Educação revista quadrimestral
ISSN 1981-2582
Porto Alegre, v. 41, n. 3, p. 347-361, set.-dez. 2018
http://dx.doi.org/10.15448/1981-2582.2018.3.31795

Dossier: VYGOTSKY'S DEFECTOLOGY

Vygotskian (but only partly Vygotsky's) understanding of special education

A compreensão Vygotskyana (mas só em parte de Vygotsky) da educação especial

La comprensión Vygotskyana (pero sólo en parte de Vygotsky) de la educación especial

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Abstract

In this article general principles of special education are discussed from the Vygotskian perspective. First it is suggested that for understanding of special education in particular and the psyche and its development in general, structural-systemic epistemology should be applied. To understand special education, psyche and its development should be understood at different levels of analysis. In this paper first life is defined in order to define psyche as a special form of life. Psyche, at the next more specific level of analysis is distinguished into complementary parts, that of individual and its environment. Environment is defined next and theoretically distinguished into four kinds. On this theoretical background, pedagogy and special education are defined. Special education should be based on thorough understanding of the learner at different levels of analysis: according to general stages of development, according to within-stage development, and at the level of the structure of cognition. Two principal targets of the special education and three basic strategies of neuropsychological rehabilitation and special education are distinguished.

Keywords: Special education; Vygotsky; Luria; Strategies; Structural-systemic epistemology.

Resumo

Neste artigo, os princípios gerais da educação especial são discutidos a partir da perspectiva Vygotskyana. Em primeiro lugar, sugere-se que, para a compreensão da educação especial em particular e da psique e seu desenvolvimento em geral, a epistemologia estrutural-sistêmica deve ser aplicada. Para entender a educação especial, a psique e seu desenvolvimento devem ser entendidos em diferentes níveis de análise. Neste artigo, a primeira vida é definida com o intuito de definir a psique como uma forma especial de vida. A psique, no nível seguinte e mais específico da análise, é diferenciada em partes complementares, do indivíduo e de seu ambiente. O ambiente é definido em seguida, e distinguido teoricamente em quatro tipos. Nesta base teórica, a pedagogia e a educação especial são definidas. A educação especial deve basear-se na compreensão completa do aprendiz em diferentes níveis de análise: de acordo com estágios gerais de desenvolvimento, de acordo com o desenvolvimento durante o estágio, e no nível da estrutura do conhecimento. Destacam-se dois alvos principais da educação especial e três estratégias básicas de reabilitação neuropsicológica e educação especial.

Palavras-chave: Educação especial; Vygotsky; Luria; Estratégias; Epistemologia estrutural-sistêmica.

Resumen

En este artículo, los principios generales de la educación especial se discuten desde la perspectiva Vygotskyana. En primer lugar, se sugiere que, para la comprensión de la educación especial en particular y de la psique y su desarrollo en general, la epistemología estructural-sistémica debe ser aplicada. Para entender la educación especial, la psique y su desarrollo deben ser entendidos en diferentes niveles de análisis. En este abordaje, la primera vida se define con el propósito de delimitar la psique como una forma especial de vida. La psique, en el nivel siguiente y más específico del análisis, es diferenciada en partes complementarias, del individuo y de su ambiente. El ambiente se categoriza a continuación, y distinguido teóricamente en cuatro tipos. En esta base teórica, se definen la pedagogía y la educación especial. La educación especial debe basarse en la comprensión completa del aprendiz en diferentes niveles de análisis: de acuerdo con las etapas generales de desarrollo, de acuerdo con el desarrollo durante la etapa, y en el nivel de la estructura del conocimiento. Se destacan dos objetivos principales de la educación especial y tres estrategias básicas de rehabilitación neuropsicológica y educación especial.

Palabras clave: Educación especial; Vygotsky; Luria; Estrategias; Epistemología estructural-sistémica.

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Vygotsky's ideas have been popular in the West for about half a century. More than in other fields, his ideas have contributed to cultural and developmental psychology and also education. Vygotsky's ideas seem to have also had some impact on special education. Usually a few of his ideas are brought as significant. One of them is the idea that learning disabilities are not originally biologically grounded but rather socio-cultural and the other is the concept of the Zone of Proximal Development (ZPD) that helped to improve the education of students with special education needs considerably (e.g., CHALAYE & MALE, 2011; GINDIS, 1999; KOWALIK-OLUBINSKA, 2012; YAN-BIN, 2009). Some scholars have gone further and provide a little more detailed account of Vygotsky's ideas as related to (special) education. Yet central themes of Vygotsky's theory, I discuss below, are either ignored or described superficially (cf. DANIELS, 2001; DANIELS & HEDEGAARD, 2011).

It is also noteworthy that Vygotsky's ideas – usually those I just mentioned – seem to be relevant only for some scholars and practitioners. For instance in a recent highly valued *Encyclopedia of Special Education* Pavlov, whose ideas disagree in several fundamental ways with Vygotsky's, is about as important as Vygotsky; and both are mentioned just superficially in a few places. Jean Piaget, in turn, is very popular in that Encyclopedia (cf. REYNOLDS & FLETCHER-JANZEN, 2007). From fifty-seven chapters of an important *Handbook of Special Education*, only two mention Vygotsky's theory (KAUFFMAN & HALLAHAN, 2011). In one chapter we learn that "many early childhood educators based their educational efforts with children on the cognitive developmental theories developed by Piaget and Vygotsky" (MARSHALL et al., 2011, p. 705) and in another chapter Vygotsky's ZPD is mentioned on one line without even citing any of his works (BRIGHTON, GARDNER, & MICHAIL, 2011).

If Vygotsky's main contribution would be only the concept of the ZPD and understanding that learning difficulties are related to socio-cultural environment then ignoring his theory would be well justified. These two ideas are trivial (see more on this: TOOMELA, 2015b). Obviously formal education system is a socio-cultural phenomenon and therefore difficulties in coping with it would also be socio-cultural. The situation is not better with the concept of ZPD. Even though Vygotsky himself called the concept important (VYGOTSKY, 1984b, p. 263), he actually dedicated only a very few pages to elaborate it. Furthermore, in different works he defined the ZPD differently. The ZPD: (1) distinguished actual level of development from the further maturation of the very same process (VYGOTSKY, 1935a, p. 120); (2) was a difference score between the test result achieved independently and the test result achieved by imitating behaviors of more developed others (VYGOTSKY, 1984b, p. 262-265); (3) referred to pedagogical practices where it is necessary to adjust teaching to the developmental level of a child (VYGOTSKY, 1935b, p. 12-14); or (4) was related to the child's play, where a child goes beyond the actual level of development (VYGOTSKY, 1966). Such differences in the definition of the concept indicate that there was no coherent theory developed about the ZPD. So, altogether, the concept of the ZPD refers to understanding that children can learn more than they know or can do at any moment; that their learning potential is limited and that the realization of their learning potential is related to the organization of their environment – either by social others or by organizing their own environment in the process of play. The ideas mentioned are, of course, important, but no pedagogy could actually be efficient unless these principles would not have been followed already ages before Vygotsky. In fact, Vygotsky himself also mentioned that the idea of ZPD was discovered in practice earlier than it was brought into theory (VYGOTSKY, 1935b, p. 14).

There would be no point to write this article if Vygotsky's ideas about special education needs would be only trivial. As I am going to discuss next, Vygotsky's theory (and not a few trivial slogans attributed to him) has actually very high potential to contribute substantially to the development of special education – (major) part of his theory, usually not discussed in this context is anything but trivial. In this paper I am relying on Vygotsky's theory but I am also going beyond it. If not shown otherwise, the definitions relevant for (special) education I provide below are mine. If they are not theoretically sufficiently grounded or if they just do not make sense then it is the author to be blamed, not Vygotsky's theory.

Vygotsky's way of scientific thinking

Vygotsky discussed enormously many ideas in his works. Usually some of them, such as the ZPD or the social origin of the human mind, are taken as the core of his theory. With very rare exceptions such ideas are taken out of the context so that they lose connection to the theory as a whole. Of course it can be said that Vygotsky did not have (time to formulate) a theory as a whole and so the only meaningful way to approach his ideas is to take what seems to be important and forget about the rest. To some degree such a statement is justified; Vygotsky did not formulate hierarchical and coherent theory of the (human) mind and its development. Yet I think his works are actually much more connected one to another than

it is usually realized. What we need is an assumption that Vygotsky did not have serious memory problems and applied fundamental principles of science discussed in some of his works in all his other works. Without knowing these principles, I suggest, it is not possible to understand his theory. It is also important that today these principles are, with extremely rare exceptions, not followed in psychology. Thus almost all interpretations of Vygotsky's theory today rely on a very different and incompatible with Vygotsky's theory understanding of what is science and scientific explanation. No wonder the ideas attributed to Vygotsky today turn out to be at closer analysis relatively empty abstract slogans or trivial observations about human mind and its development.

Vygotsky described his general approach in a few works. Perhaps the most straightforward among them is *The problem of the cultural development of the child* (VYGOTSKY, 1994a; see also VYGOTSKY, 1960c, 1982b, 1983a). There he suggested that for understanding mental phenomena it is necessary to describe: (1) the components they are made of; (2) the specific relationships between the components that comprise a whole or structure of the phenomenon; and (3) development, how the phenomenon emerges and changes in time. This scientific worldview, I have called structural-systemic – to distinguish it from atomistic structuralism and quantitative variable-oriented so-called systems theories – is fundamentally different from dominant today in psychology and educational sciences approach that limits its quest to description of linear cause-effect relationships between events (see for detailed discussion on different scientific worldviews: TOOMELA, 2007, 2009, 2012, 2015b, 2016b).

Thus in Vygotskian theory, it does not make sense to talk about teachers, social relationships, educational programs, socio-economic-status, etc., that have an effect on or influence the child development. Following Vygotsky's theory, development is understood as a dynamic reorganization of mental structures of an individual in the process of interaction of the individual and his or her environment. And questions a teacher must ask in educational context are not about correlations or influences but rather about parts, relationships and emergent wholes.

According to structural-systemic approach, novel phenomena emerge in the process of synthesis of existing elements into novel wholes; a whole at one level of analysis is part at another level of analysis. Therefore, in order to understand development, it is necessary to distinguish the levels of analysis. Applying structural-systemic thought to special education requires such a distinction of the levels of analysis because pedagogical activities can be efficiently performed only at a relevant level. For instance, we know that human mind develops in the social-cultural environment. Now, if we would like to support human development better, it would not be enough to stay at that general level – we would have no idea how to change a social-cultural environment as a unit, as a whole. Thus too general level of analysis is not appropriate for grounding pedagogical activities.

The same is true about too specific level of analysis. I suppose all would agree that human mind requires highly complex brain. Further, we know that brain is composed of cells and mental activities require certain patterns of interactions between those cells. If we would now try to ground pedagogy on changing something in the way a neuron works, we would achieve no pedagogical aim as well. Because the way how cells of the brain are organized into networks with mental content depends on the organization of the environment – all we learn is about environment and about the ways how to relate to it. Thus even the most detailed knowledge about the functioning of a neuron could not inform us how to teach more efficiently.

What is psyche or mind and why we need to define it?

Level of analysis is not just an abstract-theoretical idea; the level of analysis must correspond to the reality, to the hierarchical levels of organization of the thing or phenomenon we want to understand. It is not possible to determine levels of analysis for something we are not able to define. This is so because the highest level of analysis describes a thing or phenomenon as a unitary whole. If we are not able to define what this whole is, we also have no method to demonstrate that the proposed more specific levels of analysis do characterize that particular whole and are not arbitrarily attributed to it.

Quite interestingly, it is not usual to find the definition of what it is exactly, what develops in the process of education. It seems that commonly the purpose or aim of education is defined as something "acquired" by a learner – knowledge, experience, skills, refinement, culture, vocation, etc. This way of conceptualizing education is not theoretically well grounded: if we define the aims of the education as something acquired by an individual, paradoxically, the individual is left out of the theory. Of course it is supposed to be an individual who "acquires" this something but analysis of what is acquired isolated from a learner would not support understanding of the process of education. It is the individual, who develops and therefore it is necessary to define what exactly is individually developing. I think it is hard to object the

idea that what is mainly developing in the process of education is mind or psyche.[1]

As practically all concepts in psychology today, psyche or mind is also defined in many ways. Usually the definitions are only partly overlapping. Thus different definitions of the psyche refer to different things or phenomena. As different things must have different structures, it is not possible to define levels of analysis that would fit to all definitions. So we have to choose one from the existing definitions or create a new one that would define what psyche as a real phenomenon is. This subject is too complex to be discussed in details here. So I just provide the necessary definitions discussed in details elsewhere (TOOMELA, 2016a, see also TOOMELA, 2015a). I think psyche is best defined as a special form of life, so life needs to be defined first. Following Anokhin's theory (cf. ANOKHIN, 1974, 1975; KONSTANTINOV, LOMOV, & SHVYRKOV, 1978), I have defined life as follows:

> Life is a form of organization of matter, which, on the basis of the anticipatory reflection of the environment and corresponding goal-oriented activities leading either to change of itself or its environment, is able to sustain its integrity despite potentially destructive effects of its environment (TOOMELA, 2015a, p. 434; see also TOOMELA, 2016a, for detailed discussion).

Thus living is a body that can anticipate future potentially destructive events. This, of course, is not sufficient for survival. Survival is achieved by changing itself (e.g., many plants dehydrate before (!) temperatures falling below zero) or changing one's environment (the simplest way to change one's environment is to move into another place; nest-building would be an example of more complex active change of an environment). As changing oneself or the environment requires time, harmful conditions must be anticipated in order to have time to change.

All living organisms rely on biologically based ways of anticipation of future events and corresponding to them activities which support survival in harmful environments. Yet there is another way to support survival that is not available for all living organisms. This form of anticipation and corresponding to it adaptation to the environment is psyche or mind "Psyche is a form of organization of living matter that is characterized by active, purposeful aimed at self-preservation relation to its changing environment on the basis of individual experiences" (TOOMELA, 2015a, p. 441-442; see also TOOMELA, 2016a, for detailed discussion).

The main difference between psychical and non-psychical organisms lies in the ability of the former to learn, to develop novel ways of anticipation and activity that are not available at birth. Obviously learning allows the organisms to increase their survival rate considerably. If individual learning is a powerful way to adapt to environmental changes better, it has its shortcomings also. One of the problems of psychic adaptation is that it is individual. Everybody has to learn nonbiological forms of adaptations anew. Biological mechanisms of survival are overall cumulative; novel forms are added to existing ones in the process of evolution. Accumulation of psychical forms of adaptation emerges also in the course of evolution: such accumulation of individual knowledge and skills emerges socially first from learning from the others by imitation and then with the emergence of pedagogy or teaching, where more developed individuals actively support the development of the offspring.

Psyche: the highest level of analysis

To follow Vygotskian way of thinking we have to define the levels of analysis of the central concept for education – psyche. This may seem to be easy: many scholars today would assume that psyche is purely individual phenomenon that can be located in the brain. This level of analysis, however, is already too specific. Absolutely necessary aspect of the psyche would be left out in this way. If psyche is a special form of adaptation to the changes of the environment, then it would be wrong to leave the environment out of the concept of psyche. In structural-systemic approach it is always important to try to distinguish the genuine parts of wholes (e.g., KÖHLER, 1959, p. 98). The concept of the structure grounds also clear understanding how to do it. Wholes with specific qualities emerge in the process of the synthesis of the parts. In the beginning of the study, the scholar does not know what the genuine parts are. The study begins with a hypothesis; hypothetical parts are theoretically defined. Now, if the part is genuine, then there can be no studied whole if that necessary part is taken away. If, however, the whole continues to exist unchanged after removing its theoretically important part, the theory turns out to be wrong.[2]

[1] Physical education supports mainly (but not only) the development of the body but this aside, all other aims of education are about the development of different aspects of mind. It is also true about the development of skills, which may superficially seem to be body developments also. Yet it is not so. Planning and execution of motor acts is definitely a mental phenomenon and therefore the development of skills is a special form of the development of psyche.

[2] Theoretically the situation is more complex. The whole also changes when the specific relationships between the parts change – removing a part is just one way to change the relationships between the parts (removal of the part means removing all relationships of that part with other parts of the whole). Further, when we remove what we think is a part, it may actually be that we have removed several distinguishable parts together or we have removed just a part of the part as all the elements of the wholes are wholes themselves at a lower level of analysis. In the context of this

I suggest that psyche, at the most general level of analysis, can be distinguished into two parts: *individual* and *environment*. Obviously, if the individual is taken away, there can be no psyche. But in the same way, environment cannot be taken away as well. Psyche would have no content without the environment because individual experiences are about the environment. Furthermore, environment is not important only developmentally. It is obvious also that life would cease to exist if an organism would be left without its environment. Psychic or mental environment is not fully overlapping with the environment necessary to be alive. Individual experiences that ground psyche emerge only on the basis of senses; thus removal of all sensory experiences should lead to the disappearance of the psyche. So far no such experiment has been conducted because there is no known way to suppress all sensory input. In situations of sensory deprivation, visual input can be suppressed, but even hearing, not talking about all other senses, cannot be fully switched off: we would still hear noises created by our own body. Nevertheless, even studies of selective social and sensory deprivation confirm: in impoverished social or sensory environment, the psyche begins to disintegrate (see for a review: TOOMELA, 2016a, ch. 3).

What is environment

Before going further, the concept of environment must be elaborated a little. For our purposes it is sufficient to distinguish four kinds of the environment (even though more kinds can be distinguished, cf. TOOMELA, 2016a). Generally, *environment is that which surrounds* (e.g., REBER, 1995, *environment*). Structural-systemic approach grounds the way how to go further. An important idea to realize is that *environment is always relative* – it is always something specific that is surrounded. Even two elementary particles cannot have identical environments because one would be a part of the environment of the other and vice versa.

It would be clearly insufficient to conceptualize the environment at this most general level alone. Structural-systemically we know that the same elements can be in different relationships; depending on the kind of relationships that emerge between the elements, the emergent whole has also different qualities. As we are discussing human education here, let us see, how humans can relate to their environment. First we relate to the environment as physical bodies. Let us call the kind of the environment we relate to physically, the *geographical environment* – this term with a connotation close to the one implied here was introduced by Kurt Koffka (1935).

article, the methodological complexity of the issue does not change the main argument and thus can be ignored.

Adaptive actions are based on anticipation. Anticipation, in turn, is based on a special kind of a relationship between an organism and its environment. Living organisms' purposeful activity is based on receptor systems. Receptors connect to physical or chemical parts of the environment, which constitute only a limited part of the whole geographical environment of the organism. Thus there is a specific kind of the environment of the organism that relates with an organism through its receptors; this kind of environment has been called *umwelt* or a *self-centered world* by Jakob von Uexküll (VON UEXKÜLL, 1909, 1926). As the receptor systems of different organisms are different, the same geographical environment can ground rather different *umwelt*s for different organisms.

Uexküll did not distinguish clearly between psychic and biotic forms of *umwelts*; nevertheless these two are qualitatively different. It is very important that both psychic and biotic worlds emerge on the basis of receptors, which relate *only* to limited aspects of physical-chemical environment. Yet the way how receptor-based information is interpreted, is very different. First there are purely biotic, inborn mechanisms of interpretation available for all living organisms. I suggest to constrain *umwelt* to that kind of the environment. In addition, some organisms can further interpret the receptor-based or sensory information psychically, on the basis of individual experiences. What aspects of the geographical environment and in which way can be interpreted by an organism psychically, is fully determined by individual experiences, by what an organism has learned about its environment. Active planned behavior is based on psychic mechanisms; this kind of environment was distinguished by Kurt Koffka, who called it *behavioral environment* (KOFFKA, 1935). We can say that as mental beings, we do not live in the geographical environment or in *umwelt* but only in the behavioral environment. This environment changes constantly with learning and forgetting.

Finally, there is *cultural environment*, a special language-based kind of behavioral environment created by humans (see for the psychologically relevant definition of culture, TOOMELA, 1996a, 1996b, 2016a; WHITE, 1949, 1959). Essentially it is an environment that is interpreted with semiotically mediated psychic processes or, in Vygotsky's terms, with culturally based Higher Psychic Functions (HPF).

Essence of pedagogy and special educational needs

What is pedagogy

The theoretical ground discussed so far allows us to go further and connect general ideas about psyche and

its development to pedagogy. Often Vygotsky's name is associated with the concept of "scaffolding." This term was introduced to understand the nature of the tutorial process where an "expert" helps somebody who is less expert; originally the concept did not have relation to Vygotsky's theory (WOOD, BRUNER, & ROSS, 1976). Later the concept was connected with the idea of the ZPD and it became a metaphor to refer to the process of working in the ZPD (WELLS, 2004). Even though the concept is well-known today (e.g., VERENIKINA, 2008), I do not think it corresponds to what teachers are actually doing as teachers.

What is usually stressed in so-called Vygotskian approach to education is the active role of the learner and kind of a dialogue and co-construction of knowledge in the process of learning. I think there can be no doubt that learning can be only active. We saw above that psyche, relationship of an individual with his or her environment based on individual experiences, emerges on the basis of senses. Senses, however, transform only certain limited physical-chemical contacts into nerve-impulses. Thus there can be no meaningful psychic sensory experience in the beginning of the mental development. Every individual has to construct one's own behavioral environment; this environment, i.e. psychic interpretation of the sensory world, cannot be given or transferred to a passive organism. Importantly it also follows that any cooperation between people, any true dialogue is possible only if all participants individually attribute social dimension to physical-chemical sensory experiences. In other words, social cooperation is also emergent, it must be learned and after that constantly individually re-created in every act of cooperation.

Vygotsky seems to disagree. According to his famous general genetic law of cultural development "every function in the cultural development of the child appears on the stage twice, in two planes; first – the social, then – the psychological; first between people, as an interpsychic category, then in the child, as an intrapsychic category" (VYGOTSKY, 1983a, p. 145).

He stressed the role of the social environment and social relationships between people in psychic development also in several other works (e.g., VYGOTSKY, 1956, 1982c). But we need to go further from the general idea of the role of social relationships in the development of the human mind. I think it is very important to look into what exactly Vygotsky had in mind with his law. So, after formulating the law, he discussed it further and wrote:

> Genetically, behind all higher functions[3] and relations between them stand social relations, real relations of people. [...] The word "social" when applied to our subject, has great importance. First of all, in the most general sense, it means that all cultural is social. Culture is a product of social life and communal actions of man and for that's why formulation of the problem of the cultural development of behavior already leads us directly to the social plane of development (VYGOTSKY, 1983a, p. 145).

Here we must remind ourselves again that Vygotsky did not necessarily have memory problems; his theory was structural-systemic. In this quote we see that he was talking about social *relations* of *people*. Thus we have actually a structure here: there are parts – people, and specific relations between them – social. All cultural is thus a whole that emerges when people relate socially. Further, he was talking about *higher psychological functions*; the central characteristic of them is that HPF include as a part in them a word or speech; HPFs, as it is expressed today, are semiotically mediated: "all higher psychological functions are united by a common feature that they are mediated processes, i.e. that they *include into their structure as a central and primary part* of the process as a whole use of the sign as the main instrument to direct and gain control of psychic processes" (VYGOTSKY, 1934, p. 110, my emphasis).[4]

Further, it is not only social relations that are important for the development of the mind. In fact, the way how ideas about the world, representations and psychic functions are synthesized into higher-order structures, is determined by extracerebral connections:

> The investigation of aphasias, agnosias, and apraxias leads us to the conclusion that in the localization of these disorders an essential role is played by the disturbance of extracerebral connections in the activity of the system of centers which in the normal brain ensure correct functioning of the higher forms of speech, cognition, and action (VYGOTSKY, 1982b, p. 173).

Indeed, psyche in general emerges on learning how the environment is organized; the relations between sensory attributes correspond to relations sensed in the environment. Thus *all* learning is based on extracerebral connections, connections of the parts of the environment.

[3] The concept of higher psychological functions is complex and often not fully understood. See for the discussion of Vygotsky's theory of them, Toomela, 2016c.

[4] This quote allows to see how questionable is actually interpretation of the Vygotsky's theory by the Western scholars. Kozulin in his translation just left this sentence out (cf. VYGOTSKY, 1986; Ch. 5, I). In the collected works published in English, the same sentence is translated as follows: "all the higher mental functions are mediated processes. A central and basic aspect of their structure is the use of the sign as a means of directing and mastering mental processes" (VYGOTSKY, 1987, p. 126). So sign as a *part* of the whole structure of the higher psychological functions became "aspect". I do not think it is accidental mistranslation. The translators and editors did not realize that Vygotsky's theory is structural-systemic to the core.

Social connections constitute one special kind of relations in the environment, these are necessary for the development of HPFs.

Now we need to step back and take a look at the whole idea. As we saw, Vygotsky indeed stresses the role of connections or relations in the development of the HPFs. But we also saw that he discusses also parts and wholes when theorizing about development. Indeed, it makes actually no sense to talk only about relations because relations or connections can be understood only knowing what are the units that are related, what are the related parts that are synthesized into a higher order whole (see on impossibility of the purely process approach in science, TOOMELA, 2009). The only way to know psychically what is there in the environment that is related (socially or not socially) is through senses. But senses relate exclusively with physical-chemical parts of the environment; there is no difference at the sensory level, whether observed relations were physical, chemical, biotic, or social. The sensed relations *become* social *only if interpreted* as such by the *individual*.

Thus pedagogy or teaching cannot be primarily dialogical or co-constructive or scaffolding. Rather, *pedagogy or teaching is purposeful organization of the environment by the teacher for the learner*[5]. Teachers organize the environment, they select or create certain environmental units (such as books, maps, words, etc.) and connect them in specific ways trying to make that organization salient for the learner. Focusing on certain form of environmental organization is accompanied with reducing possibilities of the learner to pay attention to other aspects of the organized environment that is not the focus for the teacher.

Everything we learn is about organization of the experienced environment; in human culture many forms of environmental organization emerge only when created again and again in human activity. First of all we find this kind of continuous creation in the process of learning language: a child learns language only when social-communicative language environment is created for the child by those who already have internalized language and know how to externalize it in speech, how to organize the environment by saying or writing words. The child learns the language by constructing psychically representations that correspond to the organization of his or her behavioral environment.

What is special education

To understand the essence of special education, we need to understand the essence of what can be called disability or "defect." The definition of disability can be grounded on Vygotsky's theory. He wrote:

> Human culture evolved in conditions of a certain stability and consistency in the human biological type. That is why its material tools and adaptations, its sociopsychological apparatuses and institutions are all intended for a normal psychophysiological organization. [...] Child's growth into civilization is conditioned by creation of corresponding functions and apparatuses [...] A defect creates a deviation from the stable biological human type [...] disturbs the normal course of the child's growth into culture. After all, culture has adapted to the normal typical human being and adjusts to his constitution. Atypical development caused by a defect cannot directly grow into culture as in the case of the normal child (VYGOTSKY, 1983c, p. 22-23).

Here we need to take into account that human culture or civilization is a special kind of environment created by humans themselves. Every newborn human being can be understood as a potential part of the culture or civilization, a potential member of the human society.

Now it is useful to remind some general structural-systemic principles. The notion of *quality* is relevant here: Quality is the potential of a structure to become into relationship with another structure (TOOMELA, 2014, p. 283). Everything is qualitatively constrained, nothing in the known universe can become into relationship with everything else, with all its environment. At the same time, things can be categorized according to the set of overlapping qualities. Even though every thing is in some respects unique, i.e., with some unique qualities, there are other qualities that characterize a category of things.

Humans comprise a category of living beings with certain qualities. These qualities can be categorized according to the kinds of human environment: there is geographical environment, *umwelt*, behavioral environment, and cultural environment. Every "normal" or typical human adult has a set of qualities that allow him/her to relate to all these kinds of environments. It is important that the sets of qualities distinguished according to the kinds of environment are in hierarchical developmental relationships; these qualities emerge and change in time and in the course of development. First of all, all humans are physical bodies; as such they have qualities to relate to the geographical environment. Then there are biotic qualities that ground the relationships with the *umwelt*.

[5] This definition also helps to understand Vygotsky's theory of the ZPD. Vygotsky suggested: "the processes of development follow after the processes of teaching, which create the zone of proximal development" (VYGOTSKY, 1935b, p. 18). If the essence of teaching is purposeful organization of the environment, then the ZPD is essentially determined by the learner's ability to recognize that organization and learn to understand it. It is also noteworthy that without teaching certain forms of knowledge, such as language, cannot develop at all because the forms of organization of the environment that correspond to these forms of knowledge exist only as processes when created actively by other humans (cf. VYGOTSKY, 1935b, p. 16-17).

These qualities are dependent on physical qualities. If the body of an organism would not have necessary flexibility and stable structure at the same time, it could not survive. Further, there are psychic qualities, ways to relate to the world on the basis of individual experiences, which can develop only on the basis of biotic qualities. And finally, there are cultural qualities that are necessary for relating with the social-cultural environment.

On that background it is possible to define disability: *disability is lack of qualities that characterize typical individuals*. Space limits do not allow to discuss this definition in details. So I just mention a few ideas to reveal the complexity of the concept of disability. First, quality is a relational term; it requires both the individual and certain kind of environment. Thus if, for instance, there is no cultural environment – like in case of so-called feral children – the individual is not necessarily disabled until brought (back) to human society. Second, psyche is an emergent phenomenon that is not present at birth. Thus for a newborn child there is no behavioral or cultural environment yet. There is only developmental potential for the emergence of the psyche first and then human semiotically mediated mind on the basis of it. So if typically developing child does not yet relate to behavioral or cultural environment, it is not disability. Third, all four basic kinds of environment are variable in space and time. Thus an individual who has developed in certain environment is not able to relate to differently organized environment s/he has not experienced. In that case inability to relate to novel aspects of the environment is not disability also. So typical individuals from cold regions may have problems to adapt to hot weather and vice versa; individuals who have developed immunity towards bacteria common in their environment may not be immune to bacteria common in other regions, etc. Finally, there are (as far as I know) no clear criteria to determine what qualities exactly define typical individuals with no disability. Thus typical individuals are qualitatively different and lack of certain qualities may be categorized as disability from one perspective and not necessarily from some other perspective including the disabled individual's own viewpoint. Therefore the definition of disability is always to some degree arbitrary or socially constructed (see for the support of this idea several chapters in HANES, BROWN, & HANSEN, 2018).

From the definition of disability we can go further and define special education needs. Education or pedagogy is related only to psychic and cultural development. Disabilities in these areas, however, can be to some degree overcome by pedagogical support. Thus *special education need is a form of psychic or cultural disability that can be overcome by special pedagogical support*.

Now it is possible to define special education. Vygotsky's quote in the beginning of this section is relevant for defining special education as well. I repeat the idea we need: "human culture evolved in conditions of a certain stability and consistency in the human biological type. That is why its material tools and adaptations, its sociopsychological apparatuses and institutions are all intended for a normal psychophysiological organization" (VYGOTSKY, 1983c, p. 22).

So it is *sociopsychological apparatuses* and *institutions* of the human culture that correspond to the typical human biological type. Among the sociopsychological apparatuses are also those that support child development (certain forms of home environment, for instance) and among the institutions are those of education. Both have emerged and evolved spontaneously until relatively recently. So the ways to support mental development of children also were to some degree suitable for the typical children. It seems most of pedagogy was pragmatically oriented – if it brings expected results, it is the way how to teach. And if it does not, then there is something wrong with the child. Understanding that instead of selecting children for pedagogy the pedagogy should be adapted for children appeared only in the 18th century (WINZER, 1993)[6].

Vygotsky understood very well that in certain cases novel forms of teaching must be created and used: "frequently, unique, specially created cultural forms are necessary to realize cultural development of the defective child" (VYGOTSKY, 1983c, p. 23).

From here we get the definition of special education: *Special education is a form of pedagogy designed for overcoming special education needs*.

Psyche: specific levels of analysis

In a way, only the surface of the complexity of special education has been discussed so far. For efficient planning and execution of pedagogy, i.e., teaching, much more must be understood about the learner. Vygotsky demonstrated with numerous studies that the actual learning potential of any learner is constrained:

[6] It is interesting that with the emergence of special education, the main theoretical advancements in education and pedagogy – in my opinion – also first emerged in special education. There it was necessary to find ways to support the development of children whose development was not sufficiently supported by the traditional system of education. The latter, in turn, continued to a large degree ignore the qualities and developmental potential of the students and rely on teacher-centered ideology of education. Even though we arrived already to the 21st century and a lot of educational theory has been developed during last century and a half, there are still strong atheoretical trends just to stick to "best practices" or "core practices" and based on it "practice-based" teacher education (e.g., FORZANI, 2014; GROSSMAN, 2018; GROSSMAN, HAMMERNESS, & McDONALD, 2009; NEEL, 2017; ZEICHNER, 2012).

> [...] only at a certain level of the internal development of the organism does it become possible to master any of the cultural methods. (VYGOTSKY, 1994a, p. 63)

> [...] one should always approach environment from the point of view of the relationship which exists between the child and its environment at a give stage of his development. [...] First of all, *a child's environment in the direct sense of this word keeps changing at every age*. [...] Even when the environment remains little changed, the very fact *that the child changes in the process of development*, results in a situation where the role and meaning of these environmental factors, which seemingly have remained unchanged, in actual fact do undergo change, and the same environmental factors which may have one meaning and play a certain role during a given age, two years on begin to have a different meaning and to play a different role because the child has changed; in other words, the child's relation to these particular environmental factors has altered. [...] one can easily see that the same environmental situation and the same environmental events can influence various people's development in different ways, depending on what age they happen to find them (VYGOTSKY, 1994b, p. 338-341).

These ideas I discussed partly already under the concept of environment. Physically identical environment can be very variable as a behavioral or cultural environment: As the last two kinds of environment are psychical, based on individual experiences, then obviously the content of the behavioral and cultural environments constantly changes together with learning. Vygotsky added here a third aspect: learning is ordered and hierarchical. Thus it is not possible in principle to learn everything at any specific level of psychic development. Pedagogy must be based on the study of the learner; this study must aim at understanding the state of the learner from the specific perspective of the knowledge and skills that are planned to be taught by the teacher:

> The question emerges what kind of actuality is reflected in paedological analysis. This is actuality of real internal connections of the processes of development, awaken to life by teaching at school. In that sense paedological analysis is always oriented inside, it reminds a study with the help of Röntgen rays. It must reveal to the teacher, how occur in the head of each and every individual child the processes of development, evoked into life by the course of teaching at school. Revealing that internal, underground, genetic network of school subjects constitutes the primary aim of paedological analysis. (VYGOTSKY, 1935b, p. 18-19)

Thinking how complex is human mind, it may seem that the level of understanding of the learner the teacher needs is impossible to achieve. In some sense it is true, especially in the area of special education where the teacher has to cope with unusual situations. Yet the situation becomes manageable if the "paedological analysis" is arranged according to the levels of analysis. I think there are three such levels that help to organize the ways the learner can and should be described.

General stages of psychic development

First, following Vygotsky's theory, the development of psyche in the unity of individual and his/her environment, proceeds over general stages at the next more detailed level of analysis. I suppose here some readers may feel uncomfortable. In several secondary sources it is suggested that for Vygotsky development was less stagelike than for Piaget (e.g., SHAFFER & KIPP, 2010); in others it is declared that for Vygotsky the development was continuous and not stagelike at all (e.g. STERNBERG & WILLIAMS, 2010). The latter position seems to be the most common in internet (Google search: *Vygotsky vs Piaget stages*). I think the idea of the continuous development might be correctly attributed to the Western so-called sociocultural or activity theory. This theory, however, has very little – and only superficially – in common with Vygotsky's (cf. e.g., TOOMELA, 2000a, 2008, 2015b, 2016c).

Vygotsky distinguished altogether seven stages of development, three prelinguistic forms of thought and four stages of the development of semiotically mediated mind. The prelinguistic stages (in the developmental order) were the stage of inborn reactions, the stage of conditioned reflexes or taming, and the stage of the intellectual reactions (cf. VYGOTSKY, 1960b; VYGOTSKY & LURIA, 1930). Language also begins to develop at the so-called natural line of development that correspond to the prelinguistic stages. The language-based thought develops over four stages: syncretic concepts, everyday concepts or complexes, so-called scientific concepts (which may have no relationship to science) and true concepts (cf., among other works, LURIA, 1974, 1979; VYGOTSKY, 1926, 1934, 1935d).

I think the developmental relations between stages and the content of them can be more elaborated today; four prelinguistic stages instead of three and five instead of four stages of the development semiotically mediated thought can be distinguished (TOOMELA, 2000b, 2003, 2017). Whatever would be the final theory of stages, there is very strong evidence to support the idea of the psychic development over hierarchy of stages. Understanding the stage of thought available for the learner in the specific subject area[7] would considerably help to understand the developmental potential of the learner.

[7] It important to mention that the stages do not characterize the mind as a whole at any period of psychic development. The development proceeds over the same stages in different areas of knowledge. Psyche, thus, is

Within-stage development

Developmental stages cannot be characterized only at the level of general stages. There is also within-stage development that must be assessed. Understanding of arithmetic, for instance, requires thinking in "scientific" or logical, as I call them, concepts. The same applies for algebra, which at the same time cannot develop without understanding arithmetic first. So the developmental hierarchy of the knowledge in different subject areas must be made explicit both from one stage to another as well as within one stage. The level of understanding achieved by the learner must be described in order to know what exactly can be taught next.

Structure of cognition

Further analysis of knowledge reveals another more specific level of analysis. Psyche can develop only if certain cognitive processes are all functioning together. First, in order to stay alive, an organism must be organized in a certain way; such a living unitary organization was called *functional system* by Anokhin (1974, 1975; KONSTANTINOV et al., 1978). According to Anokhin's theory, the organism must have motivation, needs, receptors/senses, activation of the activity, programs for action and a system to recognize whether the expected result was achieved (Anokhin called it the acceptor of the result).

The organism, in order to learn from individual experiences, must further have thinking (internal organization of experience), recording (also called encoding in cognitive psychology today), and a system for planning of activities. In addition, relatively recently in evolution, emotion emerged possibly for integrating otherwise unmanageably complex system of mind and body (cf. TOOMELA, 2016a).

All these cognitive processes should also be assessed in comprehensive paedological analysis, especially in case of special education needs, which often are grounded in dysfunction of one or several of the listed cognitive processes. This kind of analysis, it must be stressed, is much more complex than it may seem. The cognitive processes are parts of the system of psyche. Theoretically, when an element is included into a structure, its qualities change. If the whole changes, all its parts also change qualitatively. Thus in the course of the development, thinking, memory, motivation, and all other cognitive processes change qualitatively – as was well demonstrated by Vygotsky (1935b, 1960a, 1982a, 1984a; VYGOTSKY & LURIA, 1994). Thus the state of none of the cognitive processes can be known on the basis of superficial, essentially behaviorist, testing as it is done in psychology today. It is not some quantitative "level" that is important but rather the *modus operandi*, the way a particular cognitive process operates as part of the psyche as a whole.

always developmentally heterogeneous: more advanced stages in some areas of knowledge exist in parallel with developmentally less advanced forms of thought in other areas (cf. TOOMELA, 2017; VYGOTSKY, 1935c, 1956).

Mechanism of development

All details relevant for (special) education obviously cannot be discussed in one paper. Yet there is one very important idea without which understanding of psychic development in general and pedagogy in particular is incomplete. Vygotsky wrote: "observations of the history of development of the higher forms of activity of consciousness [...] demonstrates that initially all these functions appear as closely connected with external activity and only later on as if go inside transforming into internal activity" (VYGOTSKY, 1982b, p. 174).

Here it becomes clear again that Vygotsky did not connect the development of HPFs only with the social relations; the development is related to *external activity* in general[8] (see also, e.g., VYGOTSKY, 1926; VYGOTSKY & LURIA, 1994). The relations between activity and psychic development are theoretically complex. I just mention the most important ideas here (see for details, TOOMELA, 2017). Psychically we learn about the organization of our environment. There are, however, endlessly many aspects of organization that could be learned in principle. Thus it is necessary to select what to learn. This selection is based on activity. At every stage of development we can plan activities to change our environment. In activity we create a level of organization that is ahead of our ability to understand the world around us. Thus in activity we create our own ZPD in Vygotsky's terms. Without activity, there would be no learning. But it is also important to understand that with the development of psyche, novel forms of activity emerge, including conscious purposeful mental activity. Thus activity that grounds learning and development is not always external, especially in last stages of psychic development.

Furthermore, externally the same activity may have internally different structure:

[8] The idea that psychic development is based on individual activity grounds so-called activity theory today. This theory, however, is not Vygotskian (cf. TOOMELA, 2000a, 2008). In activity theory, activity is understood as efficient cause of development; this understanding ignores thus structural-systemic essence of Vygotsky's theory. Even though activity is essential for the psychic development, the form and content of the activity is constrained by the qualities of the developing individual. Ignoring the perspective of the individual, his/her developmental level and structure of psyche makes it impossible to understand the role of activity in the development.

> psychological operations can from an external perspective be very similar to one another, they can lead to one and the same result, according to their structure; however, according to their internal nature, according to what a person does in his head, so to say, according to the causal connection, they may have nothing in common (VYGOTSKY, 1983b, p. 122).

This fact is very important from the pedagogical-paedological perspective as well. The learner may behave in a way that according to the teacher's understanding reflects – or does not reflect – process of learning; yet that interpretation can be wrong. Pupils may learn what is taught without looking like learning and vice versa, they may seem to be actively learning and yet not learn at all (or learn something that is not taught at the moment by the teacher).

Two principal targets of special education

It is possible to relate the ideas discussed so far to practice. The concept of disability, if understood as a lack of certain qualities, implies two basic targets of special education. Quality is a relational term, it implies, in this context, an individual and his/her environment organized in a certain way. Lack of a certain important for adaptation quality means that an individual is not able to relate to a specific form of an environment. Commonly the target of special education is to support the development of lacking qualities so that an individual learns to relate to those forms of environment otherwise not available for him/her. There is, however, another way to overcome the same disability: an environment can be organized so that missing qualities are not necessary. If a person in a wheelchair cannot reach high cupboards, then the cupboards can be placed lower so that the individual can use them. If a person is not able to create a plan, for instance how to prepare a meal, then this plan can be made for him/her in the form of a picture-book or special arrangement of things in the kitchen. So special education can support overcoming special education needs either by supporting the *emergence of lacking qualities* or by *reorganizing the environment* for the disabled individual so that the missing qualities are not necessary.

Three ways to support the emergence of missing qualities in special education

If the aim of special education is to support the development of qualities that have not developed or qualities that have been lost then there are different strategies to support the emergence of lacking qualities of an individual. These strategies were developed on the basis of Vygotsky's theory by Luria for neuropsychological rehabilitation of individuals with brain damage (LURIA, 1947; TSVETKOVA, 1985).

First, in case of brain damage occasionally functions are lost not because necessary for these functions regions have been damaged but rather because certain brain regions have been inhibited. In such cases it is possible to support *disinhibition of the inhibited regions*. The structure of the recovered function remains the same as it was before the brain damage. Obviously this form of recovery is not possible in case of developmental disabilities.

Second, in limited number of cases – because such kind of brain plasticity is limited – *another part of the brain*, usually in the opposite hemisphere, *may take over the function of the damaged region*. In that case, again, the psychological structure of the function remains the same. Again, in case of developmental disabilities there is no pre-existing function that could recover. Nevertheless, this path to emergence of a novel function also applies to developmental disabilities. In case of typical development when the learners correspond to typical human biological type and the institutions supporting their development are operating similarly, typical psychic structures emerge in the process of development. For instance teaching to read typically supports alphabetic reading. Alphabetic track to reading is especially efficient when supported by phonics teaching (BRADY, 2011; EHRI, 2005; EHRI et al., 2001). In this kind of reading, regions responsible for sound analysis become connected with regions of visual analysis so that sound-letter relations can be learned. Dyslexia is often related to difficulties in speech/sound analysis (e.g., NEEF et al., 2017; PERRACHIONE et al., 2016; VANDERMOSTEN et al., 2010). It has been found that sound analysis can be significantly improved by different techniques (RUFENER et al., 2016; SERNICLAES, COLLET, & SPRENGER-CHAROLLES, 2015; YLINEN & KUJALA, 2015). This, in turn, may support learning alphabetic reading similarly to individuals without difficulties in sound analysis. That would result in the typical structure of processes that underlie reading. Theoretically it is possible that in some cases of such atypical development, other regions of the brain became involved in sound analysis.

The last example, however, is actually quite complex. First of all it demonstrates the limitations of understanding (developmental) disabilities. The idea according to which difficulties in speech/sound analysis underlie dyslexia, is leaving out very important idea that disability is essentially a relational term; it implies individual in unity with his/her environment. Deaf individuals can learn to

read and they do it without any sound analysis. I suppose nobody would diagnose deaf individuals dyslectic if they could not learn to read in a regular classroom. Similarly those individuals who have difficulties to learn to read alphabetically due to difficulties in sound-processing would not necessarily have any problems with learning to read if taught differently.

Another important issue is related to the choice of special education strategy. One possibility is indeed to support the development of dysfunctional sound-analysis mechanisms. Yet it is not possible to be certain that in case of a particular individual such strategy is going to be efficient. Very likely there are cases who do not benefit from such form of teaching. Perhaps other strategies of intervention should be used in parallel.

Such other strategies would rely on the third strategy of Luria-Vygotsky's approach to neuropsychological rehabilitation and special education. Vygotsky formulated an important principle: "the same problem, if solved by different means, will have a different structure" (VYGOTSKY, 1994a, p. 61; see also VYGOTSKY, 1983a, for the same idea).

Thus there are different possible ways, different structures that may underlie the same function. This principle grounds the most important strategy for special education: if a function and corresponding to it psychic structure that underlies the function, cannot develop in a typical way then another possible structure that could underlie the same function should be defined. Special education should aim at the development of that another structure by organizing learning environment in a specific way. Language can be learned visually in case of deaf individuals, but it is possible only if visual language is created first by the teachers. Similarly, reading can be based on touch as in case of blind and actually all the language can be based on touch as in case of deaf and blind individuals. In all these cases the psychic structure of the (language) function is not typical and involves functional elements (and corresponding to them distinct brain regions) not involved in the same functions in case of typical development. Neuropsychological rehabilitation and special education can actually go far beyond such obvious (today) cases to many different psychic functions and special programs of intervention (cf. LURIA, 1947; TSVETKOVA, 1985).

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Recebi em 30.08.2018
Aprovado em 11.10.2018

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