

**"CONSTRUCTIVIST" PEDAGOGICAL PRACTICE IN PRE-SERVICE TEACHER  
EDUCATION - THE CONSTRAINTS OF CONSTRUCTION.**

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## "CONSTRUCTIVIST" PEDAGOGICAL PRACTICE IN PRE-SERVICE TEACHER EDUCATION - THE CONSTRAINTS OF CONSTRUCTION

*Recent policy documents such as the Discipline Review of Teacher Education in Mathematics and Science (1989) advocate "constructivist" pedagogy in the tertiary sector so that pre-service teachers are enabled to learn mathematics "by constructing their own knowledge through discovery, exploration and problem solving in relevant and supportive environments (p.17)". Having completed a three-year action research project implementing just these recommendations, I am led to critique "constructivist" practice for the dangers inherent in its framing in the metatheoretical perspectives of cognitive psychology. The persistence of an acritical view of the social and discourse relations within "constructivist" practice cannot but prejudice the dual expressed goals of the Discipline Review for "...a literate society, a problem solving society" which "...recognises social justice and equity as major goals" (p.7).*

### INTRODUCTION

One of the most important things I have learned from my research is that good pedagogical practice does not equate with getting "the" method right. The inverted commas around "constructivist" in the title of this paper herald the differing interpretations given to a form of practice based on an epistemological notion of active construction in a supportive environment. Take for example Malone and Taylor's (1993) *Constructivist Interpretations of Teaching and Learning Mathematics*. As in the initial cycles of my research, there is invariably represented the individual, constructing knowledge in an environment recognised as "social" towards socially shared understandings. Mathematics is suddenly enjoyable and comments such as the following from my students are representative of the group and quite often cast me in an almost evangelical light:

Hands on learning means that each week I have had lights go on in my head. Mathematical concepts that I dismissed as being too hard for me, have suddenly made sense. Oh why wasn't maths taught like this when I was at school? I am enjoying maths for the first time in my life and I thank you for being the one to show me the light.

Some students expressed the opinion, when asked, that the only students disadvantaged by the constructivist pedagogy "were the lazy, laissez faire". But I noticed minority groups with disproportionately large failure rates and in re-assessing the data from the evidentiary archive became aware of

the constraints of the construction of all students within a discourse which<sup>375</sup> still does not adequately appreciate the "sociohistorically and culturally constituted dialogical process of meaning making" (O'Loughlin, 1992, p.811).

## THE POLICY

The *Discipline Review (1989)* laments that in many cases the teaching of mathematics has not changed much in the past twenty years. Changes are deemed necessary to address "the developing needs of our society which is being driven to respond to, and interact with, more technologically advanced countries and regions" (p.16). These societal demands are "very much a responsibility of mathematics education" (p.16). What is required of mathematics teacher education programs are that prospective teachers are taught in a manner similar to how they are to teach and that programs are gender inclusive.

The *Discipline Review (1989)* presumes that if student teachers are taught in a "constructivist" manner then they will be able to pass on knowledge gained to children in classrooms. By the manner of teaching, teacher educators are to "overcome the students' anxieties" and "promote enthusiasm for mathematics" (p.24). Although there is much to celebrate in student teachers' grasping of mathematical understandings previously denied them, there is much more to be considered before "constructivist" practice as depicted in the *Discipline Review (1989)* can also be deemed responsible pedagogical practice. Cognisance needs to be given to the notion that the self *is socially constructed* in discursive practices such as "constructivist" pedagogy and though probably more efficient, is such practice (can it be) any more socially just than transmission models of instruction?

## THE METATHEORETICAL FOUNDATIONS OF CONSTRUCTIVISM

A notion of mathematical activity in a supportive environment is "a common thread" uniting all constructivists according to Davis, Maher and Noddings (1990, p.3) where the teacher is to "provide the setting, pose the challenges, and offer the support that will encourage mathematical construction". Though not all who would call themselves constructivists have expressly grounded their work in Piaget's developmental psychology (Ernest, 1991), the importance accorded individual cognitive development

towards higher levels of abstraction in a supposedly value-free and neutral "environment" ensures the continuation of "business as usual" in mathematics education with regard to possibilities for transformation.

First, individual cognitive development is given priority over "material interests, social practices or objective properties of the stimulus situation" (Sampson, 1981, p.731). The learner is an *epistemic subject* who "abstracts from experience logical schemes and discards the experiences themselves as empty shells" (Venn and Walkerdine, 1977, p.79). The knowledge constructed, abstract reasoning and logico-mathematical problem solving valorises the instrumental and serves the interests of efficiency in technologised societies. By unquestioningly accepting these metatheoretical assumptions underlying "constructivist" pedagogical practice, we affirm these values, so constructing students in particular ways as they themselves are involved in the active construction of knowledge.

#### "CONSTRUCTIVIST" PEDAGOGY CRITIQUED

Although there are many interpretations of "constructivist" practice in mathematics, in this section of the paper I examine such practice as enacted in the first two cycles of my research and as suggested in the *Discipline Review* (1989). This interpretation finds expression as an educational practice not informed by a developed pedagogy and often equates with a method of teaching or instruction prioritising the provision of a "supportive" environment. For example, in my research with pre-service teachers, there was an emphasis on student construction of knowledge in a problem-solving environment where "students are able to question and be critical of their own previous learning experiences and where no blame is attached to previous failures or negative attitudes" (*Discipline Review*, 1989, p.24).

While I progressed through the various stages of this action research project, my responsibility was to adequately prepare large numbers of students for teaching mathematics in the primary school. An aim of the course was to have students reconstruct (or construct) some knowledge of angles so that they would be able to pass on this knowledge to their pupils later (*Discipline Review*, 1989, p.24). Activities were set up so that students themselves turned quarter turns, half turns; turned pages and doors to make small and large (acute and obtuse) angles; investigated

simple and difficult ways of making a "square corner" to measure right angles; discussed the use of various angles in the environment; learned (or revised) the use of a compass and a protractor; and investigated finding the heights of buildings and trees using an isosceles triangle as well as constructing spirolateral walks. 377

Comments from students about the activities were invariably very positive. Generally students hadn't previously grasped the "amount of turning" concept of angles and they felt empowered that they had now at their fingertips lots of activities to do with children in the classroom. Representative comments read:

"Hands on" tutorials were great. Breaking up into groups to discuss was beaut. The subject kept us motivated and was very relevant to teaching. Yey! I showed my supervising teacher my geometry and she was impressed how I used it in the classroom. The activities gave me more confidence in maths. Thank God I'm still allowed to be a learner!

As far as my memory goes, this would be one of the few times in my life that mathematical knowledge has been imparted in such an easy understanding way. Up until now I had always considered maths as something you would have to know to do accounting or technical drawing or other such subjects. I did not consider then that it had many real uses in the real world.

However, at the completion of the second cycle, although the students themselves felt empowered, it was not at all clear whether they would be capable of realising either of the aims previously expressed by the *Curriculum Review (1989)* for a "productive society" with "a commitment to equity and social justice". Although the majority of students had learned a lot of mathematics, they still wrote frequently of "imparting" "conveying" and "transmitting" mathematics to pupils, demonstrating still a purely cognitive view of an individual learner of mathematics in an apolitical and ahistorical "environment". Although "constructivist" practice alludes to the "social" construction of knowledge, the "social" is inadequately theorised and so cannot account for the individual himself/herself constructed through *knowledge effects* - an individual ultimately incapable of bringing about transformation because any problems are invariably perceived as cognitive and individual/technical, not "social" (socio-cultural) in origin.

The concern lies in the translation of an epistemological position directly into a method of teaching which places "a cosmetic bandage on the hard body of classroom contact" (Lusted, 1986, p.2). The result is the

elision of "constructivist" practice and constructivist pedagogy. The inverted commas can be removed if we draw attention to the *process of knowledge production* and do something to address the inherent implications. If we are to talk at all of *pedagogy*, we must address the dialectical relationship between the learner, the act of construction and the knowledge produced and theorise the "environment" as much more, and often much less than, supportive. The process of *coming to know* and the co-constitution of students (and teacher) within the co-ercive spaces of the institution is a political process, and all relationships are power relations. Two implications for "constructivist" practice discounting the aims of the *Discipline Review (1989)* would seem to follow: (a) since practice is dialectically related to context, there seems to be little reason for presuming that simply because students have learned mathematics through involvement in problem-solving activities, that they will be able to reproduce these activities in the classroom; and (b) while learning mathematics is seen as a purely cognitive, individual act of construction of pre-determined mathematical concepts and principles, and not as a socio-cultural political process of inscription, there can be no realisation of social justice and equity as process or product.

#### THE POLITICS OF CONSTRUCTION - SOCIAL AND DISCOURSE RELATIONS

That prospective teachers come to tertiary education inadequately prepared for "teaching mathematics for understanding" (Ball, 1990, p.465) obviates the need for change. Pre-service teachers can be provided with the opportunities for constructing mathematical understandings previously denied them and often feel empowered for having been actively involved in learning. But the notion of empowerment warrants serious consideration. Secada (1989, p.40) adds a cautionary note that "those who are situated to take advantage of educational innovations receive a disproportionate amount of their benefits". So questions need to be addressed of empowerment for *whom* and *for what*?

Wertsch (1991, p.8) proved instrumental in helping me think about active involvement in a sociocultural context where "human beings are viewed as coming into contact with, and creating, their surroundings as well as themselves through the actions in which they engage". Drawing heavily on the work of Bakhtin (1981, 1986), a soviet theorist introducing the concept of "mediational means", Wertsch (1991) demonstrates how one's

social, cultural, historical, and institutional setting are linked in engagement in knowledge construction. So as teachers and learners are involved in the negotiation of meaning towards "viability" in mathematics, they are socially and culturally constituted through language forms that are socially based. "Negotiation of meaning" is culturally framed "because any frames of reference we bring to bear, and any language forms we choose to use, are sociocultural in origin, and come to us burdened with their share of culturally laden significances (O'Loughlin, 1992, p.811). The process of construction of knowledge is multivoiced and dialogical and those in positions of power determine the genre of the discourse. A primary constraint of construction within "constructivist" practice as within transmission methods, is that through *knowledge effects* - concerning the reinforcement of mathematical knowledge as immutable and unchanging, and pedagogical practice as a method of instruction in an ahistorical and apolitical "environment" - many students will continue not to learn set content. Rather they see the world of mathematics as irrelevant and alienating, as contexts and pedagogical practices are culturally and socially unresponsive to their needs. Similarly constituted are the students who have managed to learn mathematics previously denied them, and who are even less inclined to question the "status quo".

It is instructive to peruse video tapes recorded during the initial cycles of my research. Data can be considered from Bakhtin's (cited in Wertsch, 1991, p.127) interpolation "Who is doing the talking?" At first glance, one might look at students actively involved in problem-solving in groups and suppose that it is the students who have found voice as they are involved in rational communication. But "rational communication" itself is a practice imbued with asymmetries of power, and the dominant voice is always that of objective authoritative knowledge. Any construction of knowledge by students must ultimately accede to the "correct" interpretation advanced by the teacher and sanctioned by the whole institutional apparatus. As became evident in my research, the power of the authoritative voice is all the greater when on first glance it appears muted.

Lave (1988) adds another dimension as, in capturing the dialectical nature of the person-acting-in-setting, she casts doubt on students' ability to put into practice in the classroom what they have experienced within tertiary education. Students ultimately will be operating in institutional

spaces which to a large degree will determine later pedagogical practice. The constitutive order "...consists of the mutual entailment of culture, conceived as semiotic systems, and organisational principles of the material and social universe (of political economy and social structure)" (Lave, 1988, pp.177,178).

## CONCLUSION

An implication of my research is that to adopt a technical rationality and to try to find and adopt the one best solution is fraught with danger. "Constructivist" practice itself can be seen as a regime of truth warranting critical analysis due to its framing within the metatheoretical assumptions of cognitive psychology. There is an urgent need for a developed constructivist pedagogy where the dialectical relationship of person-acting-in-setting is properly prioritised. After all, ultimately "...learning is a way of being in the social world, not a way of coming to know about it" (Hanks, 1991, p.24).

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