being studied. Students cannot skip over knowledge acquisition and jump right to an understand of higher order thinking skills. However, there is no evidence that the teaching of critical thinking cannot take place along with lower order skills.

Even small children can be taught critical thinking skills while at play, by asking higher order, open-ended questions, such as,

- What ideas do you have?
- What do you think is happening here?
- That is interesting. Tell me why you think that.
- I am interested to hear your thinking about this.
- How would you solve this problem?
- Where do you think we might find more information to solve this problem?

In addition, they can be taught how to form hypotheses and encouraged to think in different way, by asking,

- If we do this, what do you think will happen?
- Let's predict what we think will happen next.
- What other ideas could we try?
- Let's think of all the possible solutions.

2) Critical thinking is not a stand-alone single lesson.

Critical thinking is a life skill and a lifelong process. It is not enough for teachers to teach a critical thinking lesson and then for students to complete a critical thinking assignment. Students cannot just imitate the teacher's lesson on critical thinking. They must think critically for themselves. Instructors need to demonstrate the essential role of critical thinking by demonstrating their own critical thinking skills in their lessons on a regular basis.

Critical thinking must be infused in every lesson, not taught as a stand-alone. For students to master critical thinking it must be practiced in every course, for every subject, in every lesson.

3) Critical thinking requires constant practice.

Both teachers and students must practice critical thinking – repeatedly. In his best-selling book, *Outliers*, Malcolm Gladwell explained the 10,000-hour rule, which he described as a key to mastering any skill or subject. Gladwell argued that mastery of skill requires an investment of time and practice [10].

### **Conclusions. How to Foster Critical Thinking in the Ukrainian Classroom**

As studies show, teachers are convinced of the importance of critical thinking. However, too many are uncertain about what critical thinking actually entails. The first step in fostering an overall climate of critical thinking in Ukrainian classrooms requires the disseminate of information faculty need to change their perceptions about critical thinking. Teachers must be made aware of the gap between what is currently

taught in Ukrainian universities and the job skills required of Ukrainian students as they enter the third decade of the 21<sup>st</sup> century.

Secondly, as critical thinking is not a single lesson to be mastered with a single training, skill-building professional development workshops must be provided for the professional development of all university professors. These workshops should be a regular, ongoing part of the educational profession, not simply a once every five years requirement for re-certification. To stress the importance of life-long learning in critical thinking these workshops should be incentivized.

Thirdly, critical thinking should become an essential component of all tests and exams, both for university students, as well as for prospective teachers. Content acquisition is no longer the mark of a modern education. Content is easily available to anyone with a mobile phone and the internet. The leaders and innovators of the 21<sup>st</sup> century will be those who are able to use that content to arrive at reasoned judgments, make informed decisions, and solve meaningful problems.

Universities are at a critical crossroads in the modern age, although too many administrators and teachers don't even realize it. Never before has so much information been so easily and freely made available to so many people. If universities continue to operate as 19<sup>th</sup> century repositories and disseminators of information they will eventually go the way of the steam engine. To be relevant in the modern age universities and university teachers must prepare students to make sense of the avalanche of information at their fingertips by modeling and teaching the essential 21<sup>st</sup> century skill of critical thinking.

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