Mixed methods in studying the voice of disaffection with school mathematics

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Disaffection with school mathematics is a complex phenomenon as well as a serious problem. It is clearly related to affect, but the study of affect in mathematics education is also problematic. A case is made that it is necessary to study the phenomenon beyond the quantitative study of attitude in order to understand better the complex and multi-dimensional nature of disaffection and to understand the subjective experiences of students who are disaffected. In order to do this, new methods and approaches are needed. This paper reports on a study of disaffected students of mathematics in a Further Education College. It describes the novel methods used to understand disaffection as a motivational and emotional phenomenon. The paper outlines a range of quantitative and qualitative methods used to elicit the subjective reality of disaffected students in relation to mathematics. It provides an opportunity to evaluate these methods, and their efficacy in capturing the dynamic nature of the motivational and emotional reality behind the phenomenon of disaffection.

Keywords: disaffection; motivation; mixed methods

Literature Review

Disaffection with school mathematics is a serious problem. Concern about standards of achievement, both in the public domain in general, and in the research community specifically, have fuelled interest in the phenomenon. Disaffection is seen as related to poor performance, and is often identified and measured by attitude. Smith et al. (2005) in their review of motivation in schools speak of current concern about significant numbers of pupils who are becoming disaffected and disengaged.

Alongside problems in attainment, evidence of negative attitude has also been documented. The Smith Report pointed out: "the failure of the curriculum to excite interest and provide appropriate motivation" (Smith 2004, 4). The report goes on to say: "(for many) GCSE Mathematics seems irrelevant and boring and does not encourage them to consider further study of mathematics."

However, disaffection itself has not received the attention that this negative impact deserves. In the UK there have been a number of studies. Nardi and Steward (2003) widened the definition of disaffection to include the 'quiet disaffection' that they discovered in school pupils. Kyriacou and Goulding (2007) reported on the effectiveness of teaching strategies to raise the motivation of pupils studying mathematics in schools. They recognized the importance of encouraging student engagement in mathematics, and they refer to "the need for researchers to make greater use of measures and indicators of pupils' motivational effort" (2007, 2). They proposed a model that related attitude to motivational effort and thus to attainment.

Brown, Brown, and Bibby (2007) examined reasons for participation and non-participation in mathematics post-16. They noted that 37% of students characterized mathematics as boring, and they identified the perceived difficulty of the subject and low efficacy as other key factors that influence students in not choosing to study the subject further. Interestingly, and in contrast to Nardi and Steward, they encountered disaffection charged with negative emotion. This suggests that the phenomenon of disaffection may be more complex than the statistical study of binary oppositions such as positive and negative attitude or positive or negative self-efficacy represents. Since disaffection is clearly related to affect, and since affect itself is highly complex and problematic in research terms (Hannula et al. 2010), then this is perhaps not surprising. Support for this argument comes also from other sources. For instance, Cremin, Mason, and Busher (2011) also conclude that disaffection is more complex than simple categorisation allows.

This complexity surrounding attitude to mathematics education has been recognized more widely. Schorr and Goldin argue for "the need to study affect more deeply than the study of attitude permits" (2008, 132). And further 'It is increasingly clear that the functioning of affect is far more complex than is suggested by considerations of positive versus negative emotions and attitudes.' (ibid, 133). The Cerme group on affect has noted the multidimensional and complex nature of affect and the need to widen the methods used to study it (Hannula et al. 2010).

The current study

The current study was undertaken with the purpose of understanding more fully the phenomenon of disaffection beyond attitude. Only by understanding the problem more fully and in all of its complexity is it possible to gain traction on the problem and make it subject to improvement through policy, curriculum or teaching practice. In addition, there is too little evidence of the subjective experience of disaffection from the voice of the student. Thus the current study was conducted from a phenomenological and constructivist position, with a focus on motivation and emotion. Reversal Theory was used as a coherent account and framework of motivation and emotion from a phenomenological perspective (Apter 2001).

The study involved students in two further education colleges. Since 'failing' mathematics in school, they are required to study a Use of Mathematics course. It is thus likely that many of these students will be disaffected with mathematics.

The methods

A mixed methods approach was adopted, with a quantitative survey used alongside a range of qualitative methods to elicit aspects of the experiences and the subjective meanings of that experience.

The Tension and Effort Stress Inventory (TESI) (Svebak 1993) was designed to be a one-page survey measure with an integrative orientation to the experience of stress. It is based on the Reversal Theory account of unpleasant emotions or moods. "The TESI has proved to be a practical instrument for quantitative assessments of the subjective experience of exposure to stressors." (Svebak 1993, 204). It can be used on a face-value basis without recourse to the theoretical assumptions inherent in its design. A stressor is a source that gives rise to the experience of unpleasant emotions (called tension-stress). Tension stress is the perceived difference between our motivational need at that moment compared to our felt experience. The eight emotions are: boredom, anxiety, anger, sullenness, humiliation, shame, resentment,

guilt. It is reasoned that disaffection will be associated with the experience of such unpleasant emotions. The test was adjusted to make the wording appropriate and relevant to the mathematics education context (TESI-ME). In addition, the labels for the emotions were altered where necessary to reflect current language use within this social context. Students were asked to report the degree to which, in relation to mathematics, they experienced stress, effort, and eight negative emotions on a Likert - type scale from 1 to 7. 130 students were surveyed.

The questionnaire was seen as a way of characterising disaffection through emotion rather than attitude. In effect it provides answers to the questions; *'how stressed are you about mathematics?'* and *'how do you experience that stress?*'

In terms of overall stress, the mean score was 4.4 (out of a possible 7), suggesting that the experience of stress is present and strong for many in this population. 26 of the students (21%) scored 6 or 7, but there were large individual variations. Effort scores were also high (mean = 4.7). However, it can't be discounted that there is an element of social desirability in the effort scores. If we look at the mood scores themselves, boredom stands out as the most problematic (mean = 4.1). Within the distribution, anxiety, humiliation, shame and guilt also figure. If we look at individuals, we see a wide variation in responses. The mean for the total stressor score (by totalling the eight mood scores for each respondent) is 21.4, with individual totals ranging from as low as 9 up to 53 (out of a possible 56), and with 20 students (16%) scoring 32 or more. Individual responses to the survey were available and discussed in the subsequent interviews.

Qualitative data was acquired in interviews. However, since the population was likely to include students who may not be highly articulate about their own motivational and emotional landscape, it was decided to employ a number of techniques to provide stimulus and structure to the elicitation of data. There are precedents for such techniques in social-psychological research, and more specifically in educational research. However, there is very little evidence of their use in mathematics education research.

One of these methods ('me and mathematics' – see below) is a participant-generated visual technique. Such visual methods are increasingly being used in educational research, as they seem to be particularly useful for younger, less articulate or marginalised groups (Davidson et al. 2009). Chula (1998) has investigated the use of drawings as a methodological technique for visual data analysis in the study of the perceptions of adolescents' experience of education. She concluded that drawings are useful as a singular source of interpretive inquiry, and she makes the case for drawings in research as an alternative, non-discursive form of knowing. Chula sets out a number of purposes that the use of drawings can satisfy. These include: as a stimulus to the retrieval of thoughts; as a means of expression and articulation where words are difficult to find; as an interface between the interviewer and the individuals. She also points out that a further advantage is that new and emerging theories of learning have implied a range of learning styles, and that the techniques under discussion can offer a means of expression for people with more visual styles of learning.

Borthwick (2011) also uses visual techniques in her investigation of young pupils' views in relation to their experience of school mathematics. She points out that visual representations can be used to elicit expressions and emotions for pupils for whom verbal expression may not be easy. Davidson et al. (2009) also argue the case for the use and acceptance of visual sources in qualitative research. Their study encompasses a number of features that characterise the most important affordances of

using visual sources. One of these is the access they give to complex realities and multi-layered meanings in the subjective experience of those studied. That these methods are able to access meanings, interpretations and themes not possible through other methods is also reported by Sewell (2011). Dottin talks of 'the hidden consciousness of their experience', and states that 'visual images have the capability of bypassing cognitive defences of our experience to tap directly into our emotional and spiritual/intuitive zones of consciousness' (Davidson et al. 2009, 10).

However, a number of commentators also point out that such visual data can be reinforced by combining it with other means such as interviews. For instance, Chula states "When interpreting beyond what is visible and descriptive, other methodological techniques such as written narrative and interviews are necessary to clarify ambiguity and vague symbols, and to maintain the integrity of the stories told" (Chula 1998, 1). This is echoed by Croghan et al. who say "combining verbal and visual forms of self-presentation allows individuals more scope for presenting complex, ambiguous and contradictory versions of the self" (2008, 355). Chula also points out the importance of the interview alongside the drawing. This not only allows for the elicitation of meaning within the drawings, but allows for the elicitation of data beyond the drawing itself.

Another methodological approach used was the card sort. Based on the original idea of the Q-sort, developed by William Stephenson in the 1930's, the use of techniques of selecting/sorting prompts presented on cards has been used and developed over the years in psychological and sociological research. Indeed there has been a substantial number of papers published referring to the technique (Thomas and Watson 2002). They comment that the method offers 'a powerful, theoretically grounded, and qualitative tool for examining opinions and attitudes.' (Thomas and Watson 2002, 141). Although the original method is structured by having participants rank statements on cards, and thus producing quantitative analyses, the method used in this study was modified by simply asking participants to choose cards that represented their own experiences. These choices could then be discussed at interview. We can now look at the individual techniques.

Life history

This instrument, labelled **'Me and mathematics'**, is a grid with a horizontal axis marked out with school years 1 through 12, and a vertical axis marked from -5 to +5. Students were invited to place a point on the scale for each school year. In this way, they plotted visually their mathematics life history. This was then discussed in the interview, with particular attention given to the 'dips'. This simple instrument enables the exploration of the question; *'How has your relationship to mathematics changed over the years'*, and subsequently, *'What causes rises and falls in affect?'* The sample of 22 students is not big enough or representative enough to allow for generalisation. If there is one pattern it is that there is no pattern – the responses are highly individual. In about a third of these life histories, the early years are most positive, but for 6 of them, the early years are the most negative. For another third, there is a dip on transfer to secondary. One interesting feature is the influence of contingent factors affecting 'dips' which emerged. Moving country, being ill, losing a parent and a whole range of out-of-classroom factors had a massive (and often poignant) effect. Two key factors that seem to be associated with dips in affect are testing and being placed in a lower grouping – what Boaler (2010) has called 'brutal labelling'.

Card sort

During the course of the interview, students were then offered two sets of coloured **cards** in turn and asked to choose those cards which represented something meaningful about their own experience of mathematics. The first set of cards represented positive emotions, as indicated by Reversal Theory. The emotions included: excitement/curiosity, relaxed, mischievous/playful, proud, virtuous, modest, grateful. In the second set, each card was labelled with a motivationally significant or valent word or phrase – again all positive. Again, these were suggested by the eight motivational states as defined in Reversal Theory. They included: feeling cared for, sense of achievement, freedom, sense of purpose, helping others, powerful/in control, feeling part of the group, having fun, sense of duty. The card sort is an attempt to understand the presence of more positive affect in the experience of these students. In effect, it answers the questions: *'In what ways do you feel positive emotion, what motivates you, and where do you derive satisfaction?*' All students were able to identify positive emotions and feelings, and to describe in quite vivid ways how these come about, and their meaning for them.

The most chosen positive emotions were *pride* and *relaxation*. Pride was usually associated with being able to understand or do something, or to the achievement of test or exam results. Relaxation relates to the experience of being able to cope, to do what was being asked. It is the absence of anxiety. *Mischievous/playful* and *excitement/curiosity* were chosen by approximately a quarter of the interviewees. The two most chosen cards representing feelings related to individual states were *achievement* and *helping others* (both chosen by half of the students). Other cards chosen frequently include *freedom*, *being part of the group*, *fun/enjoyment*, *powerful/in control* and *sense of duty*. These choices were supported by strong personal stories and examples. It is interesting to see that the experience of mathematics, even for the most disaffected, is punctuated by these more positive affect and episodes. This in turn suggests that aspects of their motivation are, as it were, 'turned on' and alert for motivational opportunities and experiences.

The interviews were conducted with the TESE-ME available, and the life history and card sort were administered during the conduct of the interview. These were then explored during the interview. Also included in the interview flow were questions about best and worst experiences of mathematics, and questions around attributions for success/failure. It is feasible to view the data relating to each individual as a holistic case study with a range of data sources. In this case they are highly individual and even idiosyncratic. A small number of the interviews can be characterized by a 'dominant narrative' – being suffused with an over-riding theme that weaves in and out of the narrative. Examples include 'struggle', confidence (loss of), and competitiveness. The data can also be analysed method-by-method. These will be reported more fully in future publications.

For now we can say that each of the methods has been successful in eliciting rich data about the motivational and emotional landscape of disaffected students, and that the emerging themes and messages are worthy of fuller analysis and reporting.

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