Tamás Varga’s Reform Movement and the Hungarian “Guided Discovery” Approach

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Plan of the lecture

I. Tamás Varga’s reform in its historical context

II. The main characteristics of Varga’s conception on mathematics education

III. Varga’s legacy today
I. Tamás Varga’s reform in its historical context
Tamás Varga

- Family: son of a Calvinist priest
- Well-known siblings (D. Varga writer, B. Vargha historian of literature, anthropologist of games)
- Married Ágnes Binét psychologist
- 1945- mathematics teacher
- 1947- Educational Ministry, then National Institut of Education
- 1951- Eötvös Loránd University, mathematics teacher education
- 1967- National Institute of Pedagogy

- Several short experiments from the 1950s
- Teaching mathematics in one class from 1955 on
- 1963-1978 the Complex Mathematics Education experimental project
Varga’s reform project (1963-1978)

- **Direct antecedents**
  - 1960 Paul Dienes’ lectures
  - 1962 UNESCO conference on mathematics education in Budapest

- **The complex mathematics education reform**
  - Primary and middle school level (grades 1-8)
  - Experimentations since 1963 in a primary school
  - Progressively growing project (levels, number of schools and teachers included)

- **Selected at the beginning of the 1970s as basis for the new national curricular reform**
  - 1974 provisional curriculum
  - 1978 obligatory national curriculum

- **Controversial reception**
The political and institutional context

- Political background
  - Hungary in the communist „Eastern block”
  - But from the beginning of the 1960s, an easing of the dictatorship, international opening

- Educational context
  - 8 year (4+4) unique and obligatory primary school since 1946
  - Centralized direction and ideological control until the 1960s
  - A slow liberalisation process from the late 1960s
    - Taking into account pedagogical and psychological research
    - Some liberty for teachers
    - Differentiation starts to appear
  - 1978 general curricular reform
An international context in mathematics education

- Participation in the “New Math” movement
  - From the ’60s, participation in international exchanges, in the work of international organizations (CIEAEM, OECD, UNESCO etc.)
  - Co-editor of the UNESCO book about the Budapest congress with W. Servais
  - Invitations, publications in various countries (Soviet Union, Germany, France, Italy, USA, Canada etc.)
An international context in mathematics education

- Varga follows the reform movements and publications of various countries

- Some internationally shared ambitions
  - Answering the social and economic needs of industrialized societies: reinforcing the role of mathematics in the frame of a democratised educational system
  - Reforming the content and the structure of curricula: presenting mathematics as a coherent subject and integrating elements of “modern mathematics”
  - Reforming the teaching practices: taking into account the results of psychological research and methods of “active pedagogy” - Influence of Piaget, Dienes etc.
Hungarian mathematicians and a „heuristic” epistemology in the background

László KALMÁR (1905-1976)

Rózsa PÉTER (1905-1977)

Alfréd RÉNYI (1921-1970)

János SURÁNYI (1918-2006)

George PÓLYA (1887-1985)

Imre LAKATOS (1922-1974)
Hungarian mathematicians and a heuristic epistemology in the background

- A coherent epistemology described in philosophical texts, books popularizing mathematics, texts about mathematics education

- Mathematics is viewed
  - In permanent, organic development
  - Based on intuition and experiences
  - Guided by series of problems
  - Social activity
  - Dialogic nature
  - Creative, playful activity

- Emphasis on heuristic methods

- Limited use of formal language
Hungarian mathematicians and a heuristic epistemology in the background

- Hungarian mathematics in Varga’s reform
  - Discrete mathematics
  - Logic – Kalmár, Péter
  - Probability – Rényi
  - Geometry – Hajós?

- The textbook series of Péter, Gallai et al.

The pedagogical-psychological background

- Complex influences, not always well documented
  - Piaget
  - Russian pedagogy
  - Ferenc Mérei
  - Sándor Karácsony
The pedagogical-psychological background

Sándor KARÁCSONY
(1891-1952)

- Calvinist pastor
- Psychologist, philosopher, linguist, educator
- In the 1940s, an intellectual circle around him, discussing questions about education
- Several mathematicians connected with him (L. Kalmár, A. Rényi, J. Surányi, I. Lakatos, T. Varga and his brothers)

- Some probable influences
  - importance of visual intuition
  - a social psychology of learning
A controversial implementation

- **Period of experimentation**
  - Progressive dissemination, direct contact with participating teachers
  - More than 100 participating classes in the early 1970s
  - Generally successful (complex impact assessment, Klein 1972)

- **Period of obligatory introduction**
  - Political expectation, against the intentions of Varga’s team
  - Public debates, controversies
  - Resistance of teachers and parents
  - New curriculum and textbooks in 1985

- A partial presence of the reform’s effects, in curricula, textbooks, teacher education and practices, until today
II. The main characteristics of Varga’s conception on mathematics education
„Complex” mathematics education

- Complexity of the approach
  - Curriculum, resources, practices...

- Mathematical complexity
  - Mathematical coherence, connection of various domains

- Pedagogical complexity
  - Various tools and methods
Tasks in Varga’s approach

- Rich tasks (problem-situations)
  - Allowing students to make sense of mathematical notions
  - Students’ active contribution to the construction of mathematical knowledge
  - Linking several mathematical domains
  - Open to different solution strategies

- Use of various tools, manipulatives
  - Logical sets, Dienes sets, Cuisenaire rods etc.
  - Ordinary objects from the classroom

- Importance of playfullness, pleasure
Tasks in Varga’s approach

- Example: substraction by rolling a dice

The goal is to make the difference as great as possible. They can fill the boxes in any order, but only with random numbers produced by rolling dice. After a number is given by the dice, children write it into one of the boxes which is still empty and cannot change it. After filling the third box they have no choice for the fourth random number. Those with the largest difference get three points, those with the second largest get two, those with the next get one and the others none. Then they start again.

T. Varga (1982). *New topics for the elementary school math curriculum*
The curriculum of Varga’s reform
A structure favoring discovery processes

- A diversity of the subjects treated; early introduction, dialectic relation between them:
  - sets-logic
  - arithmetic-algebra
  - relations-functions-series
  - geometry-measuring
  - combinatorics-probability-statistics

- Flexible structure:
  - „Compulsory” and „suggested” topics
  - Difference between compulsory topics and requirements
    "many concepts and skills not appearing as requirements in the school year where they are first mentioned in the syllabus, get enrolled to them in subsequent years when they are supposed to become ripened" (Halmos & Varga 1978 p. 231)
Resources and expected teaching practices
Series of problems

- Not isolated problem situations but “series of problems”

- In the textbooks and teachers’ handbooks
  - Examples of series
  - Suggestions to create and organize series
  - Encouraging teachers to elaborate their own long term teaching trajectories
Resources and expected teaching practices
Series of problems: combinatorics in the 1st grade teachers’ handbook

- General level
  - Diversity of the problems (e.g. materials)
  - Increasing abstraction

- Sub-series:
  - Free game with the material
  - Towers with a given height
  - Different towers with the same height
  - All different towers with the given height (the number of possibilities)
IV. Resources and expected teaching practices

Series of problems: combinatorics in the 1st grade teachers’ handbook

- Apparent differences, making the problems new in students’ eyes
- Recognizing analogies between corresponding phases of different series
- Progressive generalization of methods and solutions
IV. Resources and expected teaching practices

Series of problems: building towers in (Varga 1982)

T. Varga (1982). *New topics for the elementary school math curriculum*
Resources and expected teaching practices
Classroom dialogues

- **Fictive classroom dialogues in the textbooks**

- **In the teachers’ handbooks, suggestions for the management of dialogues**
  - Not completely autonomous student work, but important responsibility in the construction of notions
  - How to intervene supporting the emergence of mathematical notions but without directly transmitting knowledge?
The teacher’s work

- Varga’s approach expects from the teachers:
  - High-level mathematical knowledge
  - Pedagogical creativity
  - Autonomy on several levels
    - Long-term teaching trajectories
    - Task design
    - Management of classroom interactions

- Supporting elements but difficult use of the resources
Summary of Varga’s approach

- Many elements present from the international New Math movement
  - Coherence of mathematics curricula, elements of „modern mathematics”
  - Focus on mathematical notions and structures instead of mechanical counting and measurement
  - Use of various manipulatives and the methods of active pedagogy

- But also emphasis on problem solving and mathematical discovery
  - Represents the „heuristic” epistemology of a Hungarian mathematical community
  - Teaching mathematics by „guided discovery”
  - Connects Varga’s approach with other approaches related to Inquiry Based Mathematics Education (Artigue & Blomhøj 2013)
Summary of Varga’s approach
Elements of „guided discovery”

- A „heuristic” epistemology of mathematics
- Rich tasks (problem-situations)
  - Allowing students to make sense of mathematical notions
  - Students’ active contribution to the construction of mathematical knowledge
  - Linking several mathematical domains
  - Open to different solution strategies
- A collective re-discovery process of mathematics
  - Long, complex teaching trajectories structured by series of problems
  - Classroom dialogues
- Curriculum
  - Diversity of the domains treated in parallel
  - Spiralic and flexible structure
- Diversity of tools and representations
- Emphasis on the playful and aesthetic character of mathematics
- Respect and valorization of students’ diversity
III. Varga’s legacy today
Varga’s legacy today

- Partial presence of his approach in
  - Curricula
  - Textbooks
  - Teacher education (especially primary level)
  - Practices – in a narrow circle of teachers

- Recognition among specialists of mathematic education
- Difficulties of dissemination
The ongoing MTA-ELTE research project

- MTA-ELTE Complex mathematics education research project (2016-2020)
  - Revisiting Varga’s approach
  - Adapting it for current mathematics education
  - Theoretical description, better connection with current research
  - Supporting the dissemination

- Various participants (researchers, teachers), several sub-projects
The ongoing MTA-ELTE research project
An example of current research

- A subgroup focusing on the teacher’s work with series of problems
  - A mixed group of researchers and expert teachers of the approach
- Aims
  - Analysing expert teachers’ work
  - Supporting the dissemination of the approach
- Preparation of a commented collection of SoP
  - Generic examples, illustrating the principles of constructing and using SoP
  - The process of preparation as a research tool for analysing expert teachers’ work („reverse engineering“)
The ongoing MTA-ELTE research project
An example of current research

A PRIORI ANALYSIS OF SERIES OF PROBLEMS

Network of problems

Series of problems

PB1
PB2
PB3

„Schemes of use”:
purposes + Realisation
(classroom management; tools...)

ANALYSIS OF TEACHERS’ DOCUMENTATIONAL PROCESS
Thank you for your attention.