HOW TO BRIDGE THE GAP BETWEEN THE RESULTS OF PSYCHOLOGICAL RESEARCH AND THE REALITY OF EVERYDAY CLASSROOM LEARNING

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Abstract

The article discusses a systematic research approach to the transformation of the educational system in the midst of curricular reform in Slovakia. During this period of curricular reform in Slovakia, experts consider what the features of an ideal school system and the goals of their reforming efforts should be. This article argues that: reforming tendencies should not ignore the results of the latest neuropsychological and cognitive-psychological research into learning and refers to the growing divide between the results of neurological and psychological research and their application within the classroom. The author describes an example of interdisciplinary research involving expertise in four different academic fields aimed at restructuring the curriculum for teacher trainees. The main goals of the research are: to analyze the principles of cognitive education; to create preconditions for its legal implementation into practice; to justify the position of cognitive education as a key principle of education; to create a supportive environment for its development starting with a paradigmatic change of teacher training. Both on the level of basic and of applied research, the research team aims to contribute to the understanding of what is meant by the ability to learn and to identify part of the spectrum of processes which make up this ability. The ability to learn will be examined from the point of view of the cognitivist paradigm, with focus on executive functions and their involvement in the learning processes. The results of this study will then lead to creation of a series of tasks aimed at stimulating and developing those executive functions of the pupils which are identified as being critical in the process of learning curricular contents. This stimulus programme for development of a pupil's executive functions will cover the key curricular subjects in primary education of Mathematics and the pupil's mother tongue.

Keywords: Curricular reform, cognitive education, executive functions

Introduction

The article discusses a conceptual and systematic research approach to the transformation of educational system in the midst of curricular reform in Slovakia. The Slovak school system, following the regional traditions of Central and Eastern Europe by having a highly centralized system with a normative curriculum, is currently in the stage of developing more effective educational approaches. Education reform is a process of progressive changes with an impact on the most general levels as well as on single school classes and is not a one-off time-isolated event. Within a reform, it is not only the conceptual outline that is important. Educational reform involves a process of gradual changes ranging from the most general to those on an individual classroom level, changes which are not merely one-off events. In creating a compact and cohesive system of education, it is necessary that the experts charged with this task can support their arguments for such a programme:

with a theoretical and philosophical outline of its most general aims
educational ideals relating to key social values
specific description of its practice in the classroom.

During this period of curricular reform in Slovakia, we consider the questions: *what are the features of an ideal school system today? How should we define the goals of our reforming efforts?* Our thoughts are determined by the fact that in the last few decades, on the basis of new research results in behavioural sciences, neuropsychology, research into artificial intelligence and Information Processing Theories, the behaviourist perspective on learning processes has been shown to be untenable. The relatively newly emerging cognitive paradigm dared to study exactly those aspects of learning that couldn't be looked upon by behaviourists. In the last decade, however, many authors (such as Tokuhama – Espinoza, 2012) have pointed to the growing divide between the results of neurological and psychological research and their application within the classroom. It is often argued that current educational practice fails to reflect the results of the latest research into the brain and into learning processes. The reason is simple: explaining the results of complex neurological and psychological research so that it can then be used in everyday classroom conditions is extremely difficult. The connection between these results and classroom practice, however, is very limited and the dichotomy between those who produce neurological and psychological research findings and those who should be applying them within the teaching process continues to grow. Which leads to the question: who should be the mediator or transmitter in this process?

Cognitive pedagogics – the borderline between neuropsychology, cognitive psychology and pedagogy

Let us now consider the role of cognitive pedagogics and whether it can serve as a border area between neuropsychology, cognitive psychology and pedagogy. What are the possibilities of tying neurological and psychological research projects in with their educational application? We would justify the need to integrate cognitive pedagogics into the teacher's professional profile accordingly: one of the reasons for the absence of a systematic approach towards the study of cognitive aspects of education in the teacher-training process as a possible basis for school reform[378] can be the insufficient professional framework within which such preparation could be carried out. The volume of general psychological and pedagogical disciplines in the curriculum of teacher trainees leaves little space for the application of cognitive approaches. In our country, specialist didactics[379] concentrates on the processes of harmonizing the curriculum of a specific subject with the methodical potential for its transmission in educational practice. We contend that the systematic and end-focused development of cognitive and metacognitive processes in education requires: 1. an interdisciplinary approach to the problem; and 2. a content framework which provides teacher trainees with space in which to gain the competencies for the systematic process of developing a pupil's cognitive processes. Can cognitive pedagogics integrating the latest neuropsychological and cognitive research be a platform for the systematic preparation of a teacher to diagnose and stimulate the thinking of their pupils? In a special issue of the Journal of Cognitive Education and Psychology, R. Sternberg (2013) formulates questions which now face the academic public and which need to be addressed in the upcoming period: *What is cognitive education? How should it be undertaken? And how not? How should the effects of cognitive education be measured? What examples of successful programs/conceptions of cognitive education exist? What recommendations do we have (addressing the community of psychologists, author's note) for cognitive education?* (Sternberg, 2013, p. 4). Sternberg urges experts to reflect on the need to define an area which could transmit learning research into

[378] We are thinking here primarily about Slovakia, however the situation is similar in all countries where educational principles are based on the traditions of the normative pedagogy, of an input-based curriculum with emphasis on acquiring encyclopaedic knowledge.

[379] The didactics of subjects in the primary school curriculum, for instance the didactics of mathematics and the mother tongue.

classroom practice, i.e. to form cognitive pedagogy, the subject of which would be systematic, contextual and procedural definition of cognitive education.

Cognitive education is not a new term in either pedagogical or psychological discourse and was first coined in the 1970s (Arbitman- Smith – Haywood, 1980; Haywood, 1977). Dynamic development of this model was encouraged by numerous psychology research projects documenting higher performance levels in children resulting from intervention or the stimulation of cognitive functions (see, for instance, Feuerstein et al., 2008; Feuerstein, 1970; Paour & Soavi, 1992; Tzuriel, 2001; Kozulin, 1999; Vygotsky, 1978). The need for cognitive education is clear from evidence demonstrating the plasticity of neural structures mediating cognitive processes (see Drubach, 2000; Doige, 2007; Howard-Jones, 2010; Sousa, 2001; Kolb, 2000; Kulišťák, 2003). We have stated that the flexible transfer of cognitive science research results to educational practice can be seen as being insufficient. In literature, however, we find the following conceptual definitions both of cognitive education and of cognitive approaches to education: 1. cognitive education is the deliberate and systematic development of the plasticity of functioning and operations using with both mature and not yet fully mature cognitive structures; 2. it is the systematic modification of thinking under the influence of direct or mediated perception and awareness of surrounding impulses; 3. cognitive education teaches a strategic and purposeful approach to acquiring, evaluating and applying knowledge using such methods as regulation of thinking, focusing attention, the ability to plan and problem solving In other words, this is learning focused on a process not merely based on acquisition of knowledge but one also focusing on the means of this acquisition. Teaching involves the controlled and conscious activation of cognitive functions. According to Lebeer (2006) cognitive functions are not just a product of the physiological maturing of the brain but – as recent neuropsychological research and theories about the plasticity of the brain and possible structural cognitive change show – also a product of mediated learning. *"The duration, intensity and diversity of experience will have a marked influence on the plasticity (of the brain); a child should have enough opportunities to try new and stimulating activities... and the experience of mediated learning" (*Lebeer, 2006, p. 56).

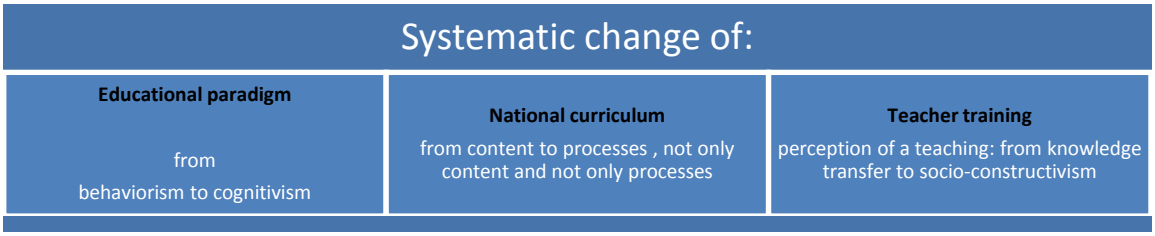
In specialist literature, cognitive education is defined as an educational model based on the study of cognitive sciences (psychology, neurosciences, linguistics, philosophy of the mind and information technology). The primary goal of cognitive education is development of such cognitive functions in the pupil as perception, elaboration and application of information for the purpose of increasing the effectiveness of learning (Sawyer, 2006; Glaser, 1988). Cognitive functions are also essential for mental functioning outside of school education and constitute the ability to think, plan, monitor complex mental activities, regulate emotions, creativity or the ability to gauge the importance of social interaction (Ashman – Conway, 1997). An educational output in the area of cognitive education is therefore not the acquisition of curricular contents but the internalization of higher forms of thinking and metacognitive strategies, as well as the improvement of elementary cognitive functions involved in more complex cognitive processes (Haywood, 2004). The theory of cognitive education is infused with a wide-ranging research base of cognitive sciences looking at aspects of learning abilities, attention, perception, memory, thinking, languages and planning, as well as at affective and cultural aspects. At present (at both the institutional and national level in various countries), a number of cognitive education operational processes are being implemented (Lebeer et al., 2011). Despite clear definitions of what cognitive pedagogy and education are, however, school practice struggles with questions such as: *How should and how shouldn't cognitive education be realized?*

Conditions for the introduction of an educational paradigm in schools or: Why a cognitive education paradigm can provide a framework for curricular reform

The term 'educational paradigm' is used as a system of complementary opinions, knowledge and research findings for interpreting key system-forming elements and aspects of education. In other words, an educational paradigm is a theory of education which is usually determined by a philosophical outlook, a set of opinions defining and describing: 1. the aims, objectives and ideals which the educational process is designed to fulfil; 2. the content, i.e. concretization of the goal – demands placed on the pupil; 3. the methods and approaches used to achieve the aim; 4. the organisational forms within which these methods are used; 5. the means (teaching aids) which help to make the teaching and learning process more effective; 6. the relations and status of the people involved in the educational process – teacher and pupil. Any paradigmatic change – and its success – is dependent on change to all the system-forming elements. If we reflect on how to bring cognitive education and neuro-scientific and psychological research to the classroom, the only possible way is to think systemically and ask such questions as: 1. How are cognitive approaches manifested in terms of formulation of educational and didactic goals? 2. How will they be reflected in the curricular content? 3. What are the implications for teaching methods and forms? 4. How should these changes be reflected in the preparation of teachers and what demands are placed on them? 5. What is the ideal student at the end of the cognitive education process like? 6. How are standards for his/her evaluation defined? And perhaps the most important question of all is: should cognitive education mainly be for specific groups of the population (the very gifted, the challenged...) or is the standard population its main target group?

The three-in-one approach to cognitive education research

The essence and purpose of restructuring the teacher-training curriculum in Slovakia is the effort to integrate cognitive pedagogy and education processes into the systematic institutionalization of teaching practice. Such integration is perceived as changing the traditional teaching process in a typical school so that the teaching is not just orientated towards factual knowledge, but also (and not just on a declarative level) towards procedural knowledge. Cognitive education concentrates on the systematic activation of the pupil's cognitive functions. We assume that the process of restructuring the teacher-training curriculum will be supported by consequent changes being made to classroom practice in primary schools as part of the process of curricular reform in Slovakia (*fig. 1*).



In the next part we present an example of interdisciplinary research using expertise in four academic fields with the purpose of restructuring the teacher-training curriculum. Since 2012, this research project has been supported by the Agency for the Promotion of Research and Development at the Slovak Ministry of Education[380] (APVV MŠ SR). The research is orientated towards the diagnostics and stimulation of the executive functions of primary school pupils (ISCED 1) and the research team is made up of 14 experts from two Slovak universities. The specialists are as follows: psychologists, experts in statistical modelling, pedagogues, maths didactics experts and linguists (*fig. 2*):

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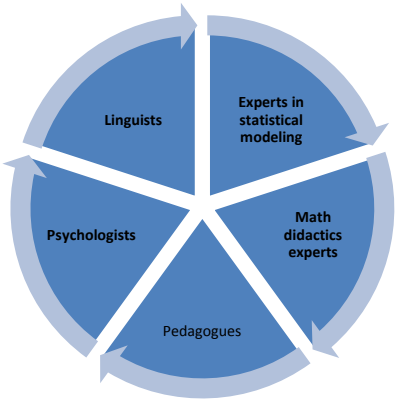

The main aims of this interdisciplinary research are: *to analyze the principles of cognitive education; to create preconditions for its legal implementation into practice;to justify the position of cognitive education as a key principle of education;to create a supportive environment for its development starting with a paradigmatic change of teacher training.* Research processes aimed at justifying the need for a shift from a traditional input-based curriculum to cognitive-oriented educational paradigm are characterized by the following: 1. basic-research-focus dimension (more psychological); 2. applied-level-focus dimension (more educational).

We can now concentrate on a description of the structure of the research activities of the interdisciplinary team. As stated above, an interdisciplinary approach to exploring learning processes is perceived as: 1. a way of combining basic and applied research in the field of psychological sciences and pedagogy; 2. a means of reducing the dichotomy between produced research results in the area of psychology and the everyday work of a teacher. The aim of the research – both on its basic and its applied level – is to contribute to our knowledge of *what learning ability is and how to identify the processes which this ability constitutes.* The ability to learn will be explored from the cognitive paradigm point of view with focus on executive functions and their part in the learning processes. As part of the project, the *Delis-Kaplan Executive Function System* (D-KEFS; Delis, Kaplan & Kramer, 2001) was used – an instrument for measuring parts of the system of executive functions. This is a set of test assignments based on the latest conception of cognitive functioning. The basic research uses multivariant static models to analyse variations in the child's ability to learn, variations which may be explained by the child's executive functions. From this there will be then be a series of tasks created for stimulation and development of those executive functions which were identified as being of key importance in the process of learning curricular content. The stimulus programme for the development of a pupil's executive functions will cover the curricular content of the key subjects in primary education of Mathematics and the mother tongue. After creation of the stimulus programme, there will be a series of training sessions for primary school teachers. The aim of these sessions will be: 1. to familiarize teachers with the concept of executive – higher cognitive functions: 2. to present diagnostic approaches aimed at discovering the pupil's learning barriers; 3. to present instructions for creating a stimulus programme for pupils with a diagnostic deficit in the area of executive functioning.

Conclusion

This article describes the aims and processes of interdisciplinary research carried out to create a supportive environment for conceptualization of cognitive education as a basis for a paradigmatic change of teacher training and consequently for educational reform.

Research aims include the following:

Exploring the possibilities of child's cognitive performance assessment

Studying the executive functions in relation to the ability to learn

Defining and specifying the underlying processes that affect cognitive performance

Creating the cognitive and executive profile of gifted children

Creating the cognitive and executive profile of children whose native language is not the language of instruction

Identifying the peculiarities of executive functioning in children from socially disadvantaged environments

Analysing how to prescribe the remediation of deficient cognitive functions

Designing curricular-oriented stimulation programmes aimed at the development of executive functions within the curricular domains of Slovak language and Maths

Finding out how it is possible to stimulate the child's metacognitive processes within the standard education environment

The research represents an approach to both understanding and measuring cognition in such a way that it stresses the triple function of: 1. measuring cognitive abilities (including intelligence): norm referenced measurement; 2. specifying processes; and 3. prescribing remedies and interventions in the school setting. The above functions provide a framework for understanding the processes of standard, exceptional (including gifted children and children with learning disability) and lower cognitive performance. They also provide implication for remedial intervention. It is supposed that the research results will contribute to wider areas of discourse than psychological diagnostics. Developing cognitive and learning abilities by introducing cognitive approaches in everyday educational practice is a strategic priority of the Slovak school system in the period of school reforms and curricular transformation. The research has a real-life utility and seeks to identify the elementary components of the ability to learn. The entire research can thus be seen as a preliminary phase preceding the development of stimulation and intervention programmes aimed at various target groups. In short, the research project is designed so that its added value is assessed in terms of how it can be contributory in the areas of:

A) cognitive psychology – exploration of the concept executive functions as a mechanism of activation and control of cognitive performance,

B) educational psychology – studying relations between the domains of executive functions and learning ability,

C) psychological assessment – a) establishing construct validity on the selected tools for measuring the cognitive abilities of a junior school age child, b) validation of the tool for measuring cognitive abilities including setting partial norms for pupils with specific educational needs (gifted pupils, pupils from ethnic minority),

D) education – making the effort to synchronise the diagnostics of cognitive abilities with subsequent intervention – using research results to make cognitive analysis of the contents and tasks of Mathematics and Slovak language lessons in terms of their value in stimulating the pupil's cognitive functions.

The results of the above interdisciplinary research show how it is possible to tie in psychological research with educational practice. Results of psychological research into the relationship between executive functions and learning ability enable us to use and adapt the content and process of teaching Slovak language and literature and Mathematics in order to stimulate cognitive functions through development of the pupil's linguistic and mathematical abilities. We assume that after a training course, teachers will be qualified: 1. to apply the strategies and methods of cognitive diagnostics and stimulation within the framework of the mathematics and Slovak language and literature curricula at primary education level; 2. to create stimulation programmes according to individual content areas of the taught subject as part of the school's educational programme and the pupil's individual educational programme.

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