Diagnostics and Development of Mental Mechanisms: From Theory to Pedagogical Practice

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Fractal Academy
Issue 1 (Autumn 2026) Article 6
Series: "From the School-Conveyor to the School of Thinking: Theoretical Foundations and Practical Implementation of the Communicative-Cognitive Framework of Personality (CCFP)"
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DOI: [to be assigned]
Publication date: 31.10.2026

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Title (English): «Diagnostics and Development of Mental Mechanisms: From Theory to Pedagogical Practice»
URL: https://fractal-academy.com/articles/article-1-6/
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Abstract

In this article, I transition from the theoretical justification of the communicative-cognitive framework of personality (CCFP) to a question that is key for the practical implementation of the model: how to diagnose the level of development of mental mechanisms and how to purposefully develop them? Relying on the works of L.S. Vygotsky on the zone of proximal development [6], modern developments in the field of psychodiagnostics [9], and the practical experience of teachers' diagnostic activities, I propose an approach in which diagnostics and development form a single, inseparable process. Diagnostics here is not an end in itself - it serves as a tool for identifying the developmental potential of each student and determining an individual trajectory of work with them. I pay special attention to the principle of dynamic diagnostics - assessing not a static level of "knowledge", but progress in skill development. I also propose using a system of criteria with the application of artificial intelligence (AI) to collect, analyze, and interpret data on the development of mental mechanisms throughout the child's education. At the same time, I emphasize that the diagnostics of unique abilities is impossible without creating the corresponding infrastructure - studios, workshops, sports facilities - which allows the child to manifest their "hidden" talents and find an "entry point" for the development of all mental mechanisms. The article follows the structure introduced in the revised Article 5: first, the diagnostics of the core mechanisms (MM-1, MM-3, MM-5, MM-6, MM-10, MM-11), and then - the support mechanisms (MM-2, MM-4, MM-7, MM-8, MM-9).

Keywords: diagnostics, dynamic diagnostics, mental mechanisms, core, support, zone of proximal development, individualization, artificial intelligence, facilitation, school infrastructure.

Introduction: Why I Speak of Diagnostics as a Process, Not an Event

Any pedagogical model remains merely a well-intentioned wish if it lacks practical tools [9]. The question I hear most often from teachers and school administrators sounds like this: "This is all well and good, but how do we do it? How do we measure that a child is developing critical thinking? How do we know if I am working correctly?"

I consider these questions absolutely fair. And the answer to them, in my view, lies in rethinking the very nature of diagnostics. The traditional school understands diagnostics as a knowledge check - a test, an exam. This is an event that occurs at a specific moment and provides a static picture. But mental mechanisms are not a set of memorized facts. These are abilities that manifest in activity, thinking, and communication. Their diagnostics must be procedural, dynamic, and embedded in the learning process itself [6], [9].

The key difference between my approach and the traditional one is that the old model evaluates the result (a correct or incorrect answer). My model evaluates dynamics - progress in skill development. Imagine you are observing the growth of a tree. You cannot measure its growth by simply taking one photograph. You need a time series; you need to see how the leaves unfold, how the trunk strengthens. The same applies to thinking: at the initial stage, a student uses a short "chain" of facts to determine a cause-and-effect relationship, which is not always logically constructed. Over time, this chain lengthens, facts are verified, and the logic becomes more coherent. It is precisely this dynamics of change that should be evaluated. It will be individual for each child. But the main thing is that it exists.

It is this principle - diagnostics as the identification of potential and tracking of progress, rather than the statement of deficits - that lies at the heart of my approach [6]. However, diagnosing potential is impossible without a space for trial. A child cannot manifest their unique abilities if the school does not provide the conditions for it. This is exactly why diagnostics and infrastructure - studios, workshops, sports facilities - must be inextricably linked [1], [4].

Why the Traditional Assessment System is a Trap

Before moving on to the description of specific methods, I want to dwell on what I consider one of the main reasons for the viability of the old pedagogical model. This is the simplicity of the traditional assessment system. In the old school, everything is simple: there is a right answer, there is a wrong one. For a right answer, the grade is higher; for a wrong one, it is lower. This system is understandable to the teacher, the parent, and the student. It is easily scalable and amenable to control.

But it is precisely this simplicity that is its main vice. By assessing only facts, the system does not assess thinking. It does not see how the student arrived at the answer, what reasoning they built, what mistakes they made, and how they corrected them. It assesses a static slice, not the development process. This is like trying to measure the depth of a river by throwing a stone into it and looking at the ripples: we see only the ripple on the surface, but we do not understand the currents hidden in the depths.

In my model, I propose a fundamentally different approach: assessing the dynamics of skill acquisition. Not "what he knows," but "how he thinks." Not "right or wrong," but "how he has progressed compared to the last time." This approach is more complex to organize, but it is the one that reflects the real picture of a child's development [6], [9]. The transition to dynamic diagnostics is not just an "improvement of the method," but a change in the very institution of education, a transition from the paradigm of control to the paradigm of facilitation.

The Role of Artificial Intelligence in Diagnostics

As history shows, it was precisely the simplicity of the traditional assessment system that was one of the main reasons for the prolonged viability of the old pedagogical model. But in the new model, I propose using the capabilities of artificial intelligence (AI) to make complex dynamic diagnostics accessible and manageable.

Why is AI needed? A teacher cannot always analyze changes in a student's skill development over a time perspective due to various objective reasons: heavy workload, a large number of students, limited time [9]. AI can automatically collect and systematize data on each student throughout their education, creating a "digital footprint" of their development. It can analyze changes in the student's reasoning, compare their current answers with previous ones, identify progress or regression, and determine zones of growth and zones of difficulty. Based on the collected data, AI is capable of proposing individual development trajectories for each student, selecting tasks that correspond to their current level and zone of proximal development [6]. In addition, AI ensures objectivity by applying uniform assessment criteria to all students and eliminating teacher subjectivity related to fatigue or personal preferences.

For AI to work, a database for each specific student is needed, which accumulates throughout their education. This database should include the results of diagnostic tasks (with the fixation of not only the final answer but also the reasoning process), teacher observations of the student's behavior in various situations, the student's self-assessment and reflective reports, as well as assessments of progress in dynamics. It is important to technically implement the ability to "snapshot" the necessary information for the AI and ensure a "mechanism" for filling this database with the necessary data. This can be implemented through a specialized digital platform that integrates with the educational process and automatically records key moments of each student's development. The use of AI in diagnostics is not a "technological fashion," but a consequence of the transition to dynamic diagnostics. If diagnostics must track progress throughout the entire education, the volume of data that needs to be collected and analyzed exceeds the capabilities of a single teacher. AI here is not a "replacement for the teacher," but a tool that makes possible what would otherwise be impossible.

Principles of Diagnostics of Mental Mechanisms

Before moving on to specific methods, I want to formulate several principles that, in my view, should be followed when diagnosing the development of mental mechanisms.

First principle: diagnostics as a process, not an event. Mental mechanisms develop in activity. A one-time test can only give an approximate idea of the level of development. The true picture is revealed when observing the child in different situations, in the process of solving different tasks, in cooperation with others [9].

Second principle: dynamic diagnostics. It is important to evaluate not a static level, but progress. This requires fixing "reference points" and regular comparison.

Third principle: orientation towards the zone of proximal development. L.S. Vygotsky emphasized that "learning is good only when it goes ahead of development" [6]. Diagnostics should reveal not only the actual level of development but also the potential - what the child can do with the help of an adult. As Lewis Carroll wrote in "Alice's Adventures in Wonderland," to stay in place, you have to run as fast as you can, and to get to another place, you must run at least twice as fast. Diagnostics must notice this movement, this run of thought, and not just fix the point where the child is now.

Fourth principle: diagnostics in activity. Mental mechanisms manifest in activity - in problem-solving, in discussion, in debate, in creativity. Diagnostics must create situations in which these mechanisms are actualized [9].

Fifth principle: rejection of formalized assessment in favor of qualitative analysis. Instead of giving a score, it is important to understand the nature of the difficulties the child is experiencing and determine what kind of help they need to move forward.

Sixth principle: individualization through the identification of unique abilities. As I have already noted in Article 5 [10], every child is unique. Diagnostics should identify not only deficits but also strengths, unique abilities that can become an "entry point" for the development of all other mental mechanisms.

And finally, the seventh principle: diagnostics requires a space for trial. Diagnostics of musical abilities is impossible without musical instruments. Diagnostics of artistic abilities - without paints and easels. Diagnostics of technical abilities - without workshops and lathes. Therefore, the creation of the corresponding infrastructure is not an "additional option," but an integral condition for the diagnostics and development of mental mechanisms [1], [4]. This is not an expense, but an investment in the future, which allows every child to find their "entry point" and, through it, develop all other mechanisms.

Diagnostics of Core Mechanisms

Now I move on to specific approaches to the diagnostics of mental mechanisms. In the revised Article 5 [10], I divided the eleven mechanisms into two levels: the core (six mechanisms that constitute the act of solving a hard problem) and support (five mechanisms without which the core does not work). In this section, I describe the diagnostics of the core mechanisms. Dividing diagnostics into "core" and "support" is not just structuring the material. It is a methodological move that determines priorities. If the core constitutes the act of solving, then its diagnostics is primary: without it, we cannot understand whether the student is capable of solving a hard problem.

Diagnostics of MM-1 (Establishing Cause-and-Effect Relationships) begins with observing how the child builds their reasoning. At the initial level, the student may name one or two reasons for an event, but the chain of reasoning is short and not always logical. At the intermediate level, they build a logical chain of 3-5 links, but do not always verify the facts. At the high level, the student builds an expanded logical chain with verified facts, sees several causes and several consequences, and takes the context into account. An example of a task might sound like this: "Imagine that the air temperature in the city has sharply increased in the summer. What consequences might this have? Name as many reasons as possible for why this could have happened, and how it will affect the lives of people, animals, and plants. Try to build a logical chain: from cause to effect, from effect to new effects." By tracking the dynamics, we fix the length of the "chain" of reasoning, evaluate the logicality of the connections, and the completeness of the factors taken into account. A student who says "A is related to B" is at the initial level. A student who says "A generates B through mechanism C" is at the high level.

Diagnostics of MM-3 (Emotional Intelligence) must distinguish access to experience from a simple social skill. At the initial level, the student has difficulty naming their emotions, confuses them, and does not always understand what others feel. At the intermediate level, they can name their emotions, understand the basic emotions of others, but cannot always manage their own. At the high level, the student accurately names their emotions, understands the complex emotions of others, knows how to manage their emotions, and express them through associations. An example of a task: "Imagine that your friend lost their favorite toy. What do they feel? How did you understand that? What would you say to them? And now imagine that you yourself lost something important. What do you feel? How can you cope with this feeling?" A student who knows how to "get along with people" but cannot distinguish the shades of their own experience is at the intermediate level. A student who can accurately describe their experience is at the high level. To solve a hard problem, access to experience is needed, not just social adaptation.

When diagnosing MM-5 (Socratic Dialogue), it is important to distinguish dialogue from argument. A student who tries to "win" in a discussion is at the initial level. A student who tries to understand the interlocutor is at the high level. An example of a task: "Have a conversation with a classmate on the topic 'What is friendship?'. Your task is to ask questions that will help your interlocutor express their thought more fully and deeply. Do not express your own opinion, only ask questions." By tracking the dynamics, we evaluate the types of questions (closed/open, superficial/deep) and the ability to listen (whether they rephrase what they heard, whether they clarify).

Diagnostics of MM-6 (Critical Thinking) must distinguish external criticism from criticism of one's own foundations. A student who finds errors in others' arguments but does not question their own is at the intermediate level. A student who is capable of deconstructing their own axioms is at the high level. For diagnostics, I use case-based tasks. For example, the case "Assessing the reliability of information": "Your friend told you that a news item has appeared on the Internet stating that chocolate helps to learn foreign words. The news says that a study was conducted by scientists from Oxford and they proved that if you eat chocolate during classes, words are remembered 40% better. Your friend has already bought chocolate and is preparing for an English lesson. What will you say to your friend?" It is evaluated what questions the student asks (are there questions about the source, the sample, the methodology), how deeply they analyze the situation, and whether they see hidden motives (possible advertising).

When diagnosing MM-10 (Spatial Imagination and 3D Visualization), we must distinguish static visualization from dynamic. A student who can imagine a cube but cannot rotate it is at the initial level. A student who can imagine a four-dimensional structure (taking time into account) is at the high level. An example of a task: "Imagine a cube. Mentally rotate it 90 degrees to the right. Now draw how it looks. And now imagine that there is a sphere inside the cube. How do you see it? And now imagine that the cube is made of transparent glass. What do you see?" As in Abbott's famous "Flatland," where two-dimensional creatures cannot comprehend volume, the student must learn to go beyond flat diagrams.

Diagnostics of MM-11 (Forecasting and Strategic Thinking) must distinguish predicting events from calculating the consequences of theoretical moves. A student who guesses what will happen tomorrow is at the initial level. A student who calculates what consequences follow from their hypothesis is at the high level. An example of a task: "You are playing chess. Show how you analyze the position. What options are you considering? Why do you choose this particular move? What consequences do you expect?" Like a high-level chess player who sees not just pieces, but possible trajectories of their movement, the student must be able to calculate scenarios several steps ahead.

Diagnostics of Support Mechanisms

In this section, I describe the diagnostics of the five support mechanisms. They do not constitute the act of solving a hard problem, but without them, the core does not work. Therefore, their diagnostics is important, but it is secondary to the diagnostics of the core. The diagnostics of support should be carried out after the diagnostics of the core. If the core is not formed, the diagnostics of support makes no sense: it is pointless to evaluate a student's "eloquence" if they do not know how to build cause-and-effect relationships. Conversely, if the core is formed, but support is not, this indicates specific zones of growth: for example, a student may build causal models but cannot explain them (a problem with MM-2).

Diagnostics of MM-2 (Eloquence and Conciseness) must distinguish rhetoric from the transmittability of thought. A student who speaks "beautifully" but whose thought remains unclear is at the initial level. A student who speaks simply, but whose thought reaches the listener, is at the high level. An example of a task: "Tell us about what you did on the weekend, but in such a way that it is interesting for everyone. You have 2 minutes. Then try to retell the same thing in 30 seconds, keeping the main point." The structure of speech, the accuracy of formulations, persuasiveness, and conciseness are evaluated.

Diagnostics of MM-4 (Long-Term Memory and Mnemonics) must distinguish mechanical memorization from structuring. A student who repeats a list many times is at the initial level. A student who structures information into a coherent picture is at the high level. An example of a task: "Here is a list of 15 random words. Look at them for 2 minutes and try to remember them. Then write down how many words you remembered. And now try to come up with a story in which these words will appear in a certain order. Write down again how many words you remembered. Compare the results."

Diagnostics of MM-7 (Constructive Debate) must distinguish debate from dialogue. A student who tries to "win" at any cost is at the initial level. A student who tries to understand the opponent's position is at the high level. An example of a task: "Split into pairs. One student claims that 'reading books is more useful than watching movies.' The other claims that 'watching movies is more useful than reading books.' Conduct a debate, trying not just to 'win,' but to understand each other's position. After 5 minutes, swap roles."

Diagnostics of MM-8 (Non-verbal Communication and Charisma) is the most subtle element on the list, and I acknowledge this. The connection between non-verbal communication and solving a hard problem is the most tenuous of all. The diagnostics of MM-8 must be cautious: it should not turn into an assessment of "charisma" as an end in itself. An example of a task: "Imagine that you are telling a story to a group of friends. First, tell it sitting, looking at the floor, in a quiet voice. And then tell the same story, standing, looking the listeners in the eye, using gestures and expressive intonation. Ask your friends to say in which case the story sounded more convincing." Observing the child, we evaluate posture (open/closed), gestures, eye contact, and intonation.

Diagnostics of MM-9 (Information Search and Analysis) must distinguish search from synthesis. A student who finds isolated facts is at the initial level. A student who synthesizes data from different sources into a coherent picture is at the high level. An example of a task: "You have been assigned to prepare a project on 'The Impact of Smartphones on Children's Health.' How will you search for information? What queries will you enter? What sources will you choose? How will you verify their reliability? How will you synthesize the information into a single whole?"

The Role of the Teacher: From Assessor to Facilitator of Development

In the new model, the role of the teacher changes fundamentally [9]. They cease to be just an "assessor" and become a facilitator of development. A teacher-sculptor molds the student according to a given pattern, while a teacher-gardener creates the conditions for a unique sprout to unfold. It is the role of the gardener that corresponds to the new paradigm. The teacher does not give grades (in the traditional sense), but tracks progress, identifies zones of growth, and helps the student see their dynamics.

What does this mean in practice? Instead of the question "What grade did you get?" we ask: "How have you changed compared to the last time?". Instead of "You answered incorrectly" - "Let's look at how you reasoned and find where the logic can be improved." Instead of "You must learn this" - "What are you interested in learning? How is this connected to your unique abilities?" But the role of the teacher-facilitator has another important dimension. The teacher must not only track progress but also help the child find their "entry point" - that unique ability through which they can develop all other mental mechanisms [10]. To do this, the teacher must know about the opportunities the school provides, observe the child in different types of activities, create conditions for trial, and link diagnostics with infrastructure.

This requires not only pedagogical but also organizational skills from the teacher: the ability to see the child's potential, find suitable activities for them, and coordinate work with additional education teachers. But it also makes the teacher's work more meaningful and creative. The experience of Kyrgyzstan shows that teachers who receive Human-Centered Design tools are capable of creating innovative solutions for their classes [4]. The experience of Singapore shows that systemic support for teachers and the creation of appropriate infrastructure yield outstanding results [3]. Conversely, the experience of Australia shows that reforms that do not change the teacher's role and do not create conditions for individualization do not yield a return [1].

Conclusion: From Assessment to Development

Thus, the diagnostics and development of mental mechanisms is not an additional burden, but the main content of the educational process [9]. It is important that the teacher masters the tools for diagnosing and methods for developing these mechanisms. In my model, diagnostics must be procedural, not event-based [9]; dynamic, evaluating progress rather than a static level; oriented towards the zone of proximal development [6]; embedded in activity [9]; individualized [10]; technologically supported (using AI to collect, analyze, and interpret data) and infrastructurally provided (with studios, workshops, sports facilities that create a space for trial and the manifestation of unique abilities [1], [4]).

Only when diagnostics and development form a single, continuous process, and when this process is supported by the necessary infrastructure, can we speak of the real implementation of the communicative-cognitive framework of

personality model. Not about the "implementation" of new methods from above, but about a living practice in which every child gets the opportunity to develop their mental mechanisms, and every teacher gets to see and accompany this process. The creation of this infrastructure is not an expense, but a strategic investment in the future. It is an investment in the motivation, engagement, and psychological well-being of children. It is an investment that pays off many times over - through the development of thinking, through scientific breakthroughs, through the evolution of the cognitive potential of the entire species [3], [4].

Diagnostics is a condition for the possibility of developing thinking: without it, we cannot understand what is happening with the student, and we cannot correct pedagogical practice. But diagnostics does not guarantee development: it only creates conditions in which development becomes possible. This distinction protects me from accusations of naive optimism: I do not claim that "correct diagnostics will solve all problems." I claim that without it, problems cannot be solved.

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Conflict of Interest
The author declares no conflict of interest related to the publication of this article.

Funding
The research was conducted without external funding.

Data Availability Statement
The data discussed in the article are contained in the text of the publication. Additional materials can be requested from the author.

Author Contributions
Aleksandr Kleymenov - concept, research, text writing, final editing.

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