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Abstract

Vygotsky's life goal was to create a psychology adequate for the investigation of consciousness. He stated that consciousness is constructed through a subject's interactions with the world. Consciousness is neither reducible to behaviour nor separate from it, but instead is an attribute of the organisation of practical activity. It is the process that organises behaviour. Vygotsky introduced the idea of externally mediated activity that involves the use of external means to reach a goal. This led to the idea that mental processes could only be understood if we understand the tools and signs that mediate them. Wertsch believed that it was with this concept of mediation that Vygotsky made his most important and unique contribution (Wertsch, 1985).

Keywords

proximal, zone, development, theory, vygotsky, cultural, socio

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General Introduction to the Theory

Vygotsky's life goal was to create a psychology adequate for the investigation of consciousness. He stated that consciousness is constructed through a subject's interactions with the world. Consciousness is neither reducible to behaviour nor separate from it, but instead is an attribute of the organisation of practical activity. It is the process that organises behaviour. Vygotsky introduced the idea of externally mediated activity that involves the use of external means to reach a goal. This led to the idea that mental processes could only be understood if we understand the tools and signs that mediate them. Wertsch believed that it was with this concept of mediation that Vygotsky made his most important and unique contribution (Wertsch, 1985).

According to Vygotsky, the important part of psychological development is acquisition of the culture to which humans belong. The culture influences development through its artefacts, which are the main attribute of any culture. Artefacts, or cultural products, are those things which are manufactured and created by people in the culture. They include all the "things" we use, from simple physical tools like a pen, spoon, table, to the most complicated psychological tools like language, traditions, beliefs, arts, science and so on. (Vygotsky, 1978; Cole, 1997) The functions (way of using) of these artefacts are not always obvious; they are frequently not exposed in their outward appearance.

Vygotsky used the concept of the mediation of elementary mental functions by psychological tools to explain the means by which the human mind evolved with a socio-cultural determination. He also used the idea of tool mediation to explain how the specific properties of the higher mental functions (possessed only by humans) could arise on the foundation of the lower ones (possessed by all animals). This means that the higher mental functions in humans originate only in the interaction of people with people. Compared to lower mental functions, the higher mental functions are deliberate and are used for a purpose. They are mediated by language (symbols and signs) and contain internalised parts, which are not observed (internalised words, signs, symbols and converted actions). As humans grow from childhood through adolescence to adulthood their mental capacities become increasingly deliberate and gradually obtain the ability of self-regulation and self-control.

Vygotsky related mediation to the concept of external and internal mental functions. According to him any higher mental function necessarily goes through an external stage in its development before becoming an internal, truly mental function because it is initially a social function. This was called internalisation. Thought is a mode of organising perception and action. Consciousness is inseparably linked to language and it is through communication that the habits of practical activity are acquired as well as the perception a person has of themselves as the activity of others. Communication therefore is a way an individual is able to assess their every action by the social standards held in common with other people (Vygotsky, 1962)

Socio-Cultural Mediation of Human Development

Vygotsky emphasised the social and cultural nature of development. He claimed that psychological development happens within social interactions not through the unfolding of innate structures. Development cannot be separated from its social and cultural context. The social context refers to interactions with the people who surround us. His view was that social interactions are crucial for development from the very beginnings of life.

The acquisition of language and the role of social interaction in it also emerged as an important foundation of the theory. Vygotsky (1962) claimed that language is social from the very beginning of life and first appears *in* communication and *for* communication. This means that language exists first in its external form as a communicative function, then, as we are able to internalise language (inner speech) the dialogue becomes one of the main forms of our thinking. In other words, the external function which appears during childhood in social interactions, transforms into the personal, internal cognitive ability to think. The process of such transformation - internalisation was regarded by Vygotsky as the main principle of psychological development.

Another important development in this theory concerns "learning assistance". Since the functions of artefacts are not obvious, children can't discover their whole meaning by themselves. They need the assistance of adults or in some cases more capable peers. We now look at how these concept fit into the development of higher mental functions and the zone of proximal development.

Development of Higher Mental Functions

Vygotsky emphasised the social and cultural influence of development but at the same time he regarded both nature and nurture to be very important. If we ask, for example, "Is memory capacity inherited or nurtured?" Vygotsky would answer "both", as he believed that nature and nurture interact with each other. He distinguished two kinds of mental (psychological, cognitive) functions: lower and higher. The *lower (basic) mental functions* are sensations, reactive attention, spontaneous memory and sensorimotor

intelligence. Humans share these with animals and they are innate. Lower (basic, elementary) mental functions depend primarily on maturation for their development. The *higher mental functions* are acquired through learning and teaching. They include mediated perception, logical thinking, deliberate attention and memory.

Compared to lower mental functions, the higher mental functions are deliberate and are used for a purpose. They are mediated by language (symbols and signs) and contain internalised parts, which are not observed (internalised words, signs, symbols and converted actions).

The Zone of Proximal Development

Perhaps the best known concept of Vygotskian theory is that of the zone of proximal or potential development (ZPD). Initially, it was elaborated for psychological testing at school. Vygotsky stated that testing should be based not only on the current level of a child's achievements but also (and mainly) on the child's potential development. He claimed that the actual level of development (level of independent performance) does not sufficiently describe development. Rather, it indicates what is already developed or achieved, it is a "yesterday of development". The level of assisted performance indicates what a person can achieve in the near future, what is developing (potential level, "tomorrow of development", what a person "can be"). Thus, the ZPD is the distance between what a person can do with and without help. It is defined as the difference between actual level of development as determined by independent problem solving and the higher level of potential development as determined through problem solving under guidance or in collaboration with more capable peers (Vygotsky, 1978). The term proximal (nearby) indicates that the assistance provided goes just slightly beyond the learners current competence complementing and building on their existing abilities (Cole & Cole, 2001).

To arrive at this position Vygotsky had to come to grips with two types of reductionism - biological, which is the normal maturing of the physical brain and sociological, the appropriation by the child of society's cultural assets (language, etc) thrust upon it by adults. It is within this latter area that Vygotsky placed his ZPD by arguing that rather than having education dragging behind in sociological development it must anticipate it - it must "run ahead". This meant distinguishing between actual and potential development. Actual level is determined by tasks that a person is capable of solving by themselves and potential, the one at which the help of instruction is necessary. Vygotsky recognised that the distance between doing something independently and with the help of another indicated stages of development, which do not necessarily coincide in all people. In this way he regarded an instructors "teaching" of a student not just as a source of information to be assimilated but as a lever with which the students thought, with its structural characteristics, is shifted from level to level. (Yaroshevsky, 1989)

In other words learning in the ZPD refers to performing a range of tasks that the person cannot yet handle alone but can accomplish with the help of instructors or more capable peers. As people engage in cooperative dialogues with more capable partners, they take the language and make it part of their private speech and use this speech to organise their independent performance in the same way. They acquire the methods of collaborative performance and use them in their independent performance later.

Learning in the ZPD awakens a variety of internal developmental processes that are able to operate only when people are interacting with more experienced people. These processes are happening externally, in between two minds and they are called inter-mental processes. The process when the adult and the instructor come to a shared understanding is called "intersubjectivity" by contemporary psychologists. It is very important to achieve intersubjectivity to enable the next stage - internalisation - to occur. The processes then become internalised and turn into a part of the child's independent achievement; that is, they become intra-mental (within one mind). According to Vygotsky (1978), developmental processes do not coincide identically with learning processes. There is unity but not equivalence of learning and internal developmental processes: it presupposes that the one is converted into the other.

In summary we can say that internalisation is the transformation of inter-mental, external processes into intra-mental, internal ones. Internalisation occurs through the means of language (the signal system). Learning is a necessary and universal aspect of the process of human development, which is culturally and socially determined and specially organised.

Social Learning

Daniels, (2001) looked at the nature of the 'social' within the ZPD. He claimed that in many ways the concept of ZPD lay at the heart of Vygotsky's social account of learning. Vygotsky, he says, was concerned with developing an account in which humans were seen as 'making themselves from the outside' through acting on things in the world they engage with the meanings that those things assumed within social activity. He in fact developed a way in which social and participatory learning takes place. As Zinchenko (1996) explains, Vygotsky gave primacy to the sociopsychological nature of internalisation, the general course of which, he believed, went from the inter individual to the internally individual. In other words, peoples relations - culture - are what are internalised. Kaptelinin (1996) also describes this social internalisation and acquisition of abilities as being characterised by the transformation "from inter-subjective" to "intra-subjective" mental actions.

Scaffolding

Daniels, (2001) also gives an account of the concept of scaffolding defined as a form of assistance that enables a novice to solve a problem, carry out a task, or achieve a goal which would be beyond their unassisted efforts. In this respect it shares a similar philosophy to ZPD. He claims that the scaffolding

approach has tended to concentrate rather more on distribution across people rather than on artefacts or things. Crucially, it involves simplifying the learners role rather than the task. Bruner (1997) has described the term scaffolding in direct relation to the Vygotskian concept of the ZPD. Bruner saw this concept as embodying a new philosophy of development evolving in a definite socio-cultural stratum. He recognised the genius in Vygotsky's work and singled out consciousness and communication as features of the theory of proximal development worthy of special merit. (Yaroshevsky, 1989).

Further Developments

Other researchers have developed the idea of the ZPD. Rogoff (1990) introduced a technique based on the ZPD which is called guided participation. This involves collaboration and shared understanding in routine problem-solving activities. Adults assist children in their development by guiding their participation in relevant activities, helping them to adapt their understanding to a new situation and structuring their problem-solving attempts (Rogoff, 1990, p.191).

The idea of dynamic assessment was elaborated on the basis of the ZPD (Feuerstein, et al., 1980). This allowed an alternative to the problem of measurement of current performance that may be depressed for a variety of reasons and does not estimate the learning capability of a person. Dynamic assessment is aimed at the process of a change and co-constructing of knowledge and skill in the process of collaboration with instructors or more capable peer (Roth, 1992; Kirschenbaum, 1998). In their book on dynamic testing Sternberg and Grigorenko (2002) explained that the ZPD reflected development itself by saying that it is not what one is but what one can become, it is not what has developed, but what is developing. They go on to describe the assessment of these maturing cognitive functions by setting up a collaborative effort between a child and others to provide a basis for estimating the discrepancy between what the learner can do independently and what they can do with the help of others. The implications here for the role of information technology as a tool within this ZPD need to be studied carefully if it is to assume some of the role of "more capable peer".

An important concept in Vygotsky's theory is that "the potential for cognitive development within the 'zone of proximal development' is limited to a certain time span". (Kearsley 1994). He defines the 'zone of proximal development' as having four learning stages. These stages "range between the lower limit of what the student knows and the upper limits of what the student has the potential of accomplishing" (Gillani and Relan 1997, p 231, in Patsula, 1999). The stages can be further broken down as follows: the performance is assisted by more capable others (coaches, experts, teachers); the performance begins to internalise with less dependence on external assistance and finally the emergence of talking aloud (self-assistance) indicates the performance is developed and automated (Tharp & Gallimore 1988, p35).

Role of Tools

Another notable aspect of Vygotsky's theory is the claim that instruction is most efficient when students engage in activities within a supportive learning environment and when they receive appropriate guidance that is mediated by tools (Vygotsky, 1978). These instructional tools can be defined as "cognitive strategies, a mentor, peers, computers, printed materials, or any instrument that organises and provides information for the learner." Their role is "to organise dynamic support to help [learners] complete a task near the upper end of their zone of proximal development and then to systematically withdraw this support as the learner moves to higher levels of confidence." (Patsula, 1999).

Conclusion

The application of the concept of the ZPD to the realm of computer assisted instruction including mastery of information systems is still in its infancy. Much of the work done to date has involved the development of children and applications in educational settings. However there seems no reason to doubt that some of this work can be applied to areas of education outside the traditional classroom setting such as the training of adults to learn complex tasks frequently encountered in the use of information systems. To do this may require an expanded look at the ZPD.

Wells (1999, p 333) summarises characteristics of an expanded conception of the ZPD, which although developed for classroom education, could equally be applied to any learning situation. Listed here are those characteristics which may be applicable to information systems use and development.

The ZPD may be applied in any situation in which while participating in an activity individuals are in the process of developing mastery of a practice. The ZPD is not a context independent attribute of an individual rather it is constructed in the interaction. To instruct in the ZPD is to be responsive to the learner's current goals and stage of development and to provide assistance that enables them to achieve those goals and to increase their potential for future participation.

To learn in the ZPD does not require that there be a designated teacher. It is feasible that some form of computerised instruction can be included. Some activities have as one of their outcomes the production of an artefact, which may be used in a subsequent activity. This is particularly interesting from the point of view of learning by developing software to teach others. Learning in the ZPD involves multiple transformations of the participants potential for future action and of the tools and practices that mediate the activity and the social world in which that activity takes place.

The above gives an insight into the rich potential for this theory in the development of computer information systems which are easy for users to master. It provides a blueprint for learnability, a recurring problem with computer interfaces and systems which are developed by people (programmers/developers) who have no ultimate need to use them and

hence do not consider how easy they are for non developers to master. This is further explored in the chapter on usability in this volume (see Verenikina & Gould) which deals with usability of the modern phenomena of web pages.

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