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A STORY OF A STORY: SOME METHODOLOGICAL ISSUES ARISING FROM

NATURALISTIC RESEARCH IN MATHEMATICS

- **Case study is the way of the artist, who achieves greatness when through the portrayal of a single instance, he communicates enduring truths about the human condition.** •

  (Macdonald & walker 1975)

This is not meant to be an exhaustive inquiry but simply a brief account of some of the issues posed by case study and in particular the processes of validation. What it is that I am searching for when I seek to substantiate my interpretation of a case study ? In what sense are the insights that I yearn 'enduring truths '?

Data Collection

On this occasion the primary data, an interesting vignette of mathematical activity was collected by hurriedly scribbled transcript. I am always very aware when working with case studies that I am telling a story about a story of an event. The primary source of data is not what actually happened but my portrayal of that event. Lakatos (1970) reminds us that we are not looking for facts to ground theories but for " interpretative theory to provide facts and explanatory theories to explain them." Is it possible to unravel what really did happen ? Having relinquished the notion of objective truth ,can I give a subjective account of what I experience entirely expunged of ideological bias ? I would assert not. Judgements and partiality are even inscribed in the language I use to describe the experience.

How accurate is my original story on this occasion and what did I miss in capturing it? The odd word perhaps .... but then there are the visual indicators missing of course, the pointing, the expressions. Then there are the syntax indicators, the pauses and intonations which break the undifferentiated sound string into meaningful ideas, I as scribe insert these myself. It appears that in order to reconstruct the meaning of even the simplest of statements I bring with me much more than just a vast internal dictionary I also bring a complex web of interpretational skills and responses fashioned by years of experience. The meaning of an utterance cannot be established solely by reflection upon the actual words, regard must also be paid to the intention and circumstances of the speaker. Fortunately as a participant in this event I developed an empathy for the speakers and along with the bare transcript I took with me much ephemeral evidence.

Covert Effects of Data Collection

As a participant observer in the classroom did my presence in any way influence the unfolding of the event ? Most probably very little on this occasion, I was the class teacher and the sight of me scribbling on the back of a worksheet was clearly so unremarkable that nobody even sought to question what I was doing or why. This however brings to my mind a very different episode which occurred a couple of years ago when I decided, on a impulse, to monitor the 'on task' activity of some students with an observation schedule. To ensure that I would collect some interesting data I choose a pair of girls known to be easily distracted. Typically the girls began to chat and I immediately became aware of my dilemma . Clearly it was an activity I had not

thought through because I was the person who would normally censure this type of behaviour and yet to do so now would prejudice my account of the very behaviour that I was monitoring. It was possibly at this point too that the girls became aware of my particular interest in them. The scenario must have seemed puzzling, I was glancing at them frequently, but not reproachfully, and made no attempt to rebuke them for their behaviour. The episode quickly evolved to a more bizarre level when my activity clearly became the focus of their discussion. In one easy step I had actually precipitated the behaviour I was attempting to monitor. The incident was amusing and very transparent but how often am I unaware that I am provoking certain responses by my very presence? Neither is it just the 'human effect', even a video camera which enjoys a reputation for furnishing an impartial and dependable chronicle of activity can affect the unfolding of an event. Aside from childish exhibitionism it is not easy to ascertain which behaviour is enacted specifically for the camera but one snippet which I picked up as I was scanning a tape was, "Quickly somebody say something or she will take the camera off us." How many vital pieces of evidence slotted into my jigsaw were just thrown in to stop me turning the camera away I mused? Neither is it just the social sciences that are prey to such soul searching mearly to be sure of the evidence they are collecting. Pawson reports that Collins (1975, 1981)

" Has produced some influential work which relates to how science operates in the absence of a secure observational base."

He cites the physics of gravity waves as an example of an area in which it is immensely difficult to collect data. The apparatus used to investigate Einstein's prediction that the gravitational forces on earth fluctuate as a result catastrophic events in outer space is a vast metal bar weighing several tons, it is suspended in a vacuum chamber to protect it from influence by other more localised forces. When minute variations in the gravitational forces are recorded, before attempting to explain them in the light of Einstein's theory, the debate rages as to how the scientists can be sure that the oscillation is caused by a super nova and not a man drilling up the pavement out side !

Observation is Theory-Laden

"Numbers gathered without some knowledge of the regularity to be expected almost never speak for themselves. Almost certainly they remain just numbers." (Kuhn 1961) . Most probably I already have a theory which prompted me to notice what I did. For example, I am continually noticing that observation is theory-laden. Very often after experiencing a new insight I find that in the next few days I am aware of instances of it everYWhere I go. I am often left wondering whether there has been a sudden epidemic, or if the cases were always there and I never noticed them before Language operates in a similar way, it does not determine thought most would assert, but it does regulate what we pay attention to. That is, I notice around me things that I recognise and can easily categorise or label. I do not of course always have one specific theory overtly in mind when I go out to collect data. I do however always have at my disposal a network of conjectures and suppositions, interpretative schema, within which I can situate new experience and observational data. I have built up this interpretative network over the years, distilling it from external data and internally generated reflective knowledge which I have sifted, classified, refined and generalised .

<u>Validation Techniaues</u>
" Any statement can be held true come what may, if we make
drastic enough adjustments elsewhere in the system. " (Quine
1951) Possibly I may now wish to convince others, to whit, 'a
friend and an enemy', that I have not made too major an
adjustment in the system! It may be to add to my personal
conviction, to increase the credibility of my research or simply
to jump through an academic hoop ! I have various options open to
me, one is peer validation which appears a seductively simple
process but is I find problematic in certain respects. My primary
concern is that the more explicit I am to my colleagues about
what I am paying attention to and the theoretical framework I am
using to construe it - the more likely it is that they will see
what I see. And, conversely, the less explicit that I am, the
less likely it is that they will be able to focus on anything
very easily. As a consequence I feel it is very difficult to
construct a truly critical community. What does it mean then if
people confirm my way of looking ? It certainly means that it is
less likely to be completely unreasonable. But it could just be
that they have not questioned my hypothesis rigorously. If they
all completely disagree with me it definitely means that I must
rethink, but must keep my mind open to the possibility that I am
surrounded by a lot of flat earth freaks! Whatever the response I
can never be certain that my interpretation was valid, I can only
be hopeful that it was not a completely unsatisfactory fit?
A second option open to me is that of involving the students who
were the subject of the study. This again raises certain issues
Tripp (1983), who has explored the avenue of co-authorship and
the question of who 'owns' the data ,concludes that "researchers
are not so much outright owners as majority shareholders. As such
they may decide policy, but they also need to justify it.The
participants as minority shareholders, are entitled to criticize
publically." Where the study is of covert cognitive process of
students however other issues are involved. Time has almost
inevitably elapsed since the study and the students will have
undoubtedly developed in their understanding and knowledge of the
work which they were exploring. Subsequent interests and insights
will in the interim, even if this is only a matter of days, have
imposed new structures on their memory of the event. It is also
clear that the researchers account of the event will have
analytic purpose which will be incomprehensible to the student.
Rather, their contribution would be essentially on the level of
examining the researcher's interpretation of their statements. In
the event of a disagreement occurring however what criteria could
be applied to establish the favoured version? Bloor concludes
that "Members' pronouncements on findings cannot be treated as a
test of validity ... (but) can generate material which is highly
pertinent to the researcher's analysis ... not as a test (but) as
data."
<u>Theoretical perspectives on validation</u>
"That multiple research methods should be employed in a variety
of settings in order to gain a total picture of some phenomenon.
" seems a commonly held view but as Silverman (1985) continues
"Putting the picture together is more problematic than such
proponents of 'triangulation' would imply. What goes on in one
setting is not a simple corrective to what happens elsewhere-each
must be understood in its own terms." Viewing a situation from
different perspectives may however give me more confidence that

I have questioned my interpretative framework rigorously enough to ensure that it is supportable. For, as Heidegger cautions, " Our first, last and constant task is never to allow our fore-having, fore-sight, and fore-conceptions to be presented to us by fancies and popular conceptions, but rather to make the scientific theme secure by working out these fore-structures in terms of the things themselves."

Gadamer developing his mentor's theme doubts the possibility of developing universally valid principles. His position is that practical situations yield moral knowledge which guides the choice and judgement of the inquirer, whose values and beliefs are continually being tested and modified through his interaction with the world. It follows, that the meaning of a situation is not an objective characteristic derived from setting aside values and beliefs but rather it is an attribute generated by applying them to the situation. Elliot (1987) observes that;

" one does not first understand things and then interpret their significance for one's values and beliefs and the practices they shape. Interpretation constitutes a moment within the process of understanding itself."

Habermas supports a different paradigm, however, which asserts "one cannot reduce all social understanding to an interpretative science" (Elliot 1987). Following in this tradition Kemmis and Carr have developed 'critical theory' the function of which is " to expose those false beliefs which sustain practitioners' misunderstandings of their practice, to identify those organizational arrangements which frustrate the pursuit of genuine educational aims and purposes, and to indicate to practitioners what needs to be done for those misunderstandings to be removed and the adverse effects of these organisational arrangements eliminated." (Carr 1983)

This seems to be a very powerful narrative supporting the notion that there is an ideal position from which to view the playing field. And, that it is inhabited by critical theorists who are capable of adopting an objective stance in order create a framework of awarenesses that we, the practitioners, may use to "eliminate false consciousness" (Gubba 1990). Critical theorems can be rejected by the practitioner only in circumstances of free and open discussion, presumably by practitioners who have passed successfully through the debugging framework ! Who one might ask is going to monitor the consciousness of the expert who is "concerned with the development of explanations for the ways political and social forces in the society ideologically distort teachers self-understandings and practices." (Elliot 1987) .
Elliot himself believes that "The moral science paradigm of educational research incorporates its own critical perspective. It does not need to be supplemented by a critical paradigm based on absolutist and objectivist assumptions about the nature of human understanding. The advocacy of such a paradigm could itself do with a little ideological unmasking, for does it not once more allow the academic experts to play God with the teachers?"

Conclusion

So how does my case study rate on the validation front ? Well I find that if I assess my findings against commonly held criteria (eg. Lincoln and Gubba 1985 'trustworthiness' of naturalistic enquiry) there are many ways in which it falls short of expectations. Firstly it is not replicable or 'confirmable' ‚if I waited and watched for a year I would most probably not see a

similar episode enacted before me. Neither would I expect the result to be 'dependable', it is particular case rooted in particular circumstances and there is no guarantee that, even if the circumstances were identical, which they couldn't be, that the event would unfold in the same way. I would hope however that the findings were 'transferable', not directly, but through their link to a theoretical framework. It is this aspect of the research which establishes its robustness. Kilpatrick observes; "Each empirical research study in mathematics education deals with a unique, limited, multi- dimensional situation, and any attempt to link the situation considered in the study with one's own 'practical' situation requires an act of extrapolation. Extrapolation requires, however, that one embed the two situations in a common theoretical framework so that one can judge their similarity in various respects."

Leaving what is to me a most difficult question, are the findings credible ? Wherein lies the credibility? Is it in the eye of the beholder ? Is it in the research ? Or is it in the researcher ? Would the findings be more credible if John Mason had stated them rather than me ? Certainly were the findings to be highly controversial, the credibility of the researcher would become an important issue. The same issue is at stake when I use quotes to help me marshall an argument, I attempt to make the argument seem more substantial by demonstrating support from eminent people. So why do I feel the need to demonstrate the 'trustworthiness' of my research ? The reasons may be many and may vary from personal gratification to academic necessity. Does the apparent rigour of the validation process have any affect upon the perceived 'worth' of the research findings ? How is worth measured? Well certainly when looking at research aimed at creating knowledge for teachers 'relevance' and 'affect upon practice' might seem two possible criteria. But strangely there appears to be a negative correlation between the rigour of the validation process and the accessibility of the research to teachers. On a physical level, the most firmly substantiated research findings are often hidden away in Phd theses, possibly to be eventually filtered down in a simplified version to a professional journal. On a cognitive level the language is often exclusive in the extreme and psychologically there can be a barrier, a mystique, which both researchers and teachers are guilty of promulgating.

I do not expect my case studies to establish knowledge by predicting regularities or determining rules. Rather I would hope that they would do so by generating new insights about mathematical activity by illuminating fragments from a whole set of interlocking theoretical frameworks (eg. linguistic, educational, epistemological). There is, I would assert, no ideal position from which to mount a critique of a piece of research. The standards any critic employs are inevitably limited by their particular perspective. And from that perspective, to me, validity lies in credibility and the overall cohesion of the story which *you* tell with its network of interrelated theories.

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