UNIVERSITY OF ŠIAULIAI  
SMC “SCIENTIA EDUCOLOGICA”

2nd International Baltic Symposium on Science and Technology Education

BalticSTE2017

“SCIENCE AND TECHNOLOGY EDUCATION: ENGAGING THE NEW GENERATION”

Thursday

15th June 2017

09:00-10:30

INTERACTIVE PLENARY

(Second Floor, Room 203, Library of Šiauliai University, Vytauto Street 54, Šiauliai)
Moderator: Vincentas Lamanavas

Andris Broks. Systems Thinking - joint philosophical and psychological basis for modern Science and Technology education (University of Latvia, Riga)

Reviews to the theme: 
Raffaele Pisano, Italy
Angela James, South Africa
Jack Holbrook, Estonia
Boris Abersk, Slovenia

Discussion
INTRODUCTION

Let us STOP at least for a moment and think a little bit about
SYSTEMS THINKING!

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PHILOSOPHY

SYSTEMS

SCIENCE and TECHNOLOGY EDUCATION

PSYCHOLOGY

THINKING

Systems Thinking:
joint philosophical and psychological basis for modern science and technology education
Part 1   WORLD and HUMAN – two worlds

DIALECTICS

World of Thoughts

Material World

Humans’ life purposeful activities:
cognition – consideration - behaviour
WORLD and HUMAN

Hello, I am a Human!
Material World
It is Me
and My outer environment
Humans' unknown part of the Universe

Human within the World and
World within the Human –
TWO WORLDS

Exitation of
Thoughts

World of
Thoughts

Materialization
of Thoughts

Material World -
where Human is part of it

Material World – it is a set of diverse phenomena (changing bodies)
All material world’s phenomena are reflected –
cognized within Human’s World of Thoughts as SYSTEMS
World and Human

Human - spiritualized alive material being – part of the Material World

Material World - it is ME and my outer environment

My inner environment

Physical (body - physiology)
- Consciousness

Spiritual (spirit - psychology)
- Subconsciousness

Feelings
- Emotions
- Image

Will
- Conclusions
- Concepts

Mind
- Art
- Practice
- Science

My outer environment

Societal
- People

Natural
- Plants
- Animals
- Gases
- Liquids
- Solid state bodies

Technical
- Not alive

Real and Unreal Thoughts

World of Thoughts

Material environment of human’s life

Material (perceptible or real) world

Transmission and materialization of Thoughts

Excitation of Thoughts

Unreal Thoughts

Real Thoughts
Part 2 Systems Thinking – spiritual activity of Human

All material world’s phenomena are reflected – cognized within Human’s World of Thoughts as SYSTEMS

SYSTEM – it is the whole, what contains interconnected parts (inner environment of the system) and what is surrounded by other systems (outer environment of the system)

Cause of everything is interconnection of everything
World - it is a set of changing diverse bodies, what is reflected as a SYSTEM in Human's World of Thoughts.

World - it is a known part of the UNIVERSE and ETERNITY.
Hierarchical structures of the systems, arrangement of systems’ structures

**Simple** functional structures and **complex** stochastic structures of systems as observed material world phenomena reflections in human’s World of thoughts

Simple plain hierarchy structure – horizontal and vertical arrangement of system’s elements

General classification of systems properties

- **Constitution (SPACE)**
  - Content
  - Structure
  - Arrangement

- **Change (TIME)**
  - Content
  - Structure
  - Arrangement
**Systems thinking:** human cognizes world by parts (analysis), comparing them and connecting them together (synthesis)

What we are thinking about?

SYSTEM – it is the whole as a set of interconnected system’s parts within the outer environment of other systems

System’s BASIC PROPERTIES are CONSTITUTION of the system and CHANGES of system’s properties

CAUSE of everything is interconnection of everything

What we are thinking about and how we are thinking – so we are living!

Universal hierarchical structure of human’s purposeful activities

Human’s LIFE – system of diverse human activities to satisfy their needs of life
Part 3  Modern LIFE and EDUCATION today for tomorrow

General structure of modern State

- Policy
- Education
- Economy
- Art and Science
- State security
- Health care

State's outer environment (other states)

LIFE – joint physical and spiritual activity of Human as well as of Society

- Artistic (feelings-images)
- Practical (will-actions)
- Scientific (mind-concepts)

General structure of purposeful Life activities

- NEEDS
- RESOURCES
- MANAGEMENT
  - WILL - conscious need, goal
  - POWER - ensure execution
- EXECUTION
- VALUATION
- SATISFACTION
  - OF NEEDS

EDUCATION – it is specially gained Life experience for Life

- Humanitarian education
- Social education
- Natural science and technology education
Basic structure of **LIFE** experience as well as of **EDUCATION**

- **Education is the set of person's knowledge, skills and attitudes**
- **Education as a process includes learning and upbringing activities**

**Cleverness (intelect)**
- **Knowledge** (what is this?)
- **Learning process**

**Honesty (moral)**
- **Skills** (how to do this?)
- **Upbringing process (value orientation)**
- **Attitudes** (why to do this?)

/ Latvia state Law of Education, 1998 /
Human’s research activities as gaining new life experience for Life

Hierarchical structure of Human's realized research activities

**Fundamental Research**
- Full description of phenomena (comprehension, causality)
- Initial description of phenomena (understanding, factology)
- Perception of phenomena (sensations, communication)

**Applied Research**
- Projecting application of selected theory to satisfy corresponding need
- Attachment of resources
- Execution of the project

**Theory**
- Consideration
- Cognition
- Behaviour

**Practice**
- Need to be satisfied

**Satisfaction of given need**

Educational Research within General education - it is gaining new educator's personal life experience and includes both Fundamental and Applied Research experiences
Diverse people realize different LIFE styles - they need different level
GENERAL and PROFESSIONAL EDUCATION
What Education for what Life tomorrow?

<table>
<thead>
<tr>
<th>EDUCATION - specially gained Life experience for Life</th>
<th>Development</th>
<th>Existance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SCIENTIFIC</td>
<td>MIND (concepts, conclusions)</td>
<td>Fundamental and applied scientific research</td>
</tr>
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<td></td>
<td></td>
<td>Mindful exploitation and repair of technologies</td>
</tr>
<tr>
<td>PRAGMATIC</td>
<td>WILL (needs, goals, resources, satisfaction)</td>
<td>Creative practice</td>
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<td></td>
<td></td>
<td>Exploitation of scientific and artistic achievements</td>
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<tr>
<td>ARTISTIC</td>
<td>FEELINGS (images, emotions)</td>
<td>Fundamental and applied artistic research</td>
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<td>Inspiration and interior designe</td>
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Hierarchical structure of the Society
CONCLUSION

It is the time to look forward again: changes are all around us and we are part of these changes.

It is not a Big Ban again, but there is an explosion of information today. We feel lost within a flow of local as well as global information.

It is the time, when we experience changes within our value orientation.

It is the time we need to develop conscious Systems Thinking!

WORLD

HUMAN

LIFE and EDUCATION

INTERACTIVE PLENARY

15.06.2017

EDUCATION

Humanitarian Education  Social Education  NSTE

Physics, Mathematics, Chemistry, Biology, Informatics
Let us think about thinking -
SYSTEMS THINKING

What about and how do we think –
such is our life!

Systems Theory

top general concept –

EVERYTHING IS
INTERCONECTED
SYSTEMS THEORY – general theory of systems thinking

SYSTEMOLOGY – applied systems theory

EDUCATION

Life experience for Life

(knowledge, attitudes, skills) (cognition, consideration, behaviour)

Systemology of NSTE - applied theory of systems thinking – fundamental part of modern general education didactics
Thank you for attention!

My recent short publications:

* THINKING ABOUT THINKING: START-UP FOR MODERN EDUCATION FOR TOMORROW
  Gamtamokslinis Ugdimas/Natural Science Education, vol.13, No.3, 2016 (pp. 94-95)

* SYSTEMS THEORY OF SYSTEMS THINKING: GENERAL AND PARTICULAR WITHIN MODERN
  SCIENCE AND TECHNOLOGY EDUCATION
  Journal of Baltic Science Education, Vol. 15, No. 4, 2016 (pp. 408-410)

* SCIENTIFIC THINKING – THE BACKBONE OF MODERN SCIENCE AND TECHNOLOGY EDUCATION
  Journal of Baltic Science Education, Vol. 13, No. 6, 2014 (pp. 764-766)

Some my selected materials in English are available in internet:
APPENDIX
Explosion of information – changes within our life and education

What's unusual about Finnish schools?
• Teaching is a highly respected, well-paid profession
• There are no school inspections or teacher evaluations
• The school system is highly centralised and most schools are publicly funded
• School days are short and the summer break is 10 weeks
• Children are assessed by their teachers. The only nationwide exam is for those who continue studying to 18
• Average school size is 195 pupils; average class size is 19 pupils
• Success has been attributed to a traditionally high regard for teaching and reading, as well as a small, largely homogenous population
• Though still high, Finland has been slipping down the Pisa rankings in recent years
• Like other nations, it faces challenges of financial constraints and growing immigration

Systemology of humans’ communication – problems within local and global linguistics – regional and international English
**Philosophy can teach children what Google can't**

With jobs being automated and knowledge being devalued, humans need to rediscover flexible thinking. That starts in schools.

Ireland’s president Michael D Higgins: ‘The teaching of philosophy is one of the most powerful tools we have at our disposal to empower children.’

Amid the political uncertainties of 2016, the Irish president Michael D Higgins provided a beacon of leadership in this area. “The teaching of philosophy,” he said in November, “is one of the most powerful tools we have at our disposal to empower children into acting as free and responsible subjects in an ever more complex, interconnected, and uncertain world.” Philosophy in the classroom, he emphasised, offers a “path to a humanistic and vibrant democratic culture”.

In 2013, as Ireland struggled with the after-effects of the financial crisis, Higgins launched a nationwide initiative calling for debate about what Ireland valued as a society. The result is that for the first time philosophy was introduced into Irish schools in September.

A new optional course for 12- to 16-year-olds invites young people to reflect on questions that – until now – have been glaringly absent from school curriculums. In the UK, a network of philosophers and teachers is still lobbying hard for a GCSE equivalent. And Ireland, a nation that was once deemed “the most Catholic country”, is already exploring reforms to establish philosophy for children as a subject within primary schools.