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Narratives of students learning mathematics: Plurality of strategies and a strategy for practice?

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Reporting from a study conducted at a grade six classroom in Sweden, this paper takes a closer look at narratives from a Brunerian perspective. The features of what constitutes a narrative and what the conduct of narrative inquiry could offer are discussed. Researcher narratives of students are rendered providing insight into strategies beyond voices that students bring to situated learning. Robust recognition of narratives is argued for, as a means with which to strengthen teaching-learning practice and as implementable strategy with which to bridge research, theory and practice. In having potential to simultaneously be object, tool and result of the study of human development in practical activities, narratives seem also to satisfy a key premise of activity theory.

Advocating the active role of teachers in educational and professional research Lawrence Stenhouse is often quoted as “It is teachers who, in the end, will change the world of the school by understanding it”. Yet the manner in which either teachers or research grasps the complexity of schooling remains wanting of appropriate means. In this paper I attempt to address this problematic area by utilising narrative inquiry and report from a study conducted during the spring of 2009 at a grade six mathematics classroom at a Swedish school. Obtained by way of observations and interactions with students and their teachers my approach recognises that as storylines, narratives both represent and resolve the situated nature of individual experiences. In sharing narratives, I portray not just the voices of students but also their strategies towards learning mathematics in their classroom. The question thus addressed is - what range of voices and strategies do students narrate and display within the classroom teaching-learning of mathematics. Towards these aims I first refer to literature that illuminates the need for recognising the narrative mode of meaning being made within schools, followed by its study in the form of narratives. I then sequence student narratives before bringing my discussion to conclusion.
Schooling and narrative
While reflecting on Bruner’s legacy to educational theory, practice and research, Olson (2007) draws our attention to his exposition of intersubjectivity. Essential to the meeting between child and adult as also between mind and society, Olson points out that this notion of intersubjectivity is central to being able to understand our goals of education as well as the means with which to pursue them. Schooling in society for students, Bruner argues, is not only about the acquisition of valid knowledge and useful skills but also about being fulfilled and satisfied in experience - resulting in a deepening of understanding and an increasing level of the control. It is to arrive at such understanding that Olson (2007) reiterates the need for an anthropological study of schooling - to be in a position to appreciate its complexity and situatedness. This would also inform he says a pedagogy that encourages students as learners to formulate their own views and test them against those of others.

Bruner’s notion of intersubjectivity is accompanied by the attention he draws in particular to narratives. A principal means in which meaning is made and shared, a child’s narrative Bruner (1991) points out, is a vicarious means of accessing his or her meaning making and construction of reality. Bruner explains narrative (1985, 1990) to be a normative manner in which an individual deals with her or his intentional states and experience, offering us a window to a person’s voice, position and perspective while participating in any culture. As a mode of thinking that accompanies participation, narratives must be cultivated and nurtured Bruner (1996) argues for two vital reasons - to help children find their identity in the culture they are growing up with, as also to bring forth the plurality of voices that are to fill democratic classrooms. Attention to narratives towards understanding how students come to know and make use of the mathematics they come to know, has been argued for by Burton (1999). Such an approach she says provides access to a child’s agency within socioculturally complex settings, wherein the product of educational activities and practices is a text that has to be authored by learners.

My interest in narratives is to understand another aspect of pedagogy that Olson (2003) draws attention to - the formation of joint intentionality between students and teachers so that it is students who take up responsibility for their own learning. I found the incidence of this in an earlier classroom study (Gade, 2006) to be a process that involved negotiation of the bridge between personal and propositional forms of societal knowledge. This bridge in terms of which Bruner (1996) conceived schooling is analogous with what Vygotsky (1978) saw as that between everyday and scientific concepts. Making either transition involved students actively utilising available cultural resources - enabling them to define themselves as individuals in the process. Analysis of the use of the cultural resource of language is informed in particular by the Bakhtinian
construct of utterance (Holquist, 1990). As units of verbal communication as well as narratives, these are the stock in trade of teaching-learning. Bakhtin argues utterances resolve situated experiences and are realised materially in them. According to Holquist (1990) utterances are forms of communication that are particular to a person, relative to other speakers and never isolated from the context in which the speaker is situated. From such a perspective a student is constantly authoring her or his self in a process that transpires the length of teaching-learning. With a need to attend to narratives both to understand meanings that are being negotiated within schooling, as well as to grasp how students author themselves individually, I now turn to the possibilities afforded in utilising narrative as method of inquiry.

**Narrative inquiry**

The ubiquity of narratives is acknowledged by Barthes (1977) who states that they are simply found everywhere. Towards conducting narrative inquiry, I thus address what counts as a narrative before discussing what its pursuit can offer. With reference to the notion of truth Bruner (1991) argues that narratives being situated constructions cannot be verified and can only be judged by truth-likeness or verisimilitude. However and even though they are never faceless Riessmann (1993) argues that narratives can be sorted into categories allowing one to always ask why particular stories are told in particular ways. Ochs and Capps (2001) say in addition that narratives as stories may not occur in a finished form, as a narrator could well be in the middle of sorting out his or her experience. How then are we to distinguish everyday conversations and talk of students and teachers from narratives? In not being restricted to the medium of texts that I offer, Herman (2009) offers four characteristic features of a narrative: (1) a quality of being situated in a sociocultural setting; (2) a sequencing in time of events that take place; (3) a certain disruption of the world for a particular story to have been made or told; and (4) a concern for what it is like for the narrator to have the kind of experience that he or she is relating. Identifying narratives with these principal features I now turn to the conduct of narrative inquiry.

As a text that is both a process and a product, Clandinin (2007) points out that a narrative is a profoundly relational piece resting heavily on the ethical role of a researcher. As a method within qualitative research, Clough (2002) adds that the challenge of any narrative is in its being able to translate life as experienced - offering insight into events that seem familiar. In such a rendering the voice of the researcher, mine in this paper, not only offers the narratives of students but also the basis for their interpretation. My writing then is meaning made by me in retrospect, combined with a search for the distinct voices of students while learning mathematics in the sociocultural classroom I studied (Chase, 2005). The narratives that I offer are thus obtained by conducting what Mishler (1986) calls
research interviewing wherein the context of my conversations are not relegated to the background, but a living part of my interactions with students and teachers. Either of them were collaborators with whom I shared control so that we could together understand what the story being made was about (Creswell, 2002). Working with narratives has advantage of working in a medium in which most teachers as practitioners work (Polkinghorne, 1988) making it possible to be a form with which to bridge a research-practice divide. The need for practice based empirical evidence within mathematics education is also argued by Silver (2009) with an objective of developing what he terms as a practice based professional development for teachers. With narratives having potential to inform a wide range of issues across educational practice, I now outline my role as researcher and the relevant aspects of the classroom in which I conducted my study.

The students in my study were taught mathematics by Lea in a class whose class teacher was Sofia (all names are pseudonyms). Lea consented to my being participant observer and took permission from the concerned parents, introducing me as a researcher at the University close by. Since I was not Swedish speaking everyone understood that I could learn some Swedish and they could learn some English. I observed Lea's conduct of instructional activities in a naturalistic manner. Lea eased me into her class with great sensitivity, which I hope to have reciprocated. After initial curiosity about my country India and if I could tell and spell their names correctly, Lea's students would approach my working table placed behind their desks. This table was used by Lea to work with students who sought her attention, though she also sat with them if necessary at their desks or with them in the adjacent group room. Over time students would ask her if they could work with me and Lea also asked if some students in particular could. Where some of my interactions with them were not in English I would ascertain the meaning and context of the Swedish used. An aspect of Lea’s practice that I found noteworthy was her having readily available, worksheets of mathematical problems copied from a book designed for such purposes (Rockström, 1996). I found students to attempt these on their own, as well as Lea to recommend specific ones depending on her judgement. In this manner Lea’s students always had some form of mathematics to pursue at all times. I offer in the next section, narratives of three students with whom I had opportunity for greater interaction than others. Drawing also upon observations made by their teachers, these were triangulated with observations I made while conducting problem solving sessions with student pairs and a year-end interview with both Sofia and Lea.

**Alex, Felix and Kim**

“Your work with Alex was a success” said his mother whom I met when he was in grade seven. Lea asked if I could work individually with Alex, who she said would ask her once again something she had mentioned to him a moment or two
ago. During her meetings with Lea and Sofia, Alex's mother would agree that Alex needed to work additionally at his mathematics. Looking to explain his performance she would surmise “He is a humanist, like his father.” Lea wrote to her saying I would work with him. “I will also encourage him at home,” she replied. Alex had a sensitive command over English making it easy for me to work with him. He struggled with reducing fractions to their lowest terms. Alex wanted to reduce 24/72 at one go to get 1/3 which he saw other students being able to do. I suggested we simplify his fraction by reducing the numerator and denominator one factor at a time. Upon suggesting the factor of two, Alex was able to divide 24 but was hesitant and unsure of dealing with the carry over in 72. We soon spread out in the space of the group room and worked at building tables with appropriate number of rows and columns of coloured pencils. He was able to find patterns in the tables of 2, 4 and 8 as well as 3, 6, and 9. This was after finding more obvious patterns in the tables of 5 and 10. I encouraged him to find patterns in a 10 by 10 number grid over his mid-semester break but he said he lost the papers. During my conduct of problem solving he solved one problem easily and fluently in English, “Is it 12 [cm²] ... Because if this is 6 [shaded star] and this is one star too and when you put them together you get 12.”

When asked if he enjoyed his problem solving session, Felix chose his words in English and said “This was special!” My interaction with Felix was mainly when he attempted a numerical crossword in one of Lea's worksheets. He worked through the clues to arrive at numbers that were to fill the crossword. Occasionally he turned to me to solve say 2 × 47 × 5. On blanking out 47 with my finger and asking him what 2 × 5 was, he saw the point of not multiplying 2 and 47 first. He turned to me again when the clue asked 124 ÷ 89 – 123 where my finger on the number 89 was followed by his saying “90”. Working quietly he finished the crossword which then asked children to add all the digits that were entered. The instruction beneath read “If the sum is 108 you have worked correctly”. Felix now started working with a pencil and shifted to writing on his table. He wrote down the digits he had entered and added them in pairs obtaining get six secondary sums. Adding these sums two each at a time, he obtained three tertiary sums. Upon adding these three tertiary sums at one go he did not obtain the stated total of 108. But I was nearby. We then took a blue coloured pencil and tallied the entries on his worksheet. A few needed correction. What now about the many sums on his table. With a green pencil we now tallied and traced which one of those were incorrect and corrected the same. “Mycket tack [Many thanks] Sharada!” was his low cry when he obtained 108, hands on his head. “I am not too worried about Felix” Sofia would say, summarising him as a student at the end of the year, “His parents are patient and good with him.”

I found Kim waiting patiently at my table one day. I wondered why he was there yet soon got involved with his class work wherein he showed great facility
with numbers. “You are good” I said and asked him a question a notch tougher. “You are good” I reacted. “But I am not good at my reading” he said, conversing in English. The next day, I took suitable material to evaluate his reading which he showed no problem with. “I’ve told my colleagues about you, but I did not tell them who you are.” I said. “Oh thank you” he said, happy to not be in the midst of limelight. What was his problem then? He showed me a page of text from a story book. “I am slow” he said. I shifted strategy and took him mathematical problems (Hagland et al., 2005). How many different kinds of ice creams combinations, each with two flavours, could be made with four different flavours? He paired his fingers and showed me six possible pairs on the diagram given. He went on to say that “if three flavours were to be chosen, then …” Kim chose to next work with a problem related to the pieces of a tangram. If the area of all seven pieces together was 400 cm² what was the area of each piece? Kim obtained a ruler and measured the many sides and struggled. I introduced him to an algebraic approach in a while. “Which of the pieces look alike?” He pointed to the two largest triangles that made up one half of the square and said each had an area of 100 cm². We now found ourselves working with the other half. “Are there any more similar pieces, and, shall we give them a name?” He suggested “A” and labelled each of the two smaller right angled triangles. Some more silence with three more pieces to go - a square, a larger right angled triangle and a parallelogram. Proceeding intuitively he said that the square was “Two A’s” just as the larger right angled triangle was also “Two A’s”. The parallelogram he concluded “Must be two A's as well!” and went on to calculate the area of each of the pieces saying “I did not think this would be so easy!”

**Voices and strategies**

The three narratives I present were formulated against a textual backdrop of nineteen other classmates, some of whom I now sketch in brief. In their efforts at learning mathematics, I observed Emma to cut the net of a particular cube drawn on paper with scissors to be able to convince her partner Lisa as to why the given diagram would not form one in reality. I also noted Lisa to one day cut a net of five squares and tape the adjacent sides, in order to measure the volume of water that could be held. I found Casper to keenly observe Lisa in her attempts. Lea mentioned Casper to “think fast yet fell short in written work”. Casper solved a particular problem which awarded three negative points for an incorrect answer and five points for a correct one in no time. On inquiring how, he simply said “Oh! It just came to me.” The class also consisted of Elias and Ella a pair of twins who seemed to exhibit a reversal of gender stereotypes. While Ella was probably the most adept at football in the class, Elias was fond of art and puppets and on one occasion used matchsticks to explain his solution to his partner. Taken together with narratives of Alex, Felix and Kim, these thumb line sketches of
their classmates, allow me to evidence not merely the presence in them of a plurality of voices but more crucially the presence in them of distinct strategies with which each were, as Burton (1999) argued, authoring themselves.

I crafted the three narratives I present towards the end of my study, by which time I had assembled in a historical manner for each student, utterances and anecdotes that I took down in my field notes. I now discuss how these differed greatly with reference to Herman’s (2009) four features of a narrative: sociocultural setting, sequentiality of events, disruption of everyday routine and the individual experience of the students. While the sociocultural setting in Alex's case bridged his home environment and school, that in Felix's case was limited to a single problem in the classroom, where in my interaction with Kim both classroom and University were involved. The sequence of events from which I drew upon also differed in that my interaction spanned a few months with Alex, about an hour with Felix and the duration of my study with Kim. The disruption of routine events that allowed me access to the narratives also varied. In Alex's case this was initiated by Lea. My physical proximity to Felix led to my accessing his, and my presence as a researcher in the classroom led to Kim's. I point out that it was while eliciting the experiences of students as narratives, that their attempts at learning each portrayed a different story. While Alex's story is window into the nature of his struggles with respect to the mathematics being demanded of him, Felix's story is one of his ability to utilise assistance to diligently pursue his own goals. In this he revealed that he knew when he needed guidance, as well as how to utilise the guidance that was available near him. Unlike Alex and Felix, Kim's storyline of learning was different yet equally demanding. Kim both thought and demonstrated that he was adept and capable. It is possible that Kim was looking for challenges not available to him within classroom teaching-learning.

Five aspects of the conduct of narrative inquiry seem significant and worthy of a closer look here. Firstly, the utterances of students and teachers I drew upon in my study spoke for them in the material of language. Following Bakhtin (Holquist, 1990) they were the medium in which students participated in various classroom contexts in which they found themselves every day. Secondly, when formulated as narratives following Herman's (2009) criteria, one was able to highlight and discern the strategies of students from familiar talk that prevailed in the discursive space of the classroom. Third, in accessing the narrative mode of thinking that students were sharing and making public, one had insight into the nature of relationships that they were formulating with themselves, with one another as well as with the subject of mathematics. Following Bruner (1990) and even if vicariously, such access to their intersubjectivity offered a window into the world-making of students within which they were acting. Fourthly, my conduct of narrative inquiry offered means as argued by Olson (2007), with
which to gain insight in anthropological terms into the manner in which classrooms realise the goals of schooling. Finally, in the form of situated narratives I find teacher, educator, researcher and policy maker to have the same basis with which to appreciate, though upon differing expertise and verisimilitude, the everyday actions of students in their classrooms.

**A strategy of and for practice**

Drawing attention to the need for understanding how the personal knowledge of teachers is shaped by the practical realities in which they work, Clandinin and Connelly (1996) argue for new ways with which to relate to the contextual nature of professional landscapes in schools. Towards meeting this objective I argue that the benefits of the conduct of narrative inquiry in classrooms deserve a closer look at two noteworthy levels – of practice as well as for practice.

At the level of practice, my study evidences how students utilised various cultural resources that were prevalent in their classroom, to demonstrate the sense they were making of the mathematics they were learning. For this they utilised scissors, paper, matchsticks, their language, the teacher, each other and even the researcher. In so doing they brought forth and shared their personal knowledge of mathematics, which Bruner (1996) and Vygotsky (1978) argued that education was to change into academic and scientific forms. The utilisation of various cultural resources by students in my study in turn informs another aspect of practice, the kind of teaching practice that Lea had established in her classroom. In her students being able to share in comfort and without hesitation their natural dispositions and understanding of the mathematics they were learning, Lea was able to inculcate as pointed out by Olson (2007), the adopting of responsibility by students of their own learning. I however argue that these very features of Lea's classroom also lie at the heart of a larger initiative of sustaining and strengthening teaching-learning in classrooms contexts. Whereas conceptualising education in terms of bridging personal and scientific forms of knowledge, and of students taking responsibility of their own learning may seem straightforward, the fact that Lea has to deal with the plurality of voices and strategies that her students demonstrated arguably makes very high personal and professional demands on her.

While Lea is seen to have considerable freedom to interpret her teaching on the basis of her students' experiences, interests and needs (Skolverket, 2008) in the light of my study it seems possible that this is the challenge that not just she but all of us who are keen on improving classroom practice face. Curriculum guidelines (Skolverket, 2006) seek that Lea stimulate her students, take as her starting point each student's needs and thinking, while also provide them scope for individual creative expression. I find both these guidelines well grounded in Lea's teaching practice. However, finding syllabus and curriculum guidelines
well grounded in my study in no way diminishes the challenge that I contend Lea to face in her classroom day in and day out. The goals that Lea needs to achieve and strive for weigh in her classroom, alongside the expectations that Sofia as class teacher has about the performance of her students at National Tests. Though additional materials like worksheets were found to be of time-saving value in my study, I argue that we may need to think in terms of assisting specific areas of ongoing classroom teaching-learning or, for practice.

What can be done I ask, to strengthen Lea’s teaching-learning practice so that she is not left feeling she that had no time for any of her students. And even if Lea had the time, I am not sure we are in a secure position to say in what way she is to cater to the plurality of voices that her students exhibited. I maintain that we may be encountering a problem that research needs to pursue - one which better understands the nature of learning strategies that students adopt, so as to gather these in more identifiable and perusable forms. With adequate number of cases pooled together, we may have the basis with which to contribute to and build a practice based professional development for teachers as argued by Silver (2009). The sketches and narratives of students at grade six for example, show the manner in which their mathematical abilities were embedded in the concrete as well as how students were both wanting and deserving of explicit attention from their teacher. As with Alex, one’s personal ability at mathematics seemed inseparable from the disposition that one brought to one’s learning as a student. Being able to discuss narratives in the form of such cases would, I argue, allow practising teachers the opportunity to draw from both personal as well as professional experience and offer reflections that could be beneficial when analysed and shared with one another.

Deploying narrative inquiry as a means with which to strengthen teaching-learning may have yet another advantage, that of communicating in a medium in which most teachers conduct teaching practice either with students, parents of students, fellow teachers or in various acts of mentorship. A narrative approach could thus afford teachers, implementable means with which to grasp one’s own professional landscape, the benefits of which Stenhouse argued had potential to bring about change in schools. Present tacitly in a teacher's repertoire such an approach may however have to be recognised, legitimised and endorsed in robust terms of research. Such attempts would be able to inform two critical and crucial aspects of classroom practice – the gap between personal and scientific forms of knowledge that students are expected to bridge and the persisting gap between theory, research, policy and practice that teachers are left with bridging.

One final thought crosses my mind in the conduct of my study - that of the parallels I observe in the methodology of narrative inquiry with those forwarded by Vygotskian (1978) perspectives. In having potential to appreciate and understand human development within practical activities, in a medium and
means that is simultaneously object, tool and result of the study, I believe the
counsel of narrative inquiry to reflexively complement a central tenet of Activity
Theory. Drawing upon a mode of thinking that Bruner (1985) differentiates from
the logico-scientific mode - a mode synonymous with mathematics, I contend
that attention to a narrative mode of thinking and situated narratives to be
beneficial to the education of mathematics or mathematics education. Can a
narrative approach as outlined in my study, not be an implementable strategy
with which to bridge educational research, theory and practice within
mathematics education?

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