Using Valsiner

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Students develop within rich, complex cultural community settings involving teachers and the environmental surrounds. To investigate the multiple perspectives in such a teaching and learning setting a suitable framework incorporating sociocultural practices is needed. The developmental works of Valsiner and associated double stimulation methods of Vygotsky, are proposed here which, it will be argued, assists in the identification and analysis of developmental issues. The application of the theoretical framework presented in this paper is exemplified in the development of numeracy in a 1st year nursing

Introduction

In recent years, Valsiner's zone theory has been used in a number of contexts in mathematics education (Galbraith & Goos, 2003; Goos, 2005; Warren, Cooper & Lamb, 2006; Blanton, Westbrook & Carter, 2005). However the use to which the theory has been put has been relatively narrow, often in relation to teacher development or teacher practice (Brown, 2005). In this paper it will be argued that Valsiner offers much more, and that his human development theory could be applied in wider contexts (Galligan, 2005) including the development of mathematical understanding in children and adults. In this paper specific reference will be made to the development of adult mathematical skill development in university and how Valsiner's theory can be applied in this context.

The Theory

Valsiner first wrote about his theory of human development, incorporating zone theory in 1987 and then expanded his theory in a second edition of his book (Valsiner, 1997). Since then he has extended the notions that underpin this theory, particularly in the methodological considerations (Valsiner, 2000; 2006); theory of dialogic self (Valsiner, 2005) and personal cultures (Valsiner, 2007). Valsiner himself said in an interview in 1998 that he "didn't want to make these fragile concepts [i.e. zone theories] into an orthodoxy for myself" (Mey & Mruck, 1998, p. 17), and in a personal communication (Valsiner, 2008, personal communication, 21 March) he seemed hesitant to use the ideas further as in reality these terms seemed deceptively superfluous. However, these original notions do permeate his later work. This paper will first explain the human development and zone theory from his 1997 work; summarise some of his later work, then argue that these notions, far from being 'fragile' are important concepts for investigating human development, particularly in educational settings.

Valsiner (1997) theoretical system conceptualises three aspects of human development:

- Organisation of person/environment relations in context of everyday actions (interpersonal);
- Relation between actions and reflection on actions in the process (intrapersonal);
- Experiences transfer to the general life-course development.

Valsiner's theory is based on a concept of development as a "change in an organisational system in time which is maintained (rather than lost) once the condition of its emergence disappear" (Valsiner, 1997, p.3). Valsiner argues that:

A person involved in mastering a skill is no longer lacking that skill, nor is the skill present in its fully-fledged form. The skill is coming into existence. The phenomenon here is quasi structured. Rudiments of the skill can be detected in the flow of conduct, yet nobody can say for sure that the skill as such already exists. (2000, p.105)

He focuses on microgenetic studies (i.e. the immediate processes of emerging new phenomena) as he is interested in the whole set of possibilities that may or may not actualize (not just the actual emergent possibilities). In the 1997 edition of his book he developed this in set notation as:

$P = \{a, b, c, d, e \,\&\, f \,\&\, g, h \,\&\, b, ?\}$ - (Valsiner, 1997, p.177)

Here P is a set of possibilities. The person may actually go from *b* to *h&b* and then to *a* which is finally actualised. The failed set of possibilities, the tried ones as well as the successful ones are all informative, not just the successful ones (as would be the case in a competence-performance study). So now at the time (time = $t+1$) that has been actualised we have another set of possibilities:

$$P(t+1)/(\text{given } a(t)) = \{b, c, d, e \,\&\, f \,\&\, g, h \,\&\, b, i, j, \&?\}$$ - (Valsiner, 1997, p.178)

Upon this model, which at the moment is just a set of possibilities at different times, Valsiner constructed a canalization process of development through the concept of zones.

Valsiner's theoretical framework includes three Zones: the Zone of Proximal Development (ZPD) from Vygotsky (1978), the Zone of Free Movement (ZFM), originating from Lewin (1933; 1939, in Valsiner, 1997), and the Zone of Promoted Action (ZPA).

Valsiner's three zones constitute an interdependent system between the constraints put on the environment of the learner and the actions being promoted for the learner. Both the constraints and the promotions are usually imposed by others so that:

> the developing child is conceptualised in the context of his relationships with the culturally and physically structured environment, where the child's actions upon that environment are guided by assistance from other human beings - parents, siblings, peers, teachers etc. The particular physical structure of the environment of a human child is set up by the activities of other human beings, and modified by them over time. (Valsiner, 1997, p. 76)

It is tempting to conceptualise Valsiner's theory by visualising the three zones as intersecting (as in Venn diagrams). This is what Goos, Warren et al. and Blanton et al. have done. Goos (2005), for example has used the ZPA/ZFM/ZPD as if these three zones exist at the same point in time. However Valsiner specifically set up the ZPD as an emerging next set of possible actions from the ZFM/ZPA interaction. These ZPD cannot be predicted so could be inside, outside or intersecting with the current ZFM/ZPA interface. Despite this difference between Valsiner's approach and the one taken by Goos, the model developed by Goos is helpful in school environments to help explain, for example, why development in one school has not occurred while in another, with different ZPA/ZFM interactions, development can be identified.

However, I believe Venn diagrams simplify the theory. Valsiner didn't use a Venn diagram model for his theory. In particular, in 1997 he used set notation to show the relationship between the three zones. In his later work, he also tentatively uses topology to help model parts of his theory (Valsiner, 2005; Diriwachter & Valsiner, 2006). This next section will detail the three zones and use the set notation to model the theory.

Zone of Free Movement

While acknowledging students' freedom of action and thought, the Zone of Free Movement represents a cognitive structure of the relationship between the person and the environment, seen in terms of constraints that limit the freedom of these actions and thoughts. This environment is socially constructed by others (teachers, administrators, the curriculum writers) and the cultural meaning system they bring to the environment, but the ZFM's themselves can either be set up by these 'others', the students themselves or through joint action, but are ultimately internalized. Thus ZFM structures access to areas and objects such as technology, time, curriculum, and class rules as well as the teachers' and students' expertise, experience, beliefs and values. By the time a student enters university, the adult student has in place a set of constraints that cannot be discarded, but have experienced other constraints that, given the right circumstances, are replaceable. For example a nursing student may have been disengaged with maths at school but in the context of drug calculations, sees arithmetic application and may become excited about learning the division algorithm.

Valsiner suggested zones such as:

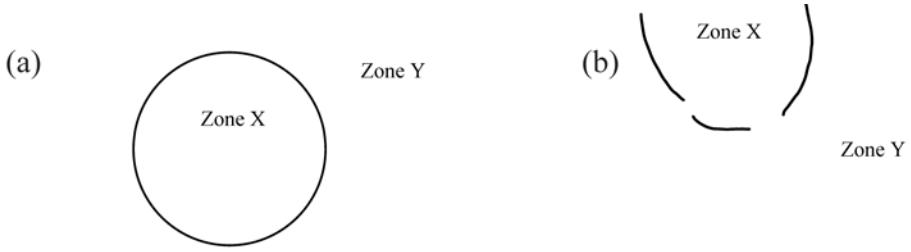

Figure 1. Two explications of the zone concept (Valsiner 1997, p. 187).

Scenario (a) is made up of two zones X and Y but this situation is rare. In reality there are often fuzzy, impermeable, or undefined boundaries (like scenario b). Hence the move from Venn diagrams to set notation to clarify the elements. At a given time (t_1) a ZFM can be identified by:

$ZFM(t_1) = \{a^*, b^*, c, d, e, f, ?, ??, g^*, h^*\}$ - (1: Valsiner 1997, p.190)

Here *c, d, e, f* are interior areas and *a*, b*, g** and *h** are areas in contact with the boundary. The ? and ?? are areas that are unknown to the students or the teachers. They may exist but they haven't been detected. Valsiner refers to this as a "reserve area of possible experiences" (p.192) if the ZFM remains static for a period of time. This notation thus allows for fuzziness not available in a Venn diagram.

In an extension:

$ZFM(t_2) = \{a^*, b^*, c, d, e, f, m^*, ??, g^*, h, j^*\}$ - (2: Valsiner 1997, p. 191)

Notice the *h* is no longer on the boundary and a new element *j** is now seen on the boundary. The ? is now replaced by an *m** as it has actually been detected. (e.g., having a greater understanding of division (perhaps in context) and then seeing long division maybe useful or just being interested to learn).

Zone of Promoted Action

While the ZFM suggests which teaching or student actions are possible, the Zone of Promoted Action (ZPA) represents the efforts of a teacher, or others to promote particular skills or approaches. For example, a nursing department promotes students to go to numeracy classes. However the ZPA is not binding; thus students may not wish to actively participate in this course. The ZPA should also be in a student's ZPD (see next section), so having very poor mathematics skills in a class which assumes basic mathematics skills, may result in students' inability to participate or learn. On the other hand those students who believe (and may have) the skills already, may not participate. This is what Valsiner calls an "illusionary construction" (1997, p.193). This concept was developed further by Blanton et al. (2005) as the Illusionary Zone (IZ).

In terms of set theory we first look at the ZPA in terms of the ZFM. Taking the example (2) ZFM/ZPA at time (t_x):

$\text{ZFM/ZPA}(t_x) = \{a^*, \underline{b^*}, c, d, \underline{e}, f, ?, ??, g^*, h, \underline{j^*}\}$ - (3 Valsiner 1997, p. 192)

To complete the microgenetic examination, the model is furthered by, for example, promoted action outside the zone (say *k*), and an action/reflection stage. Thus the model, perhaps now incorporating *k,* can become:

$\text{ZFM/ZPA}(t_{x+1}) = \{a^*, B\underline{b^*}, c, d, B\underline{e}, f, ?, B??, Bg^*, h^*, Bj^*, k\}$

Here at Bb* the action is promoted and there is sign mediated reflection but this reflection is not promoted. Thus with each action there are both promotions of actions (or not) and reflections on actions (or not), depicted in Figure 2.

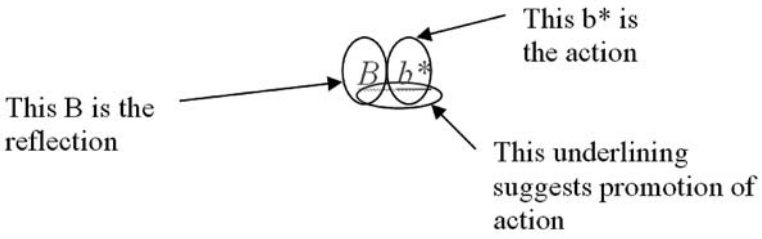

Figure 2. Model of an action, reflection and promotion of action.

In later articles, Valsiner expands on the notion of semiotically mediated reflection (Valsiner, 2005)

Zone of Proximal Development

The third Zone concept Valsiner uses is the Zone of Proximal Development (ZPD), borrowed from Vygotsky. For Vygotsky it was the difference between a learner's "actual development level as determined by independent problem-solving" and the level of "potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (1978, p. 86). So if teachers or curricula promote tasks (e.g. numerate practices) that are too far away from the student's present capabilities (both too high and too low), then the tasks are unlikely to be assimilated. However Valsiner's concept is more narrowly defined as the "set of possible next states of the developing system relationship within the environment" given the current state of the ZFM/ZPA interface and thus the ZPD becomes subservient to the other two concepts (Valsiner, 1997, p. 200).

When these three zones merge, what emerges is, not so much a Venn diagram that is promoted by Goos (2005), Blanton et al. (2005) and Warren et al. (2006) suggesting interdependent circles, but a "family of possible novel forms of change" where the ZPD is dependent on the ZFM/ZPA complex. It can be depicted as:

ZFM/ZPA(t) ZPD(t+1)

$\{a^*\} \rightarrow \quad \{a, a^*, Aa, Aa^*, A, ?\}$

$\{B\underline{b^*}\} \rightarrow \quad \{b, b^*, Bb^*, Bb, B, ?\}$

(Valsiner 1997, p.203).

Here there is a set of ZPD's that represents a further mapping of a time extended kind. It consists of the options for each ZFM/ZPA. In the ZFM/ZPA of $\{a\}$, There could be no change {a}; a change in boundary status $\{a^*\}$; semiotic mediation on these $\{Aa$ or $Aa^*\}$; or further open ended options {?}. The actual development emerges from the negotiation process within this set of possibilities. With this set of microgenetic contexts, over time a more stable pattern with a more ontogenetic flavour may emerge.

In this model Valsiner examined semiotic mediation as being more complex than simply reflection on action. It also becomes a set of possible new senses. While the initial ZFM/ZPA complex describes the primary field of action, there is also a secondary "personal sense"; the connection between the primary and the secondary, and also a metafield emerging from the interacting fields. This concept of mediational fields appears more strongly in Valsiner's later work on semiotic mediation and dialogic self in 2001 and 2005 (Valsiner, 2001; 2005; Lawrence & Valsiner, 2005). In 2001 he describes a developing semiotic regulatory system:

> A person feeling something (but it is not yet clear to oneself what that something is)…then at some instant, the person realised "I am angry" (i.e. creating a sign…to reflect upon the feeling process). (p. 93)

In 2005 he brings in the concept of scaffolding into the theory of dialogic self (i.e. "construction of meaningfulness of the self in relation with others" (Valsiner, 2005, p. 199). Here Valsiner uses scaffolding as a semiotic mechanism that allow people to regulate, construct and reconstruct their "I-positions".

The investigation of these human developing systems within a framework of the zone theory and dialogic self theory may have importance for research into the ways adults learn mathematics. If these theories are placed within the context of adults developing mathematical concepts that may have been troublesome in the past, then new ways of approaching adult learning may be possible. Dialogic self is focussed an adult development (Valsiner, 2001) and zone theory links the environment (including past feelings, and context, self-efficacy etc) and promotions within that environment (for example universities needing mature aged students to learn academic skills; or adult self-promotions of learning). Finding out how adults re/learn these concepts is important in many areas of both university and everyday life. This learning occurs first at the microgenetic level. How is the microgenetic captured? What methodology fits this theory?

On Methodology

In mathematics education, where a researcher aims to change or improve students' understanding of concepts, action research or design experiment is often used (Kelly & Lesch, 2000; Collins, Joseph, & Bielaczye, 2004). However there have been a number of criticisms of this approach (Dede, 2004; Engeström, 2007). Engeström rejects design experiment, particularly as it emphasises completeness and ignores the "contested terrains that are full of resistance, reinterpretation, and surprise from the actors in the design experiment" (p. 368). Instead Engeström advocates the use of Vygotsky's double stimulation as a basis for interventions as it aims to elicit "new, expansive forms of agency in subjects … making subjects the masters of their own lives" (p. 363). Valsiner also believes the method of double stimulation in a developmental quasi-natural experimental setting is useful when researching human development. In double stimulation experiments, subjects are provided with a richly structured environment which can be restructured in a goal oriented way. Figure 3 shows the general structure of the method concentrating on the unfolding of the intermediate forms, both the ones that eventually turn into final forms and those that don't. Microgenesis at this level may be limited to developmental transformations in very short periods of time, even measured in microseconds (Diriwachter & Valsiner, 2006).

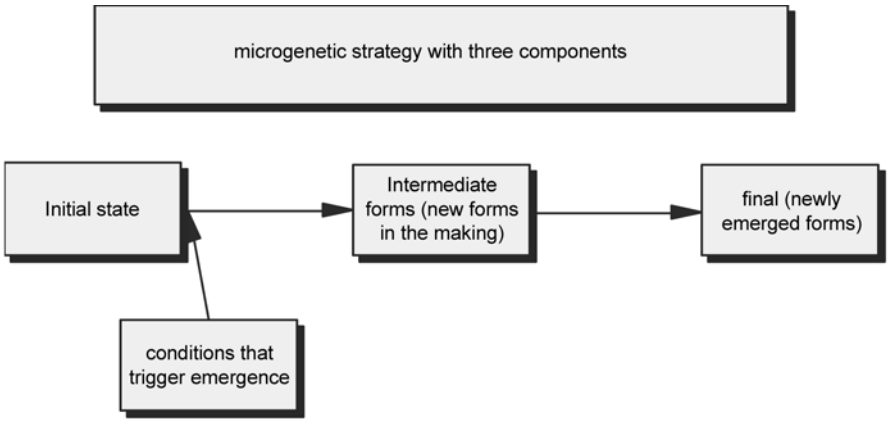

Figure 3. General structure of the method: Development studied as it unfolds (Valsiner, 2000, p 78).

Valsiner depicted Vygotsky's approach diagrammatically in Figure 4. In his original work, Valsiner exemplified this double stimulation with the development of young children learning. However this method can be used in many contexts. Engeström, for example, uses the method in the context of post office workers in the redesign of delivery work of mail carriers (Engeström, 2007). Here it will be exemplified with adult nursing students learning mathematics. The researcher asks the nurse to solve a drug problem (Researcher STIMULUS-OBJECT). The student aims to answer the problem (Actual STIMULUS-OBJECT). When the student selects the task the researcher suggested, the task is reconstructed, even if the STIMULUS-OBJECT seems to be the same. In the room there may be books, pens, formulae, calculator, perhaps even models (environment). She/he may see the formula (stimulus X). She decides to use the formula to solve the problem (STIMULUS-MEANS 1). The nursing student thinks about how to solve the problem, as well other thoughts may be involved, fear anxiety, self-efficacy etc (STIMULUS-MEANS 2). It is this "moment of human interpretation" (Valsiner, 2000, p.79) i.e. that moment of present-to-the-future development, that Valsiner highlights from Vygotsky's work as important for investigation. In later articles on the *Social Mind* (2000) and *Dialogic Self*

(Valsiner, 2005), Valsiner appears to focus on the growing importance of this reflective social nature of the phenomena (i.e. the STIMULUS-MEANS 2). This reflection is particularly important in the study of adults. While the traditional notion of ZPD links teachers or others to scaffolding student learning, Valsiner develops the idea of self-scaffolding where

> [t]he developing person constantly acts above his or her actual-already mastered-developmental competencies and through such constant probing into the domain of incompetencies-expands the competence. (Valsiner, 2005, p.203)

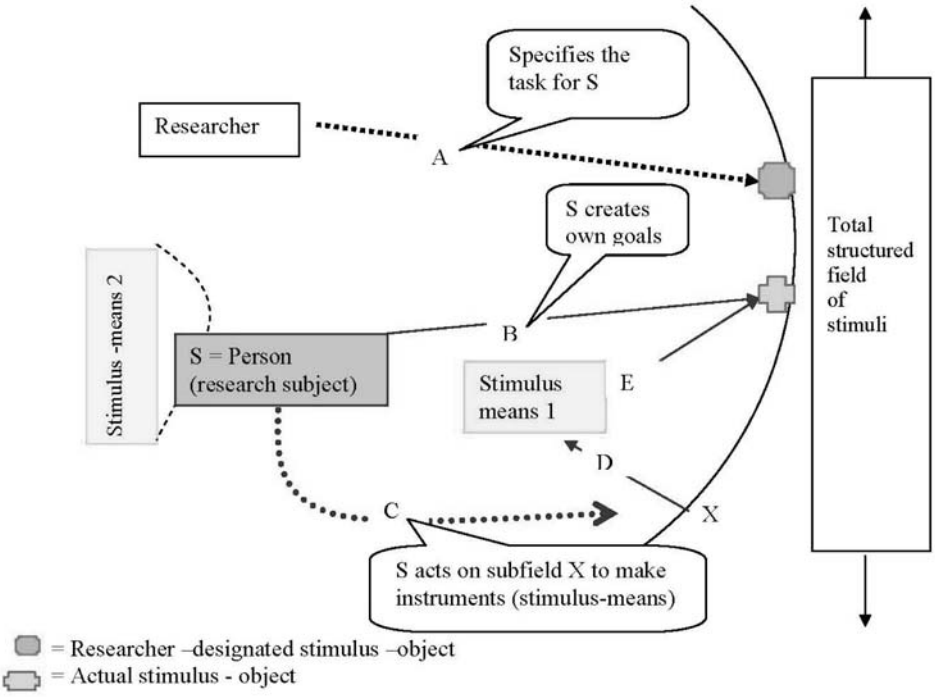

Figure 4. A schematic depiction of Vygotsky's methods of double stimulation (from Valsiner 2000, p. 79).

In researching adults learning mathematics, a series of double stimulations involving a richly structured environment, and means for self-scaffolding and may provide a "constant flow of microgenetic episodes" (Valsiner, 2005, p.204) which may lead to new understandings of how ontogeny emerges for adults re/learning mathematics.

Discussion

Throughout Valsiner's work, his passion for a "second psychology" (Cole & Valsiner, 2005, p. 293) can be felt. He advocates to move away from statistically oriented sciences that treats humans as acultural beings, that measures subjects "as they are" rather than "as they become" (Diriwachter & Valsiner, 2006, para 8). Rather, he proposes methodologies that centre on careful observation in microsettings, where development may be observed. His approach to the total environment through ZFM; to scaffolding through the ZPA and later self scaffolding in his work on dialogic self; and his take on the role of the ZPD as a set of possible future actions that result from the ZFM/ZPA interaction (both successful and not), all fit, I believe in the methodology of double stimulation. The challenge is to move the theoretical approach into an experimental setting to see how well it can explain human development.

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