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This paper discusses the potential of Vygotskian units in researching classroom practices. Adopting a close-to-practice approach and action research where possible, an attempt is made to shed light on ongoing practices across grades 4-6, 7-9 and the gymnaisum. The theory/practice approach adopted keeps alive the relationship between theory-which-informs and theory-being-built, as well as existing-practice and steered-practice in these studies. The potential to inform researcher reflexivity and guide educational action along with the ability of units to grasp complexity, from as many perspectives as possible, and ascend to the concrete is brought forward. Such a strategy is deliberate, geared towards informing practitioner inquiry in ongoing classrooms.

**INTRODUCTION**

For the past nine years I have trained and conducted research in mathematics classrooms. For many years prior I taught sciences including mathematics at these very school grades. A meta issue that I thereby attempt to now address is the ways in which research can aid either practitioner or researcher to grasp the complexity of ongoing classrooms. I have adopted a Vygotskian outlook towards such complexity, articulated in his introductory psychology for teachers prior to developing his now widely accepted perspectives. Vygotsky emphasised:

> In education there is nothing passive or inactive. Even lifeless objects, when they are brought into the educational area, when they are assigned an educational role, acquire a sense of purpose and become effective participants in this process. ... An active role is the lot of the teacher. ...The teacher fashions, takes apart and puts together, shreds, and carves out elements of the environment, and combines them together in the most diverse ways in order to reach whatever goal he has to reach. Thus is the educational process an active one on three levels: the student is active, the teacher is active, and the environment created between them is an active one. (Vygotsky, 1997, pp. 47-58)

In drawing upon neo-Vygotskian perspectives, I attempt to discern how classroom practices can be productive in a variety of ways. Articulated with respect to teacher education, I pursue:

Close-to-practice research, which keeps its roots in robust theoretical frames can throw light on immediate pedagogical affordances, can highlight tensions and contradictions at the system level and can become integrated as informed problem-solving into professional practice. Additionally it can itself be open to questions from practice that can help disrupt the assumptions that support theory. (Edwards et al., 2002, pp. 123)
In exploring the potential of Vygotskian units towards my stated goals I respond to the need for incorporating classroom complexity in educational theory (e.g. Grouws, 1985; Lester, 2005; Niss, 2007; Arbaugh et al., 2010). My pursuit addresses Bauersfeld’s (1980) seminal call for not only identifying hidden social dimensions in mathematics classrooms but also allowing teachers therein to reflect upon their teaching. While I make cursory reference to advances made in this direction in the empirical sections, I adopt too an action research approach whereby the need to facilitate teachers to become key stakeholders in university led research along with researchers becoming stakeholders in teachers’ classroom practice is now argued (Krainer, 2011). A close-to-practice theory/practice pursuit provides opportunity in addition to aid practitioner inquiry, termed by Cochran-Smith and Donnell (2006) as one in which the practitioner is researcher, the professional context the research site and the practice itself the focus of study. The enduring issue that they single out of privileging the contribution of K-12 teacher-practitioners to research driven knowledge, is thus an underpinning goal. It is towards these aims that I first discuss theoretical and methodological aspects of Vygotskian units. I then detail deployment of Vygotskian units in my studies in four successive sections. In conclusion, I reflect on the nature of science that is so capable of being built. What nature of insight can Vygotskian units of analysis provide when deployed in ongoing classroom practices, is the research question that I herein pursue.

**VYGOTSKIAN UNITS – THEORY AND METHOD**

In philosophical terms Vygotsky examined mind as embedded in material activity, rather than existing independently of the world that it came to know. In his adopting such a stance Derry (2004) highlights that individual freedom in terms of self-determination and coming to be in the world is integral to education. Applicable to both students and teachers it is in this light that I pursue the ability of Vygotskian units to inform teachers, to both know and hold on to actions they execute through cultural signs and tools in their activity of teaching. With reference to the Vygotskian concern of instruction leading development Daniels (2008) views teaching as social collaboration towards the conceptual formation of students, where content based scientific or academic concepts lead their spontaneous or everyday concepts. Detailing various collaborations that espouse Vygotskian principles, Daniels offers contexts that could shed light on social patterns in classrooms that Bauersfeld (1980) sought. These illustrate also Vygotsky's (1997) premise that educational processes are active at the level of student, teacher and the environment. Before detailing Vygotsky's arguments about units that can examine such environments, I address the issue of self or identity of participating individuals be they students, teachers or research in their collaborative practices. Mindful of the socio-political underpinnings of Vygotsky's endeavour, Stetsenko (2009) herein argues for knowing or knowledge as central to an individual's pursuit of self. Integral to becoming, such knowing she points out needs to stem out of, through and for the very social practices being that are being participated in. In such knowing being inherently personal, Stetsenko advances the need in particular to see teachers as activists who with future scenarios in mind teach with deeply held beliefs and commitments. Far from guiding students to merely acquire factual information, it is towards the fulfilment of such an activist outlook and practitioner inquiry (Cochran-Smith & Donnell, 2006) that I attempt to deploy Vygotskian units.
Vygotsky's construct of unit analysis is just as methodological as it is theoretical. Building on the premise that human mind is constructed in communicative and concrete praxis, it is practical activity that was his analytical focus. Such an attempt was coupled with attention to human consciousness, which he declared was planned and pursued goals inherent in practical activity - an ability not present in animals (Wertsch, 1981). In deliberate, conscious actions being more than a sum of a person's skills, reactions, perception, behaviour and the like, Vygotsky rallied for wholistic analysis which understood human thinking as embedded in concrete activities and inclusive of both external and internal processes (Scribner, 1997). It was in pursuing objectives of various activity that human consciousness was a product of society and not innate but produced (Leont'ev, 1981). In such pursuits the individual was objectivised and in the individual the object was subjectivised (Wertsch, 1985).

In spelling out units for analysing activity Vygotsky laid down norms, though gave no easy recipes for either what counted as a unit or how to select an appropriate one. Units were to however satisfy three aspects: first, analyse processes and not things since psychological functions were processes that developed; second, have explanatory beyond descriptive capability and finally be dynamic so as to uncover the existence of functions in a genetic manner (van der Veer, 2001). With specific reference to classroom practices, learning in such a perspective is understood as a student's expanding social and intellectual involvement over time with other students, as well as the cultural tools available in one's local environment (Russell, 2004). Cognitive development is here understood as not occurring in isolation but as located in what students do with their collaborating peers. Cultural tools utilised therein are thus not external but essential to their subjectivity (Stetsenko, 2001). The task of identifying units of analysis towards grasping the nature of collaboration with peers and cultural tools in classroom practices is therefore as Zinchenko (1985) argues, only the beginning and not the conclusion of analysis. Engeström (2011) rightly draws attention in addition that instructional or what he terms formative intervention into social practices could by nature be contested terrain, full of resistance and reinterpretation from those who are participating. In adopting an activist teacher stance (Stetsenko, 2009) or conducting practitioner inquiry (Cochran-Smith & Donnell, 2006) it is therefore vital following Engeström, to keep the needs of actors, their identities and their agency in mind while deciding upon suitable units of analysis.

In an action research stance neither theory nor practice has a more valued position. The goal of immediate impact on practice is achieved by reflective practitioners through collection of data from within practice (Noffke & Somekh, 2011). Conceived as Vygotskian learners, teachers as reflective practitioners are both shaped by and shape the social situations of their development (Edwards, 2010). It is towards this need of teacher-practitioners to collect data, interpret and act in their classrooms that I explore deploying Vygotskian units. The resultant psychological knowledge as Seeger (2001) explains, provides insight into one's practice and enables the taking of actions across theoretical and practical settings as a practitioner. It is the coming upon such nature of reflexivity in inquiring practitioners that makes it possible to conceive teachers as activists, as argued by Stetsenko (2009) and the activity of teaching itself as a resourceful practice, as argued by Edwards (2010). I now turn to detail examples which illustrate such an emphasis in close-to-practice research.
COLLABORATIVE CLASSROOM PRACTICE AT A GYMNASIUM

In my first and doctoral study (Gade, 2006) conducted as a participant observer, I observed two teachers direct students cooperate in small groups during instruction. Commencing with a single teacher during the first chapter of their textbook and two teachers thereafter, I noted classroom practice being steered from a single teacher at blackboard instructional practice, to one in which both teachers guided students to cooperate in small groups at their tables. Towards the end of the third chapter, I also observed classroom practice facilitate students from various groups to collaborate with each other. Participation in the instructional practice so established, wherein rules for cooperating were both discussed and agreed upon, was one of the units that I deployed in this observational study. Informing a person-in-practice view, such a unit was dynamic and a living part of classroom practice. Such deployment shed light in a genetic manner on how the teacher first established his own intentions, next had students participate in one's own intentions as well as those of one's peers, allowing for students to participate with independent intentions in the final stage (Gade, 2011c). Participation as unit led me to evidence herein how a zone of proximal development was formed when students cooperated as well as collaborated in instruction (Gade, 2010a). From a close-to-practice perspective this unit elicited how students' thinking was embedded in concrete classroom activity (Scribner, 1997). The objective of students learning mathematics was subjectivised and in their collaboration their learning of mathematics was objectified (Wertsch, 1985). As argued for in literature it was possible to incorporate the complexity of ongoing practice, into the theory I built as an observing researcher. As van Oers (2001) has argued in favour of, there was insight about the manner in which the two teachers, whom I observed in my study, initiated their students into the larger culture of the mathematical community.

NARRATIVE INQUIRY AND ACTION RESEARCH AT GRADES 4-6

It was my attempt to understand the many narratives that students and teachers offer as they participate in various practices at school, which led me to deploy narrative as unit of analysis in my next study. Informed by considerable writing in literary theory my deployment of narrative as unit was however instinctive and drew upon my own mentorship and teaching practice at school (Gade, 2011a). My ability to use narrative drew also on the freedom I had in post doctoral work of interacting with students and teachers in a manner of my choosing at the grade 4-6 school I was associated with. I thus endeared myself to individual students as they worked at various problems in mathematics. I was able to understand how Felix say while working at a numbers crossword utilised me in filling blanks that demanded repeated multiplication, as well as finding out where an error was made when the numerical entries in the crossword did not add up to the required total (Gade, 2010b). I was able to also grasp the narrative of a weaker student Alex, who found it difficult to meet the expectations of the mathematics being demanded of him, and for whom his teacher Lea found it difficult to set aside extra time during classroom practice. It was exchanging narratives with Lea in relation to her students' learning that led both of us to gain each other's trust, resulting in a specific intervention to address a problem she recognised that students had in relation to the '=' sign (Gade, 2012). Narrative as unit thus facilitated my conducting action research. My drawing upon narrative led in addition to understand and respond to Nelly, who broke down in tears.
while responding to paper and pencil test that Lea conducted (Gade, 2011b). Drawing upon Nelly's predicament in practice and Vygotskian theory on mediated action it was possible in close-to-practice approach to come upon and act on researcher reflexivity (Seeger, 2001). The action cycle conducted thereafter was instrumental in bringing about immediate impact in classroom practice (Noffke & Somekh, 2011). I am presently working on a more detailed account, inclusive of emotions, of the classroom environment as experienced by Nelly in terms of the Vygotskian unit perzhivanie (van der Veer, 2001). That emotion and cognition go hand in hand towards knowing as well as being in the activity of teaching-learning is explicated recently by Roth & Radford (2011) an approach I find highly relevant to researching classroom practices. The other unit used that was basis for grasping how Lea's scientific concepts lead her students' spontaneous concepts (Daniels, 2008) was talk. In reporting on action possible in Lea's classroom through such talk, I have pointed to the direct bearing such action has had to her own professional development (Gade, 2011d).

**TEACHER AND STUDENT VOICE AT ANOTHER GYMNASIUM**

The third study I present, witnessed the use of computers by students in classroom practice, unsettling any assumptions that I had as researcher about the active role for teacher, students and environment in instruction (Vygotsky, 1997). Acknowledging that my understanding about the role of technology in classroom practices is fleeting, I retained an observational role in this study. With teacher voice as unit of analysis, I herein found Lukas to utilise his humour towards drawing the attention of his students and remaining in contact with them. I inferred Lukas' hands to be tied as teacher in the presence of limitless digital access students had through their use of computers. Overwhelmed by the presence of digital technologies, the chances of my taking action therein seemed minimal. Lukas becoming an activist teacher (Stetsenko, 2009) or resourceful practitioner (Edwards, 2010) seemed improbable given the material conditions prevailing in such practice. While it is difficult to speculate on the self-determination that was possible for Lukas' students, the issue of Lukas being free to teach mathematics appeared problematic in prevailing practice (Derry, 2004). Drawing upon positioning theory, I was thereafter able to distinguish between what was deemed logically possible in any mathematics classroom and what seemed socially possible in Lukas' practice. Instigated by one of Lukas' students leaving his class for another course less demanding, I interviewed all of them and deployed student voice as another unit of analysis (Gade, 2011f). Evidencing students struggle with many a feature characteristic of post-modernism it was possible via this unit, to shed light on the pedagogical affordances that were available in their practice (Edwards et al., 2002). Leading to question the wisdom of granting students unlimited access to computers, my choice of units seemed merely the beginning and not the end of my analysis (Zinchenko, 1985). I was left with wanting to ascertain what nature of becoming Lukas and his students have opportunity for (Stetsenko, 2009). Teacher and student voice as units however did inform the agency Lukas and his students had in their contested terrain (Engeström, 2010). The issue of individual as well collective identity and agency of either was importantly not peripheral, but central to the teaching-learning of mathematics (Grootenberger & Jorgersen, 2009). Towards these aims the units deployed had potential to advise the nature of engagement that could be sought in future educational action.
REGULAR AND MORE BASIC CLASSES AT GRADES 7-9

The final study I mention problematises once again the restricted agency that students and teachers face within classrooms, in a school setting governed by global socio-economics. Located in an industrial area and drawing students from households facing possible closure, the anxieties of parents that school fulfil its perceived societal function, were an important factor in the conduct of my study at this school. Another factor having tangible impact on classroom practice was the presence of specialist youngsters training for professional sport. Upon my approaching this school for the possibility of conducting research, I was asked if I could help out with a particular class in which the impact of these factors were so great that the Greta the teacher could do with assistance in whatever form possible. Two theoretical approaches guided this study which I conducted in a ground-up fashion. The first drew upon cultural studies where the role of theory is viewed as being at the service of the concrete, leading to ascertain in what ways one could refashion the concrete in more productive ways (Grossberg, 2010). The second drew upon the impediments encountered when students learn decontextualised mathematical knowledge. What is learned by students in classrooms, Lave (1990) ably argues, is integrally implicated in how mathematics is learned there.

In taking a more active researcher stance than in Lukas' class, it was drawing upon these perspectives that I conducted an action strategy for classroom practice. As in the first of my studies my unit of analysis was participation, though the zoom of my analytical lens was informed by larger socio-economic dimensions in which the school was immersed in. In meeting with parents at the request of Greta and in her allowing me to experiment, it was possible for us to conduct a strategy and attempt to address the issue of meaning of schooling itself, that seemed central to problems being encountered at this school (Gade, 2011e). We conducted the said strategy in both regular and more basic sections into which the students divided themselves into. The deployment of participation as unit against such a backdrop brought forward also, ways in which working class, gender and issues related to adolescence became central to agency and identity students displayed (Walkerdine et al., 2001). In contrast to participation as unit deployed as participant observer in my first study, my role in this study was that of an action researcher. Such researcher role had bearing not only on the nature of intervention that I brought with me to either practice, but importantly on the breadth of issues that I had to factor in while conducting action research.

CONCLUSION – RESEARCHING CLASSROOM PRACTICE

In drawing on the Vygotsian oeuvre and addressing theory/practice issues while conducting close-to-practice research (Edwards et al, 2002) I have attempted to portray the nature of complexity encountered in the conduct of my four studies. Deploying units of analysis appropriate to the task at hand, it was possible for me to uncover many a hidden dimension that Bauersfeld's (1980) seminal paper sought attention to. With greater possibility to draw upon Vygotskian perspectives in contemporary times, I was able to come to grips with the not only complex but also multivariate issues that seemed to spill across self, classroom and school itself in the larger pursuit of education. In such ability to deploy units and gain insight, I am heartened by the potential Vygotskian units have both for building theory as well as
directing classroom practices by way of research. The Vygotskian (1997) premise that students, teacher and the environment between them be an active one led me to shed light on its promise, as was the case with exploratory talk at the grade 4-6 school and as well as its unfortunate restrictiveness, as was the case with unlimited usage by students of computers at their gymnasium. While in the first Lea the teacher was able to steer teaching-learning in her classroom practice, Lukas as teacher was restricted in his role, coupled also by the fact that his students were young adults free to seek their self-determination. Research seems to have come a long way since Bauersfeld's (1980) call to attend to social and hidden dimensions of mathematics classrooms to realise that aspects such as thoughtful use of talk or unfortunate use of computers, could vitally alter the manner in which students could be initiated into the larger culture of the mathematical community (van Oers, 2001).

The adopting of a close-to-practice (Edwards et al., 2002) stance across my four studies and an action research (Noffke & Somekh, 2011) stance where possible, enabled me to draw simultaneously on neo-Vygotskian perspectives that could be deployed in concrete realities of various classrooms in my four studies. The relation between theory-which-informed and theory-being-built as well as existing-practice and steered-practice was a continuous and ongoing endeavour. I was left thinking on my feet as a researcher, with insight gained into multiple issues of situated practices on one hand and no readymade solutions on the other. My ability to address such an ongoing demand was however informed by the psychological knowledge that a theory/practice stance that lead to dynamic researcher reflexivity (Seeger, 2001). Drawing on perspectives that understood human thinking as inclusive of external and internal processes and embedded in concrete activities (Scribner, 1997) it was possible to take action across theoretical and practical settings as a researcher-practitioner.

Not to say this was easy, since students, teachers and myself had varying affordances and agency in practice, as was the case in the four studies I conducted. Towards this I was informed by my choice of wholistic units that were dynamic and applied in a genetic manner along the length of my studies (van der Veer, 2001). My objective of portraying the grasp possible in deploying various Vygotskian units in this paper, has had to be traded off with the more detailed analysis afforded in each study in the limited space available. Yet I hope there is more than cursory argument to appreciate the objective of Vygotskian science to ascend to the concrete (Luria, 1979). By this is meant an approach by which scientific observation does not merely describe separate facts but develops the ability to view any fact encountered from as many perspectives as possible. It was persevering for a wealth of such qualities, that Luria argued, one comes closer to the inner laws that determine its existence.

My arguing in favour of Vygotskian units towards close-to-practice, action research and researcher reflexivity, was with a decided objective of making such units available to and implementable by teacher-practitioners. The need for teachers' to reflect on their teaching in their classroom practices seems unaddressed even today (Bauersfeld, 1980). The need for K-12 teacher-practitioners to contribute to research driven knowledge also seems elusive (Cochran-Smith & Donnell, 2006). My deploying Vygotskian units towards these important goals, is thus purposeful and inviting of wider efforts which allow a greater ascending to the concrete (Luria, 1979). It is towards these aims that I participate in a Topic Study Group on
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classroom practice (TSG21). I rally ICME12 as well, that maybe it is time we make a move from research on classroom practice, towards researching classroom practices.

References


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