Is ‘Connected Teaching’ in Mathematics a Gender-Equitable Pedagogy for Adults?

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Dedicated to the memory of Professor Lyn Taylor (1948-2007).

Abstract

"Connected teaching" is a feminist theory first proposed by Belenky, Clinchy, Goldberger and Tarule (1996, p. 214) then related to the teaching of mathematics by Becker (1995, 1996), Buerk (1994b) and Morrow (1996). The theory of intellectual development elaborated by Belenky and her colleagues uncovered themes common to many women's lives, for example, those related to "silencing", "disempowerment" and "lack of voice" (Goldberger, 1996a, p. 7). Such experiences are common amongst adults who fear and avoid mathematics, both men and women. It therefore seems appropriate that this theory informs my teaching practice with such adults. This paper reports on a six-month supervised study course in mathematics taken by Charles, a 33-year-old businessman, who had a debilitating fear of mathematics. Connected teaching emphasizes “seeing the other, the student, in the student’s own terms”, hence “trusting their thinking and encouraging them to expand it” (Belenky et al., 1986, p. 227). So Charles and I “shared in the process” of mathematical problem solving (Becker, 1995 p. 168). Opportunities were also created for him to "weave together multiple aspects" of his life (Morrow & Morrow, 1995, p. 18), another goal of connected teaching. Overall there was a very successful outcome for Charles. After this course of study was completed he believed that mathematics was creative and that it involved a search for patterns. He expressed a distinctly more positive belief in himself as a learner of mathematics, more enjoyment of mathematics and, as he said, "general confidence" when it came to using mathematics in his workplace. This case study strongly suggests that connected strategies in teaching mathematics, a pedagogy which enhances women’s mathematical competence and confidence (Kalinowski & Buerk, 1995), can also improve the mathematical competence and confidence of men.

Key words: adult education; mathematics instruction; affect; beliefs; gender; epistemology.

1. Introduction

Connected teaching enabled one student to progress from viewing mathematics as "the most disgusting, unappealing building" to one "with form, balance and symmetry". The supervised study course undertaken by an intellectually able 33 year-old man, Charles, who feared and avoided mathematics is the focus of this paper.

Charles was referred to me by the Head of the Department of Mathematics as I had years of experience teaching students who had had a ‘rocky road’ in mathematics. Charles’ mathematical ability was "atrocious”, he said. He had failed School Certificate Mathematics, a national examination at age 15 years, and all other mathematics examinations. Mathematics was hard for him even in Primary School. Now he felt that he was at a turning point in his career. It felt like “running a race with one leg”, he said. He worked in business management in the city

and was a share broker before that. He agreed to be taught by me as part of my larger research project and was willing for our classes to be audiotaped.

During discussions in the first few classes Charles made it clear that his decision to seek help to try removing the block he had to mathematics was extremely important to him. He felt that his early mathematical experiences had damaged his self-esteem. This course was a means to achieve future change (Coben, O'Donoghue, & FitzSimons, 2000), a common theme among adults learning mathematics. He talked about the lack of choice of career options because his maths was "abysmally weak" and he continued:

> In order to make a valid career choice I have to either say 'OK, it is, for want of a better description, that horrible black hole, or it's not'. … I have to find out whether there is a choice because, if there's not a choice, OK, I do have other skills which are quite strong and are undeveloped. Can you see the importance of this? I mean it's actually quite a big life decision.

Later, that same class, he said "Barbara, you do understand the significance of what I'm doing? I don't mean to labour it but it is really significant". I acknowledged this and also emphasized that it would take a lot of effort on his part and that I would expect him to devote time to study outside of class time. He said: "I'm fully prepared. I wouldn't take on anything else for the year if I'm doing this. I'll just study." It is known that for many adult students a major life change, transition, or developmental task is probably involved in the decision to return to study (Smith, 1990). During the third class Charles again emphasized the importance of this course to him and said:

> I'm making a major career decision - you're understanding more now I think. … I just want to obtain an average level of mathematical ability which will make me feel better about myself, which will enable me to progress, I believe, on the business side.

He had a high level of motivation which I utilized. He became a full partner in the process of improving his mathematical confidence and competence. In connected teaching an important goal is that "the teacher and students engage in the process of thinking and discovering mathematics together" (Becker, 1995, p. 168). He experienced this process immediately because the first topic taught was a shared experience, an investigation of multiplication that involved us working together with hands-on material. A fuller discussion of the background to the theory of connected teaching of mathematics follows.

2. Literature

There are many theories of adult development and many view adult development as a series of stages or phases that adults go through, for example, stages of moral development, ego development, intellectual and ethical development (Merriam & Brockett, 1997). Criticisms of some theories of adult development are that they largely describe white, middle-class and male perspectives. Indeed, Gilligan's (1982) work has been influential in showing there are variations in the personality and moral development of women and men. Research by Belenky, Clinchy, Goldberger and Tarule (1986), based on Gilligan's work, suggests that women's ways of knowing also differ in some fundamental ways from how men know. They proposed a theory of intellectual development with five stages of knowing. In the first stage, "silent knowing", the learner's "survival depends on blind obedience" and the learner has a "sense of feeling dumb and stupid" (Brew, 2001, p. 99). The "received knowing" stage depends on knowledge being transmitted, authorities "hand down the truth (so) knowledge is dependent upon an external source" (Becker, 1995, p. 166). In the "subjective" perspective of knowing there is an awareness of an "inner resource for knowing and valuing" so that it is no longer only the authority who

knows (Erchick, 1996, p. 113). Systematic reasoning is a feature of the next stage of knowing (namely, “procedural”[1] knowing). It is here that “knowers become critical of their own thinking, they begin reflective thought” (Erchick, 1996, p. 115). They fluctuate between speaking in “either the separated/knowledge voice or the connected/understanding voice” (Erchick, 1996, p. 117) and this is gender-related, that is, women favour connected knowing as the way in which they come to know. The last stage is constructed knowledge, in which the knower “views themselves as creators of knowledge and they value both objective and subjective learning strategies” (Merriam & Brockett, 1997, p. 145).

While essentialist issues have been raised regarding Belenky et al.’s (1986) theory, (e.g., Hare-Mustin & Maracek (1989) and Lewis (1989), both cited in Goldberger, Tarule, Clinchy & Belenky (1996)), Goldberger explicitly rejected this accusation, stating that she and her associates had not claimed any essential differences between women and men. Rather, Goldberger (1996b) believes that their interviews uncovered salient themes, missing or de-emphasised in Perry’s earlier theory; themes that “related to the experience of silencing and disempowerment, lack of voice, the importance of personal experience in knowing, connected strategies in knowing, and resistance to disimpassioned knowing”. A second criticism levelled at their thinking was that it did not pay sufficient attention to race and culture. For example, Schweickart rejects silence as a passive position, drawing attention to the need for listening as an active position in communication. In her culture, “among Filipinos, silence attends to wisdom” (Schweickart, 1996, p. 306). Goldberger and her colleagues (1996) accepted these criticisms, recognizing that the value assigned by people to the positions of silence and received knowing varied with their importance to the listener.

How is the theory developed by Belenky and her associates relevant to the study of adults who avoid mathematics? As Goldberger (1996b, p. 7) noted, their theory uncovered themes common to many women’s lives, in particular, those related to “silencing”, “disempowerment” and “lack of voice”. These experiences are also common amongst both men and women who fear and avoid mathematics (Taylor & Shea, 1996; Zaslavsky, 1994). Hence some of the perspectives, or ways of knowing, in Belenky et al’s (1986) theory of intellectual development are evident amongst such students of mathematics (Boaler & Greeno, 2000; Brew, 2001; Erchick, 1996; Koch, 1996). Brew (2001, p. 97) believes the silent perspective is “particularly pertinent for women returning to study mathematics due to the anxiety many have with the learning of mathematics as a consequence of poor experiences at school”.

Drawing on their theoretical study of women’s development and ways of knowing, Belenky and her associates (1986) developed the theory of connected teaching, which Renne (2001, p. 166) succinctly describes as a “shared conversation in which the teacher and students collaborate to jointly construct new understanding”. Furthermore, this teaching theory has been related to the teaching of mathematics by several researchers (Becker, 1995; Buerk, 1994a; Morrow, 1996; Morrow & Morrow, 1995). Their resulting theory of ‘connected teaching in mathematics’ informs my teaching approach with adults who fear and avoid mathematics. Morrow and Morrow (1995, p. 19) discuss the aims of connected teaching in mathematics as student’s “confirmation of self in the learning community”, “learning in the believing mode of communication and questioning”, “taking on challenges with support”, “gaining a sense of their own voice in mathematics” and “becoming excited about possibilities of posing their own problems and inventing new knowledge”. These are all important goals in my teaching practice. Jacobs and Becker (1997, p. 114) suggest that connected teaching will help students who have not previously been successful in mathematics. They describe connected teaching as

[1] The terminology can be confusing at this point as the meaning of the term ‘procedural’ in this context is rather different from the meaning attached to the same term in mathematics learning. Procedural knowing is about systematic reasoning but procedural learning in mathematics is about rule following.

> teaching (which) promotes learning by allowing students to use their strengths and experiences to pursue knowledge, providing a supportive atmosphere in which students can direct their own learning, and allowing for a variety of approaches for doing mathematics. A broader view of mathematics as a discipline also makes it more inclusive. With increased emphasis on intuitive understanding and visual proofs, more students will become engaged in doing mathematics.

This theoretical 'lens' will mainly be used to interpret the results of the analysis of Charles' data. Much of the theory is explained later in this paper, when the results of the data analysis are presented. Results will sometimes also be interpreted through the literature on adult learning, adults learning mathematics and gender-equitable pedagogy in mathematics. Dorothy Buerk employed connected teaching strategies with maths-avoidant undergraduate women and showed the many ways this pedagogy increased women's interest and confidence in mathematics and facilitated their development as mathematical thinkers. She concluded that her students' "remarkable progress suggests the power of connected teaching to enhance women's competence in mathematics" (Kalinowski & Buerk, 1995, p. 16). Jacobs and Becker (1997) suggest that "by listening to women's voices and using feminist pedagogies teachers can facilitate *all* students' mathematical growth". My paper addresses this issue. Does this pedagogy also enhance men's development as mathematical thinkers, as Jacobs and Becker suggest, and increase men's interest and confidence in mathematics?

I chose to focus on affective change in the student. FitzSimons and Godden (2000, p. 17), in their survey of research on adults learning mathematics, state "clearly the affective domain is a critical influence on adult learners and their background experiences have helped to construct their attitudes and beliefs". McLeod (1994) asserts that research on student beliefs has made a substantial contribution to understanding the difficulties they have in solving non-routine problems and Schoenfeld (1989) exemplifies this by showing that problem solving performance can be undermined by beliefs. McLeod's (1994) analysis of the affective domain to include aspects of beliefs, attitudes and emotions is still a basis of much affective research today (Evans, Hannula, Philippou, & Zan, 2004). A recent framework of student's mathematical beliefs, developed by Op't Eynde, de Corte and Verschaffel (2002, p. 28), gives three categories of beliefs:

- "beliefs about mathematics education which include beliefs about mathematics as a subject, beliefs about mathematical learning and problem solving and beliefs about mathematics teaching in general;
- beliefs about the self which includes self-efficacy beliefs, control beliefs, task-value beliefs, and goal-oriented beliefs;
- beliefs about social context, which include beliefs about social norms in their own class (the role and functioning of the teacher and the students) and beliefs about socio-mathematical norms in their own class."

McLeod and McLeod (2002, p. 120) believe that this model is a "useful foundation" for future research. Beliefs about mathematical learning and mathematics as a subject will be addressed in this paper, as well as beliefs about the self as a learner of mathematics.

The commonly held belief that "mathematics is procedural rather than conceptual is so implicit that students do not even realize it as a belief – to them, that *is* mathematics", according to Oaks (1988, cited in Gourgey, 1992). Buerk (1994, cited in Jackson, 1995, p. 5) reinforces this statement, believing that one of the major problems for maths-avoidant adults is "their perception of mathematics as something that's rote, something in which they have to shut off their own thinking and try to reproduce somebody else's thinking, without it having to make sense to them". An Australian study (Crawford, Gordon, Nicholas, & Prosser, 1994), seeking to identify conceptions of mathematics held by students beginning to study mathematics at

university, also found that the majority viewed mathematics as a necessary set of rules and procedures to be learnt by rote.

3. Methodology

In investigating the effectiveness of the connected teaching approach in a course developed for an adult learning mathematics I used a case study approach. A case study is defined by Leedy, Newby and Ertmer (1997, p. 157) as an “in depth study of a phenomenon” in “its natural context” which usually “includes the point of view of the participants”. Romberg (1992, p. 57) suggests that, in a case study, the researcher is “writing a natural history of a particular situation”, collecting detailed information by using a variety of data collection procedures over a reasonable length of time. The phenomenon explored in this research study was a particular teaching approach in a supervised study course in mathematics for an individual.

In this paper I am presenting the analysis of the qualitative data which was gathered as part of a larger study (Miller-Reilly, 2006). All teaching sessions with Charles were audiotaped and some questionnaires containing open questions were completed. Metaphors about mathematics were gathered using the Mathematics Metaphor Questionnaire (Buerk, 1996; Gibson, 1994). I used this technique initially to acknowledge, as a teacher, the student’s fear of mathematics (Section 4.3). Then, as a researcher, metaphors were gathered to monitor changes in his beliefs about mathematics and beliefs about himself as a learner of mathematics (Section 6). Theoretical discussion about this projective technique appears in Section 4.3 and Section 6. Some details of his mathematical experiences up until the present were gathered using a Mathematical Autobiography Questionnaire (University of Central Queensland, 1992).

The sections of the paper which follow cover important aspects of the pedagogy, the mathematics covered and the results.

Firstly, a supportive atmosphere is particularly necessary in connected teaching because the student is encouraged to “take reasonable risks and be able to make mistakes” to, as Morrow and Morrow (1995, p. 20) describe, “gain a sense of their own voice in mathematics”. Section 4 describes the procedures I followed over the first few classes in order to acknowledge Charles’ negative experiences, feelings and reactions to mathematics. We spent a *significant* proportion of the time talking about his previous mathematical experiences and, while I initiated some discussion, more often Charles wanted to talk about his experiences and resulting feelings (Section 4.2). He also wrote his mathematics autobiography. I believe it was important to listen and accept, without blame, his views about the impact of these experiences on his life. Charles' fear of mathematics and his conceptions of mathematics were creatively and effectively captured using metaphors (Section 4.3). By using metaphors he also became much more aware of my concern for him as a learner (Gibson, 1994) and my empathy and regard for him.

Interspersed with these strategies I used to develop a supportive atmosphere, I began teaching some mathematics during our first class, being very careful, as Charles seemed so fearful of mathematics. I chose a visual, geometric, investigation of multiplication. In connected teaching the teacher emphasizes visual representation to develop first hand experience (Morrow, 1996). My aim was for Charles, as Morrow and Morrow (1995) describe, to gain a sense of his own voice in mathematics. A sense of working together and sharing ideas develops, an important teaching goal. Adults usually find this activity different to their expectations of a mathematics class, they discover number patterns, and are excited to have learned some mathematics.

In addition, the context of this mathematics course was very important. In Section 5.1 I describe how Charles was the context of this course, in particular, his culture and his mathematical knowledge, experience and needs. By providing appropriate mathematical challenges, I allowed Charles to take the risks necessary to develop his mathematical thinking (Section 5.2). With support and encouragement from me, Charles could cope with struggling for

understanding, because questions could be posed and potential answers explored together. I regularly requested Charles to clarify his ideas because I believed in him and valued his experience and thinking. Section 5.3 contains a brief description of the mathematical topics covered in this six-month course.

Finally, Section 6 presents outcomes of this course, in particular, affective changes in Charles. I include parts of his statement listing key aspects of the course that he thought enabled him to change. A comparison is made of his metaphors at the beginning and the end of the course. There are clear changes in his attitudes towards mathematics and his conceptions of mathematics. Section 7 discusses later contacts and developments with Charles and concludes the paper. Charles' experience indicates that overcoming his debilitating fear of mathematics as an adult has been a transition of major magnitude; an important life event (Parker, 1997).

4. Acknowledging Negative Experiences, Feelings and Reactions to Mathematics

4.1 Creating a Supportive Environment: Introduction

I believed it was necessary to take plenty of time during the first few classes to acknowledge Charles' current feelings about mathematics and past experiences dealing with mathematics to develop a rapport with him. This provided a "riskable" environment. Kellermeier (1996, p. 9) describes this as a "nurturing, supportive environment where students are encouraged to express themselves and find their own personal power and knowledge". Charles acknowledged the importance of such an environment by saying, in his analysis of the success of the six-month course, that

> Barbara approached my problem, which was very real, in a thoughtful, gentle and completely encouraging manner. She was able to empathise with me and fully understand what had been an on going and seemingly never ending horrible experience.

He said, several times in the first few weeks, that I was the first person who had understood these feelings and experiences. His relief at being understood was palpable, which supported my belief, similar to others (Becker, 1995; Buerk, 1982, 1985, 1996; Damarin, 1990; Morrow, 1996), that addressing affective issues early in (and during) any course of study is important. As Damarin (1990, p. 149) states, "to fail to recognize a student's anxiety, uncertainty, and concern about whether (they) are mathematically inferior is to deny an important part of the mathematical reality of the student".

4.2 Acknowledgement of Charles' mathematical experiences in school, family and employment

To begin the process of acknowledgement of his experiences I asked him to write his mathematics autobiography, a story of his mathematical experiences up to the present time. He was happy to read it to me during our first class. A summary of some of Charles' background experiences, gathered from his autobiography and our discussions, is in Table 1.

Table 1: Charles’ mathematics autobiography

AGE	Experiences
5-8 years	I remember numbers and not really understanding their conceptual role but being reasonably comfortable with their practical value. I thought visually and hence numbers were somewhat out of my realm of thought and interest. From this point I recognised that I didn’t understand maths and I certainly didn’t enjoy failing. Teachers merely assumed I wasn’t applying myself, when in reality and on reflection I was disinterested and didn’t understand.
10 years	I was failing tests. I remember studying for a multiplication test early one morning, memorising simply by repetition. I was starting to feel inadequate.
13 years	IQ test for streaming, no problems with English and comprehension, knew I was hopeless at maths, and therefore ended up in a lower stream than that which really I should have been in. On all other subjects I was bored because I could do them and I wasn't being extended. I didn’t realise that because I was poor at maths, though good at English, I'd been held back - this affected my self-confidence.
15-17 years	I was working to apply myself but **I failed every maths exam throughout my secondary school career*** and nobody seemed to understand. I just didn’t comprehend it. Maths homework was a complete nightmare. Despite listening attentively and taking the necessary notes, I could **never** apply the concepts to a different set of numbers. It was totally frustrating! Despite assistance from Dad, I never really improved. Therefore my association with and attitude towards maths was completely negative. **Application was not the issue, understanding was!**
17 years	Shop work - dealing with money, a little scary to start with, but in reality extremely simple and practical. I actually enjoyed overcoming this fear.
20 years	After the completion of my 1st degree, majoring in English literature, I was unable to complete my 2nd degree (Commerce) because of the mathematical component.
21 years	I had to leave a fabulous job, share broking, trading and providing advice for clients on equities, fixed interest. I was offered an opportunity to become a partner at 21, but I had this total fear of maths and recall breaking out into a sweat at the prospect of undertaking this work. I was surrounded by numbers, and I just thought, I can't do this, this is ridiculous. But, in reality, they could see skills that were good for them in me, which I can recognise now but ….
30-33 years	Continuing fear of maths. There were experiences where I just completely freaked with maths! How could I possibly use a computer under pressure? By listening, observing, taking notes and being determined, I largely overcame this fear to become competent but it took an unbelievable amount of energy. I can hardly explain it. I can never relax when dealing with those things. I’d review (any work) again and again -- complete insecurity in my own ability. In general my analysis was correct however it took me forever to reach a result. Maths from a practical perspective, e.g., profit or loss, shares, etc, isn't a problem. Conceptual maths is like an entirely bizarre language with which I have **no rapport whatsoever**. Continued failure with maths is frustrating, hurtful and demeaning.

* The text emphasized in bold font in this table was underlined by Charles in his statement.

Charles was hurt and puzzled by his past experiences, assuming that he was to blame, that he did not have the ability to learn mathematics, in common with many silent and received knowers of mathematics (Belenky et al., 1986). Zaslavsky (1994) also discusses this issue, that there are many factors in our society that may have led to a student’s difficulties with mathematics so that it is important that they do not blame themselves for their negative feelings about mathematics. I was careful not to blame him.

Johnston (1995) writes about Marie, whose memories of her school mathematical experiences at age 11 were similar to those of Charles, that of repeated shaming and

humiliation. Taylor & Shea (1996, p. 60) mention the anger felt at "being robbed of understanding" which led to Shea's avoidance of mathematics as an adult. Such avoidance of mathematics by adults, particularly women, is well documented in the literature (Buerk, 1982, 1985, 1996; Fennema, 1995).

After Charles had finished reading aloud his autobiography during the first session, he said:

> That's really true, it is just horrible. It's such a shame no-one … really understood. You're the first person. The application I put into my maths at school, I put into my other subjects. I would come first or second or third in these, and in maths I'd still be failing.

I began teaching some mathematics during our first class. I carefully chose an activity which gave Charles the chance to "construct his own knowledge by … reflecting upon patterns and … relationships" (Zaslavsky, 1994, p. 181), a visual, geometric, investigation of multiplication (Burns, 1987). This investigation allows for effective visualization of some patterns in the counting numbers. It drew on his strength as a visual learner. He acknowledged he had learned some mathematics, even after the first class, and had enjoyed this investigation. He felt *very* good about that.

Alongside this acknowledgement of past mathematical experiences is the acknowledgement of the strength of his feelings, his beliefs about the learning of mathematics and his conceptions of mathematics.

4.3 Acknowledgment of Charles' feelings and beliefs about mathematics

> For me maths is most like a hyena, a scavenger-predator, rearing its head when I least want it. Always succeeding in removing my self-confidence and sense of self. It brings me down, holds me back, confuses, and upsets me. I hate it.

Charles, May

Charles' feelings and beliefs about mathematics were discussed during the first few classes and particularly when he completed the Mathematics Metaphor Questionnaire, a protocol developed by Gibson (1994) and Buerk (1996), used regularly by them in a classroom setting. The quote above is his answer to the last question; "which of your metaphors best describes what maths as a subject is like for you". He gave graphic, profoundly negative, responses to the questionnaire. Table 2 lists some of the metaphors Charles used.

As Gibson (1994) and Buerk (1996) found with many other (adult) students, Charles' metaphors were about intense feelings of anger, despair and frustration, viewing mathematics as something beyond his control. Learning mathematics had been a demoralizing experience and he had felt manipulated by mathematics, an object of humiliation. Buerk has informed my thinking on the use of metaphors, both in mathematics teaching and in educational research (Buerk, 1982, 1985, 1996). (I will use the word 'metaphor' in the "broadest sense", as Buerk (1996, p. 27) does, to mean "any comparison between two objects, ideas, concepts, or experiences".)

Table 2: Charles’ responses to the Mathematics Metaphor Questionnaire

The questions	Charles' responses in May
Imagine yourself doing or using maths, what does doing or using maths feel like? List all the words and phrases.	Using maths from a practical point of view, i.e., profit and loss is great. Maths for the sake of it: cosine, co-efficient, square root are just nonsensical, non-stimulating, academic gain. I don't even know what it is really. I think it's a self-confidence thing, a lot of it. On a mountain - skiing on blue ice, with no edges, blindfolded. That’s what it feels like!
Think about the things that maths is like.	A house with no doors or windows, you can’t get out of it.
If maths were food what kind of food would it be?	Tripe, the only food I can’t eat, it’s disgusting.
If maths were a hobby, what kind of hobby would it be?	Counting grains of sand on a beach. Looking for an emerging pattern or formula because it’s a futile exercise for me.
If maths were a colour, what colour would it be?	It would be the absence of colour. Why? Because it offers no life.
If maths were a way to communicate, what way would it be?	A forgotten dialect, making communication, two-way communication, impossible.
If maths were a building what kind of building would it be?	The most disgusting, unappealing structure in history. Maybe a prison, white, grey and ugly.

An extract of the dialogue after he has read his powerful negative images about mathematics is given below to show how Charles and I completed this discussion. In this extract Charles is acknowledging that he is beginning to enjoy and understand mathematics and is also recognizing my acceptance and understanding of his feelings. Charles expressed satisfaction with the way the metaphors had captured the intensity of his feelings, and he emphasized to me how genuine these feelings were.

Charles: You can see now why I want to know whether it is a ‘black hole’ - they’re my genuine feelings. Ninety-nine percent of people, when they say they’re not good at whatever, they maybe can be taught - but these feelings are pretty strong.

Barbara: Very strong, I agree. Well, we’ll just go slowly because these *are* strong feelings and it will probably be difficult for you.

Charles: Well I’m enjoying it so far! Primarily for two reasons: First, I’ve actually learned something, and secondly, you understand. You’re the first person who I’ve come across who can genuinely understand. It's a huge relief.

This projective technique allowed me to understand the intensity of Charles’ feelings which were not as easy to describe literally (Bowman, 1995). I realised he was extremely fearful of mathematics. As Buerk (1996, p. 27) found with her students, it was therapeutic for Charles, a “catharsis”, a “relief”, “somehow freeing to get the negative feelings out” and to have them accepted. The next section describes the mathematics content covered in this six-month course.

5. Teaching the Mathematics

5.1 The context of the course: valuing Charles' experience and thinking

A theme running through Section 4, and now in Section 5, is that Charles was the context of this course. This is a characteristic of connected teaching. The "weaving together objective and subjective knowing in mathematics" (Becker, 1995, p. 170) allowed the course to become a "meaningful educational experience" (Morrow & Morrow, 1995, p. 18). Morrow and Morrow also explain, if "students (are) encouraged to build on their entire knowledge base rather than leaving all personal experiences at the classroom door" this enables them to construct their own knowledge. Charles' experiences, culture and interests are the contexts that I used, accepting his culture as a young businessman as the class context.

I encouraged Charles to bring examples of mathematics used by him in his workplace to class. As you will see in Section 5.3, he brought examples of his financial planning, costing/pricing etc. This aligns with Freire's (1976, cited in FitzSimons & Godden, 2000, p. 20) view that educators need to "refrain from imposing their values on learners, and see themselves as co-learners, learning about the culture of the people among whom they are working, mutually responsible for growth and change". I believe that "mathematical meaning" for Charles was possible because, as Bishop (1985, cited in Boaler, 1993, p. 344) believes, he was making "connections between (his) knowledge and present knowledge". This connection is possible, Boaler (1993, p. 344) states, when "mathematical activities emphasise the learner's involvement with mathematics rather than the teachers presentation of content and when communication, negotiation and the resulting development of shared meanings are a part of the process". This is a key aspect of connected teaching.

I aimed to help Charles become aware of his own thinking. I also found it very interesting to gain an insight into his thinking. These aims are characteristics of connected teaching as he was "in charge of the interaction" but my responses provided "a 'safety net' whereby (his) misconceptions (were) recognized and addressed" (Morrow & Morrow, 1995, p. 19).

5.2 Appropriate mathematical challenges: providing support but allowing student to take risks to develop their thinking

Morrow and Morrow (1995, p. 19) describe another integral aspect of connected teaching as allowing the student to take on challenges with support because, "in order to grow intellectually, a student must take reasonable risks and be able to make mistakes". Rogers (1995, p. 181) relates this issue to her undergraduate mathematics classes and says

> A classroom climate characterised by safety and trust is essential for risk-taking to occur and for students to be willing to test their ideas and thoughts and develop fluency in mathematical language.

The types of risks include "risks that one's assumptions are open to revision, risk that one's insights are limited, and risk that one's conclusions are inappropriate" (Ocean, 1996, p. 425). In addition, Lampert (1990) suggests taking risks also requires courage and honesty. Rogers (1995, p. 178) describes this approach as "student-sensitive pedagogy" because it is

> grounded in the students' own language, focused on process rather than content, and centres on the students' individual questions and learning processes. Students who are 'cared for' in this way are set free to pursue their own legitimate projects (Noddings, 1984).

This sense of 'care' is related to the positive aspect of one of the two moral perspectives identified by Gilligan (1982). Ocean's research (1996, 1997) relates these moral perspectives to mathematics education. She examines Gilligan's "Care perspective", which emphasizes mutual dependence and connection to others, and the "Justice perspective", which emphasizes individualism, independence, equality and fairness. She relates these perspectives to the moral climate in the classroom. For example, teaching which includes values such as those of "co-operation, connection and communication" (Ocean, 1997, p. 8) illustrates the positive side of the Care perspective and "the negative side of Care morality in mathematics education is seen when Care slips into patronage" (Ocean, 1996, p. 427). This negative side of Care was highlighted in research by Walkerdine (1989, cited by Ocean, 1996) where UK high school teachers entered girls into a less difficult examination to protect the girls not push them. When Rogers (1995) suggests that one must become a caring teacher in the specific sense of caring as in helping "the other to grow and actualise himself", she is talking about the positive aspect of the Care morality. She suggests that caring teachers "do no work upon their students, but with their students, looking at the subject matter from their perspective and at their level" (Mayeroff 1971, quoted in Rogers, 1995, p. 178).

This environment fosters the intellectual growth needed for students to broaden their strategies for knowing in mathematics. Morrow and Morrow (1995, p. 19) expand on this idea and suggest that the connected teacher "must become skilled in active listening and asking questions that will allow the student to become more aware of her own thinking, as well as decide which of her ideas to pursue further". I valued Charles' thinking, believing that my role was as a facilitator and guide. Connected teachers, as Becker (1995, p. 170) describes, "trust the students' thinking and encourage them to expand upon it", rather than replacing it with a "different, teacher-generated 'better' thought … to help the student's thought to grow, mature and develop. … Both the teacher and the student engage in this process".

Connected teaching of mathematics also aims to help the student become "used to justifying ideas" by asking for clarification or a more detailed explanation as part of the "belief-based-inquiry process", helping the student to "elaborate, deepen and extend" the ideas (s)he presents. "Listening in a believing mode" (Elbow, 1973, cited in Morrow, 1996, p. 7) assumes "that the speaker has a valid basis for his/her opinion". Requesting clarification is not done because the teacher disbelieves the student but because she believes the student and "believes in" the student (Morrow, 1996, pp. 7-8). The alternative mode to the believing mode is the "doubting mode", an "argumentative mode" where the presenter of an idea is "challenged to 'prove' the validity of the observation or claim", a very common approach employed in traditional mathematics classrooms.

Hence, during our classes I would keep asking for clarification and justification of Charles' ideas because I 'believed in' him. I was also careful to acknowledge his discoveries, his mathematical power, and therefore my trust in his thinking (Becker, 1995), another feature of connected teaching.

The mathematics topics covered in the course follow. The pace was dictated by the time it took for Charles to understand each topic.

5.3 An overview of the mathematical content of the course

The mathematical content of the course is now outlined. Key comments Charles made which illustrate his affective changes and growing understanding are included at the end of this section. Usually we met each week for 1-2 hours. There were 17 sessions in all. In choosing mathematical topics, I took into account Charles' needs and interests.

I was aware that the main use he made of mathematics in his work was arithmetic, so I decided we would initially explore multiplication through a geometric, hands-on, investigation

of rectangular arrays (Burns, 1987; Stenmark, Thompson, & Cossey, 1986). Exploring these patterns could help him in his work, and it would enable me to assess some of his background mathematical knowledge. This investigation continued for several classes while he also discussed his feelings about mathematics, his past experiences and his mathematical goals (Section 4.2).

At the 4th session we reviewed factors, multiples, primes, even and odd numbers, patterns in the multiples of 10, 9 and 3. Charles initiated a discussion of the division algorithm that he had never understood. He asked to do some division of larger numbers, so we tried division of a larger number by 10, then by 3.

I introduced some history of number systems next (Joseph, 1991; Marr & Helme, 1987) which led to a discussion of scientific notation using a scientific calculator. Following this topic we worked with some decimals and fractions.

During the eighth class Charles had brought an example of the mathematics he was using at work and explained it to me. He was going to have a style of outdoor chairs made and was going through the process of pricing them. He confidently explained the cost, sale price, the “margin” and the “mark-up”.

I had realized that he was fearful of algebra, as he had said “conceptual maths is like an entirely bizarre language with which I have no rapport whatsoever”. I thought it would increase his mathematical confidence to become familiar with the beginnings of algebra, to generate, understand and use simple formulae (Brooker, Butel, & Carson, 1990; Langbort & Thompson, 1985). Initially we explored word and number patterns, using 'function machines' as a model. We continued to explore linear patterns and how to describe them using different representations: in words, algebraically and graphically.

We discussed again the pricing of his chair - markup and margin calculations. During our 11th session, we worked through problems on decimal fractions, tenths, hundredths, and thousandths. Introductory exercises using graphs were worked on early next class.

At the 12th class a start was also made on using a spreadsheet for generating linear functions (Healy & Sutherland, 1991); spreadsheets were commonly used in his workplace and he had expressed a fear of using them. We each entered linear formulae for the other to guess. Then Charles took the initiative, thinking of the idea of entering one linear function followed by another. We entered some examples into the spreadsheet, which led to the need to introduce the convention for the order of arithmetic operations. During our thirteenth meeting we worked on the spreadsheet again, practicing entering a formula and 'filling down' to generate a sequence of numbers.

We discussed again, during the 14th class, how algebraic formulae incorporated the convention for the order of operations. We discussed the pattern of 'row sums' in the Pascal's Triangle initially on our 15th class, but this non-linear pattern was too difficult for him. I decided to return to the previous examples of linear functions. He practised writing clearly, in words, what each formula meant. We explored the universal formulae for these examples, e.g., $r = 2i + 6$, and then the recurrence formulae, e.g., $r_1 = 6, r_n = r_{n-1} + 2$. We used both types of formulae on a spreadsheet also. When we plan for our last session, he suggests we review all we had covered. I ask if he would agree to answer the metaphor questionnaire again to describe his views about mathematics.

The final appointment for the year was in mid-October. It was our seventeenth class. We discussed how this course had affected him and he says “I felt a cog go in my brain for the first time”. He now “knows he can (do maths), given time – before it felt impossible”. He completed the Mathematics Metaphor Questionnaire again. For homework he has agreed to write one or two pages explaining what aspects of the course he thinks have helped him make the changes in his feelings and beliefs about mathematics, enabling him to learn mathematics (see Section 6).

To summarise, by the end of the 6-month course, Charles has now explored some patterns in our number system, some history of number systems, and learned more about the decimal number system. He has also understood the beginnings of algebra, to generate, describe and use linear functions.

His mathematical confidence and competence were slowly growing over this time. For example, by the seventh class Charles commented that already he has noticed that when he has mathematics to do he says to himself “I will be able to do it”, rather than “I don’t know if I can do it”. He was very excited by the initial work with algebra (in the 9th and 10th classes) commenting that another word for algebra could be “associations” or “connections”. He commented that he had “gone a long way – especially on the fear side – I think I’m going to enjoy algebra”. He was excited by the use of spreadsheets and the explanation of the order of arithmetic operations saying, “I am enjoying this – this is the best thing that has happened to me this year!” During the 14th class he commented that when he got stuck now he just left it to discuss with me. He doesn’t feel “devastated”, as he used to, when this happens.

6 Results: Analysis of Final Affective Data

> I’ve gone from foggy mess to sense that a door has been opened and there is light. You can see some light, and you know there’s a mile of other doors to be opened. It's not that every time you open the door it's still dark. It was always dark, and I just probably expected it to be. What we’ve done is gone back to the smallest door, but in opening the smallest door we’ve generated the greatest light. And although each door subsequent to that which we open is larger, the light sort of remains the same. It's just the expanse maybe becomes greater.

Charles, October

During the final session in October, Charles talked about what this course had meant to him using the imagery above. Our conversation continued:

Barbara:	It's lovely to see what you’ve been able to achieve.
Charles:	But I’m enjoying it. I’m finding it so rewarding! … I was never getting ahead (in maths), whereas now I’ve got a bit of foundation and I’m comfortable with it.
Barbara:	And how is it affecting your day-to-day work?
Charles:	Oh just general confidence when it comes to using maths. When it comes to business matters, it's not a problem, but when it's something complex, some spreadsheet which I haven’t done, it doesn’t concern me if at first I don’t see what’s happening, because I know if I analyse it, slowly I will. So my attitude has changed. I look at it more objectively, feel more at ease.
Barbara:	Ok. Well that would have made a big difference.
Charles:	Huge! Enormous! I’m just so grateful.

We both, understandably, were very pleased with the results of the course. Since Charles had been one of the most maths phobic students I had taught, I was initially concerned that I would not be able to break through that strong fear to achieve changes in his beliefs and feelings about mathematics, and to facilitate his development as a mathematical thinker. At my request he agreed to write a statement describing what he thought were the key aspects of the course that had enabled him to make the changes he has described. Parts of his summary statement follow:

> What exactly has Barbara done which has been so enlightening? I need to list the points and ideas which have made the change as there have been so many.
>
> 1. Identifying the gaps.
>
> 2. Really starting with the basics. Letting me know it was fine not to understand some rudimentary concepts with certainty. Previously I had been greatly embarrassed by my lack of certainty.
>
> 3. Encouraging my memory and actually saying on many occasions: "you'll probably find you realise more than you first thought".

4. Approaching problems in bite-sized pieces.

5. Patterns. These were a major as they illustrated a concept (an alien one at that) in a visual fashion which I could relate to.

6. Building on knowledge and the basics as I learnt engendered great confidence.

7. Being completely encouraging and motivating. What an amazing teacher.

8. Letting me know it was OK if I didn't get it first hit.

9. Once the logic emerged from the patterns it was fun. Now I thoroughly enjoy maths and would like to spend more time discovering it. In some instances it's like reading a fabulous book, interesting and expanding your perceptions. At other times it's like feeling a cog turn in your brain for the very first time.

Since Charles is a graduate in English literature, this last item in the table is a particular significant analogy. Charles' comments are like Marie's, who said that she "came from being very damaged to increasingly feeling, 'I am worthwhile'" (Johnston, 1995, p. 233).

Of the eight aspects of the teaching methods in the independent study course which Charles has identified as the most important reasons why his course was so successful for him, four of them focus on the fact that I engaged with him at an appropriate mathematical level and pace. Coben (1996, p. 5) highlighted this issue in her agenda for adult learning in mathematics for the next millenium, stating that teaching "should proceed at a pace which suits the learners". Ramsden (1992), addressing issues about teaching and learning in higher education, also said that good teachers must have the facility to engage students at their level of understanding.

Some of the other points Charles makes relate clearly to my goals in teaching, very similar to the theory of connected teaching of mathematics. Morrow and Morrow (1995) describe one aspect of connected teaching as creating an environment where the student feels no need to apologise for uncertainty. Charles acknowledges above, in point 2, that an important aspect of my teaching approach was that I let him know it was fine not to understand some concepts with certainty. Because I aimed to find a balance between providing success while at the same time challenging Charles, it was particularly important to avoid blaming him.

Explicit recognition and valuing of his prior knowledge and experience was an essential aspect of my teaching approach and a key goal of connected teaching (see Section 5.1). Charles emphasises, in his third point above, that this was an important aspect of this course for him. Other points Charles makes are also reflected in the metaphors he uses at the end of the course. Table 3 lists some of Charles' responses to the Mathematics Metaphor Questionnaire, in May and in October, when he started and finished the supervised study in mathematics.

A vivid picture emerges from the creative images he uses which indicate new attitudes towards mathematics, new beliefs about the learning of mathematics and new conceptions of mathematics. Charles' metaphors in October show how he now had the idea that mathematics is creative; that it involves a search for patterns, for possible routes to solutions, for relatedness amongst ideas and concepts (Ocean & Miller-Reilly, 1997).

Charles' attitudes towards mathematics change from fear to enjoyment, from disgust to valuing mathematics. In May Charles' imagery indicated extreme fear of doing mathematics, comparing it to skiing blindfolded on blue ice but, by October, he described mathematics as enjoyable and compares it to yellow, which he describes as a "cheerful colour". In May mathematics was "disgusting food" which he "loathed" but, by October, mathematics had become "really good quality food". By October believed that mathematics had value and also that mathematics was useful. Its use was not "limited or specific" but rather it was "multi-useful" like kitchen tongs (Charles; October). This change in Charles' beliefs is possibly the result of him being the context of this course (see Section 5.1) and thus engaging him in purposeful and meaningful activity (Rogers, 1995).

According to Thompson (1992, p. 132) conceptions of mathematics can be viewed as “conscious or subconscious beliefs, concepts, meanings, rules, mental images, and preferences concerning the discipline of mathematics”. Romberg (1992) found that most people see mathematics as a fixed body of knowledge, set in final form, involving manipulation of numbers and geometric deduction. Mathematics is thought of as a cold and austere discipline, without scope for creativity. Contrasted with this is the view that mathematics is a creative, dynamic and changing discipline. Charles’ metaphors will reveal a significant change in his conceptions of mathematics. Initially he had an instrumental view, that mathematics is a set of accumulated facts, rules and skills to be used by trained persons. Now he has a human creation view of mathematics, that it is a process of enquiry not a finished product (Ernest, 1995).

Connected teaching advocates teaching mathematics as a process, not a universal truth (Becker, 1995). I tried to “demystify the doing of mathematics” by “calling (his) attention to mathematics as a creation of the human mind, making visible the means by which mathematical ideas come into being” (Rogers, 1995, p. 178-9). Instead of the futility expressed by Charles in May, where doing mathematics was like “counting grains of sand on a beach”, in October he describes the process quite differently: “I think maths starts with rubble and you’ve got to find a pattern that creates a structure from the rubble. Once you’ve got a pattern, you’re away”. In May he described mathematics was a forgotten dialect where two-way communication is impossible but, by October, it has become direct and clear, rewarding and satisfying (Table 3).

Burton (1999b, p. 31) found that mathematicians experience mathematics as “creative, dynamic, evolving and in process” which “allows for the expression of the personal, imaginative, and intuitive capabilities”. Because I have tried to value and nurture his mathematical intuitions, Charles metaphors indicate that he now has recognized the importance of making connections or links in the building of mathematical meaning (Burton, 1999b). Charles talked, in October, about mathematics as pattern forming, investigative and where “every path is related to the previous path”. By October, he experiences doing mathematics as a creative and imaginative process: he says he can understand “how a mathematician and an artist can be one and the same”. Instead of mathematics being the “most disgusting unappealing structure” in May, by October, mathematics, as a building, would have form, balance and be quite classical. Buerk (1985) describes her personal experience of mathematics as a process that is subjective, intuitive, inductive, involving playfulness of ideas. Charles described mathematics as non-stimulating in May. By October he describes it as intellectually stimulating and “good for the mind”, i.e. he now believes that mathematics is playing with ideas (Burton, 1999a). Connected teaching encourages the student to use his/her “intuition in an inductive process of discovery” (Becker, 1995).

Mathematics had “scavenged” Charles’ “self-confidence” in the past but, by October, he is confident enough to feel that he can direct the pace and movement of it like a wheel. He now has agency, as he sees doing mathematics as a process, a path, an evolving story. I have travelled with Charles, as Johnston (1995, p. 233) travelled with Marie, “from a position as a victim … to the possibility of autonomy”.

Collecting data by using metaphors has produced some particularly interesting, useful and rich data that would have been difficult to gather any other way. The metaphors provided a trigger for conceptualisation, and comparison, of Charles’ conceptions of mathematics (Briscoe, 1991; Sims, 1981). They illustrate the “synthesizing function” of a metaphor, “a metaphor’s ability to compress a great deal of peripheral, intuitive and emotional content into one symbol” (Sims, 1981, p. 402), and how metaphors can be helpful in “framing the meaning one assigns to events – a way of understanding our perspective” (Chapman, 1997, p. 202)

Table 3: Charles' responses, in May then in October, to the Mathematics Metaphor Questionnaire

The Questions	Responses in May	Responses in October
What does doing or using maths feel like? List all the words and phrases.	Doing maths feels like being on a mountain - skiing on blue ice, with no edges, blindfolded!	Enjoyable, investigative, pattern-forming, rewarding, satisfying. Patterns, solutions, stimulating, rewarding. Intellectually stimulating, engaging your brain. Brain food, but different brain food to the arts.
If maths were food what kind of food would it be?	Tripe, the only food I can't eat, it's disgusting.	I see really good quality cut of meat on a plate with a very simple herb sauce, with really beautiful vegetables but simple. It doesn't need to be dressed. Why? I just think it has its own path, it's quite clear, clean and straight forward.
If maths were a hobby, what kind of hobby would it be?	Counting grains of sand on a beach. Looking for an emerging pattern (is) a futile exercise for me.	Quite a stimulating and rewarding hobby, something which is good for the mind. It engages cogs which previously haven't turned.
If maths were a colour, what colour would it be?	It would be the absence of colour. Why? Because it offers no life.	Not green yet. Not yet. What would it be? Previously I would have said it's no colour. So now it's definitely a colour. It's almost like two colours, blue with yellow. The depth and the solution, the dark and the light, the dark being the problem, the light being the solution. Yellow's quite a cheerful colour, and blue is quite a strong colour. Yes.
If maths were a building what kind of building would it be?	The most disgusting, unappealing structure in history. Maybe a prison, white, grey and ugly.	It would have a lot of form, it would have balance, it would have symmetry, quite classical, as in Roman and Greek times. Symmetry is very pleasing to the eye - it creates balance. There would definitely be a pattern. I would never have said that before. I can now see how a mathematician and an artist can be one and the same. I think maths starts with rubble and you've got to find a pattern that creates a structure from the rubble. Once you've got a pattern, you're away. The development is quite clear, direct, cheerful.
What about if maths is a kitchen utensil?	NA. This question was not answered in May.	I think tongs. Why? Because of multi-use: you can pick something up with them irrespective of its shape; you can flip something with them.
What if maths was like a tool?	NA. This question was not answered in May.	A wheel, because you can move with it, it continues to move, and the pace with which it moves is dependent on the input. The greater the input, the greater the movement. You can move it faster, or slow it down, depending on what you're trying to do with it. It's a useful tool that doesn't have a limited or specific use.

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7 Later Developments and Conclusions

Five years after the course was completed, Charles contacted me again and I taught him again for a few months. At my request he wrote a statement about his current attitude to mathematics and the usefulness of his new knowledge in his workplace now. Part of his statement follows:

> I am delighted to say that I now approach mathematics with a degree of pleasure and relative confidence. … The knowledge gained from expert tuition has enabled me to tackle such problems without fear and in a reasonably timely fashion. The method of teaching adopted by Barbara has opened up doors within my brain which were firmly closed and enabled me to progress with a greater sense of confidence. … I would rate the knowledge gained and consequent confidence as the highlight of the last five years.

Charles’ experience supports Parker’s (1997, cited in Safford-Ramus, 2004, p. 57) conclusion, that “overcoming mathematics anxiety during adulthood” is a “transition of major magnitude”, an important “life event”. It also confirms Morrow & Morrow’s (1995, p. 20) statement that “gaining a sense of their own voice in mathematics”, as a result of connected teaching, is a “very powerful experience” for a student.

Two years after this, Charles contacted me again because he wanted me to look at some details of a mathematical model he had developed for his business - I gave him (positive) feedback. It seems that he has now “become excited about possibilities of posing his own problems and inventing new knowledge” by trying “to provide insights into mathematical connections with other areas” – he is becoming a “constructor of knowledge” in mathematics (Morrow & Morrow, 1995, p. 20), an overall aim of the connected teaching approach. Boaler and Greeno (2000, p.189) found that students often reject mathematics in response to didactic pedagogy in which memorization and procedure repetition are central practices, as they do not want to “author their identities as passive receivers of knowledge”. Connected teaching, where the process of mathematical problem solving is shared (Becker, 1995), has enabled Charles to become a ‘constructive knower’ of mathematics (Belenky et al., 1986).

Charles agreed to read this case study. (The full case study is presented in Miller-Reilly (2006).) I wanted to check, as Taylor (1995) did with the subjects of her ethnographic life histories, if I had reflected his views accurately in describing his learning experiences. The few editing changes he suggested were incorporated into the manuscript. He asked for a copy of it so that he could share it with a colleague whom he thought avoided mathematics. Charles was now providing support for another mathematics anxious adult, which Parker (1997, cited in Safford-Ramus, 2004, p. 57) believes is the final part of a six-stage process. She identified this process in a number of adults, interviewed in her research, who were mathematics anxiety success stories. The other five stages are also clearly visible in Charles’ case study: his “perception of a need”, his “commitment to address the problem” by taking “specific actions to become more comfortable with mathematics”, his “recognition of a turning point having been reached”, which has resulted in a change in his “mathematical perspectives”.

Charles' letters and his continuing contacts with me illustrate long-lasting change. I notice that when he works with me now, he looks for patterns in the mathematics, which he calls principles, and is then very satisfied with his learning. Davis (1992, p. 731) states that "for serious long term learning, one does not learn facts, one acquires a culture". It seems that Charles has acquired a culture, for example, he knows that mathematics is about recognizing and describing patterns.

Information or knowledge is one thing, agency or power is quite another. Boaler (1998, p. 87) has pointed this out in her study of two schools with completely different approaches to the teaching of mathematics. In a traditional, examination-oriented, school “teachers tried to give the students knowledge” while at the open, project-based, school the students “learned how to do things” (quote from a student). Charles has learned how to use mathematics.

This case study strongly suggests that there do not seem to be any essential differences between the needs of men and women who have avoided mathematics because they are fearful of the subject. A connected teaching approach has worked well with a man who had experienced silencing and disempowerment in his mathematics learning experiences. This indicates the importance of using connected strategies in teaching mathematics to men as well as to women.

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