

Methodical Approaches to the Acquisition and Application of Mathematical Concepts

Rasma Garleja, Ilmārs Kangro¹

University of Latvia, Aspazijas blvd. 5, Riga LV – 1050 Latvia, Tel. 7034615, Fax 7034614, E-mail: evf@lanet.lv ¹Rēzekne Higher Education Institution, Atbrīvošanas aleja 90, LV – 4601, Rēzekne, Latvija, Tel. 4625150, Fax 4625901, E-mail: kangro@ru.lv

The subject's object-based activity aimed at acquiring and developing new knowledge is dominated by two **types of experience** (Пижае, 1965), (Давыдов, 1972): one is focused on the result obtained during object-based activity and the other – on the *analysis of actions* performed by the subject to achieve the result.

Physical, mathematical and other reality objects have two forms: the **status** form and **modification** (rearrangement, transformation) form, whereas the cognitive functions are characterised by **figurative** aspects (types of perception, concept images), and modifications – by **operational** aspects, which are used to reproduce these modifications and gain understanding (Пижае, 1965), (Щедровицкий, 1995).

The difficulties in mental representation are related to the formation of an adequate object and its concept image, which match the relevant sign, concept and form (Carreira, 2001), (Kangro, 2006). The difficulties are caused by differences among the concept, object and its mental image both on the representative and cognitive level, (Miller, Paredes, 1996), (Garleja, Kangro, 2006).

The article analyses the possibilities of implementing figurative and operational aspects (in a visual and analytical form) to solve a task/problem, thus ensuring the connection of declarative, procedural and conceptual knowledge: 1) by characterising the *functional states* of the relevant system; 2) by reinforcing (through practical application) the changes of the major functional states of the system and their interactions; 3) operations with symbols by adequately harmonising the *symbolical-operational* components of thinking (presented, e.g., like formulas, equations, etc.) with the *structural-objective* components of time and space, which reflect the relevant object (presented, e.g., with plane elements – curves, plane shapes, etc; with spatial elements – surfaces, spatial shapes, etc.); 4) within the process of gaining understanding of the relevant object, combining the *previous experience* and the *knowledge* obtained during the research and clearly defining the *uncertainty object* and its limits.

The enumerated activities are performed using mathematical computer systems (Maple, Matlab): a) implementation of graphic display (graphic visualisation of *plane, space*, etc. objects); b) implementation of the symbolical languages (*mathematical* language and *DMS Maple, Matlab* language).

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