DISCUSSIONS AND DISCOURSES
ДИСКУССИЯ И ДИСКУРСЫ

Cultural-Historical Psychology of Mastering Activity and Alternatives to Digitalization

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The article analyzes approaches to education where digitalization does not hinder the development of thinking, understanding, and acting among the teenagers. The article is based on the premise backed by the cultural historical theory of Lev Vygotsky and the concept of mastering ways of thinking by Vasiliy Davydov that existing ways of digitalization decrease the developmental opportunities of teenagers. In the case of common-sense digitalization communication processes between teenagers, teachers and different adults are reduced to scripts of interaction with monitors or digital devices according to behavioristic scheme "stimulus- reaction". These stereotypic interactive processes do not motivate teenagers to increase their level of situational awareness and understanding of others in social interactions. The operational uniformity, supported by algorithms, without stimulating the discovery of new elements and units in the actions of the students, and the excessive chaotic visibility, diverting their attention to eye-catching but not essential elements for a better insight into the learning problem in typical digital systems, reduce the ability of teenagers to master skills such as modelling and idealization. The author considers a different type of digitalization in education that gives an opportunity to master the ways of design activity, research activity and meta-game activity. In this instance proposed visual items and operational units in digitalized simulative milieu are analyzed and considered by teenagers in communication with teachers and peers as sense bearing symbols and schemes representing personal understanding of situation by different participants of a teamwork. The author proposes that conceptual instruments of the activity theory can be used as the new framework to design and to elaborate educational digital systems of next generation that stimulate development of intellectual abilities.

Keywords: activity approach, the way of action, thought act, joint activity, thought activity, cultural-historical theory digital-algorithmic approach in education, digital-cognitive approach in education processes.

Культурно-историческая психология овладения деятельностью и альтернативы цифровизации

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В статье рассматриваются условия, при которых процессы цифровизации перестают быть фактором, ограничивающим развитие способностей мышления, понимания и действия человека. С точ-

ки зрения автора, в соответствии с культурно-исторической теорией Л.С.Выготского и концепцией освоение способов мышления В.В.Давыдова, существующие походы к цифровизации снижают возможности развития подростков. Процессы коммуникации подростка с педагогом, экспертами, сверстниками редуцируются к сценариям взаимодействия с монитором и цифровым устройством по принципу «стимул—реакция». Они не требуют усилий по повышению уровня понимания ситуации действия и позиции другого человека. Однотипная (monotone repetitive) операциональность (operational sameness) и избыточная наглядность (illustratory redundance) цифровых систем не позволяют подросткам осваивать способы моделирования и идеализации при решении учебных задач. Вместе с тем автор утверждает, что возможен другой тип цифровизации процессов образования, обеспечивающий овладение подростками способами проектной, исследовательской и метаигровой деятельности. В этом случае вводимые визуальные изображения и процедуры оперирования с ними рассматриваются в коммуникации с педагогом и другими подростками как смысловые знаки понимания ситуации разными участниками. Концептуальные средства теории деятельности являются основой проектирования и разработки цифровых систем следующего поколения, экстериоризирующих работу сознания и способствующих развитию интеллектуальных способностей.

Ключевые слова: деятельностный подход, способ действия, мыслительный акт, совместная деятельность, мыследеятельность, культурно-историческая теория, цифро-алгоритмический подход в образовании, цифро-когнитивный подход в образовании.

Introduction

The main task of this article is to outline the role of the activity approach and cultural-historical theory in elaborating and designing new types of digital environment and identify how these theoretical toolkits can be applied to increase the level of consciousness in education realm and ensure conditions for the students to master the new ways of acting in a specific situation. The article outlines the principles of a digital environment that is impossible to design and implement without instruments and concepts of activity theory. At the same time, it contains some insights and defines newly identified problems for the cultural-historical theory and Vygotsky' tradition in regards to design and organization of the new type of digital environments that need to be solved to answer the question of how the students master the new ways of action tracing the genesis of knowledge.

To achieve the stated goals, the false and outdated ontic scheme "organism- environment" borrowed from the 20th century biology should be problematicized. The ubiquitous trace of this ontic scheme can be encountered everywhere: for example, in a metaphoric description of digital platforms as "ecosystems". This imitation of the natural processes of the universe in ICT language is a crooked way to naturalism. But the human being is not a mechanical entity aggregating interconnections between stimuli from the environment and reaction to them. A human being does not just live in the natural environment. He/she lives in the cultural and historical processes of activity, organizing mutual activity with other participants in teams, gaining understanding, acting in VUCA (volatile, uncertain, complex, ambiguous) situations, elaborating models to stimulate cognition and to organize thinking. The full-fledged form of human activity is thought-activity systems [18]. The problematization of

the ontic schemes "organism — environment", "human being — environment" leads to differentiation of some of the very important concepts of cultural-historical theory — the mediation (oposredovanie) and the instrumentalization (oposredstvovanie). While the first term stands for application of signs, symbols, schemes, meaning and references to increase understanding, the "instrumentalization" is usually seen as a means to organize actions.

The limitations of today's digital environments — video games, TIK-Tok and metaverse chats, Internet browsing, various gadget games — can be clearly seen if they are formulated using the activity approach, which means that the outcomes of the development of intellectual abilities (thinking, understanding, acting, reflecting and others) are defined by the student's mastery of activity tools and instruments (schemes, concepts, ways of doing, etc.).All those environments share the same characteristics: the operational uniformity, the illustrative superfluousness with an abundance of visual stimuli, and the downgrading of action patterns to previous reactions that cancel the randomness or contingency of human interactions in situations..

Furthermore, according to Yuk Hui [26], the very emergence of a digital object changes the framework of thinking and the organisation of consciousness as a result of algorithmisation, because at the individual level the performance of logical operations realised by the autonomous functioning of the machine begins to be imitated as the key element of consciousness and thinking.

Systems of AI are beginning to dominate over the intentions of human beings to plan and to realize new action by help of reductions of the new situation to previous reactions within known stimuli and former action paths. AI systems provide a set of options in actual situation on the basis of previous reactions of consumer in prior situation. Thus, digital systems determine what a

human being is willing to choose and do. This brings us a fundamental choice: either a human indulges in mechanistic "behaviorisation" within the digital "stimulus-reaction" scheme and robotization of his/her action or, on the opposite, he/she masters the digital platform using it to achieve specific goals and tasks.

New approaches to digitalization of education, elaboration of the new instruments to master research activity and design and project activity on the basis of thought-activity concepts are developed today in the Russian "Kruzhok Association" (Association of technological clubs) where the students are creating new devices and digital models to control digital environments in teams together with mentors and teachers.

1. Digitalization as a form of manipulating human behavior in the Age of Surveillance Capitalism

The emerging form of society in which various digital systems, aggregators of AI-based big data, are used to control human behavior has been named by Shoshana Zuboff as surveillance capitalism[28]. A well-known economist, Nobel laureate Joseph Stiglitz in his book "People, power and profits. Progressive capitalism for an age of discontent" calls for considerable engagement of civil society, judicial and congressional oversight to ensure against the loss of privacy, political manipulation and market exploitation when using the digital social media systems [24]. Citing the sociologist Zeynep T fek i, J. Stiglitz emphasizes that AI systems that are elaborated by the private corporations for the sake of their profits "... could exploit each of our weakness, an irrational desire for new shoes or handbags or trips to warm beaches, and feed us information that leads us to dissipate our incomes, our emotional self prevailing over our more deliberative self" [24p.126]. "Manipulation and control over human behavior on the basis of Big Data" according to Stiglitz's opinion are well beyond Orwell's imagination in the novel "1984" and another more recent novel "The Circle" by Dave Eggers. The famous economist proposes to set up certain requirements: "that data only be stored in an aggregate form, without individual identifiers (called anonymous) allowing researchers to glean information about behavioral patterns, but not to target individual"[24,p.131]. However, besides the state and public oversight of using Big Data for the benefits of society, there is a very important question about habits, skills, cognitive styles of individuals who work and live in digital environment from the early childhood.

There are periods in history when disruptive technologies transform and change the existing cultural practices as well as the forms of transmitting cultural values to younger generations. These immense and abrupt changes in functioning of cultural institutions could distort educational practices and even cancel cultural forms of interactions between child and adult resulting in an overall decrease in the level of intellectual and cognitive abilities. In that case, the task is to restore the cultural practices, their forms and content. Current

period is charachterized by this challenge as digitalization in an imperceptible way, transforms the practices of mastering the cultural patterns and ways of action in different contexts of social interactions between a child and an adult for significant groups of population.

The digitalization in its common sense begins with a smartphone, an iPad, some digital games that are always around and, thus, it rearranges the existing established matrix of formation and coming-of-age of human consciousness and even developmental age and also reorients intentions and sensitivity in the contacts between a child and an adult. Parents are often really happy that their yet non-talking toddler so deftly presses the keyboard keys or is capable of "using the iPhone". But this dexterous manipulation of a child is also available for senso-motor intellect of apes.

From a cultural-historical point of view, digitalization changes the natural established forms of interactions of a growing child with an adult and with other children. First of all, the child is overloaded and overstimulated by visual redundance of stimuli from digital toys and videogames that are disconnected and do not correlate with his/her perception of natural surroundings, i.e. faces of his/her family members and relatives, natural landscape and everyday scenery. Interacting with a digital device and the screen, the child preforms a set of operations that are not connected with a household actions in contact with an adult and other children. So the child is encircled with a specially constructed artificial "digital continent". And this "digital continent" grips child's attention. This "digital continent" is isolated and separated from the educational practices of mastering the cultural content in contact and in joint activity with adults and other children.

This artificial "digital continent" did not emerge by itself. It was designed and produced by commercial industries integrating the efforts of many specialists: from artists, game designers, animators, various programmers to marketing managers and even child psychologists. It has dark patterns. As Katie Davis explains, "Dark patterns are design features that are intended to keep users engaged with a particular device, platform or application, regardless of how their engagement might affect their autonomy or well-being" [21,p. 28]. But we can generally reconstruct how this specially organized engagement works.This constructed "digital continent" disrupts organic communication between a child and his parents in everyday situations and engages child's attention stimulating his/her unauthentic behavior under a manipulated influence of a digital device. Paraphrasing a famous line by Lev Vygotsky — "the learning steers the development" (or social learning tends to precede development) it has to be said that in existing digital environment where the child is left on its own with some devices and is not directed in his acitvity by communicative interactions with an adult and other children, digital activization of behavioral reactions to the stimuli on the screen subordinates learning activity as well as the development of a child. As a Russian philosopher Sergey Smirnov states this: "If the process of mastering own behavior is delegated to an exterior carrier (for example, to

a smart technical device, gadget, digital system), thereby the human development, development of the higher mental function is debarred"[14, p. 69].

In everyday digital environement, digital activization of a child makes one feckless and does not serve any instrumentalization (learning of useful skills). The learning that steers education is always regarded by a child as a break-through to the new forms of interactions and mutual understanding between a child and an adult [10], to the new instruments of organizing the joint action with an adult and other children.

This research should be focused, according to S. Smirnov, "on the model of human mastering of his/her own behavior, it means mastering the self, own core that is given by the first birth, own reactions and affects... Exactly these acts of mastering own behavior by means of signs and psychological tools are acts of development that configure itself in units of activity structures, represented in conceptual constructs. These conceptual constructs overcome guesses and wool-gathering about system of human psyche"(Smirnov, 2021, p. 68).

Digital gadgets that are accepted as toys by adults and given as toys to a child are not toys at all.It is impossible to see those gadgets as toys because toys are specially created to amaze child and...to be broken by him/her. A child must break the toy, according to G.W.F.Hegel ("... the most rational thing that children can do with their toys is to break them", Hegel, G.W.F.,1990,Zusatz, p.50;also Tubbs N, 2008, p. 147) to understand it's mechanism and to compare the toy as a mechanism with an alive creature — a plant, a bird, a human and so on . But the digital gadget can't be taken into pieces to re-integrate them back into a toy. The digital gadget is switched off, and then it is switched on to continue the same visual dynamics. The only operation a child can perform is to stop this visual dynamic.

This dynamic continues functioning limitlessly. And a consciousness in a child is absorbed by this visual dynamic willing to follow it. Therefore, this digital dynamics would isolate, set a child apart from an adult, from his/her suggestions and possibilities of communication and joint actions if an adult does not interfere with the interaction of a child with a screen of the device and if an adult does not subordinate child's manipulation to his/her communication and collaborative engagements with a child.

To master the digital gadget environment around a child and to restore the steering function of the learning for a child, an adult must be able to form a child-adult community surrounding the digital toys and to launch his/her own instructing and educating development meta-game. This meta-game is a game with a community around a child that transforms the rules of interaction between a child and the surrounding gadgets. Constructing and organizing such a meta-game, an adult- educator can achieve very important new results in developing and educating a child while mastering the elements of the digital environment. In a reverse situation, without any interference into the child's interactions with gadgets, this digital environment being specially constructed and organized by business development divsions and operative units of corporations would steal the child from an adult-educator.

Driving the stimuli of digital activization results in changes of children behavior, transforming sensitivity, understanding and image formation. These changes must be the subject of basic research and require further in-depth examination.

In his research, Aleksander Veraksa [1] redefines and reiterates some conclusions of American researchers that are systematically scrutinized in the book of Michel Desmurget [22, p. 45—46] . A. Veraksa states that "with increasing screen time, children's auditory-speech working memory decreases, that is manifested in their ability to memorize and reproduce spoken text. At the same time, it does not matter whether this time is passive or active" [1] ."Children with a combined screen time of less than 1 hour a day have better motor regulation and self-control than others." "As the time in front of the screen increases, the degree of resistance of children to interrupt interaction with the screen device also increases" [ibid].

And other conclusions of A.Veraksa are very important and also proved out by the analysis of M. Desmurget [22]. A.Veraksa investigates the conditions when child's interaction with screen does not cause intellectual decline and decrease in self-organization. The screen is innocuous and inoffensive at least if interactions with the screen are mediated by cooperative engagements with adults and other children. "The children, who usually watch videos operating the control panel alone, have worsened their indicators of behavioral inhibitory control over the year" [1]. "The children, who usually watch videos operating the control panel together with siblings, the indicators for behavioral inhibitory control have not changed over the year." "The children, who usually watch videos operating the control panel together with parents, the indicators of behavioral inhibitory control improved over the year". "Children who don't play video games with digital devices create more detailed images than children who play video games". "Children who have experience using a gadget together with someone (parent, friend, sibling) have a higher level of imagination flexibility than children who use the gadget alone" [1].

Anyway, it is increasingly evident that the most important path to master the screen, gadgets and video games from the position of an adult-educator is to engage in unknown, unfamiliar and new using the device as a tool. This way the unfamiliar or uncomprehensible situation for a child will require applying imagination, creating a new image and meaning for mastering understanding, entering the communication with an adult. And then the way of working with this image and its meaningful elements should be the basis of interaction between an adult and a child. In this case, a child, through overcoming incomprehensible elements and by the help of the imagination, goes on to grasping the reality that is formed in the interaction between a child and an adult.

However, contemporary digital gadgets manipulate children in their interactions with the screen, stimulating specific responses to the proposed visual dynamics through the operational uniformity supported by al-

gorithms embedded in the functioning gadget, and the illustrative superfluousness with an abundance of not meaningfully structured visual elements that capture attention. This operational uniformity consists in repetitive sameness of operations, provided by the digitalize system, without specially organized disruptions in interactions with interface to stimulate discovering new operational elements in cooperation with peers and adult. So interaction with digital system is mastered by child individually without communications with peers or adults. An abundance of visual elements is important for individual gaze. They attract the child's attention to new visual stimuli but do not initiate image analysis and visual understanding in communication with peers and adults to compare contrasting versions of grasped images by different children.

Most commonly, the existing digital interactive games and digital environment act on the principles of behaviorism: the presented stimuli lead to behavioral reactions of the child-player, and the feedback is received and is based on the operational-behavioral responses of a child-player, creating an illusion for a child of the open reality of action in the game environments. However, this is only a virtual reality that is not the reality of the ideational flow in joint actions and communication with an adult-educator and other children, this is the reality of the bioautomaton's functions that are now imitated by a child-player.

The digital system supports certain reactions of a child to the proposed stimuli. The child is unable to go beyond the stereotypical response scenarios and recursive scripts. The illustrative superfluousness, the monotonous operational manipulativeness, recursive and constantly repeating behavior script form a kind of "dams of development" in which a child is getting stuck.

At the same time, the operational uniformity and illustrative superfluousness of digital systems hinder the development of thinking and understanding. Accustomed to the operational uniformity of the digital system, the child doesn't try to transform the operational units and find new, unfamiliar forms of operation. An abundance of visual stimuli draws the child's attention to the eye-catching but not to the essential elements. So he/she doesn't gain more insight into the situational problem. So typical digital systems reduce the ability to master skills such as transformative imagination and modelling. A digital screen as an opaque membrane sets a hindrance to mastering through communication and mutual understanding with an adult of the "language thinking" [18] and it's forms of organization. This also distorts and sets a predicament for a child's mastering "the structures of thinking" that appear for the child later, and leaves in disarray, particularly the principles of classification thinking, as well as categorical thinking, including such categories as order, name, genus-type, quality, quantity, form-material, one-many. A child will not be able to master thinking structures that are embedded in language and in communicative speech forms, as he/she is not sensible to such structures and they are not obtainable and not discernable for him in a digital environment.

Moreover, a child will not be capable to manifest spontaneous unexpected gestures, expressions of his emotional mood in communication, acting on a stencil. New meanings and new forms of interaction with adults and other children do not arise for him/her being boiled down to standard reactions.

It should be noted that blocking the child-adult interaction at the pre-reflexive development stage, at the formative stage with repetitive interactions and digital screens is not the only problem. The underlying issue is that undermining this interaction means undermining one's ability to master new ways of action, thinking and working with knowledge (including the analysis of the genesis of knowledge). The cultural ways of action and connected with them abilities, as well as knowledge, are what determines the most important direction of human development when mastering one's own behavior.

2. Digital-algorithmic approach versus digital-cognitive approach in education processes

The previous chapter briefly outlines the introduction of a child to a kind of "digital continent" of gadgets, devices and computer games that oftentimes starts nearly at birth. The question is: how the task-oriented education system is organized in existing widespread digital environments based on the digital e-platforms, for example, the Sberbank platform and other e-schools? The author claims that those digital learning environments are dominated by and are built on the digital-algorithmic approach [8].

The digital-algorithmic approach to the organization of learning, implemented in electronic-digital environments, implies correlation of the student's answers with a certain established rule that is based on a given set of operations to obtain a desired answer. Within this approach, the student is forced to guess the sequence of operations in order to get the right solution. Students really give the correct answers, verified by the electronic device, however, these digital environments are not ensuring the conditions necessary for the identification and analysis of the domain-specific subject matter and of semantic aim-oriented components of thinking and action. In addition, the processes of understanding, reflection, modeling, mutual understanding and communication that determine the patterns of students's development in learning do not receive adequate support in such systems and are not represented in them. In such environments, it is impossible to organize the self-determination of the student and to ensure his/her upbringing and character building.

Digital educational resources developed on the basis of the digital-algorithmic approach are a kind of "repository" of curricula and manuals translated into digital forms. They are boring for children and rather serve as an instrument of control where a real teacher is replaced by an automatic check. The ways of providing data and information in such systems do not allow organizing full-fledged educational, research and project child-adult educational communities, and, as a result, do not allow mastering knowledge in accordance with the age characteristics of the children development.

This article suggests a different digital-cognitive approach as an interdisciplinary initiative of educational psychologists and researchers of next-generation AI. In this case, digital systems act as a form of representation of possible scenarios and scripts of action and communication, they can become the subject of analysis and transformation. Analyzing the data on the possibility or impossibility of implementing an action in this situation, students reconstruct the way of joint action on the basis of a digital model in interaction with an adult-educator or mentor, identifying the conditions for its implementation.

The most important element of the digital-cognitive approach is a digital dynamic model of activity and actions, and communication itself. P. Skobelev has elaborated a semantic web model that represents the scheme of action [12, p. 24].

This model is implemented on the basis of emergent swarm intelligence and special semantic web structures, simulating the reproduction of different wholes by tthe participants, which are an act of thinking, an act of communication, an act of action.

A variation of such digital educational system consists of the following important subsystems, according to P. Skobelev [12,23], the developer of emergent swarm AI and multi-agent environment based on next-generation AI:

Autonomous digital twins in the form of program agents of a specially designed research and educational environment. There may be a student's program agent (student's digital alter ego), a teacher's program agent (teacher's digital alter ego), but a concept as program object, a program object of a certain geometric object, such as a triangle, can also be elaborated . What does it mean?

Student's program agent (student's digital alter ego) — is a computer model of the student with knowledge and possibilities that are increasing as a result of successful learning when the student is equipped with tools and instruments. Student's digital alter ego is indexed by a real student. These indexes denote what this student's program agent also "knows", how it changes.

Teacher's program agent (teacher's digital alter ego) — is a computer model of the teacher that is indexed and specified according to the options of a real teacher: which instruction method is used: from example, top-down approach or bottom-up approach.

These student's program agents and teacher's program agents pave the way to representation and stimulation of communicative processes between members of a learning team, learning design and learning research teams among each other and with teachers and mentors.

Multiagent environment means forming the "worlds of action" on the basis of digital twins of the elements in the concrete situation: roads, trees, mountains — are the elements of specific spheres/situations where the actions are executed. What is more, the "worlds of reasoning" are also emerging with digital twins of ideal objects: shapes, models, operations.

This approach involves acquiring the formalized knowledge bases with collection of scenes and problem-based situations.

A collection of scenes and problem situations, representing learning routes of increasing complexity in the learning content, are combinations of objects with their states, and also initial given data for solving the problem. The general principle is presenting a chain of inventions and discoveries that must be passed through by
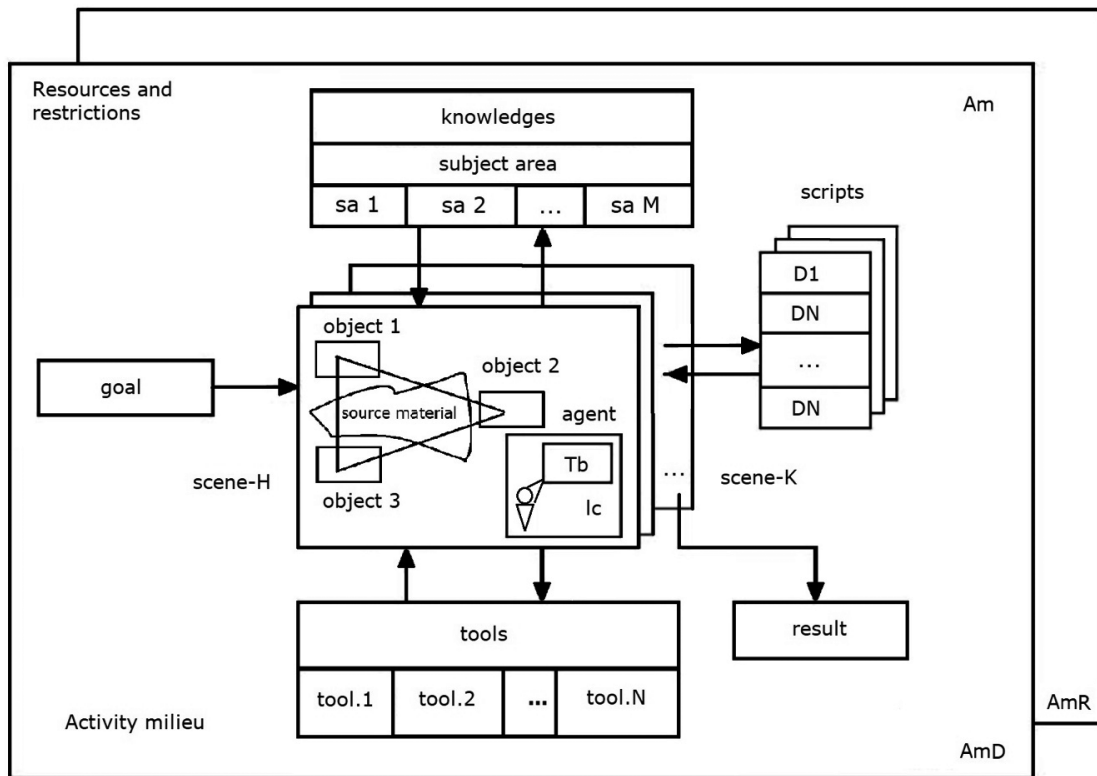

Fig. 1. Activity milieu AmD & AmR

the learner on his/her own during the training process, reinventing the wheel again, rediscovering everything that happened in the history of the given subject area (tracing epistemological genesis of knowledge) for each individual (Skobelev, 1992).

A key element of the digital environment according to the cognitive-digital approach to the organization of learning systems becomes a digital dynamic model of the way of action. At the same time, the digital dynamic model does not substitute for a real situation of action, but is "suspended" in a kind of "ether" of interactions and mutual understanding of participants to link "the worlds of action" and "the worlds of reasoning" as another mediating element of the situation besides the two "worlds". This allows to simulate and reproduce a thought act among the students and a teacher. The most important characteristic of this act is modeling a situation and processes in it. The participants are examining the digital dynamic model that is demostrating all the possible ways of action with the objects that are part of this particular situation.

Within this approach, a special type of action is being designed in educational situations when dynamic digital models become the subject of analysis for the child-adult community to reveal the form of organization of joint action and communication of group members based on the tasks of game-learning activity, of learning activity, learning-research activity and of learning-design activity. In this context, the proposed visual items and operational units in digitalized simulative environment are analyzed and considered by the teenagers in communication with the teachers and their peers as a sense bearing symbols and schemes, representing the personal understanding of the situation by the different participants of a team. Working with these digital models, the teenagers master the methods of design, research and meta-gaming activities. A consistent implementation of this approach should serve as a cornerstone to a digital platform of the Russian school of the Future [7].

The most important substantive question is how a dynamic digital model actualizes for an individual student the integrity of thinking in the form of a thought act or for a group of students in the form of a system of distributed and conjugated actions that form a kind of a "skeleton" of a thought act. As if this happens on the basis of a dynamic model in a digital environment, collective thinking of a group participants starts being modeled.

It is worth noting the way of action to create the object of thinking is revealed and represented on the basis of the dynamic model of the simulated thought act. A dynamic digital model for students and teachers sets not the final image of an object in thought process, but the very way of action that generates an object of thinking.

A very similar approach of involving students into thinking was applied by V.V. Davydov [6], the creator of the revolutionary practice of education and teaching of thinking. For him, the scheme of action and the scheme of the object were different. Reflexive thinking grasped this difference and turned it into a meaningful scheme of thought. Special ability (the ability formation) of

thinking consist in grasping polyphonic lines of thought processes — convolving and unfolding an action scheme into the object scheme and an object scheme into the action scheme to find parallel correspondence between the forward and reverse transactions. Therefore, according to Davydov's thinking and the thinking pedagogy, the thought is always practically realized in the form of a concrete action in a situation.

Thus, the digital-cognitive approach allows to implement this distinction between the scheme of the object and the scheme of the way of action generating the object in the learning situation to reveal for the students the conditions when the action in thinking turns into an object of thinking.

In this case, the central moment of the implementation of the student's action is a meta-game of the students and the teacher on "hacking" (transforming) the established rules of the digital game in which they are engaged, and changing the scenarios given in the digital platform. The development of such increasingly complex games based on digital systems has been initiated by the "Kruzhok Association" (Association of technological clubs) in Russia. This "hacking", first of all, is connected with students awareness and reflection on the game rules and the game script as well as with suggesting alternative scenarios and plans to organize the collective interactions concerning the script embedded in the proposed digital game. What is more, there are some concepts and claims to change the "digital engine" of the game. In order to implement this changes, the "Kruzhok Association" (Association of technological clubs)[15] advocates for mastering not only methods of directive programming, but also event-driven programming and programming states machines.

With such an approach to digitalization, there is a possibility for the exteriorization of abilities — one of the members of the team who identifies the way of action while working with a dynamic digital model, can actually rebuild it, thus, being able to act in a new way. It means that the ability to act is exteriorized as the possibility to realize and identify the new way of an action. For other students, it turns out to be interconnected with grasping/not grasping a new way of an action carried out by one of the group members and outlined in a digital dynamic model using special signs. Such an exteriorization of the ability, the external representation of the ability through the representation of the way of action and its semiotic fixation with the help of signs in a dynamic digital model, allows us to look at the processes of the ability formation from a completely different angle.

Thus, using the means of an activity approach as the *main alternative to existing approaches to digitalization of education* could be summarized as follows. 1. With a digital-algorithmic approach to digitalization in education, it is considered as a special type of simulator for students to practice a given set of operations until it becomes second nature when performing tasks on a digital device, and the result of their performance is controlled.

2. The cognitive-digital approach creates special situations in which the student and the study group have to

change the subject of the operation in order to solve the problem, transform the structure of the operation, differentiate new units within the operation, create another form of symbolic representation of operations and schematization of the subject of action. In the conditions of collective work in a group it is also necessary to create new forms of communication in order to draw the attention of the members of the study group and an adult to the representation of the operation by means of signs.

3. The digital-cognitive approach allows not to identify the modelled object with visualized models, but to consider and identify the limitation of modelling tools, the non-identity of the simulated object and the model. This approach should be seen as a continuation of the work of V.V. Davydov, which is devoted to the study of the structure of the act of thinking [6].

The alternative to the traditional approaches to the digitalisation of education conceptualised in this way requires a more attentive attitude to the theoretical legacy of V.V. Davydov, the prospects for the development of the practice of education outlined in it.

It is possible, following the idea of V.V.Davydov [5] on the special importance of mastering the way of action in a situation as the basis of ability formation, to assume that the true protagonist in the theater of human subjectivity — in the processes of psychical development, — are not the psychical functions, but "abilities". The psychical functions were articulated and proposed to be the subject of psychological science as a result of the introspection of the German 19th century scientists with background in Physics (V. Wundt, G.T.Fechner, etc.). This was carried out in the structure of a experiment but connected with the functions of consciousness considered much earlier by R. Goklenius and P. Melanchthon in German scholastics.

It should be noted that L.S. Vygotsky's theory of interiorization discussed not the "abilities" and the processes of mastering ways of action, but rather the psychical functions.

The ability differs from a more abstract psychical function due to a number of reasons. First of all, the ability is based on the development of a way of action; secondly, it is necessarily connected with the situation of action, its context, its uncertainty; thirdly, the ability finds its realization in action; and, finally, it is connected with the mechanisms of consciousness. Thus, the introduced models of the mode of action mastered in the formation of abilities provide ground for overcoming the theory of abstract psychical functions coined initially by W. Wundt. It is the abilities, not the psychical functions, that come out of the secluded corners of consciousness right onto the scene becoming the acting characters in the drama of development of a learner in interaction with other participants of joint actions.

In the famous statement of L.S. Vygotsky "every psychic function appears twice in the course of child development: first, in an collective activity conducted by the adult — interpsychic function — and second, like an individual activity, like a internal propriety of the child's thinking — intrapsychic function. ... [2]", in the great theater of human subjectivity development, as it seems

for the author, the replacement of the protagonist should occur. The following happened earlier: instead of a living acting hero, a man of flesh and blood — a mastering ability in the form of a demonstrated action pattern — his shadow was invited to the role of the actor — a psychical function, created by the introspective psychology on the basis of introspection.

But the protagonist — the ability — has a different fortune. The ability is simultaneously exteriorized, socialized, overgrown with accreted competence characteristics due to the external assessments of human actions; and also individualized, subjectified, overgrown with internal feelings of regulation, starts being controlled by the concrete person. The processes of interiorization and exteriorization are carried out simultaneously when mastering the ability. This is why the L.S. Vygotsky's interiorization theory can not be applied to the processes of mastering the ways of action.

Such understanding of ability allows us to assert that the psychical function is a Wundtian abstraction, being a shadow twin of the ability. The ability, if purified from its social existence, from the way of action and from the regulation on the consciousness basis of the mastering actor, turns into a psychical function. This psychical function can be both shifted into the relationship between people, and then placed in the inner subjective psychological world of a person, while remaining the same psychical function. In the famous text of L.S. Vygotsky about development of inner speech and it's functions in child's development "the inner speech" is not just a psychical function [2].

The regulation of the ability and the ability formation operate differently. Both an adult and a small child are actually given consciousness as a special type of sensitivity. This sensitivity gives an opportunity to simultaneously be included in interactions with other people and regulate your own abilities, subjectively mastering the ability formation of oneself[5].

Therefore, the real protagonist that comes to the stage of the human subjectivity theater is not a psychical function, but rather the ability. The ability appears on the stage twice: first, as a fascinating strange inaccessible action of a skilled person — an adult or an older child, and, the second time, as a child's own action. Someone else's skillful and dexterous action is observed from the outside, but it is also tried on as a future own action from the inside. One's own probing action is connected with some internal sensations and regulation, but at the same time it is a subject of communication with other skilled and experienced people, with an attempt to look at one's own action from their positions, through their eyes.

Therefore, the restoration of the actual theater of human subjectivity requires allocation of an entire set of acting characters in the form of mastering subject matter abilities (retell a fairy tale, ask adult a question, answer a question, draw a picture, dance, write a story, read a text, add, subtract, multiply, present operations with numbers as a formula, etc.) and metasubject abilities (to understand, to communicate, to carry out reflexive thinking, to solve a problem, to make a scheme, to self-

determine, to make a plan of action or to form a scheme of the operation etc.).

This circumstance has received quite a thorough attention in the works of V.V.Rubtsov [11], V.I. Slobodchikov[13],E.E.Shuleshko [17]. They demonstrated that formation of the ability happens simultaneously with the process of entering a child-adult educational community of the skillful and dexterous persons (able to read, write, solve problems). This is proved by the fact that exercising and realizing the ability is ensured in this community of a teacher and students mastering this ability.

When a child is play the common today digital games or with gadgets in the digital environment, he/she has no interest in peering at the action of an able-bodied person or trying to repeat such an action, analyzing what he/she cannot achieved, listening to the advice of an adult teacher. A type of chaotic search activity, that the digital gadgets are habituating us to, should also be specially studied from the point of blocking and reducing the communication with an adult to the exchange of signals. What is more, this type of behavior also results in active search for more effective actions for all the participants of the situation, transforming the very form of joint action.

Another type of the educational digital environment of a cognitive-digital type, is currently developed byY. Gromyko V. Rubtsov[8], P. Skobelev [12], and the "Kruzhok Association" (Association of technological clubs). This type of digital environment implies modeling and representation of the way of action in the structure of a thought act, sometimes demonstrates the specially organized impossibility of its implementation under the given conditions, which requires communication with other team members and a teacher. Thus, the sought way of action would be a new type of communication between a student and a teacher and within the student team, which had to be initiated.

An adult teacher should pull a student out of the operationalistic events of "pressing keys and buttons" in individual behavior mastered by him/her to a new COLLECTIVE JOINT action on another subject material and operationalize this completely different type of action, schematize and present it with the elements of a dynamic digital model, thereby making it the subject of transforming the way of action. An adult teacher turns out to be constantly engaging the student in a new SO-CIAL-COLLECTIVE and previously unknown practical manifold and helping him/her understanding and mastering it.

Here, at this point, we see the most important node of the transition from the cultural-historical psychology of L.S. Vygotsky to the cultural-historical psychology of Vygotsky-Davydov as a single process, but with the most important element of the development of this tradition based on the introduction by V.V. Davydov of new ideas about the development of human mastering ways of thinking in education.

V.V.Davydov was building an educational practice of thinking when no object of thinking formed and embedded in knowledge system could be taken in a ready-made form. To master the object of thinking, it is nec-

essary to reveal the genetically original way of action that generates the object of thinking. In fact, the way of action that generates the vision of an object through an operational "explosion of immediacy" (i.e. a new operational piece-unit of action discovered by the student in communication within the child-adult community) has never been equal to the original object of ready-made knowledge represented in verbal formulations. Thus, only mastering the way of action that generates the model of an object, the representation of the object in a symbolic form, leads to the ability formation of concrete thinking. Actually, this approach implies that the world of ready-made knowledge is required to be alternated with the practice of ability formation, meaning that every education situation should be based on the need to search and discover a way of action every time. The elaboration and implementation of the digital-cognitive educational environments of the new generation can ensure the formation of practice of thinking in accordance with the ideas of L.S. Vygotsky-V.V. Davydov for different age groups of students.

V.V. Davydov elaborated on a number of ideas and concepts of L.S. Vygotsky. L.S. Vygotsky was strongly against the impending behaviorism in the whole set of social practices, likening human actions to the behavior of a rat in a maze analyzed through the "stimulus-reaction" lenses. And today's digitalization language is still a behavioristic one. But the lack of an activity language, which he was just beginning to create and elaborate, did not allow him to describe a person's real practical experience in educational practices, theater practices, therapeutic practices without applying the language of behaviorism. L.S. Vygotsky was only forming the language of human self-growth as a language of activity in the development of cultural tradition beyond the boundaries of behavioristic psychology, gestalt psychology, psychoanalysis, using the main achievements of these areas of psychology.

Therefore, a number of concepts used by L.S.Vygotsky bear the vestiges of behaviorism — mastering "one's own behavior", and not the way of action, thinking, mutual understanding[V.V.Davydov], "autostimulating own behavior", a "technique of double stimulation", and not the transformation of a sign into a means of controlling intentional relations of consciousness, not the management of a semiotic sign's referring to the singled out object of one's own action and so on.

The genius of L.S. Vygotsky lied in the language breakthrough: he sought to create a new language for analyzing the human practice from the standpoint of culture and diverse cultural practices. This was the language of human activity, which was noted by A.N. Leontiev and V.V.Davydov[9], despite the absence of the "activity" category in the L.S. Vygotsky works.

However, to a certain extent, the activity language of L.S. Vygotsky was a more complex one than the activity language of A.N. Leontiev, his follower. This is explained by the fact he intended to keep the processes of thinking, the processes of speech (communication), the processes of voluntary action of a person in a situation as a whole. This particularity demonstrated in L.S. Vygotsky

works, was reproduced at the end of the 20th century within the framework of G.P. Shchedrovitsky's system-based thought-activity approach [18,19].He developed a scheme of thought-activity, which presents the processes of communication, action, thinking (Fig. 2).

Integrating the processes of action, thought-communication and thinking into a single systemic whole with the scheme of thought-acitvity made it possible to identify and externalize the processes of reflection and understanding and its specific functions in thought-activity. The processes of reflection and understanding ensure the connection of the processes of action, communication, thinking with each other. This connection is achieved by transferring the results of reflection and understanding from one type of thought-activity process to another (see Figure 3). Reflection provides the disclosure and transfer of means and methods of transformation, and understanding provides the transfer of meanings and imports from one process to another. The unity of the consciousness of the participants in a situation of joint action and the achievement of mutual understanding is ensured by generating new means of expression and controlling the results of the participants' understanding of interactions when using these new symbolic means.

This language of thought-activity was especially represented in L.S. Vygotsky's work "Thinking and Speech"[2]. Thinking and speech are not human behavior, these are socio-cultural processes, and their development distinguishes humans from animals. Introducing and elaborating conceptual vision of socio-cultural processes, L.S. Vygotsky had been "pulverizing" the behavioral language, freeing himself from it and going beyond it. But the traces of behaviorism remain in some of his various works. L.S. Vygotsky did not have a common conceptual name for socio-cultural processes, which he began to turn into a subject of study. The general category for these processes appeared much later thanks to the works of A.N.Leontiev and S.L. Rubinstein. The
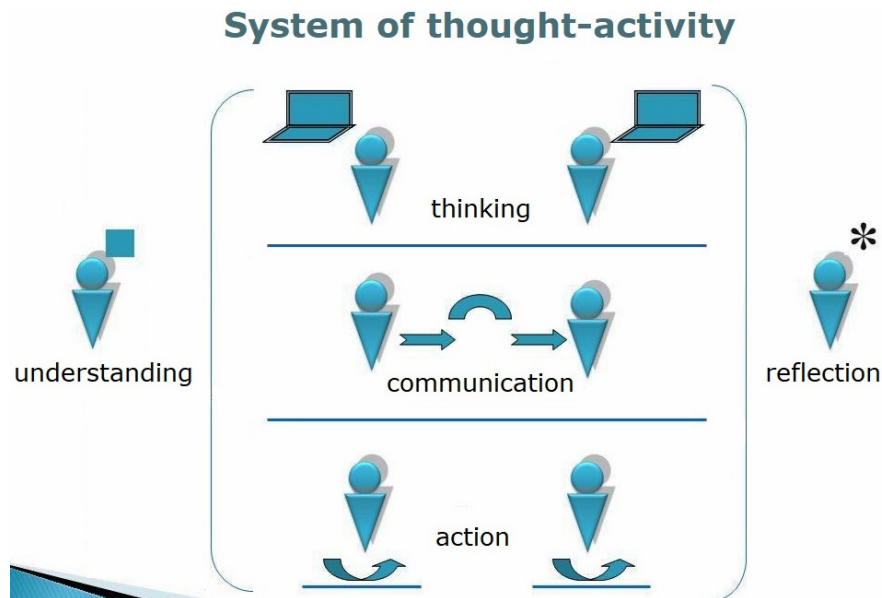

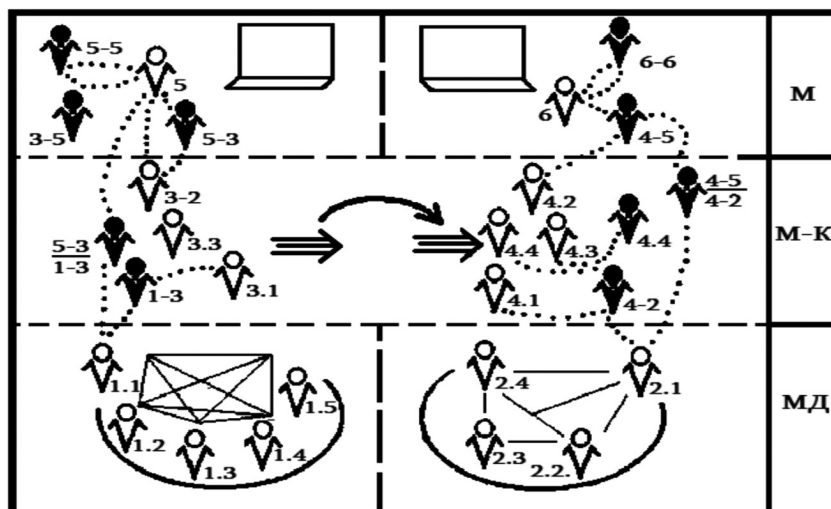*Fig. 2.* Scheme of thought-activity basic processes

Fig.3. Thought-activity scheme with reflection and understanding

main characteristic of these socio-cultural processes is that they are a form of cultural and historical reality, called activity.

The concept of "activity" is difficult to translate into English, because in English there is no distinction between "deyatelnost"(active in specific socio-cultural context) and "activnost" (active as opposed to passive). Thus, one needs context to interpret when it means activity as opposed to passivity ("activnost"), and when it means special cultural and historical reality, called activity ("deyatelnost").

L.S. Vygotsky did not use the term "activity", but the description of the processes of thinking and speech are related to activity. According to V.V.Davydov, "Thus, already in the mid-20s, L.S. Vygotsky, as a "very educated Marxist," had a historical and sociological concept of practical, sensual activity of people. Moreover, he clearly understood the role of such essential component as "instrumentality" (in Russian — orudiynost, opssredovannost) in it, putting its study as the basis for the research of his scientific psychological school" [8,p.23]. Thus, L.S. Vygotsky did not use the category of activity, did not develop models of activity, but freeing himself from behaviorism schemes, he relied on the historical and sociological representation of practical activity. And this was primarily determined, according to V.V.Davydov, by the development of ideas on instrumentalization of the psychical processes by the means of signs that are used as special tools. Moreover, L.S.Vygotsky's conceptual description of the processes of mastering thinking and speech by a child in interaction with an adult is the first attempt to identify the activity mechanisms of these processes in psychology and anthropology. The next concrete step in the study of the process of formation of thinking in modern educational practice was made by V.V.Davydov who elaborated a method to initiate child's mastering the integrated way of action [5,6].

The modern, most specific conceptual representation of activity is the system of thought-activity as a unity of three processes in their interrelations and interconnections with each other — thinking, communication, action . Two of these processes — thinking and speech (forms of communication) in their unity were considered by L.S. Vygotsky. The third process, the process of action,was identified and described in the studies of Soviet psychologists — A.V. Zaporozhets, P.Ya. Galperin, D.B. Elkonin, G.P. Shchedrovitsky. After all those processes were studied, analysed and described, a new problem was formulated: how to present these three processes in unity as an integrative whole and totality, as the most concrete representation of the activity. This was done by G.P.Shchedrovitsky by creating a scheme of the thought-activity and the system-based thought-activity approach.

3. Conclusion: developing psychology theoretical toolkit in the context of digitalization

However, such conceptual vision of activity as thought-activity problematizes the language of psychology and psychology itself as a discipline within the tradition of cultural historical psychology. The question is what is "psychological" in this idea of thought-activity? After all, neither activity in general, nor thinking, nor action, nor communication are specific psychological subjects of study. These processes require interdisciplinary and transdisciplinary approaches for their study and analysis — psychology, logic, sociology, semiotics, linguistics, cultural studies, anthropology. Neither thinking, nor mutual understanding and communication, nor action can be reduced to psychical processes.

Moreover, these notion of activity as a concrete unity of three processes of thinking, action and communication means development of three languages: the old language of higher psychical functions (perception, memory, attention, imagination, thinking, will, emotions and affects) should be preserved; the language of intellectual processes — thinking, communication, actions, and ways of organizing these processes should be developed and articulated further; and the language of states of consciousness should be introduced. The unity of these three languages of psychology is ensured by a single ontology of thought-activity processes integrating all the three languages.

The ontology of psychology is a thought-activity system, but these three languages are to be used for researching specific subjects and designing humanitarian practices. The conceptual "alphabets" of each of these languages should expand and increase. For example, Oleg Genisaretsky [4], expanding the systemic typology of mental functions, was introducing the idea of a new psychical function — "proception". However, the most interesting phenomena here is the interpenetration of these three languages into each other, their interweaving and mutual influence.

This typological expansion of the conceptual units and the increasing richness of the three different psychological languages must be achieved not only on the basis of the academic inventions of anthropologists, psychologists and philosophers, but should be applied for the analysis of a modern psyche, the forms of the organization of consciousness that are being transformed under the influence of the digital environment. One of the preliminary examples of such analysis is the work by Yuk Hui[26.27], who demonstrates that the disseminated digital object subordinated the organization of commercial and political ads, classical and abstract art, poetry and literature, by substituting attentive immersion in subject matter with instant browsing.

An algorithmized digital construction confines the perception of the new to the past operationalized reactions, asking to slough off the digitalized carapace of extrapolation of the past into the future (everything has already happened!) due to the experience of being present and spontaneously acting in this situation as a moment of affirmation and awareness of life. The digital construction of behavioral reactions should not replace the assertion of genuine values in a new situation, should not substitute the reality of an event with a possible visual scheme, reducing the truth to virtual interpretations, should not loosen moral restraints and turn into a su-

perficial digital performance and abstract digital-visual schemes, deeply personal and shameful experiences because such simplifications destroy human nature. Therefore, anthropology, theory of consciousness and psychology are today an open field of battle for the humane in man. And this involves reconstructing the events of consciousness and experience in the whole field of unfolding practices of digitalization.

Psychology, anthropology and the theory of consciousness must once again break out of the suffocating confines and enter into the field of struggle, where the danger of destruction of the humane in man is growing. This paves the way to studying the formation of the uplifting "superhuman" and "holy states", the practices of overcoming [20; 16] "human, all too human" (Friedrich Wilhelm Nietzsche). This is what is fundamentally important when considering and analyzing the processes of digitalization, as well as designing such processes of digitalization that can increase intellectual abilities (thinking, action, understanding, reflection, mutual understanding, schematization and others).

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