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BENEFITS OF TRIZ APPROACH TO ENABLE PROPER HOLISTIC EDUCATION

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Abstract

The mission of the paper is to show that in order to overcome the contradiction in holistic education (upbringing, teaching and inventing): achieve considerately a lot of benefit with little effort, is suitable apply the TRIZ approach (The secret of deciphering innovative perfecting of conditions, creators and creations) in the form of the Framework of the cycle of mutual perfecting of conditions, creators and creations (7 = 1 + 2 x 3 in the Appendix 2) developed according to the laws of education from the message of the teacher of the nations (Comenius, 1670), according to the Law of perfecting maturity of meaning of input to output transfer (Maupertuis, 1746) and according to the laws of invention (Altshuller 1946).

The mission of the Framework of the cycle of mutual perfecting of conditions, creators and creations (Framework of perfecting) is interestingly encourage creators what to use - input of transfer, clearly convince why to use it - meaning of transfer and memorizable show how to use it - output of transfer.

Keywords: TRIZ, holistic education, upbringing, teaching, inventing

1 Mission of holistic education

The aim of lifelong holistic education is to multiply individual benefits of different types of education:

- school - formal (upbringing, teaching and inventing)
- work - informal (science, research and exploitation)
- leisure - nonformal (entertainment, interest and competition)

for the preparation of an exceptional personality - creator who is constantly perfecting his holistic qualities - competencies for:

- spiritual maturity, the right habits, principles and needs, what to use
- mental maturity, the right knowledge, professionality and perseverance, why to use it
- physical maturity, the right skills, experience and reliability, how to use it

In this paper, we focus on the mission of school education (hereinafter referred to as holistic education), which, thanks to computer support, becomes ubiquitous, versatile and all-perfecting. A step forward is new ways of targeted overcoming challenges with the growing scope, uncertainty and complexity within artificial advanced thinking (AI, Artificial Intelli-

gence) such as hereditary procedures (GA, Genetic Algorithms), meaningfulness of uncertainty (FL, Fuzzy Logic), neural networks (NN), which have found use in the approach to deep learning (DL) and in creations of demanding education (IL, Immersive Learning), replacing and supplementing reality, extended reality (XR), which includes creations replacing reality (VR, Virtual Reality) and Augmented Reality (AR).

The councils for improving the maturity - humility of holistic competencies left to us by the teacher of nations and the discoverer of laws in education (Comenius, 1670) are still valid even after 350 years:

PQ	Pannuthesia	all-perfecting	leader	predetermines
EQ	Panegersia	all-awakening	challenger	motivates
IQ	Pansofia	all-cognition	scientist	explores
TQ	Panaugia	all-enlightenment	inventor	overcomes
AQ	Panglottia	all-understanding	manufacturer	adapts
MQ	Panpaedia	all-education	educator	instructs
RQ	Panorthosia	all-correction	negotiator	convinces

The aim - challenge for perfecting the current way of education is to prepare future pioneers for meeting the requirements on competencies of tomorrow according to the conclusions of the World Economic Forum (WEF, 2020, 2021) through holistic education. The challenge for advanced holistic education for the professions of the future is to lead to the ability to harmonize simultaneously belonging, specificity and cohesion:

- input harmonization: consequences of attitudes, foresight, prudence - responsibility
  humanity (upbringing - art): principles, searching up the correct incentives,
  what to use
- meaning harmonization: depth of knowledge, penetration, professionality - interest
  expertise (teaching - science): knowledge, choosing the correct rules, why to use it
- output harmonization: breadth of context, overview, versatility - synergy
  ingenuity (inventing - craft): skills, using the correct practices, how to use it

The perfecting creations, which is, thanks to adaptation, independence and predetermination, twice as fast as the perfecting of creators, thus becomes a suitable model and a demanding challenge for holistic education (upbringing, teaching and inventing):

- change of preset properties by taking over and combining benefits from different approaches: adaptive hybridization
- targeted self-adaptation: autonomous adaptronics
- intentional holistic multiplicative predetermination: active synergy

If we want to build a reliable building, then we must first build a reliable foundation. If we want to move in the right direction, we must humbly return to the groundbreaking legacy (Altshuller, Shapiro, 1956), which is the basis for the incentives, rules and procedures of the TRIZ approach for mutual perfecting of creators, creations and conditions, which is the mission of holistic education.

Successful best ranking world universities are rapidly moving to a holistic way of education (upbringing, teaching and inventing) in order to prepare students to acquire the transferable holistic competencies (principles, knowledge and skills) needed to meet increasingly demanding challenges (quantity, diversity and complexity), so they included in the content of preparation the incentives, rules and procedures from the TRIZ approach:

(https://matriz.org/resources/triz-in-academia/).

2 TRIZ approach for perfecting conditions, creators and creations

Altshuller was the first in the history of mankind who revealed the laws of inventing which can be applied on perfecting of every human activity. By analysis successful breakthroughs in human history, he revealed principles of perfecting conditions – input for transfer to output:

- proportionality, proper use of opportunities
- economy, proper availability of facilities
- sustainability, proper protection of resources

By analysis of success life stories, he revealed principles of perfecting the creators for harmony of physical, mental and spiritual maturity - meaning of transfer:

- empathy, helpfulness, correct attitudes - habits
- efficiency, correct knowledge - expertise
- effectiveness, correct skills - overcoming

By analysis of successful inventions, he revealed the principles of perfecting creations (subjects, procedures, and attitudes) - output of transfer:

- usefulness, correct mission - function of subjects - technics
- purposefulness, essence of procedures - technology
- usability, rules of attitudes - art

The TRIZ approach is a way of transforming random spontaneity into generalization of the laws of perfecting the maturity of fulfillment of the mission of creators, creations, and conditions which are based on the idea of advanced needs, advanced use of resources, and advanced overcoming of contradictions.

2.1 TRIZ approach and meaning - values of transfer input to output

People have survived by revealing the secrets of nature, now they are revealing the secrets of thinking for nature to survive. If we want to understand the laws of the development of the world events, it is necessary to equally replace its infinite complexity with a finite number of suitable representatives - patterns (conditions, creators and creations), so that our brain equipped with a finite number of sensors and states of evaluators can them distinguish (Turing, 1937).

The attractor is the final state (perfection) for a variable - dynamic system of world events (Gräbe, 2020). The ubiquitous manifestations of perfecting world events (mutual perfecting of the maturity of creators, creations and conditions) are the consequences of the effect of perfection (attractor) on world events through the attraction of perfection (Palčák, 2017). This driving force of creativity - ingenuity - discovery manifests itself according to the principle, the rule, the lawfulness of the least possible action - drawing resources to best fulfill the mission (Maupertuis, 1746) as a generally valid permanent, reliable and fair Law of perfecting the maturity of meaning of input to output transfer (1):

(V) meaning of transfer: why - values = (F) output of transfer: how - mission / (C) input of transfer: what - resources

$$V = \frac{F}{C} \quad (1)$$

The creator - pioneer uses the conditions - resources (input, C) for valuable transfer (meaning, V) of input to output to achieve the mission of creations - means (output, F).

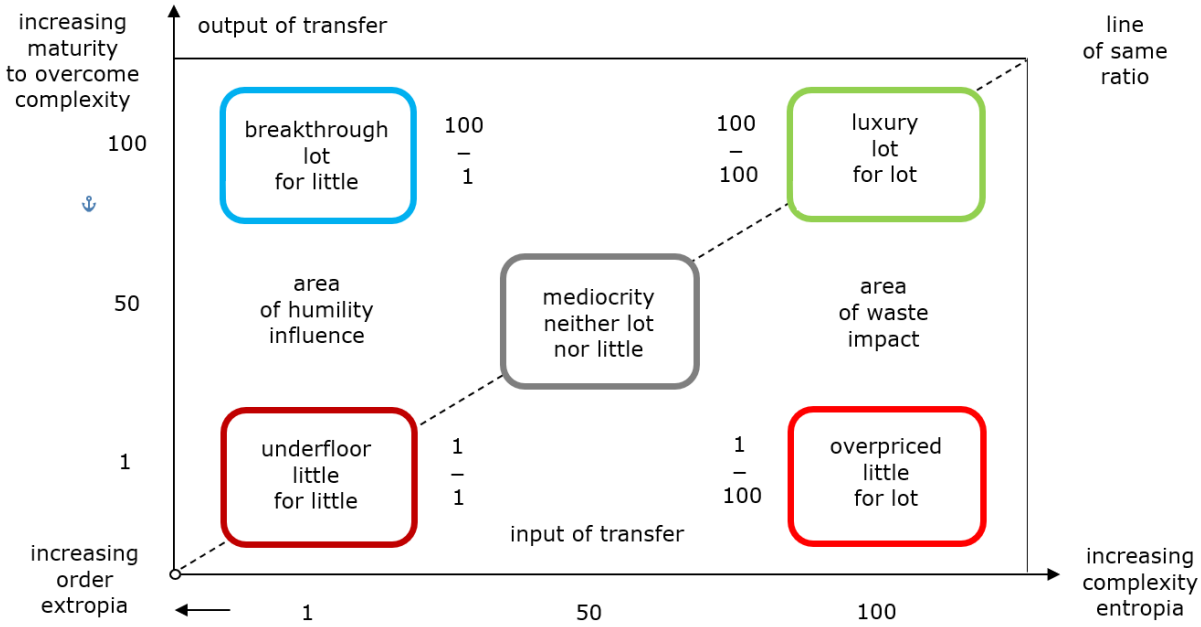

Fig. 1. Meaning - values of transfer input to output

2.2 TRIZ approach: incentives, rules and procedures

Incentives - tools, art: intention what to use, timing, input of transfer.

Support - multiplying benefits
leader predetermines, PQ (Perfecting Quotient)
multiplication, perfecting of holistic maturity, Ideality

Incentives - input of transfer
challenger encourages, EQ (Emotional Quotient)
assignment, conditions, natural, personal and group resources
scientist examines IQ (Intelligence Quotient)
generalization, essence of mission, Functionality - Value

Overcoming - meaning of transfer
inventor overcomes, TQ (Technium Quotient)
defeat of contradictions
manufacturer adapts, AQ (Adversity Quotient)
consideration, relationship of phenomena, space, time and areas, Space - Time - Domain - Interface

Application - output of transfer
educator teaches, MQ (Mission Quotient)
utilization, transfer of essence, System Transfer
negotiator convinced, RQ (Relationships Quotient)
harmonization, directions of transformation, System Transition

Rules - laws, science: reason why to use, outcomes, meaning of transfer.

TRIZ approach covers all known approaches, as its rules are based on three laws:
The law of perfection essence, input of transfer: what to use

the ubiquitous attraction of perfection is the driving force behind perfecting the creativity, ingenuity and discoveries in order to best meet the physical, mental and spiritual needs.

The law of perfection importance, meaning of transfer: why to use it
creator, creations and conditions are perfecting in the way: "considerably lot for little" with an effort to be emphatic, effective and efficient of the transfer of the proportionality, sustainability and economy of input response to the usability, efficacy and usefulness of the output.

The law of perfection procedure, output of transfer: how to use it
The mission essence of creators, creations and conditions is perfected according to the Laws of mutual perfecting - dialectics (Hegel, 1837) for overcoming contradictions, for skipping (S - curve) and for progress (self - similar fractal helix).

Table 1. Transition from current to advanced state

Current state	Advanced state
What is used: spontaneity random trials - errors habits	What needs to be used: purposefulness generalized incentives - tools adaptability, guidelines, principles
Why it is used: Inertia of thinking fragile optimization presumptions	Why it should be used: rules - laws resilient breakthrough innovation evidence, knowledge
How it is used: closedness, dependences benefit, prediction sum of benefits	How to use it: openness, procedures - instructions humility, predetermination multiplication of benefits

Procedures - instructions, craft: way how to use, realization, output of transfer.

Sequence of the ARIZ steps (Petrov, 2019) from the point of view of the TRIZ Access Framework:
Analysis - input of transfer

- assessment of baseline, needs, challenges
- setting a generalized target
- recognition of contradictions: administrative - challenge, technical - external, physical - internal

Proposal - meaning of transfer

- generalized way of resolving the contradiction
- use of resources: time, space, field, matter, knowledge - data
- feasible way of meeting given requirements and possible change of the assignment

Evaluation - output of transfer

- benefits of the proposal
- the possibility of making the most efficient use of resources
- using the way to meet the challenge of perfecting pioneers training

3 TRIZ approach for holistic education (upbringing, teaching and inventing)

Everyone is naturally curious, playful and creative - inventive, but to become a successful leader - creator who can handle current and future challenges: sustainability of survival conditions, a growing number of incentives and rapidly changing demands for holistic competences: a high degree of consideration (principles, input, what) a deep look of expertise (knowledge, meaning, why), and broad overview of openness (skills, output, how). The creator - pioneer should focus on his innate talents and collaborate with experts who will help him his talents:

- detect (doctor - psychologist)
- develop (teacher - lecturer)
- exploit (counselor - trainer)

A friendly, successful and effective way of using the incentives (what), rules (why) and procedures (how) of the TRIZ approach in education to acquire holistic competencies is based on proven results of research into the laws of holistic coexistence - humanity, cognition - expertise and creation - invention.

3.1 Framework of holistic coexistence - humanity

The aim for upbringing: the uplift for coexistence (principles), the artist encourages

What

- goodness - behavior, dedication, resilience
- goodness - thought, enthusiasm, attitudes
- goodness - pleasantness, consideration, relationships

Why

- health, physical maturity, beauty
- responsibility, mental maturity, good
- harmonization, spiritual maturity, love

How

- adequacy, diligence, regularity
- importance, consistency, consequences
- reliability, compassion, belonging

3.2 Framework of holistic cognition - expertise

The TRIZ approach unifies research on the way of thinking:

Holistic thinking (Flavell, 1976):

- there is holistic supervising, harmonizing and multiplying thinking throughout the brain (generalizing beyond cognition - metacognition in the superconscious)

  goal: upliftment, humanity - helpfulness

Contemplative and imaginary thinking (Sperry, 1961):

- conscious contemplative thinking takes place in the left part of the brain
- subconscious imaginary thinking takes place in the right part of the brain

Slow and fast thinking (Kahnemann, 2012):

- deliberate conscious slow and strenuous evaluative thinking takes place in the upper part of the brain

goal: truth - essence, pleasure, effectiveness

- spontaneous subconscious fast and easy thinking takes place in the lower part of the brain

goal: correctness - mission, survival, success, ingenuity

It has been confirmed that the knowledge we often deal with will remain in our memory for a longer period of time, because:

- spontaneous thinking is constantly imaginatively looking for context necessary for the meaningfulness of uplift, therefore it has an important influence on the correctness of the consequences in the formation of judgment - ideas for decision - making
- deliberate thinking focuses on truthfulness and essence, especially in terms of benefits
- harmonizing - supervising thinking switches the involvement of fast thinking (for common challenges) or slow thinking (for demanding challenges) according to the difficulty and thus multiplies the individual benefits of subconscious experience, conscious expertise - knowledge and superconscious generalization of ideas - inspiration, intuition

Instruction for cognition (knowledge - expertise), the scientist convinces

What

- superconsciousness: imagination, perception
- consciousness: reasoning, evaluation
- subconsciousness: harmonization, multiplication

Why

- liveliness, lightness
- purposefulness, effort
- supervision, metacognition

How

- search, choosing the right stimuli, needs
- evaluate, research of correct laws
- use, apply good habits

3.3 Framework of holistic creation – invention, the pioneer overcomes

The TRIZ approach unifies:

Eastern - empirical approach in the superconscious is focused on evaluation - analysis

- favors experience, induction, foresight
- from individual to general
- what is needed, artist, principles, input of transfer

Western - rational approach in the consciousness is focused on assembly - synthesis

- favors knowledge, deduction, prediction
- from general to individual
- why it is necessary, scientist, knowledge, meaning of transfer

Holistic - discovery approach in the subconscious is focused on multiplication - synergy

- favors imaginativeness, abduction, predestination
- from improvement to breakthrough
- how is needed, inventor, skills, output of transfer

Inventing for embodiment (skills - ingenuity), a pioneer overcomes

What

- experience, knowledge, ideation
- imagination, entrepreneurship, alertness
- opposites, jump, progress

Why

- attractiveness
- transfer
- conversion

How

- discrepancy recognition, contradiction, input, challenges according Law of perfecting
- similarity search, analysis, meaning of transfer, search using Contradiction Matrix
- invention of substance, decipherment, output, breakthrough solutions, ARIZ

4 Application of the Framework of perfecting

The features of the Framework of perfecting are based on the principles for e-learning of today's Z generation of zoomers that resize images on touch screens:

- one view-image, what is necessary to use: one incentive of the Framework of perfecting, (the 7-steps cycle of mutual perfecting conditions, creators and creations)
- one reason-essence, why is necessary to use: one rule of the Framework of perfecting, maturity equation (meaning = output / input)
- one instruction-sequence, how is necessary to use: one procedure of Framework of perfecting, (contradiction, analysis, decipherment)

The methodology of Framework of perfecting for education was successfully applied in numerous lectures, theses (BSc., MSc., PhD., habil.) and projects for industry (automotive, railway, aircraft, white goods, earthmoving machinery, nuclear) for more than 20 years at Faculty of Mechanical Engineering, Slovak University of Technology (FME STU) Bratislava, SK. Details can be found in the selected links (References 13 - 17).

http://atc.sjf.stuba.sk/english/e_projekty.html

http://atc.sjf.stuba.sk/english/e_theo_mech.html

https://triz.sk/en/papers.html

My suggestion as member of Scientific Council at FME TUL to apply Framework of perfecting into education was accepted by Assoc. Prof. P. Lepšík, PhD, Vice-Dean for Doctoral Studies and Development, who was on scientific stay at MIT, Cambridge, Massachusetts, USA (supervisor Prof. S. Ikovenko, TRIZ Master). In his habilitation thesis (2018) the TRIZ approach was applied to increase efficiency of nanofibers production.

Strategy RDI + 2030, Faculty of Mechanical Engineering, Technical University of Liberec, CZ.

http://www.fs.tul.cz/en/faculty/strategy-r-d-i-/

5 Conclusions

A great example of the impact of the Law of perfecting is the development of the brain which constantly strives to accomplish its mission as best as possible: taking the right decisions to best meet the right physical, mental, and spiritual needs (prosperity, pleasure and upliftment),

while exerting the least effort and consumption on the basis of right choice, comprehension and compliance of the right incentives - challenges.

The TRIZ community should strive to make a significant contribution to perfecting Altshuller's gift to the world through holistic education so that it would touch the heart of everyone, and make the TRIZ approach available (cheap), intelligible (favorite), and uplifting (useful).

According to the Law of perfecting based on the action of the attraction of perfection, the time has come when, after periods of survival (dealing with matter) and pleasure (dealing with information), comes a period in which humanity will engage in uplift (dealing with relationships). This means challenging the use of appropriate tools, rules and procedures (TRIZ approach) and trying to humanize creations (objects, procedures and attitudes) that can already emulate and often surpass the physical strength and achievements of human thinking and strive for advanced use of resources aiming to align the maturity of the creator, creations and conditions.

The Framework of the cycle of mutual perfecting of creators, creations and conditions allows to use the holistic complexity of tools, rules and procedures of TRIZ approach and simultaneously is concise, understandable and applicable to meeting educational challenges: recognizing, understanding and applying the right principles, knowledge and skills.

The sign - logo (Fig. 2) of a Framework of perfecting is a flower that represents manifestations of humility:

- transcendent - spiritual upliftment - love (belonging)
- inner - mental values - good (satisfaction)
- external - body beauty (harmony)

The unifying competence of holistic education is ingenuity, which combines imagination, knowledge, adaptability, anticipation, prediction and predestination, overcoming obstacles, and which is a promise for a full life, for prosperity, pleasure and upliftment - humility.

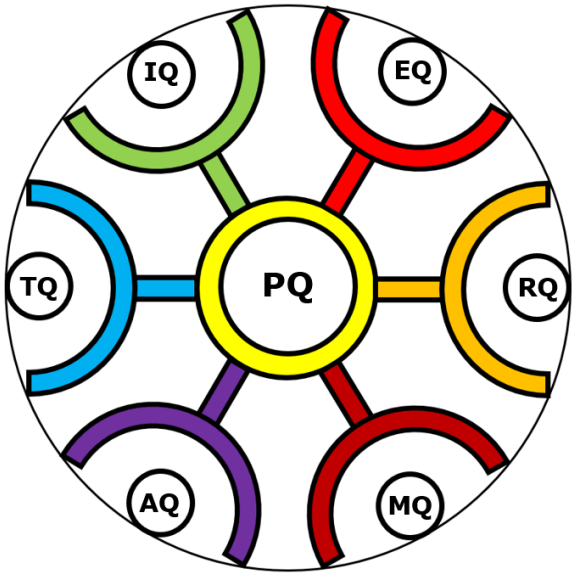

Fig. 2. Framework for the cycle of mutual perfecting creators, creations and conditions

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Appendix 1

Table 2. Perfecting the maturity of meaning of input-to-output transfer for conditions, creators, and creations through the principles of art, knowledge of science, and craft of skills to handle the quantity, diversity, and complexity of inputs.

	Perfecting the maturity of meaning of input-to-output transfer		
	Input of transfer	**Meaning of transfer**	**Output of transfer**
	conditions, investment what to use, principles economy	creators, pioneers why to use it, knowledge efficiency	creations, products how to use it, skills purposefulness
	art, upbringing incentives, love, spiritual advice, superconsciousness	science, teaching, rules, goodness, mental reason, consciousness	craft, inventing procedures, beauty, body way, subconsciousness
	quantity diversity complexity	search selection use	timing correctness reliability

The seven principles (7 = 1 + 2 x 3) of the Framework of the cycle of mutual perfecting conditions, creators and creations (Framework of perfecting) under the law of perfecting the meaning of input-to-output transfer from TRIZ approach for holistic education (upbringing, teaching and inventing) to acquire holistic competences (principles, knowledge and skills) is in the Appendix 2, Tab. 2.

- Framework for perfecting the three aspects of conditions (sources, opportunities and means) in the seven steps of the integral cycle of input to output transfer: (alignment, human resources, knowledge resources, natural resources, preparedness, equipment, and sustainability).

- Framework for perfecting the three aspects of creators (spiritual, mental and physical) in the seven steps of the integral cycle of input to output transfer: (leader, challenger, scientist, inventor, producer, educator, and negotiator).

- Framework for perfecting the three aspects of creations (rules, procedures and mission) in the seven steps of the integral cycle of input to output transfer: (predetermination, needs, motor, transmission, tool, sensor, and guidance).

Appendix 2

Table 3. Seven principles (7 = 1 + 2 x 3) of the Framework of the cycle of mutual perfecting conditions, creators and creations (Framework of perfecting) under the law of perfecting the meaning of input-to-output transfer from TRIZ approach for holistic education (upbringing, teaching and inventing) to acquire holistic competences (principles, knowledge and skills)

The Framework of the cycle of mutual perfecting of conditions, creators and creations				
	Input of transfer	**Meaning of transfer**	**Output of transfer**	
	conditions, investment what to use, principles economy	creators, pioneers why to use it, knowledge efficiency	creations, products how to use it, skills purposefulness	
PQ	harmonization maturity of input, meaning and output of transfer	exceptionality passionate multiplication of benefits	maturity predetermination significance	**maturity of transfer**
EQ	human resources pioneer, assessor, advisor	soulfulness active incitement of innovating	adaptability needs curiosity	**input of transfer**
IQ	knowledge resource lesson, information discovery	expertise patient evaluation of analyses	dexterity engine intelligibility	
TQ	natural resources phenomena, fields, substances, time, space	openness imaginative overcoming of challenges	usefulness transmission memorability	**meaning of transfer**
AQ	energy readiness do the work	resilience persistent adaptation of innovations	economy tool manageability	
MQ	amenities opportunities usability	dedication strenuous education to accountability	instructiveness sensor fun	**output of transfer**
RQ	sustainability renewable resources	consideration convincing justification for unification	friendliness guidance inflammation	

The seven principles (7 = 1 + 2 x 3) of perfecting maturity of meaning - value of input to output transfer according to abilities of creator - pioneer:

7: PQ = EQ x IQ x TQ x AQ x MQ x RQ

1: unique law for perfecting maturity of input to output transfer

PQ for maturity of transfer

2: two types of access (deliberateness, spontaneity) to overcome challenge

3: three pairs of competencies

EQ, IQ what to use: for input of transfer

TQ, AQ why to use it: for meaning of transfer

MQ, RQ how to use it: for output of transfer.