TO DEVELOPMENT THROUGH CHESS:
REFLECTION AND ACTIVITY APPROACH

The Educator's Guide to Teaching Chess in Primary School

Volume 1

Special Edition for the ISCAR 2017 Congress

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Editor's Guide to Teaching Chess in Primary School

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Editors

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This Educator's Guide will be useful to primary school teachers, psychologists, and chess club coaches who aim at overall development of children and further translation of abilities developed during chess training to other school subjects and activities. The Guide rests on the principles and techniques of the Reflection and Activity Approach to developmental psychology and the evidence obtained in terms of the Chess for Overall Development Project that has been evolving in Satka since 2004.

The Educator's Guide includes chapters by Viktor Zaretskii, the Chess for Overall Development research supervisor (Introduction, Chapters 1–4, Conclusion), and Margarita Gordon, the Project's counselor, Assistant Professor, Department of Counseling and Clinical Psychology, Moscow State University of Psychology and Education (Chapter 3).

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ADDRESS TO READERS

Dear Readers,

The Guide that we are happy to share with you gives an account of our work that has been called "a method" by tradition that was born in the routine practice of the Chess for Overall Development Project (the COD Project). Initially, we assumed that learning Chess in school might work to good advantage for children's cognitive development. The idea behind the project was to develop such a method of teaching Chess that would facilitate cognitive development, and, first and foremost, development of the ability to perform mentally. Nikita Alekseev, the author of this idea, argued in his article that Chess is a God-given game for development of the ability to act in one's head (Alekseev, 1990).

Launched in 2004 in Satka (a city in the Chelyabinsk Region, Russia), the COD Project has been evolving since then. In 2014, the first participants of the project (in 2004, they were second-grade students) finished secondary school. The authors and developers of the project were looking forward to this event and had high hopes for the pilot class' outcomes. These results did meet our expectations! Five of the twenty four students who had received chess training according to our method (hereinafter, the COD training) in 2004-2006, were awarded "gold medals" for exceptional academic performance! This was the best result in the city and the Chelyabinsk Region, and the average score on the Unified State Examination in this class was significantly higher than in Russia. It should be noted that the children studied at an ordinary secondary school which practiced no preliminary selection of students.

A team of psychologists were monitoring the children's development as compared to their peers' throughout several years. Although differences in the levels of the functions assessed (attention, memory, ability to perform mentally, cognitive performance) had faded away gradually, the overall indicators in the pilot class remained higher than those of the same-age students who received no chess training. At the beginning of the study, the pilot class showed average performance, i.e. the pilot-class students and their peers had comparable initial levels of the functions measured. Nevertheless, the pilot class' final academic performance turned out to be the best in the city and the region.

These results inspired us to further work. We were aware that the indicators measured by the cross-sectional assessment procedure captured only a few positive changes that might have been produced by our method.

Therefore, we continued refining the COD training method to gain a deeper understanding of the developmental mechanisms that were called forth when the method was applied appropriately. We worked to strengthen the method's scientific basis, reconceptualized teachers' practice, and their interaction with children and each other.

This work contributed to the development of the Reflection and Activity Approach (RAA) significantly (Zaretskii, 2007; Zaretskii, 2009), and RAA became one of the scientific foundations of the method. Our understanding of how the child develops in learning and which mechanisms and conditions facilitate this development changed as well. This understanding was reflected in the so-called *multidimensional model of the zone of proximal development* (Zaretskii V.K., 2013), and you can find a detailed account of this model in this Guide. This model allows for describing mechanisms and designing conditions that – when established in learning – may facilitate children's personality, social and cultural development, to say nothing of cognitive improvement. This Guide

discusses all these aspects and shows how a specific chess training design may facilitate progress in the child's development.

It is worth mentioning that the method has never aimed at training chess players. It has a different objective: *to help teachers learn to design Chess lessons so that children could translate the experience obtained in this training to other school subjects and – in the broadest sense – to their life*. In this context, we believe the concept of "reflection" to be crucial. Reflection is a process of becoming aware of one's own reasons, tools and modes of action; causes of one's difficulties and sources of mistakes; ways to overcome them and reform one's modes of action, and – in a broader sense – one's specific cognitive and personality aspects. Reflection is an opportunity for the child to become a principal agent of his/her learning, his/her development and to convert this process into *self-development*.

This is a supreme goal of the method. The decade-long experience of the COD Project implementation has changed our understanding of the developmental potential of Chess dramatically. At the stage of the project design and planning, the method aimed solely at developing the ability to perform mentally as one of the crucial abilities in children of primary school age. However, having witnessed a beneficial effect of Chess on the development of children with learning difficulties and special needs, we inferred that the developmental potential of Chess is much higher. We obtained empirical evidence of this effect, and the multidimensional model of the zone of proximal development gave us a theoretical clue to describing how various dimensions developed due to chess training. Correspondingly, we became able to design these lessons in a specific way so that they facilitated the child's development in the best possible way.

Thus, *the initial method was extended to include a very relevant part that became a more comprehensive "whole" in relation to the first variant of the method*. From this perspective, our

method is not "a method" in a regular sense of this word (which usually means a hard-wired algorithm of concrete actions). It is a system of principles which constitutes the basis for the realization of the main idea; it is a system of boundaries, violation of which precludes the implementation of these principles, ways of their realization and limitations in chess training (as well as their translation to other school subjects and life events).

However, there will always be some "space" between the principles and the techniques of their implementation within the framework of the COD method. This "space" prevents the principles and the techniques from becoming hard-wired and opens the door of creative opportunities to the teacher and the student. This "space" emerges due to several essential principles of the child-adult interaction which form the basis of the COD method.

The first principle is **the teacher-student collaboration**. The method builds on a premise that teachers establish **collaborative relationships** with children, wherein the child is a fully-fledged and legitimate agent of learning. It means that the child can show initiative and influence the training's process and content in an unpredictable way (varying from case to case). The teacher needs to keep this in mind and to act depending on a situation guiding him/herself by the method's core idea and principles.

The second principle. We believe that **the main condition for the activation of the self-development process** is the child's **sense of agency** in learning, i.e. his/her active and informed attitude based on his/her interests and plans. Lack of the sense of agency precludes the effect of overall development. The child externalizes his/her sense of agency when he/she becomes the agent of learning and reflecting on his/her learning. This is precisely why the approach that we have been developing and have used as a basis of the COD method, has received the name of the Reflection and Activity Approach. Working with the child's sense of agency goes beyond working on a subject matter of learning, even though this

work is being performed within its framework. Furthermore, one would fail to give a rigorous technical description of this work as the child's sense of agency in relation to any activity is unique (Zaretskii Yu., 2013).

The third principle. According to Lev Vygotsky (1984)**, development emerges** when the child is collaborating with the adult (a peer or another child) **within his/her zone of proximal development** (**ZPD**)**, i.e.** when the child faces **a challenging situation** (when he/she has difficulty performing independently or makes a mistake) and gets appropriate help. The authors of the COD method believe that this aspect of learning experience – *designing a challenging situation for the child and providing him/her with development-facilitating help – is the key developmental resource*, and the content of the method encompasses the description of the teacher's actions in these situations. However, challenging situations that the child faces depend on his/her unique personal aspects and, therefore, the need to account for these aspects makes it impossible to give a detailed account of how the teacher *should* act in these situations in terms of techniques and methods to be used. This leaves much space for the teacher's creativity.

What we call "*the method*" is indeed *an account of principles and techniques which enable the teacher to use Chess to create conditions for the child's development while helping the child to overcome learning difficulties arising in his/her autonomous work*.

Teachers need to conceptualize the guiding principles of the COD method as points of reference for their own actions, and become aware of the boundaries they have to observe lest they should destroy the whole process. The teacher may enjoy an absolute freedom of choosing "strategy and tactics" of his/her actions within these boundaries.

We conclude our address by appealing to you, dear reader: please, use this method creatively and reflect on it. We, the editors

of this book, will be happy to get your feedback. Please contact us, share your doubts, ideas, know-how and developments. This was the way how our method evolved gradually accumulating new conceptualizations, techniques, variants of the lesson design and reflection, and exercises.

This Guide into the COD method introduces the reader to the idea of designing chess training to facilitate overall development, and gives an account of the COD techniques (Volume I). The whole set includes Volume II "Using Chess to Develop the Ability to Perform Actions Mentally", "The Chess for Overall Development Workbook for Teachers and Students", and "The Educator's Guide for Chess Training Setup and Record Keeping".

In the future, we plan to expand the set with Volume III – the Educator's Guide for the Year-Two Chess Training which aims more at developing students' thinking and reflection than the ability of performing mentally. It is underway now.

Dear reader! The last thing we would like to tell you, is: if it seems to you that things discussed here are too complicated and recondite, that the real practice of teaching is much simpler, and the key thing in teaching is to observe certain methodological and didactic principles, let us disagree with you.

For one thing, we should keep in mind that we live in the XXI century and the anecdotal conceptualizations (e.g. the child as of a "tabula rasa"; assumptions about natural limitations of the learning abilities, or assumptions reducing the teaching process to the child's exposure to some patterns of action, and learning – to mastering these patterns) are history now. Since his/her birth, the child has "innate resources" (Rubinshtein, 2012) that transform his/her learning experience. One of such resources is the child's sense of agency which – as we shall demonstrate further – is the most important vehicle of development. The concept of the "zone of proximal development" (ZPD) problematizes the idea of the limited capabilities of some categories of children, as ZPD is defined

as a zone of the child's potential acquisitions. It is important to assess what the child can do by him/herself and in collaboration with the adult rather than what the child is unable to do. Tomorrow the child will autonomously do things that he/she does together with the adult today. This is what Vygotsky (1984) called development. Finally, the teacher is no longer a lesson-giver or a specialist in methodology. Today, the teacher is a *reflective practitioner*, a person who works with another person – rather than with a subject or a program – acting to create conditions for another person's development.

Below, you will read how you can achieve this by means of Chess and other school subjects.

Victor Zaretskii, Amir Gilyazov

INTRODUCTION

The Guide consists of four chapters.

Chapter 1 gives an account of scientific grounds underlying the COD method – namely, it discusses the relationship between learning, development and chess training as a learning activity that may facilitate both significant improvement in the child's intellectual abilities *and* his/her overall cognitive and personality development. The conceptualization of the learning-development relationship goes beyond the initial target of the COD method, i.e. developing the ability to perform mentally in chess training. We believe that development of the ability to perform mentally is a particular case of the child's development that may emerge in learning. Chapter 1 outlines the major mechanism of the child's development in the course of learning. It discusses the role of difficulties that the child faces and the challenging situations that the child encounters in this process, and, first and foremost, it delineates what role the helping adult plays in the child's development. This adult may be a teacher, a parent, a chess coach, a psychologist or another specialist assisting the child.

Chapter 2 investigates how primary school students (who the method was designed initially for) may develop the ability to perform mentally during chess training. In fact, it has turned out that the potential application of the COD method embraces various contexts. This method can be used for remediation and development of children with special needs, including older children who have learning difficulties.

Chapter 3 gives an account of the mechanisms which bring about positive qualitative changes in the cognitive, conceptual, emotional, motivational and other developmental aspects in the course of learning (and learning Chess as well). Moreover, this chapter illustrates

how this developmental training may benefit children with developmental disabilities that may hinder their learning or cause academic failure and social maladjustment in the broadest sense of this word.

The theoretical part concludes with a brief account of the essential principles and limitations that form the basis for the developmental chess training, as well as the conditions that enable this training to facilitate the child's overall development. In our opinion, the main event in the classroom is help that the adult provides to the child if the child faces a challenge when working on an assignment. The quality of this help determines whether the developmental potential of the challenging situation is utilized or not.

Chapter 4 describes how these principles may be implemented in the practice of the chess training design. The authors give an outline of the Year-1 training program which targets developing the ability to perform mentally. Chapter 4 delineates the general setup of one-to-one training sessions (lessons), principles and ways of providing individualized help to children in challenging situations. It also outlines the design of group sessions for teachers working tandem (it also explains why the teacher tandem work would be preferable to working alone). Chapter 4 ends with brief methodological guidelines as to carrying out lessons and creating conditions facilitating development of children who learn Chess. It also discusses issues of translating the abilities formed during the chess training to other activities and school subjects.

The Guide includes the list of references mentioned in the text. Volume II – "Using Chess to Develop the Ability to Perform Actions Mentally" – is a logical extension of this Guide. It delineates the chess training program and a sequence of steps constituting the ability to make a move with a chessman in one's head. The Year-1 program may be considered complete if having learned to play Chess (i.e. having mastered the rules, moves etc.), the child becomes able to solve chess problems in his/her head, acting within a mental image of a visualized chess position. The overall set includes the Chess Workbook designed for 64 lessons of the Year-1 training.

I LEARNING
CHESS AND DEVELOPMENT
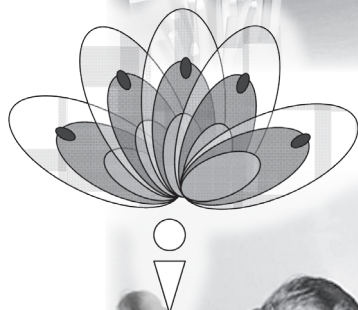
1.1. Chess and Development

As long as people play chess, they have known that a good chess player is a clever one. At the same time, dedicated chess players enjoy improvement of their cognitive abilities.

Alternatively, it may be said that it is not Chess that promotes development, but rather Chess attracts smart, naturally gifted people of outstanding intellectual ability that may display itself both in this sport and other activities where thinking is a prerequisite. Undoubtedly, both perspectives have a grain of truth in them. However, it is now widely recognized that Chess may facilitate overall development. Therefore, introducing Chess to the school curriculum has become an extensive practice worldwide. The Ministry of Education in our country (Russia) has also issued a corresponding decree.

Nevertheless, it is rather curious that research into developmental effects of Chess hardly ever accompanies teaching Chess in the classroom. Moreover, literature on developmental chess training is scarce and there are only few guides for teaching Chess in the classroom (Footnote 1); the existing textbooks are authored by chess players and designed for people who are willing to play Chess and refine the related skills[1].

Dr. Albert Frank made one of few attempts to register the positive contribution of Chess to the person's development during his experiments in 1973–1974. In Zaire, he conducted a comparison study in two groups of students. Each group consisted of 46 children aged from 16 to 18 years. One group received regular

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[1] One of few such writings is "Chess Instructional System", the book published under the aegis of FIDE. It is an official chess teaching guide used by many chess federations. It is also the first guide which integrates components of school education (goals, objectives, programs, administrative aspects, assessment etc.) and general chess characteristics [Blanco, 1999, p. 57]. In Russia, Igor Sukhin authored a package of materials for teaching Chess in preschool and primary school (see References).

chess training and the other one received no training. The comparison of the outcomes in the two groups showed that the experimental group outperformed the control group as far as verbal logic and arithmetical aptitudes were concerned. Tellingly, all the students in the experimental group (and not only those who were better in Chess) enjoyed this improvement (Blanco, 1999). Another study demonstrated that Chess contributed significantly to development of critical thinking and creativity. Chess players report that the top-level chess play requires great memory, logic, creative thinking and concentration, to name but a few.

Uvencio Blanco, a Venezuelan chess player, attempted to systematize all the findings relating to the effect of Chess on the human development (Chart 1)[2].

Chart 1

Chess Aspects	Educational Meaning
1	2
Clear positioning of chess pieces and pawns on a chessboard	Spatial planning and representation. Anticipation of a position or positional fragments
Understanding chess pieces classification and relationships between them on a chessboard	Developing powers of observation and spatial thinking
A rigorous system of recording moves	Verbal thinking. Written language proficiency: signs and symbols (symbolization)
Achieving a desired position	Developing self-control and attention. Deep thinking

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[2] Ivan Lebedev, a psychologist and a Candidate Master of Chess, made a summary translation of Blanco's book.

1	2
Need to make a certain number of moves within a specified time frame. Fighting under time constraints	Efficient time management; searching for solutions within a previously specified time frame
Making a move after a comprehensive analysis of the position	Developing decision-making skills. Independent thinking
Carrying on searching for a stronger move after a move was found	Ongoing development of thinking. Searching for a better outcome. Developing self-respect
Making an independent choice of one from many options	Autonomous personality, self-respect
Searching for a way to put oneself at an advantage when finding oneself in the equal position (combination)	Creativity, imagination and inventiveness
Possibility of reversing an action mentally	Planning ahead variations with numerous moves. Reversibility of thinking
Every specific position involves understanding of positional options resulting from different variants of the game development	Visualization, creativity and developing anticipation of events
Planning based on the analysis of the position and understanding of the ways it may evolve	Skill of synthesis. Abstract and creative thinking
A move needs to logically result from the previous move and form the grounds for the next move	Skill of analysis, control over action and coherence of thinking

The end Chart 1

1	2
The game outcome shows who of the players had a better plan and realized it more accurately	Respect for other people's opinion. Awareness of one's own mistakes. Sportsmanship. Intellect, sensitivity and tact
One position may involve both attacking and defending	Skills of observation, identification and representation of models
Being in a challenging position and short of time for thinking	Self-control, speed and coherence of thinking
Winning the game as a result of one's own achievements	Self-respect, self-actualization through success
Losing the game as a result of one's own mistakes or the opponent's supremacy	Self-reflection, assessing one's own weaknesses and on-going development

This summary deserves attention, not least because it may virtually be an exclusive attempt on a systematized review of how Chess may influence development and which specific developmental aspects it may target. Interestingly, the column titled "Educational Meaning" leaves out the ability to perform mentally as a quality developed by Chess, although this ability is implied throughout the "Chess Aspects" column. This fact is hard to explain but it is true. A potential explanation may be that the chess players (especially top ones) have a natural aptitude for visualizing the chessboard, various paths of potential moves, tension, strong and weak squares, and therefore they take it for granted as a given.

In our opinion, the ability to perform mentally which may develop in chess training is the main target of an educator's efforts; it is somewhat an epicenter. Firstly, the ability to perform mentally is one of the major abilities emerging in the primary school children; secondly, its development is a prerequisite condition for progress in Chess (Yuri Razuvaev commented aptly that Chess

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turned into "playing soldiers" when a person lacked the ability to make a move in his/her head). So, thirdly, development of this ability is prerequisite for realizing the Chess potential for overall cognitive and personality development.

This potential embraces two constituents: specific aspects of Chess and the potential of learning as such. Let us begin with an exploration of the developmental potential that learning is endowed with.

1.2. Learning and Development: Core Concepts

What is the relationship between learning and development? – Historically, views on this relationship in Psychology and Pedagogy have lain on a continuum between two extremes.

The first of these perspectives argues that learning is enabled by the child's development. As the child grows, his/her functions mature gradually and the child becomes able to do things that he/she failed to do earlier.

The second perspective states that learning precedes development. It means that development occurs in the course of learning, due to learning, and not the reverse.

This idea was authored by Russian psychologist Lev Vygotsky in the 1930s when the first perspective was predominating. His theory that relied on an assumption that learning led development received the name of the "cultural-historical" theory as Vygotsky (1982, 1984) considered learning, i.e. the process of the child-adult interaction, to be the process during which the child was adopting the cultural-historical experience of the humankind as translated to the child by the adult.

Lev Vygotsky provided a theoretical rationale for this assumption and gathered empirical evidence that human mental functions developed in the course of the activity shared by the child and
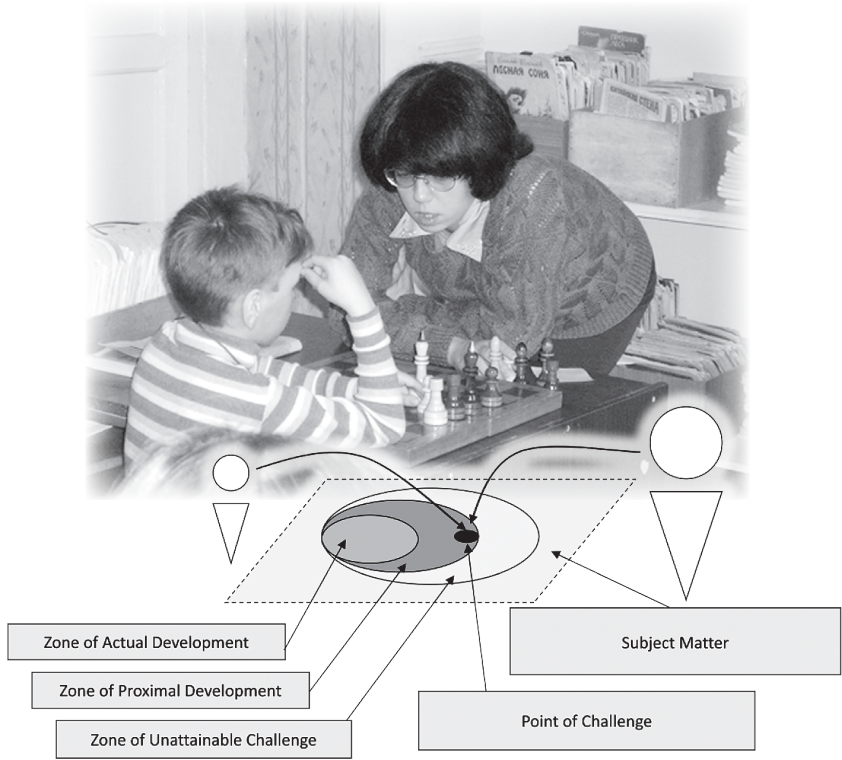
Figure 1. Vygorsky's original understanding of the zone of proximal development (Zaretskii, 2007).

the adult (collaboration). This collaboration would emerge when the adult helped the child do what the child failed to do autonomously, i.e. initially, the child and the adult would collaborate to perform a required function, and then this function would become the child's own asset.

Dear readers, any of you could share your experience when the child who used to have difficulty doing something, completed the task with the adult's help and then became able to do it by

him/herself. People have witnessed such facts throughout millennia without wondering what is really happening within this process; why it is happening in this way rather than another; and most importantly, how the child proceeds to performing the action that he/she failed to perform earlier. Apparently, there is nothing mysterious about the fact that the child has learned something.

However Vygotsky discerned an essential developmental principle from this routine fact. He used this principle as a basis for his cultural-historical theory of the human psyche development which we relied on while designing the COD method. Therefore, we would like to delineate Vygotsky's ideas, with this recourse being critical for getting into the spirit of the COD method, rather than its letter alone.

We have already discussed Vygotsky's first assumption: *the child develops in learning when collaborating with the adult*. It was long believed that the child simply imitated the adult. If learning limited itself to imitation and skill training, this learning would remind us of animal training. Lev Vygotsky demonstrated that imitation differed dramatically from conscious learning that emerged when the child was performing challenging actions in collaboration with the adult. He rejected the term imitation and replaced it with another term essential for many areas of modern education, namely, collaboration.

Why does the child need to collaborate with the adult? – The child collaborates when the child needs help, that is, when he/she fails to do something by him/herself; when he/she experiences difficulty.

The adult helps the child cope with this challenge. This help may nonetheless differ in its quality. The adult may simply demonstrate how to perform an action correctly. The child may learn this mode of action or may not. The adult may complete this action for the child – this will hardly do any good. The adult may invest effort in understanding what the child is doing incorrectly and explain it

to the child how he/she may alter his/her mode of action. The adult may help the child become aware of his/her mistakes and correct them by him/herself. The effect of learning and development will differ depending on the adult's manner of helping. Chapter 3 discusses this issue in detail, and now let us consider the crucial developmental mechanism that Vygotsky discerned in the adult-child collaboration.

We need to pay attention to two principles pertaining to this complex mechanism. The first principle is associated with the concept of interiorization. The second principle relates to the zone of proximal development.

Interiorization is transformation of the exterior into the interior. The essence of Vygotsky's cultural-historical theory is that the person develops when adopting cultural "tools" invented by the humankind. These are tools for managing one's own processes and states. The main tool is speech. When the child uses the adult's help in a challenging situation, they cope with it together. Both child and adult make their contribution to the joint activity. However if the child has learned to do what he/she had failed to do earlier; if the child has conceptualized the adult's mode of action, then the child will make a step in development.

This perspective on the learning-development relationship drew Vygotsky's attention to the fact that children differed both in the level of difficulty they could cope with autonomously and in the level of difficulty they could cope with in collaboration with the adult. As Vygotsky showed, the child's performance in collaboration with the adult has more value for understanding and evaluating the child's development than the child's autonomous performance. The autonomous performance is indicative of the child's actual level of development. It is something that the child has already achieved in his/her development, whereas the child's collaborative performance is indicative of his/her developmental prospects, – that is to say, who the child will be tomorrow if the

adult engages in an *appropriate collaboration* with the child. Thus, here we come across the second core concept introduced by Vygotsky, -namely, *the zone of proximal development*.

He suggested differentiating between a zone comprising actions that the child had already mastered and performed independently, and a zone of actions wherein the child was able to perform in collaboration with the adult. He called them "the zone of actual development" (ZAD) and "the zone of proximal development" (ZPD), respectively. It is within ZPD where the child can perform successfully only in collaboration with the adult. It is here where the child becomes aware of the modes of joint action and becomes able to act independently having adopted the experience of the collaborative performance. Thus, ZAD and ZPD are continuously expanding their boundaries.

The adult will be able to help the child efficiently if the adult is skilled in identifying the boundaries of ZPD. The lower boundary – i.e. the boundary between ZAD and ZPD – is quite easy to discover as long as the adult is gradually raising the difficulty level. For example, when identifying what a child can do independently in Mathematics, we can expose him/her to arithmetic facts like 3+2, then 8+5, then 27+6, 35+18. Each of the following facts in this sequence needs a more complicated action to be performed. In order to calculate the first fact, the child needs to add within ten. The child needs to add single digit numbers obtaining the sum exceeding the whole ten in the second problem; to add a two-digit number to a one-digit number obtaining the sum exceeding the next whole ten in the third one, and to add two two-digit numbers obtaining the sum exceeding the next whole ten in the fourth one. If the child solves all the problems successfully by him/herself, then all of them are lying within his/her ZAD. If the child fails to solve any of them, it means that we have failed to determine ZPD's lower boundary. If the child solves easier problems but makes mistakes in more difficult ones, then ZPD's boundary (in Mathematics as a

school subject) is lying between the last of the easier problems that the child has managed to solve independently and the first of the difficult problems where he/she has made a mistake or has sought the adult's help when having faced the challenge.

The practice shows that ZPD has an upper boundary as well, and the zone lying beyond this boundary is the zone of unattainable challenge (ZUC). ZUC tasks are so difficult for the child that he/she fails to do them even when assisted by the adult. It is safe to say that the child *fails to understand them*. Collaboration with the child within ZUC is impossible, and attempts to push the child to act within this zone, may do more harm than good. No one benefits from feeling helpless, stupid, and incapable of performing or even of understanding what he/she needs to do. *Unfortunately, in the classroom and at home (when parents help children do their home assignment), both teachers and parents often try to force the child into doing what he/she is unable to do, virtually traumatizing him/her psychologically.*

The "golden" moment in learning occurs when the child who is performing independently, faces a challenge, reaches out to the adult and – having obtained the adult's qualified help – learns to cope with this difficulty. These challenging situations enable the child to develop, not only to learn.

Unfortunately, in a typical classroom, such individualized help provided to students is an exception rather than a rule. During a typical school lesson, everyone would work on the same problem. Some students would find it very simple and solve it quickly; and the process would be completely useless for their development. Another group of students would find this problem extremely difficult, they would fail to do it and even to understand it. Attempts at solving this problem would be harmful for them. The third group of students would find this task difficult but doable. They would cope with it with the teacher's assistance. However the teacher would be unable to provide this help to everyone in need as, typically, teach-

ing methods in the classroom would focus on group rather than one-to-one work with students. In Chapter 4, we consider how the teacher may *work both with the class and each student in the class simultaneously*.

For now, let us sum up what we have discussed in this chapter and proceed to the question of how development in the challenging situation emerges. We would like to emphasize that the COD method builds on arranging students' autonomous work; identifying ZPD of each student and providing as much help as each student needs within his/her ZPD.

From this perspective, development may be considered as the process of the child's transition from collaborative work on challenging but manageable tasks to autonomous performance (without the adult's assistance). This transition may also serve a measure of the adult's help efficiency: help is efficient if tomorrow the child independently performs actions that he/she is doing in collaboration with the adult today. Otherwise, the adult needs to revise his/her way of helping.

1.3. How Development Emerges in Learning: Resource of Challenging Situation

The example with arithmetical facts helped us to explain the concept of ZPD in the dimension of learning Mathematics. Figure 2 represents this dimension as "*working with subject-related learning difficulties*". However Figure 2 shows other dimensions which the child will improve as long as he/she collaborates with the adult when learning a corresponding subject.

In order to illustrate how this development becomes possible, we would like to share one line of reasoning.

If the child faces a challenge and copes with it with the adult's help, the child will get something more than new knowl-
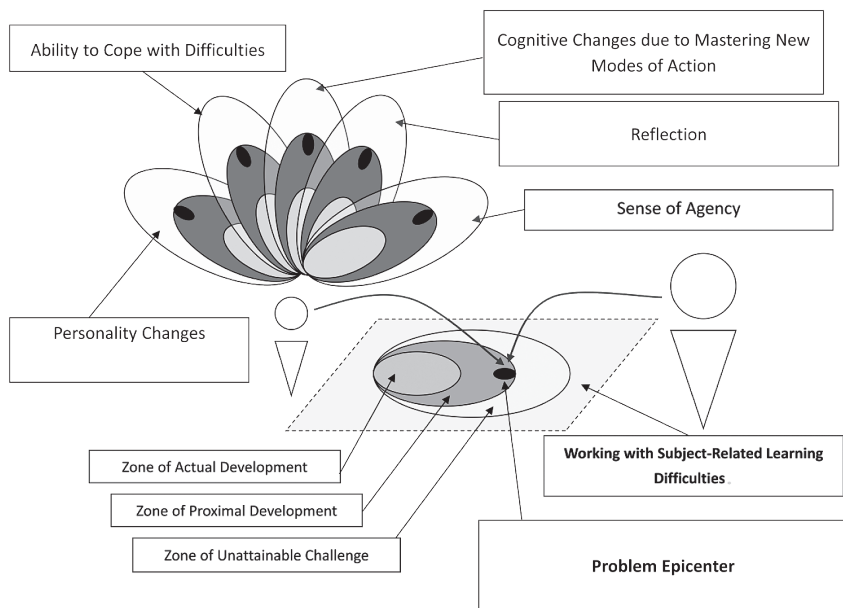
Figure 2. The multidimensional model of ZPD (Zaretskii V., 2013).

edge or a new mode of action alone. Let us imagine that when assisting the child to add numbers to get sums exceeding ten, the adult shows the child how one needs to split the second addend to make adding easier. For example, 8+5=8+2+3=10+3=13. Before, the child used to count on from the first addend increasing the sum by 1 a relevant number of times. This used to put his/her attention and working memory under severe strain and eventually led to mistakes. Certainly, if you are extremely attentive, you can count in this way too. However it takes longer time and much effort, and you still remain virtually unable to count large numbers. This approach to counting is indeed far from optimal, when the child starts to count beyond ten.

When learning a new way of adding, the child both learns to count differently, and obtains an experience of coping with a challenge. Thus, changes may occur both in the dimension of arithmetical knowledge and skill, and in the dimension of coping with difficulties. When mastering a new mode of action, the child starts changing his/her conceptual framework. The child starts using such concepts as tens and ones, place value, mode. The child learns to combine; select numbers to supplement the first addend to the whole ten; break numbers apart into addends, i.e. the child's combinatory skills start developing. If these skills are underdeveloped, this may hinder mastering a new mode of action. However, if the child invests effort in learning, then this effort will result in development of relevant cognitive abilities. These changes emerge in the cognitive development dimension (Figure 2).

The child starts developing the interior tools that he/she needs to perform the activity that he/she is learning. The child borrows these tools from the adult and then *interiorizes* them so that they become his/her own tools.

We have already provided an example from Mathematics, and here is an example from Chess.

We recommend starting lessons from a brief quiz which includes both simple and difficult tasks (please see the Workbook for the sample quiz). This quiz not only enables the children to assure themselves that there are things they need to learn, but also helps to identify ZPD as far as both Chess and development of the ability to perform mentally are concerned.

At the outset of the COD Project, we included a task for memorizing a position of 4 pieces (two Kings and two Pawns occupying different squares of a display chessboard) in the quiz. Children had one minute to memorize the position. Then we turned the chessboard upside down and asked the children to reproduce the position on the chessboard. None of the 24 second-grade students completed the assignment. As all the children failed this task

although their memory span was sufficient (7±2) to cope with it, their failure could not be explained by low memory alone. The children failed to perceive the chessboard as a system of regularly alternating light and dark squares, therefore it was extremely difficult for them to orient themselves in its space. We had the first quiz in October. After three months (in January), all the children memorized and reproduced a position of 10-12 pieces on the chessboard (i.e. positions exceeding the memory span), and some of them were able to memorize positions comprising 19-25 pieces.

Obviously, the students' memorizing skills changed their quality dramatically. But what else changed? Memorizing such a position requires mastering a number of skills: the child needs to know chess notation and to see the geometry of the chessboard (squares, ranks, files, diagonals, relevant zones); to group pieces, and correspondingly, to analyze both pieces' placement and relationships between them, i.e. the child needs to make sense of the position. Apparently, these skills are useful not only in Chess but also in other subjects. For example, one may write dictation down focusing on letters and separate words, or one may write it down focusing on meaningful units. One may solve a problem looking at the text, or visualizing it as relationships between relevant conditions. These practices rely on different modes of action and different level of abilities derivative of these modes. Furthermore, these abilities develop in a challenging situation when the child obtains the adult's help.

To sum up, the answer to the question posed in the title may encompass the following assumptions:

1. The first difficult task which the child fails to complete by him/herself and when he/she needs the adult's help is ***the boundary between ZAD*** (that is, the child's independent performance) and ZPD (no matter whether the above process occurs naturally or within a specifically designed procedure to test the child's level of development).

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2. If the child fails to fulfill some task (problem, action etc), he/she will find him/herself in *a challenging situation* when the child will fail to do things that he/she is supposed to perform independently.

3. When diagnosing ZPD or teaching within ZPD, the adult *collaborates* with the child within a challenging situation which the child overcomes with the adult's help.

4. From this perspective, *development* is a process of *transition from collaborative performance* of difficult but doable *tasks to their independent fulfillment* (without adult's assistance). This transition may also serve a measure of the adult's help efficiency: help is efficient if today the child does things that he/she used to do together with the adult. Otherwise, the adult needs to reflect on the methods that he/she uses to help the child.

5. Obviously, the zone of "maturing processes" has another boundary, beyond which the zone of unattainable challenge lies. In this zone, the child is unable to perform even in collaboration with the adult. Thus, *ZPD is a zone bounded on two sides*. One boundary goes through the zone where the child can successfully perform independently; on the other side – where he/she fails to perform successfully even in collaboration with the adult.

6. ZPD comprises actions that *the child can comprehend but fails to perform*. This is the zone within which the child acts reasonably and makes meaning of his/her performance in collaboration with adult. If the child is unable of making sense of interaction, then collaboration will fail.

7. Our final assumption is that according to Vygotsky, *the concept of ZPD may be extended to other aspects of personality* (in addition to cognitive development).

The conditions that are prerequisite for learning-related development of various functions in addition to the skills necessary for the school subject acquisition include the child's sense of agency; collaboration with the adult within ZPD; the adult's appropriate help aiming at making the child aware of his/her modes of action and their restructuring.

The key processes of the child's development in learning are the child's autonomous performance, his/her collaboration with the adult and reflection of this autonomous and collaborative activity. Hence, the name of the Reflection and Activity Approach appeared to denote an approach to supporting the child's development so that he/she could overcome learning difficulties (Zaretskii V.K., 2007).

1.4. Core Principles of Reflection and Activity Approach to Teaching

| Child's independent work. Challenging situation. | Request for help. | Child-adult collaboration. |

Turning back to the history of the COD Project, it should be noted that Nikita Alekseev's initial idea (Alekseev, 1990) consisted in integrating Piotr Galperin's (1966) and Yakov Ponomarev's

(1967) developments in the field of research into the internal plane of action and reflection (Alekseev, 2002) playing an assumingly pivotal role in the child's development (Zaretskii, 2008, 2013).

A methodological task of integrating theoretical perspectives and methods of different researchers would be quite challenging. We made no attempt at solving it, having left it to theorists to complete this task. We found it essential to integrate valuable developments of the different approaches into some practical technology of designing training so that it would provide for overall development. This technology-level integration which attempted at solving no complicated scientific problems, nonetheless, needed consistent grounds that would allow for welding various perspectives to build a method.

The multidimensional model of ZPD (Figure 2) has become a vehicle for integrating the different approaches into a method. This model has grown from the Reflection and Activity Approach to helping children overcome learning difficulties (Zaretskii V., 2007, 2013) The basic assumptions of these approaches represent the scientific grounds for the COD Project and the COD method. They include:

- understanding of the learning-development relationship in Vygotsky's cultural-historical theory;

- understanding of the process of the internal plane of action development in Galperin's theory of the stage-by-stage formation of mental actions and Ponomarev's approach;

- scientific justification of the relationship between chess training, development of the ability to perform mentally and reflection (N. Alekseev);

- ideas of the Pedagogy of Cooperation (S. Soloveychik);

- the Reflection and Activity Approach to helping children overcome learning difficulties (V. Zaretskii).

Below, we provide an outline of the core ideas that we have borrowed from these approaches.

You may find a detailed discussion of Vygotsky's perspective on the learning-development relationship earlier in this Chapter. The Vygotskian concepts essential for our method are ZPD, interiorization and Vygotsky's assumption that learning one subject may result in positive effects in several developmental dimensions.

Galperin's theory of the stage-by-stage formation of mental actions delineates the mechanism of interiorization, i.e. how an external, material action which is performed in collaboration with the adult becomes an internal (mental) action. Piotr Galperin singled out conditions that were prerequisite for deliberate formation of a mental action with desired qualities. At the same time, Yakov Ponomarev described the process of a spontaneous formation of the internal plane of action in vivo (in the natural environment). Help provided to the child within this process may target arising failures and deficits.

Nikita Alekseev's idea has opened our discussion of RAA. However it is important to draw your attention to the fact that Alekseev brought together two ideas: one – of using Chess to develop the internal plane of action, and another – of developing reflection. In the early 1960s, he taught Mathematics at school and designed his lessons to be grounded in reflection, by which he meant awareness of one's mode of action. Later, he reflected on this experience in his PhD thesis. Alekseev defended it in 1975, but the whole text of the thesis came out as late as in 2002. He contrasted conscious learning to rote memorization and doing multiple exercises which oftentimes resembled some animal training rather than teaching Homo sapiens.

The Pedagogy of Cooperation was developed and supported by Simon Soloveychik and other Russian innovative teachers (See "The Manifesto the Pedagogy of Cooperation"). The essence of this approach consisted in the idea that instead of

teaching and developing the child, the adult needed to build collaborative relationships with him/her, wherein the child would start learning and developing as a fully-fledged agent of learning. "The Manifesto the Pedagogy of Cooperation" highlighted a number of principles that could be used to build collaborative relationships in learning.

The Reflection and Activity Approach is the last scientific ground which the COD method rests upon. The authors of the COD method have been developing RAA since 1990 (Zaretskii, Gordon, 2001; Zaretskii, 2013). The main idea of the approach is reliance on such resources as the child's sense of agency in learning, reflection and personal development. Correspondingly, the teacher's task is to help the child to feel that he/she is the principal agent in his or her activity and its reflection; to be the child's partner-coworker, and to enable the child to enhance his/her own resource. As the child requests the adult's help when he/she cannot fulfill the task that is within his/her ZPD, independently, the adult can assist the child so that the child fulfills the task; understands what he/she could have done him/herself, what the adult has helped him/her with and what he/she needs to learn to fulfill similar tasks independently in the future. The approach received its name after two major processes performed by the learning child as an agent of activity.

The Reflection and Activity Approach (RAA) is a system of principles and techniques facilitating the child's development in the course of his/her collaboration with the adult and peers, which relies on supporting the child's sense of agency in terms of his/her activity, reflection, awareness, reforming and constructing modes of action.

Learning-related development occurs through interiorization of these modes of joint actions. Developmental dynamics represents a continuous expansion of the zones of actual and proximal development in terms of various directions of the

child's individual progress in the dimension of learning and in other dimensions where various capabilities and personal qualities develop.

RAA defines help as support provided by the adult to facilitate the child's sense of agency and the processes relating to implementation, reflection, reforming and constructing modes of actions.

RAA views the child as the adult's coworker and partner, and, therefore, the actual lesson is a result of their co-creative activity. Teachers using RAA guide themselves by the general idea of the approach; its principles; the limitations that are implied by the position of coworker; the idea of providing help through reflection, as well as by recommendations as to techniques. However, it should be reiterated that the actual process unfolds as spontaneous and creative: placing the teacher him/herself in the position of a "developing adult".

Below, you will find an outline of the teaching principles that RAA educators need to follow.

- Establish collaborative relationships with the child; position yourself not as a teacher but as an assistant and a counselor who helps to learn rather than teaches.

- Initiate and enhance the child's sense of agency in learning, i.e. support his/her active and informed attitude to learning (Zaretskii Yu.V., 2013); enable the child to be and feel that he/she is a fully-fledged agent of activity and its reflection.

- View mistakes and difficulties as unavoidable aspects of any activity (and, first and foremost, learning) when the child is doing something that he/she has not learned to do yet. At the same time, view a challenging situation (mistakes and difficulties) as a developmental resource as it shows the child that he/she lacks tools for working on

this task independently, and therefore the child needs to strive for improvement, to learn and to think.

- Consider a mistake as a mirror that reflects the child's mode of action with all its deficits; remember that to learn means "to re-learn": to become aware of and to re-form one's mode of action. Demonstrating how the child "should" do things takes a back seat to the major processes such as the student's autonomous performance and its reflection.

- Helping the child means, first and foremost, helping him/her become aware of his/her modes of action and reform them, i.e. reflect on their activity.

- Help may also include emotional support; enhancement of the conceptual basis of the child's activity; remediation of his/her attitude to self, learning, difficulties, relating to others etc., i.e. it may mean working with targets that may potentially hinder and complicate learning when they occur in the classroom.

- Focus on the principle that one step in learning may result in a hundred steps in development which is an ideal to be pursued when designing training. Be confident that it is something more than a metaphor, as there is a relevant mechanism behind it (see Chapter 3 for techniques that enable its realization).

Chapter II
DEVELOPING ABILITY
TO PERFORM MENTALLY
DURING CHESS TRAINING

2.1. How Children Develop during Chess Lessons

Development emerges when the child is performing challenging but doable tasks while obtaining appropriate help from the adult and adopting modes of joint action. Furthermore, development may go beyond mastering the subject that becomes the space where the child is collaborating with the adult (Chess in our case) to include other dimensions where positive cognitive and personality changes may emerge.

As we have mentioned above, when formulating the assumption that "*learning precedes development*", Lev Vygotsky argued aphoristically that one step in learning might represent a hundred steps in development (Vygotsky L.S., 1982, 1984).

This assumption may be viewed as a metaphor, or an unattainable ideal. However if we treat it as a practical task, then, it needs to be worded as a practical task, which is: how *one step in learning can represent a hundred steps in development* and what conditions are prerequisite to achieve this.

The COD Project considers this assumption to be a practical task. Correspondingly, we aim to design training so that every child may benefit from it as much as possible.

The diagram below (Figure 3) illustrates our understanding of the developmental mechanism which we formulated in the course of the chess project implementation.

In Figure 3 (just like in Figure 1), the object plane depicted at the bottom in-between the images of a child and an adult embraces three zones, namely, ZAD, ZPD, and ZAC. It is a dimension of learning Chess. If the child starts learning "from scratch", he/she will get to know the idea of the game, a chessboard, moves, rules, and will gradually become a fully-fledged chess player. Chess is more than moving wooden pieces on a chessboard: it embraces assessing options; evaluating positions; planning; guessing the opponent's plan; anticipating
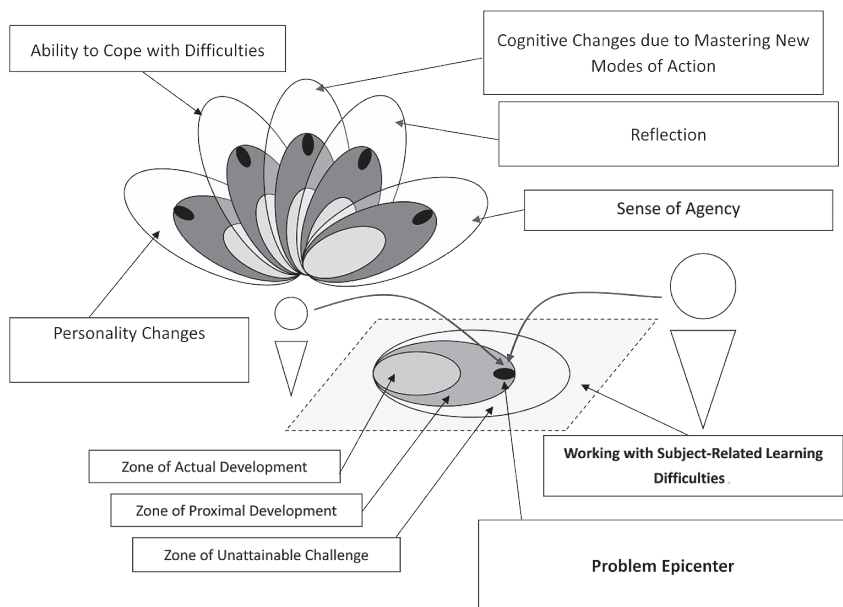
Figure 3. ZPD as a generality of dimensions of potential developmental steps. The diagram represents the Chess potential for the child's overall cognitive and personal development.

threats etc. Moreover, all these things take place "in the player's head".

This ability is still at its embryo stage in seven or eight-year-old children, and specifically designed chess training may facilitate its development.

Thus, another dimension that we can highlight in the diagram is the ability to perform mentally. The level of this ability in most children who begin training, is such that looking at the chessboard, they fail to trace the path that the Bishop moves along. For example, they start moving from a1, and stop on g8, instead of h8.

Correspondingly, the child faces a specific problem of identifying a figure ("a path") against a background (the chessboard), which becomes a prospective goal of his/her development. The child may achieve this goal by means of shaping the relevant ability relying on the principles and stages developed by Piotr Galperin. When the child becomes able to visualize the chessboard and to orient him/herself in its space, the boundaries of his/her ZPD in the dimension of the ability to perform mentally expand, and the adult may expose the child to a task of making a mental move that takes account of the position, for instance, to make checkmate in one move keeping the position in mind.

Quite soon after the outset of the training, children display significant differences in the level and dynamics of the development of the ability to perform mentally. The educator needs to account for these differences when designing doable but challenging problems for students and providing them with appropriate help. If the child fails to solve the problem in his/her head, the child may make use of chess notation, a drawing of a chessboard, a real chessboard and substitutes of pieces (marks). If the child fails to keep at least part of the problem in mind, then he/she works with a regular chessboard using additional material tools if necessary (chips, a ruler, marks). *The teacher's task is to identify the child's ZPD; to thereby provide learning tasks matching the child's abilities and to provide specific help.*

The teachers of the COD project work in tandems dividing the class into two groups, that is, they work with a group of 12-15 students. It enables them to control the whole process of a lesson (as one of the teachers takes a reflective attitude towards the process, and the other one ensures operational management). Besides, if a student fails to keep up with others, to understand something or encounters an unattainable task, the co-teacher may focus entirely on helping this child, which includes one-to-one work with this child during the lesson.

Such training design calls forth improvement in other developmental dimensions. The child may have attention deficits, difficulty memorizing and performing simple cognitive operations etc. The teacher watching the child perform on the tasks and seeing which mistakes the child makes and what he/she has difficulty with, identifies which function suffers and arranges an activity that will be especially useful and may benefit the child in the best possible way. For example, the teacher may start helping the child to memorize a chess position. When exercising in memorizing the chess position, the child starts to understand some chess subtleties and simultaneously develops voluntary (intentional) memorizing, moves from mechanical (rote) to meaningful memorizing (as the child is unable to memorize more than 5-9 pieces quickly and effectively unless he/she uses mnemonic techniques). Thus, alongside learning Chess, the child enjoys progress in the dimensions of "the ability to perform mentally" and "memory". The conditions for development of other mental functions (perception, memory, thinking, speech) emerge likewise.

Furthermore, these direct outcomes may be accompanied by other effects – side-effects as Yakov Ponomarev called them. For example, when the child keeps obtaining appropriate help from the adult, keeps facing challenges and overcoming them effectively, the child becomes more self-confident and less anxious; welcomes most advanced assignments optimistically; gets less frustrated by failures as the child understands that tomorrow, he/she will be able to do things he/she has failed to do today. All the aforementioned phenomena rely on certain personality qualities that may develop (again, if there is an appropriate combination of the child's individual performance and the teacher's specific help). Progress may occur in all these developmental dimensions.

This effect is most vivid in children who got used to poor academic performance, namely, students of remedial classes and schools for children with cognitive deficits or underperforming

students of regular schools. Provided that teachers support these children properly and arrange for translating the experience that the students have gained in Chess to other school subjects, these children – elated by success in Chess – will start feeling more self-confident when encountering learning difficulties. If the teacher is able to utilize the student's improved personal resources and to enhance them, other school subjects may enjoy the remedial effect too. For example, during the first year of the COD project, the diagnosis of "a delay in mental development" was removed for three children who learned Chess, and one of them started getting high grades (As and Bs).

The crucial role of one's personality (the "Personality Changes" dimension in Figure 3) in learning and development may be illustrated by a unique experiment. The Russian psychologist Oleg Tikhomirov led a group of researchers who carried out this experiment as early as at the beginning of 1970s (Tikhomirov, 1975). This case may be essential for understanding the role of the sense of agency which turns on self-development mechanisms. In a series of experiments aiming at studying various creative abilities (in music, drawing, Chess), the hypnotized subjects (a hypnotist who performed the hypnotic induction was the famous Soviet psychotherapist Professor Vladimir Raikov) were instructed that they were high-caliber professionals in these kinds of activity. The experiments aimed at identifying how the subjects' self-attitude and attitude to activity influenced its effectiveness and process. Oleg Tikhomirov and his colleagues gave the following account of the chess experiment. "The series of chess experiments ended with a unique control test. We invited Mikhail Tal, a chess Grandmaster and a former world champion, to our laboratory. He played six games with one of our subjects (T.). T. played three games in a hypnotic state when he was instructed that he was Paul Morphy, an outstanding chess player of the past, and he played three games without hypnosis. After the session, Tal shared his opinion on T.'s

play, 'Before hypnosis, I played with a person who could hardly move pieces. In a hypnotic state, there was an absolutely different person in front of me who played twice as good'" (Tikhomirov, 1975, pp. 183–184).

We can interpret this experiment in the following way. Hypnosis changed the subject's self-attitude, or, according to Tikhomirov, it changed his position on oneself and others. "The position of 'I never could, I can't and I will never be able to' gives place to 'Clearly I can do it at a most advanced level'" (ibid, p.184). Should we interpret these findings using our "Flower" diagram (Figure 3), "the position on self and others" as Tikhomirov put it, will be one of the constituents of the Personality Changes dimension and may determine other constituents of this dimension such as motivation (desire to do things), self-efficacy, making sense of effort etc.

In this experiment, the amateur chess player felt completely helpless when playing with the former world champion. He had no chances to win. We can say that he was in a state of "learned helplessness" ("I am unable to do anything, any effort is useless") which according to Martin Seligman means not only very low self-efficacy, but also belief in futility of any efforts, futility of desires to achieve something, expectations of an unavoidable failure and futility of all attempts (Seligman, 1992). From this perspective, many developmental and cognitive deficits identified during assessment, may be secondary, that is, resulting from the past negative experience, first and foremost, in learning.

In a hypnotic state, when a subject was instructed that he/she was an expert who was able to achieve anything, the level of any activity, for instance, chess play, improved significantly. Please note that this improvement resulted from a single change in the Flower's dimensions – attitude to self and one's own abilities as compared to other people.

This experiment enables us to better understand what is happening within our relationships when we are interacting with

the child in his/her ZPD and an efficient mode of action is being reinforced by reflection. The child starts to understand what he/she can do autonomously, and which tasks might require the adult's help. Above all else, the child starts to see progress day by day. The child experiences that the limits of his/her abilities are expanding and – most significantly – he/she becomes aware of the enabling factors.

This idea was very clearly articulated by a second-grade student who had just missed being referred to a school for mentally retarded children due to consistent academic failure. When a counselor (who observed the principle of collaboration and supporting the sense of agency) wondered whether the child would make the following task independently or together with the adult, the boy said, "We will make this exercise together, and I will try to make the next one by myself". Of course, a 9-year-old child diagnosed with "developmental delay" is unable to explain what the factors are, that enable him to do independently what we used to do together. However he knows the meaning of interacting with a counselor and sees the results of this: today he autonomously does things that he used to do together with the adult (just as Vygotsky put it). Contextual gains, small victories over mistakes and difficulties, conceptualization and changing of the modes of action, and reflection on the previous and current experience somehow breach the totality of learned helplessness. The child gets a space for action – even though very narrow at first – where the child succeeds and where the effort invested inevitably brings about actual results (awareness of the causes of a mistake is nonetheless a positive outcome as it clarifies what one needs to work on, and which cause needs to be eliminated).

Children whose learning experience has been mostly negative, who are used to failure tend to exhibit signs of learned helplessness when learning. Perhaps, this is why, "the therapy with success" is most efficient and instructive for them. We will delineate

options for working with learned helplessness in Chapter 3, and in this Chapter we would like to highlight the Chess potential for development of children who had been formally considered "ineducable" for a long time.

Amazing outcomes achieved by students of a school for mentally retarded children in Satka are a wonderful example of this potential. In this school, we provided chess training to two groups of children diagnosed with "mild mental retardation" (Group 1), and "moderate mental retardation" (Group 2), respectively. Psychologist Dina Ryazanova worked with Group 1, and Raisa Gumerova worked with Group 2. At first, we were quite sceptical about the prospects of teaching such an intellectual game as Chess to mentally-retarded children. Nevertheless, we supported the school specialists' initiative – all the more so because we had heard a lot about the Grandmaster Dimitri Komarov who taught Chess to people with mental disorders in Kiev. After two years of Chess, a fully-fledged team of chess players formed in the Satka school for mentally retarded children. This team turned in a fine performance in the City Regular School Championship, and the team's leader won prizes in the individual all-around event.

The children with moderate mental retardation (in 2005, the term "moderate oligophrenia, imbecility" was still in extensive use) showed progress in their development too. It is not so long ago (until 1999) that these children were considered to be "ineducable" in our country. In our opinion, these children made a quantum leap in their development due to improvement in the dimension of "the ability to perform mentally". The main factors that enabled this improvement were chess problems themselves and the teacher's help.

Kristina's case is a good example of this work. At the age of 9 years old, the girl's intellectual development was equivalent to that of a three or four-year-old child. Kristina's speech was underdeveloped. She was diagnosed with epileptic syndrome. Her mental retardation was a result of intoxication with medicines at the age of

three years old. In the beginning of the chess training, we found out that Kristina failed to differentiate between light and dark squares and failed to orient herself in the space of the chessboard. After three months of the chess training, an important event took place. When making an exercise ("Feel the pieces with your hand and take a necessary piece out of the box. Move it to a square of the corresponding colour"), Kristina displayed the ability to visualize an action. At first, she placed her finger onto a relevant square, and then placed a piece on her finger. Sometimes she made a mistake and then Raisa Gumerova corrected her saying "That's wrong", or Kristina corrected herself saying the same thing. At some point, when she was moving a black piece to a square, Kristina said "That's wrong" and placed the piece on a different, right square. It could be inferred that Kristina had formed the ability to visualize her actions, i.e. from the theoretical perspective, this new mental (intellectual) formation enabled her to play Chess. Kristina started playing Chess according to the rules two weeks later, having mastered moves and understanding the game's essence. Nevertheless, she forbade opponents to capture her pieces as she "pitied" them. Unfortunately, the school teachers did not take up the psychologists' work, and the translation of the abilities that had emerged during the chess lessons to other school subjects never happened. However this translation is quite feasible and practicable from the theoretical perspective.

Thus, we used several examples to show how overall development (progress in various dimensions in the context of our diagram in Figure 3) emerges when learning Chess. This development emerges, first and foremost, due to a specific contribution of the teacher who provides individual support to the child within the child's ZPD in Chess, and extends his/her effort beyond chess training to account for – and if necessary to utilize – the whole developmental potential of a specific challenging situation to potentiate progress in various dimensions: the sense of agency, au-

tonomy, awareness of learning, reflection, the ability to perform mentally, memory and memorizing techniques, attention as a function of self-control, awareness of the child's own abilities and ways to overcome difficulties etc.

The dimension of developing the ability to perform mentally which is a crucial new mental formation in children of the primary school age, gains a special importance in the context of the COD method. Let us discuss it more thoroughly.

2.2. How Ability to Perform Mentally Develops in Learning Chess

The final stage (Level 10). The child is performing all the actions mentally, that is, on the ideal (internal) plane. There is a blank sheet of paper on the desk lying there just in case (if the child fails to perform "in the head"). There are pieces and a chessboard nearby (in case the sheet of paper and the pen prove useless). If the child has performed a mental action efficiently, then he/she may proceed to pursuing a more complicated action.

Here the child is performing an action mainly on the ideal plane (Levels 6-9). Some elements of the action are partly tangible (chess notation, a drawing of a chessboard, points on the board instead of pieces etc.). In the picture, partial fulfillment of the task on the material plane is evidenced by a pen in the girl's hand. The chessboard is lying face down on the desk; the pieces standing nearby are not used. At this stage, gradual "abbreviation of an action" occurs.

The action is gradually released of the material tools (Levels 3-5). In the picture, the child is using chips instead of pieces. The chips help the child to keep the position in mind. The child is performing the action mostly on the material plane. Loud and extended speech enables the conversion of the action to the ideal plane. Speaking loudly and describing the action in detail, the child understands its logic; becomes aware of the relationships between its elements and builds an integral mental image of the action.

The material stage (Levels 1–2) means working with a chessboard, pieces, and other material tools if necessary. The material tools may include chips designating squares controlled by some pieces; slips of paper replacing paths that pieces may move along; indicators of the squares where, for instance, the King can (or cannot) move to; rules checklists etc.

The theoretical grounds underlying the procedures aiming at developing the ability to perform mentally encompass Lev Vygotsky's concept of interiorization as converting an initially external action performed in collaboration with another person into an action on the internal plane, and Piotr Galperin's method of the stage-by-stage formation of mental actions providing a clue to understanding how this conversion takes place, what conditions are prerequisite and what stages the action passes until it becomes "mental". Galperin and his numerous disciples and colleagues used various examples of formation of mental actions and concepts to show that an action is first carried out in material or materialized

form; then in speech (at first, in overt speech and then in covert speech), and then it becomes purely "mental" (ideal) (Galperin, 1966).

According to Galperin, an action has orienting and executive aspects. The orienting aspect of an action is, for the most part, ideal. During the realization of the executive aspect, we can see a chess move as moving a piece or a pawn from one square to another. The orienting aspect comprises everything that preceded choosing this move from a multitude of potential moves. However this aspect of an action is hidden from the eyes of observers. When helping to shape mental actions in people who are unable to perform them, we penetrate into the internal structure of these actions, mechanisms of their execution and formation (the mechanism of conversion of the external into the internal).

The learning objective of the Year-1 training relating to development of the ability to perform mentally (the internal plane of action) seems to be quite modest at the first sight – to teach the child to make a mental move in a specific position, namely in the problems for checkmate in one move.

This objective seems modest only on the face of it, as the developmental journey of this ability from the starting point where the person fails to visualize even squares or pieces occupying them, let alone the position, turns out to be indeed complicated and long.

Volume II provides a detailed description of the COD method as applied to designing chess training for development of the ability to perform mentally, therefore we highlight only its basic principles herein.

We have singled out six actions comprising the ability to make a move mentally.

1. Identifying a square on the chessboard.

2. Identifying a line on the chessboard.

3. Perceiving the chessboard as a whole, and identifying combinations of squares on the chessboard.

4. The ability to visualize a simple position and find squares where two paths relevant for a concrete position intersect (problems of the "double-attack" type).

5. Perceiving the position and any changes in it resulting from a mental move as a whole (problems of the "mate-in-one-move" type).

6. Perceiving the position and any changes in it resulting from a mental move as a whole, and being able to act mentally in the alternated position (advanced "check-mate-in-one-move" problems involving alternative variations of moves and defenses, combination of various functions within one move, e.g. discovered check and interception, and the mate-in-two-moves problems).

Accordingly, we consider the whole process of shaping the ability to make a move mentally as comprising six stages. In order to proceed from one stage to another, the person needs to complete ten levels within each stage.

During Level 1 and Level 2, the action is performed fully on the material plane, with the use of material tools if necessary. Material tools help students to orient themselves in the space of a chessboard, to analyze the position etc. For example, beginning chess players place chips or a slip of paper on a file to indicate the Rook's path. Then the child moves the piece along the path from a1 to a8, pausing at every square and saying its name.

During Levels 3 to 5, the action is performed mostly on the material plane, with separate elements being carried out on the ideal plane (mentally). The more elements are performed on the ideal plane, the higher the level is. For instance, a variety of material tools may shrink to the piece that is standing still, and the

child is verbalizing its "movement" naming the squares which the Rook is passing by, and is moving the Rook mentally looking at the chessboard.

During Levels 6 to 8, the action unfolds mostly on the ideal plane, with only some elements of the action taking place on the material plane (using material tools). For instance, the child may practice moving the Rook on a "blind" or "mute" chessboard (i.e. a drawing of a chessboard with unmarked white squares without any alteration of the colours). At higher levels, there may be just a square or a blank sheet of paper designating a chessboard in front of a student. As far as the position is concerned, at lower levels the position may be indicated, for example, with points on the chessboard, and at higher levels (Level 9) it may be reflected by chess notation.

At Level 10, the action is performed purely on the ideal plane without any material tools, drawings or records. The child solves all the problems mentally.

We have divided the process into the ten levels in order to emphasize that material tools may be utilized in a highly differentiated way. Still, there are four main levels: (1) the action is performed on the material plane and even with the use of material tools; 2) the action is performed mostly on the material plane; only some of its elements are performed mentally; 3) the action is performed mostly on the ideal plane; only some of its elements are performed using material tools; 4) the action is performed purely on the ideal plane.

Why is it important to single out sub-levels within these "major levels"? – The answer is that working with a concrete child, the teacher may encounter some of his/her individual traits so that the teacher will need to show skill in differentiated utilization of material tools and to increase intensity of performing on the ideal plane gradually. When a person is stretched to the limit, even a littlest increase in effort will make his/her task unbearable. For in-

stance, in weightlifting, super heavyweight competitors can complete a 250kg clean and jerk. However if the barbell's weight is increased by half a kilo only, even a high-caliber weightlifter may fail to lift it. Something similar happens in the process of developing the ability to perform mentally. For example, the child may identify each of the 5th rank and the a1-h8 diagonal separately but he/she may fail to identify a square where they intersect. The transition from the ability to visualize one line to the ability to build a mental image of two intersecting lines will represent a quantum leap in the development of the internal plane of action.

 As we have mentioned above, Volume II gives a detailed account of this process, therefore we do not dwell upon it here. Nevertheless, we would like to emphasize four methodologically important aspects.

1. Avoid forcing completion of levels and stages. Assignments should be challenging but doable for the child, that is, they should lie within his/her ZPD.

2. Avoid getting stuck on one subject of learning as the child may lose interest in studying and make no sense of it, or, which is worse, the child may start doubting his/her own competence.

3. Keep in mind that, in the beginning, two things are of pivotal importance for formation of mental actions: *material tools* which make an action doable and ensure that it is done with full awareness; and *speech*, which Vygotsky believed to be a bridge for interiorizing the external.

4. Remember that the child's sense of agency which manifests itself as the child's activity and reflective ability is the main developmental resource. It is important to "turn this resource on" when the child experiences perplexity, suggesting that he/she should think what could help him;

offering (rather than directing) him/her to use material tools (or to decrease the level of difficulty). Our experience shows that children master the logic of using material tools rather quickly, which may be easily observed when they work in pairs becoming each other's counselors. It is not uncommon that one child gives advice to another, "Well, why are you taking so much trouble? Get the chessboard", or "Take the pieces" or "Try chips" etc.

In order to check whether our chess training did exert positive effect on the ability to perform mentally, we carried out cross-sectional testing to assess developmental dynamics of mental functions reflecting the level of this ability directly or indirectly, during the first years of the COD project implementation.

The findings of the cross-sectional assessment in 2004-2010 showed that children who received the specifically designed COD chess training developed faster and better than their peers. The assessment encompassed such parameters as attention, memory, verbal and nonverbal intelligence, the ability to perform mental operations and cognitive performance (Volikova, Glukhova, 2012).

In order to identify specific effect of the COD project on the child cognitive processes, we tested three samples of children:

1. Children learning Chess as part of the COD project (the COD experimental group).

2. Children learning Chess as part of the usual Chess curriculum (the "Chess as usual" (CAU) control group).

3. Children who had no chess lessons (the "no chess" control group).

We singled out these groups for a particular purpose. Comparing the COD experimental group to the "no chess" control group enabled us to obtain scientific evidence that Chess exerted positive effects on the development of the child's cognitive proc-

esses. Comparing the COD experimental group to the CAU control group enabled us to investigate how positive effects of the COD training on the children's development changed over time. The longitudinal study covering the period from 2004 till 2008 involved 517 students (Grades 1 to 4) who studied at several regular municipal schools in Satka (Schools 14, 5, 40, 12, 13, 1).

Two PhDs in Psychology, Svetlana Volikova and Alla Kholmogorova (Moscow State University of Psychology and Education) selected methods for the cross-sectional study. The assessment itself was carried out by Moscow specialists and Satka school psychologists.

An array of psychological assessment tools, which were used to monitor children's main mental functions, encompassed almost all major cognitive processes, namely, memory (visual, auditory and externally mediated memory (based on memorization techniques)), attention, cognitive performance, verbal and nonverbal intelligence, planning and anticipation of the consequences of actions.

The researchers used SPSS for Windows, Standard Version 11.5, Copyright © SPSS Inc., 2002, a statistical software package extensively used world-wide for statistical analysis in research, to process the findings.

The subjects of the study were students of Grades 1 to 4. Each pilot (experimental) class had two control classes: children in Control Class 1 studied CAU, children in Control Class 2 had no Chess in their curriculum. All children went through psychological assessment three times over the study period: in September (at the launch of the project, the assessment aimed at diagnosing the actual developmental level), in January (intermediate assessment), in May (to assess progress made during Year 1 of the project). For the period mentioned, most students both from the chess and "no-chess" classes improved their overall level of cognitive processes. However the pilot-class students improved

their outcomes in a wider range of indicators. We believe that this improvement was due to a specific design of the COD training when students planned their actions to overcome "yesterday's" challenges by themselves on a lesson-by-lesson basis. As a result, it was the cognitive indicators involved in this process that enjoyed major improvement. The pilot-class students performed better than their peers as far as the following 7 indicators were concerned (see Chart 2): they improved auditory and visual memory; started performing better on the tasks relating to nonverbal thinking; improved attention, cognitive performance, and the ability to plan actions mentally.

Chart 2

**Comparing Levels of Cognitive Processes
in Second-Grade Students (Pilot Class), School No 14,
September 2004 – May 2005 (Project Year 1)**

Period of assessment⟍ Indicators	September N=24 M(SD)	May N=24 M(SD)	Significance Level (*p*)
1. Memory	5.4 (1.9)	**9.0 (1.4)**	0.000**
2. Visual memory	8.6 (1.8)	**9.2 (2.3)**	0.000**
3. Nonverbal intelligence	6.2 (2.7)	**7.9 (3.0)**	0.057t
4. Attention	0.77 (0.3)	**0.9 (0.1)**	0.003*
5. Performance	178.8 (82.7)	**288.7 (66.5)**	0.000**
6. Internal plane of action 1	1.4 (1.5)	**2.8 (1.6)**	0.000**
7. Internal plane of action 2	2.5 (0.66)	**2.8 (0.4)**	0.048*

M – mean;
SD – standard deviation;
* – the significance level of $p < 0.05$ (the Mann-Whitney U-test);
** – the significance level of $p < 0.001$ (the Mann-Whitney U-test);
t – trend-level significance.

Year 1 of the COD training produced the most outstanding results. Later, the older the children became, the less expressed differences in the levels of these indicators were. By the fifth grade, the researchers registered significant differences only for three indicators (attention, memory, cognitive performance), and by the ninth grade – for one indicator (memory). Taking into account that eventually the pilot-class students showed better academic performance, it may be argued that the work carried out in Grades 2 to 3 produced a long-term effect if we take account of the students' starting position. Nevertheless, this inference is an assumption needing a more rigorous scientific validation rather than a confirmed result.

2.3. How to Translate Abilities Formed
during Chess Training to Other School Subjects and Activities

We have already provided various examples illustrating how experience (in its broadest sense) received in chess training might be translated to other kinds of activity. This translation may be spontaneous, i.e. the child may do it by him/herself. Alternatively, such translation may be absent. It is illustrated well by some fictitious characters (see Stefan Zweig and Vladimir Nabokov for example) who were high-caliber chess players but failed to be particularly bright and well-behaved people beyond Chess. There are such examples in real life too. The risk of such lopsided development in children relates to the fact that having felt that he/she succeeds in Chess, the child withdraws into the game compromising the reality. This may have an adverse effect on his/her overall development despite progress in Chess.

Therefore, we will proceed from an assumption that – as it was shown above – Chess may facilitate development of various abilities, but grown-ups (teachers, coaches, parents) need to take care that these abilities are translated to other activities so that the

developmental process could be significantly enriched and harmonized.

So, how may the chess-related abilities be translated to other kinds of activity?

Nikita Alekseev (1990) outlined this process as follows. If the person employs some mode of action to carry out various kinds of activity, then the conditions for its reflection will emerge, in other words, the conditions for its informed use when the person is fully aware of the relationships that make this mode of action work. The generalized modes of action formed this way may be translated to some new activity. When facing some new activity, the modes of action may change, become more differentiated or even more generalized. This becomes a specific focus of the child's development both in terms of his /her intellectual progress and personal growth.

For instance, reflection enabled some children who consistently made mistakes and experienced serious learning difficulties, to find out that their mistakes had frequently been caused by anxiety, fear of failure, doubts about their competence rather than by lack of expertise or skill. The former phenomena interfered with results of any activity of these children. Having reassured themselves that their performance depended directly on the level of mastery of a mode of action, they gained awareness and healthy confidence in their ability to complete tasks. Furthermore, they invented a specific action (specific effort) aiming at coping with anxiety and reinforcing self-confidence to complement their personal mode of action.

A simple technique that the teacher may use to facilitate translation is highlighting similarities between Chess and mathematical problems.

There are similarities between analyzing the position in Chess and analyzing texts; between grouping pieces based on their relationships when memorizing the position, and singling out grammatically and semantically related words in a sentence.

A mnemonic technique when a person consolidates units into larger elements to memorize the position in Chess may be translated to any learning activity (understanding texts, rendering, learning poetry etc.). In order to facilitate this translation in the COD project, some teachers provided special integrated lessons allocating time for Chess, Mathematics and Russian, 15 minutes for each, respectively. Sticking to the same modes of actions while switching between different types of content facilitated the children's reflection, generalization and translation of abilities from one school subject to another.

It is especially important a continuous focus on one's own modes of action, assessment of every challenging situation from the perspective of "scanning" one's own modes of action for their feasibility in a given context, reinforces the child's active and fully informed attitude to activity, and strengthens his/her sense of agency.

Our first pilot class students who received the COD training from Grade 2 to Grade 4 achieved results that amazed the school teachers. This class turned out to be the sole class in school where the transition from primary to secondary school resulted in no decrease in academic performance. Teachers know that children oftentimes get frustrated with the transition from a single primary school teacher who taught children everything to the system with different teachers teaching different subjects and imposing different demands on students. Therefore many students exhibit an abrupt decrease in academic performance during the first and the second academic terms. The academic performance of the children, who spent three years learning to cope with difficulties during the chess training (as well as other school subjects later), stayed level. Moreover, as we have already mentioned above, by the end of the final grade, they showed the best performance in the city and the region, and completed school successfully.

The translation of the abilities developed in Chess to other activities may be carried out as follows:

– Draw a direct analogy between activities and focus on a possibility to use the modes of action formed in Chess when working with other subjects;

– Invite students to independently solve problems for utilizing some mode of action in specific learning situations;

– Support and encourage students' autonomous active search for where and how they may use the experience obtained during the COD training.

The multidimensional model of the zone of proximal development and our teaching practice have shown that continuous and versatile experience of conceptualization, flexible application of modes of thinking, activity, and reflection facilitates cognitive and personal development of children in various dimensions. Let us describe this process more generally.

Chapter III
HOW OVERCOMING LEARNING DIFFICULTIES PRODUCES OVERALL DEVELOPMENT OF COGNITIVE FUNCTIONS AND PERSONALITY

3.1. Cognitive Development

The findings of the cross-sectional assessment (See Chapter 2.3.) have shown that the chess training targeting development of the ability to perform mentally contributes to development of other mental functions (attention, memory, verbal and nonverbal intelligence, cognitive performance) in addition to this ability. However, there is every reason to argue that the COD training's effects extend beyond these functions. The underlying logic is very simple. The thing is that the cross-sectional assessment allows for registering changes that children have in common. However the COD lessons as such are designed to focus on children's individual aspects, i.e. they aim at developing "failing" functions. The focus on the ability to perform mentally is determined by the children's age as this ability forms exactly when children engage in learning during primary school. However, the range of opportunities opened by such training design is much wider. Let us clarify this idea and illustrate it by means of the multidimensional model of the zone of proximal development (Figure 3).

What is happening in the dimension of learning Chess?

Initially, the child fails to see the chessboard as a specifically arranged totality of dark and light squares. Many children perceive it as a "multi-coloured blot". In the course of the COD training, the child becomes able to see this space as regularly alternating dark and light squares which build various lines, group variously, and intersect. The child may see the chessboard as a space where the Rook is moving; and then racks and files that the Rook may move along will build the figure and the rest of the chessboard will constitute the background. The child may see the chessboard as a space where the Bishops are moving, and then the diagonals of the respective colours will be the figure and the rest – the background that they are "depicted" on. If the child fails to do it mentally, he/she may use material tools to identify the figure from the ground:

he/she may build corresponding lines with chips or paper slips and verbalize his/her actions. Then, according to the laws of Galperin's stage-by-stage theory, mental actions, or the ideal plane in the broad sense, start to take form. The child becomes able to structure the space of the chessboard in terms of a problem he/she is working on and even to see the Knight's path which is not present on the chessboard as it coincides neither with ranks nor with files. This ability goes beyond the ability to visualize things and involves constructing an image perceived with deliberate identification of a figure and a background in this image depending on a problem to be solved. This ability can be used as a mode of action in other activities, including arts.

At the beginning, the child fails to memorize a position comprising four pieces, i.e. the number of units below the lower boundary of the age norm for the memory span (which is 7+2). In a few months, the child masters modes of action that allow him/her to memorize any number of pieces provided that they represent a chess position rather than occupy squares on the chessboard at random, that is, his/her working memory capacity extends significantly. When learning chess notation, children learn to name moves and designate the pieces' locations. This forms the basis for the ability to make a move mentally. Translating the latter two abilities, for instance, to solving mathematical problems may produce a new quality for the problems that include both calculation and thinking. It can be exemplified by a curious story which happened during a City math test. The test included a problem for advanced learners (marked with an asterisk), which was optional for students. A math teacher was amazed when all the students in a class that she was supervising during the test attempted at solving this problem, and almost all of them did solve it. It was a unique case for the city and it was the class that received the COD training. As far as Russian (a school subject) is concerned, development of concentration and self-control enabled the primary school

students to decrease the number of mistakes relating to attention failures typical of the primary school age (and some of the students no longer made such mistakes at all).

Especially deep and relevant changes take place in the developmental dimension of reflection. For one thing, children get to know this word very early and understand its meaning perfectly well. Reflection is a concrete procedure rather than an abstract concept for them. You have to stop; to pay close attention to what you have done; to think what you have done incorrectly; to try to find a connection between mistakes made and a mode of action used, and having found this connection, to think what may be changed. If an action is efficient, then reflection will also be useful, as it enables the child to identify which "magic" ingredient of the mode of action has helped the child to complete the action without mistakes. Having identified this magic ingredient, the child may add it to his/her armoury to assist future actions. At some point, reflection becomes a norm for children, a natural process involved in all acts of thinking, and it benefits both thinking and learning, in general.

The multidimensional model of the zone of proximal development (Figure 3) may help us to represent cognitive development as a simultaneous progress in various dimensions which we have just described, namely, attention, memory, thinking, speech, perception, the ability to visualize and to act on the internal plane etc. It is not simply about improvement in this or that dimension. In a concrete challenging situation, dimensions start changing as interrelated entities, with every dimension representing a constituent of the mode of action which is being learned. If the child lacks his/her own modes of action, an adult near the child will provide for their deficit. Reflection and the mechanism of interiorization enable the child to gradually "own" things that he/she is doing in cooperation with the adult now. Furthermore, the child does not imitate the adult; the child does not replicate any pattern learned by rote;

rather, the child acts with full awareness becoming the sole master of his/her modes of action. The latter in its turn may as well lead to personality change, the mechanisms of which we will discuss in the following paragraph.

3.2. Development of Personality

Development of personality may be a side effect of the chess training facilitating the child's sense of agency. Indeed, let us imagine a child who is ridden with unconscious modes of actions, the use of which threatens mistakes that may emerge all of a sudden at any point. This unfortunate context prevents the child from being confident in his/her actions. This child fails to understand why he/she spells a word correctly in one sentence and why he/she spells it incorrectly in a similar sentence; why he/she solves one problem and fails to solve another problem which is just as difficult; why he/she moves a piece at a most inappropriate time when the victory is so close. This child lacks self-confidence; he/she is ridden with constant anxiety (when he/she is worrying about the result); has a fear of making a mistake; tends to give "magic" explanation of his/her failures or, which is even worse, uses his/her inability to achieve excellent results as an excuse for these failures. After some time, the child ceases to see any sense in investing effort, or starts looking for work-arounds that would help him/her achieve desired results (these work-arounds are paths that need no improvement of one's expertise and skill). There may also be another effect when the child runs low on motivation to performing some activity (be it learning or chess) if he/she enjoys no progress in this activity.

We have described quite a typical situation which can be frequently observed at a regular school when children who are taught the spelling rules for "unstressed vowels in the root" persist in making mistakes in spelling unstressed syllables up until

the last grade. As another example, they may experience insuperable difficulties learning poems, every time spending hours and hours memorizing them and remaining unsure of the result. What makes this situation typical is the fact that the child facing challenges at school (and all students without distinction have difficulties in primary school), is unable to cope with them autonomously. In order to overcome these difficulties, the child needs to get the adult's qualified help. Nevertheless, the adults in the child's environment, including teachers, parents and other parental figures, help him/her by showing "how to do things right", usually without reflecting on how the child acts, and what underlies his/her difficulties and mistakes. At the same time, causes behind the same mistakes and the same difficulties may differ from child to child. For instance, mistakes relating to attention failures may be due to specific aspects of the child's attention; lack of self-control and checking skills; lack or excess of motivation; high level of anxiety; the fear of making a mistake etc. Pointing to a mistake and telling the child "how to do things right" is not enough to eliminate these causes. In order to get rid of them, the child needs to collaborate with the adult who arranges and facilitates the child's independent work on the mode of action in question and who invests effort to understand how the child acts and to investigate (in collaboration with the child) how the mistake arises. Then, the two of them start thinking on how the child may change the mode of action so as to avoid the mistake, hence activating two processes that are quite untypical of the usual, – namely, reflection and designing one's own action.

Thus, it is the focus on the child's sense of agency, initiation and facilitation of his/her active and informed attitude to an activity which is being performed that facilitate development of his/her cognitive functions and personality. Let us consider how this mechanism works and how it may be used in the classroom when a need for facilitating personality changes arises. We will

use the aforementioned multidimensional model of the zone of proximal development which has been amended for this purpose (Figure 4).

The dimensions holding a potential for improvement in Figure 4 represent some personality traits that may change in the course of activity, and two closely-related aspects – namely, reflection and the ability to cope with difficulties (the coping ability).

To give an example of the mechanism of the personality development during the RAA-based training (may it be Chess or other play or learning activities), let us consider an extreme case when persistent failures in some activity result in learned helplessness (Seligman, 1992). Martin Seligman discovered this syndrome in the course of experiments with dogs. The dogs were divided into two groups. The researchers kept the dogs in both groups in cages and gave them electric shocks. One group of dogs (Group 1) could escape these shocks if they demonstrated search activity and pressed on a lever ending electric shocks in their cages. Group 2 had no lever in their cages and they continued receiving shocks whatever they did. Thus, the researchers reinforced active behavior in the Group 1 dogs, and virtually suppressed active behavior in Group 2. The Group 2 dogs got reassured of the futility of any effort, and eventually these dogs lay down and whined quietly. Then, the researchers changed the experimental conditions. They placed the dogs to shuttle boxes so that they could escape shocks jumping over the barrier, but there was no lever to end shocks.

Having found no lever, the Group 1 dogs jumped over the barrier. Group 2 exhibited no active behavior, lay down and whined without attempting at jumping over the barrier although it was well within their reach.

Martin Seligman called this effect "learned helplessness". This phenomenon was "learned" because the past experience told the dogs that any efforts were useless. It was "helplessness" because the dogs perceived themselves as incapable of escaping shocks.
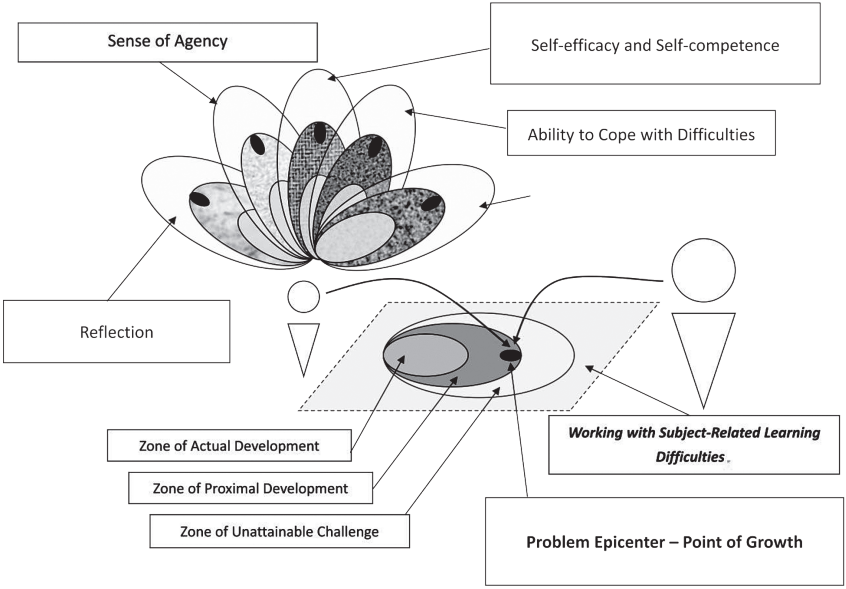
Figure 4. The multidimensional model of ZPD illustrating
the potential for personality changes (Zaretskii, 2013).

People may exhibit learned helplessness of different sever-
ity, especially children who display persistent academic failure,
come from troubled families and have nobody to help them cope
with challenges. These children are usually promoted from one
grade to another so that grade retention may be avoided. Fur-
thermore, these children find "work-arounds" themselves (crib-
bing during tests, avoiding speaking in front of the class, skip-
ping lessons), or reconcile themselves to their failure to change
their situation for the better and make no attempts to improve
it at all. This behavior (lack of useful activity) and the mode of
experiencing the challenging situation (feeling helpless; unable
to change anything; feelings of futility of efforts; self-doubt and
lack of desire to do anything) make the situation traumatizing,

and potentially harmful for healthy mental functioning. Learning recedes into the background, and its psychotherapeutic potential, i.e. the possibility to facilitate fruitful personality change (personal development), staying within the framework of learning, comes to the foreground (Kholmogorova, Zaretskii, 2011).

In this context, the problem's epicenter lies in the dimension of the learned helplessness syndrome rather than in the dimension of specific modes of action. This syndrome needs to be specifically addressed by the adult (not necessarily a psychologist but a teacher or a parent). In this case, the dimension of learning and the dimension of learned helplessness swap places in some way (Figure 5).

Assistance targeting learned helplessness initiates improvement in related dimensions (agency, reflection, willingness and ability to cope with difficulties, self-competence, meaning etc.). Figure 6 uses colour to indicate the moment when these dimensions start changing.

On the one hand, these dimensions – or, to be precise, exclusion of their resources when coping with a challenge – depend on the past experience that resulted in learned helplessness which oftentimes manifests itself as a loss of capacity to do even simple and doable things. On the other hand, "exclusion" of these resources reinforces learned helplessness and feeds the person's self-myth that he/she is incapable of the activity in question.

It is not uncommon for school when a student who performs well in many subjects becomes an underachiever, for instance, in Mathematics, reassuring him/herself and others that he/she is a "fuzzy" (a person interested in humanities) and therefore Mathematics is a continuous struggle for him/her. As a matter of fact, he/she gave up any attempts to overcome difficulties long ago, and that is why, the situation is only getting worse. We have discussed students who suffered persistent academic failure and had no one to help them, above.
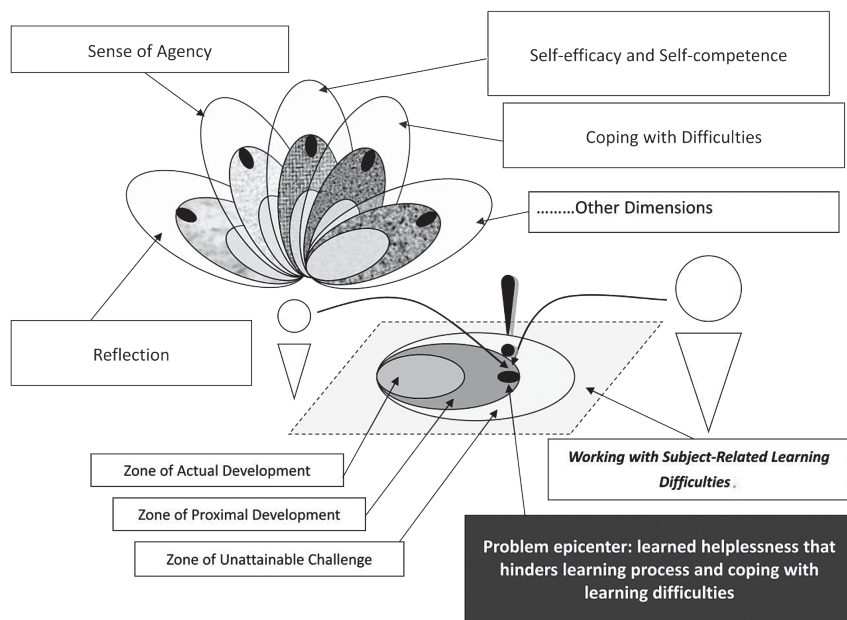
Figure 5. The multidimensional model of ZPD illustrating the case when the problem epicenter lies in the dimension of personality rather than in the dimension of specific modes of action.

If the child ceases investing in efforts necessary to overcome his/her learning difficulties, it may jeopardize his/her further development. This way of experiencing the challenging situation may entrench itself. Should another challenge and another learning activity take place, the child may repeatedly view him/herself as incapable. His/her own activity may become selective; the life space may start narrowing and he/she may become a psychotherapy client, as the child's mental health may come under threat.

So, how may personality develop in the course of activity? For one thing, the type of activity as such is of little importance. It
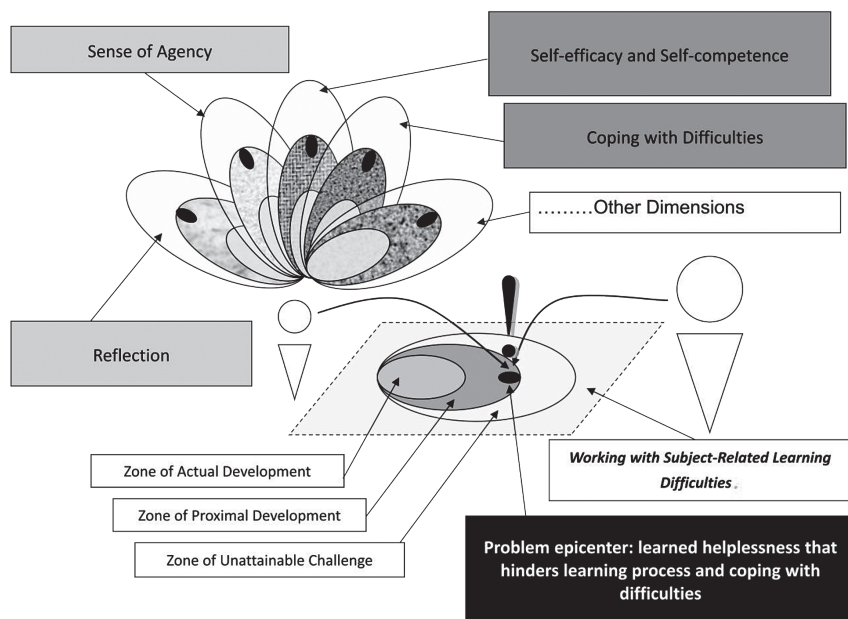
Figure 6. The multidimensional model of ZPD illustrating the point when the dimensions associated with learned helplessness start to improve.

may be some activity involving insuperable difficulties, or it may be some neutral activity, e.g. Chess. The child who is being engaged in playing chess, may be quite sceptical about his/her ability to succeed in it. However, what if the activity is designed *so* that success is inevitable?! We emphasize the fact that our joint activity is always a success and focus the child's attention on it. As a matter of fact, successes themselves may differ. If the child learns something, then it is a learning success. If he/she has failed, but he/she has been able to reflect on the mode of action and has become aware of the cause of failure, then the success lies in awareness, in a deepened understanding of what he/she does and how he/she does this.

This focus on the content of the activity distracts the child from hard feelings of helplessness and sets a positive mood even when there are no achievements in the activity itself. At the same time, it enables the child to get used to this activity. The child is indeed getting used to it as if he/she were walking carefully, feeling the ground to understand whether there was no danger to walk in that direction. The main challenge is to begin: to involve the child in the activity whereas he/she firmly believes that investing effort makes no sense. Here "another thing" comes into play. For another thing, the contact established between the child and the assisting adult becomes – in a way – more important than the activity itself. If this contact is deep, emotional and meaningful, if the relationship is built on collaboration, if the child tends to trust the adult (even when the child mistrusts him/herself) and believes the adult, these may be decisive factors in overcoming learned helplessness. If the child is resistant or irresponsive to suggestions to start doing something giving an excuse of "Nothing is going to work", then, if the contact is good, the adult can always say, "Do you think that you will fail? And I think differently. I can help so that you will make it. Do you believe me? Then let's try". Then the art of helping and designing lessons comes into play. If the child has become aware of the line between his/her zones of actual and proximal development; reassured himself that he/she can do things autonomously; if today he/she does things that he/she used to do only with the adult's assistance, then this experience will become a source of inspiration empowering the child, enhancing tolerance to difficulties and making efforts meaningful.

The littlest success may revive improvement in all the aforementioned (and unmentioned) dimensions producing the effect wherein one step in learning results in one hundred steps in development.

Below, we give an exceptionally illustrative example of the beneficial effect of the chess training on children's overall develop-

ment (including development of personality). It is a case of an orphaned child suffering from a severe somatic condition that causes muscular dystrophy. The boy could hardly move his legs and arms; his fingers were immobilized. He could raise his arm, and use his second and third fingers on the right hand as pincers to pick up small objects. He got used to being taken care of, as other people transported him around in a wheelchair; fed him with a spoon and attended to his every need. He was able to draw and write independently, holding a pencil between his teeth. His intellect was intact, but due to the life style of an orphan who spent most his time in hospitals, he had developmental delay. Having learned the basics of Chess, he got keen on this game and became a very dedicated chess learner.

Once, he was offered to make checkmate in one move. He realized at once that the Queen would be the piece that could do this and proclaimed to which square the Queen should be placed. A counselor playing with him suggested that he should move the Queen by himself. Pasha (the boy's name) answered, "I can't". The counselor responded, "I think, you can". Then Pasha contrived to raise his arm and grasped the Queen with two fingers. The arm and the Queen moved down. Pasha took a careful sight and – with the second wave of his arm – moved the Queen to the corresponding square. Indeed, some pieces fell down at that moment, but the game was ended with checkmate. A week later, Pasha ate by himself (he invented a mode of action that allowed him to eat soup and the second course pressing his elbow on a spoon or a fork lying on a plate). Then he started to expand the range of his actions. He started using orthotics which helped him move on his legs rather than in a wheelchair. Six months later, he could kick the ball and started playing soccer with his peers. He started going to school. He set a new main goal – to become independent and self-sustaining. He started to train his arms, expressed a wish to "attempt to learn to play the piano" and, indeed, he found a way how to do it. At

first he learned to play on the black keys, and then on all the others. Two years later, he learned to attend to himself autonomously; bridged the gap with his peers as far as academic performance was concerned; had various hobbies and became one of the best chess players at school.

The more severe disorders are, the more serious challenge they pose to professionals and the more evident progress and outcomes the professionals' efforts call forth. In Pasha's case, the boy may have achieved the same outcome if he had engaged in a different activity. However it was not by chance that he started from Chess. Good intellect was the only thing that he needed to play well. The boy's somatic condition mattered little for this game. Therefore, Pasha was quick to reassure himself that he could learn to play well. This confidence might have become a resource that inspired him to attempt at moving the Queen with the hand that he believed to be incapable of making this move. As we have mentioned above, learned helplessness is an extreme case of the personality deformations, a most severe one. Lessons designed so as to account for children's individual challenges and traits may facilitate a variety of personality changes that become resources for performing any activity.

3.3. Interpersonal Relationship Development

Let us outline another developmental resource activated by Chess. This resource concerns the child's development in terms of his/her interpersonal relationships. In our opinion, the relevance of Chess as a rule-governed game comes to the foreground here, and the collaborative relationship that is built between the adult and the child and that is translated to the child's relationships with other children, gains special importance. Just as any other game, Chess is interesting and playable only when you observe the rules

that it relies on. If the rules are overstepped, there will be no game. In order to observe the rules, you need both to know them and invest effort in following them. When children learn to follow game rules, they obtain an important experience. "The rules are a law for everyone"; "You cannot break the rules; otherwise there will be no game"; "The game is interesting when you follow the rules". Investing effort to observe the rules, the child develops his/her ability to exert self-control and to demand observance of the rules from others. These qualities are very important for children of the preschool age who are often unready to obey school rules when entering school. Playing by the rules becomes an important experience making their transition to school easier. When all participants observe the game rules, the game becomes feasible, interesting, clear and creates a space for the child's creativity.

The second aspect of the beneficial effect of Chess on the development of interpersonal relationships relates to the COD method as it relies on the principles of the Pedagogy of Cooperation. The child learns to collaborate; experiences the adult's respectful attitude; learns to treat him/herself and others (including teachers and peers), his/her and others' actions and mistakes respectfully. Unless there is deliberate establishment of the collaborative relationship, children may fill the relational void with unhealthy competition and hostility. Collaboration in no way means that everyone is fond of each other. Relationships in any group of people imply acceptance and rejection, liking and antipathy, even aversion. The collaborative relationship – being prerequisite for a proper learning process and personal development and relying on the students' interest in the activity's content (playing, learning, personal development) – allows for overstepping the emotional aspect of interpersonal relationships and focusing on the activity. We would like to reiterate that working in dyads or small groups when children help and support each other acting as counseling teachers for their companions is an important constituent of the COD

method.

Peers' help and support in a challenging situation, especially, if this help is efficient (that is to say, if it is similar to the support provided by the adult coworker to facilitate the child's autonomous coping rather than has an insulting and offensive quality and is accompanied with a sense of superiority on the part of "a helper") makes the relationships between peers healthy, even when these relationships are far from perfect.

Chapter IV
DEVELOPMENTAL CHESS TRAINING DESIGN

4.1. Year One Training Program Outline. Workbook

The Year One COD training program is designed for children who are new to chess and start learning the chess basics. As a rule, children who are familiar with Chess and can play, nonetheless, have a fragmentary and inaccurate knowledge of this game unless they have learned Chess in a chess club or during individual chess sessions with a coach. However the main issue is that most children play "with" chess (chessmen), rather than play chess if we stick to the point that Chess is, first and foremost, the ability to perform mentally. Therefore, the COD method is as useful for chess players as for complete beginners. The sole difference in the training approach is that teachers may introduce chess-playing tasks to chess players earlier in course of the training.

The chess part of the COD program is designed as a usual chess training program and includes the following sections: Introduction; Chessboard, Moves and Rules; Game's Essence and Potential Outcomes; Game Stages; Position; Checkmate in One Move; Chess Practice. Every lesson comprises three types of problems: *elementary problems* that all students should be able to solve; *difficult problems* that may cause challenges when children are working with them independently; *advanced problems* that a few children may solve. This is a very relative differentiation as elementary problems may turn out to be difficult, and difficult problems may convert into elementary at some point.

Therefore, we recommend that the teachers go beyond the Workbook tasks to include other problems that they will find or invent and that may be useful for their students.

The COD training differs from the usual chess training in:

– Its focus on development of the overall abilities (first and foremost, the ability to act in one's head) rather than chess skills;

– Its focus on designing lessons so that every child may progress in his/her ZPD, i.e. the focus on creating conditions

for the child to move along his/her individual developmental path;

    – Progress along one's developmental path that may be ensured both by one's progress in learning Chess, and by individual improvement of the ability to perform mentally;

    – A reflection-based constituent of the training which takes shape of a special "Reflection Form" (see "The Workbook").

As far as the last point is concerned, we need to clarify how the teacher should use the Workbook. Although the COD training design implies that lessons follow each other in a specific order, it is possible that, at a particular lesson, children sitting in a classroom may be working on problems of different difficulty, and moreover even types and content of these problems may differ, that is, each child will be working with his/her individual subject matter of learning. Different children may need different time to learn one and the same subject. There is nothing dramatic about this as everyone has the right and opportunity to progress at his/her pace. The teacher should not reproach the child for moving slowly if the child shows diligence. Furthermore, the child has the right to manage the content of his/her lessons shaping his/her own plan which the child agrees on with the teacher, of course (it is a rule that both parties of the collaboration – both the child and the adult – should obey). At first, filling out the Reflection Form may be an unattainable task for the child who has never had such experience and is not used to reflecting on his/her actions. Therefore, at the beginning of the training, the adult teaches children to use the Reflection Form. At first, the teacher gives his/her students a chance to fill the Form out independently: he/she invites them to put down what they did by themselves; what they failed to do independently; what help they received; what this help gave to them; what, in their opinion, they need to improve. The child acting independently will most likely fail to answer all the questions or his/her judgments may be extremely inaccurate and subjective. It is important to ensure

that every child gets help. This opportunity will arise if the teacher combines group and individual work; arranges working in dyads, and if the lesson is run by a tandem of teachers (or a teacher and a psychologist), as this design enables the teacher to focus on helping even one child if necessary.

4.2. Individual Lesson Design

It is recommended to carry out individual lessons (irrespective of their subject) according to the following scheme. At the beginning of a lesson, it is important to establish contact at the level of emotions, meanings and attitudes. The child, just like the adult, may be overwhelmed with strong feelings that should be shared lest they interfere with the training. Awareness of one another's emotional states promotes mutual understanding and empathy. Reflection at the beginning of the lesson facilitates establishing contact at the level of emotions, meanings and attitudes. When reflecting, the child reports what important events took place during the previous session; which thoughts they catalyzed; what suggestions for today's work he/she has. At some point in working with the adult, children start to verbalize challenges and bring issues and subjects to deal with during the lesson. The Reflection Stage ends with joint planning.

Then, the child moves to the Stage of Autonomous Performance. This stage allows for identifying the child's ZPD in Chess. Instead of working on tasks during the lesson, the child may bring assignments that he/she completed at home by him/herself. It is important that these assignments be fulfilled absolutely independently and hold no trace of other people's help. If the child has fulfilled his/her home assignment with someone's assistance, then it is important that there be some report on what the child did by him/herself and what he/she had difficulties with; which help he/she

needed; which help he/she received; what the child obtained as a result of this help. Otherwise, a specialist working with the child may start from false premises. It is important that the parents appreciate the value of the child's autonomous performance as a necessary developmental resource. Christian Gotthilf Salzmann (2011) wrote about the value of the child's autonomous performance in his vivid and transparent address to parents as early as on the cusp of the 18th and 19th centuries. He never used the "Flower" diagram, but he showed how the child's autonomous performance (today we would say the activity grounded in the sense of agency) facilitated the child's development and how important an appropriate attitude of the adult was.

Further, if the child makes mistakes or faces a challenge in the course of his/her autonomous performance (and it will necessarily happen if the problems are selected properly from the perspective of the difficulty/manageability level), this creates grounds for the child-adult collaboration, as the child may collaborate with the adult to attempt at doing things that he/she failed to complete independently, and "own" this experience later. The adult helps the child to reflect, that is, to become aware of what underlay a difficulty or a mistake. The adult helps the child to conceptualize the relationship between the challenge and the child's mode of action; to become aware of the mode's insufficiency and to develop a new mode of action that should be tested later.

To this end, the adult may give other tasks, in the course of which the mode of action will display whether it is sufficient or deficient. If it is deficient, then the child needs to continue improving this mode of action; if it is sufficient, then he/she may proceed to the next task. Designing the mode of action ends with securing it as a checklist so as to ensure that the child keeps it as a tangible object (rather than as a trace in his/her frail and unsteady memory) which the child may use to inform his/her actions until he/she masters the mode of action. It is no use wasting efforts on memorizing by rote,

as Pyotr Zinchenko obtained evidence that involuntary memorizing is more productive than voluntary. The lesson ends with final reflection for which we recommend using the aforementioned Reflection Form.

4.3. Group Lesson Design

A group lesson consists of the same stages, that is, it follows the same logic. The teacher works both with the whole class and with every child in the classroom. The teachers often object to this goal believing it to be impracticable. Indeed, the traditional lesson design implies that the whole class should work on one and the same task, learn one and the same subject. However we have already discussed disadvantages and negative consequences that some groups of children may encounter in this case. Alevtina Antonova (2013) gave a detailed account of her experience of designing Mathematics lessons in her article. This experience may be efficiently translated to chess training. It will be easier to design a lesson in a more efficient way if you follow our recommendation to divide the class into groups of 10-15 children. Teachers usually divide students into groups according to their progress in Chess. In our opinion, this division has both advantages and disadvantages, therefore we leave the division principle to the teacher's discretion. When working tandem with another teacher or a psychologist, the teacher has a valuable resource at his/her disposal. We have already discussed this type of lesson design, that's why we would like to delineate what the partner's resource is and how you may utilize it. Firstly, as we have mentioned above, the tandem work allows teachers to exert moment-to-moment supervision of both aspects that are important for their activity to succeed – namely, lesson operational management (performed by a co-teacher who is teaching the subject) and reflective management. The partner

is observing the lesson from the position of a reflecting agent and is ready to intervene at any moment when noticing that his/her co-teacher's actions need to be somewhat adjusted. Secondly, the partner may provide individual help to those children who "fall out" of the lesson and need individualized training. In this case, the class is somehow divided into two groups, with each working on their own assignment.

Thirdly, when the teacher faces creative challenges that may arise during the lesson and needs to address them, the resource of the tandem becomes crucial as two people solve creative tasks six times as efficiently as one person (Zaretskii, 2014).

Fourthly, co-teaching allows for fulfilling reflection-related tasks (including the end-of-lesson reflection) in a quicker and more productive way.

Another important resource of the group work (in contrast to the one-to-one work) is that it allows for arranging work in small groups and pairs during the lesson. Firstly, this design enables the teacher to give differentiated assignments (based on their content or difficulty level) matching the groups to activities that are most beneficial for them. Secondly, every child gets an opportunity to prove him/herself in the group work. Thirdly, children get the chance to try on various roles (a student, a teacher, an assistant, a counselor), i.e. they master not only the subject matter of learning but the modes of action that they experience when teachers help them. This experience may also become a subject of reflection and an important developmental resource.

As you see, when discussing the lesson's design, we have made little use of the chess terminology, as this design is suitable for any subject, not only Chess. As our experience has shown, educators who provide the COD training often start reform lessons in other subjects in accord with this method. We are convinced that this practice should benefit children's development.

CONCLUSION

In conclusion, we would like to appeal to people who will add the COD method to their armoury and attempt at designing one-to-one or group chess lessons in line with it. We are willing to share any materials that you may need if we have them. If you have difficulties finding literature that we recommend reading, we can share relevant books and papers (including electronic ones) with you. We can provide either live supervision (taking part in the lessons) or supervision based on your account of the process or video recordings of the lessons. For instance, working with the Satka teachers, we have established a practice of Skype supervisions and supervisions based on Reflection Forms filled out during the lessons. We are far from considering the COD method to be complete even though it has been developing for a long time now. The practice is always richer than any account of it. Therefore, we shall be grateful for any questions, any comments, any suggestions that you may share with us based on your own experience.

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