THE INCIDENCE OF DISAFFECTION WITH SCHOOL MATHEMATICS

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This paper reports the results of a study of affect and school mathematics, conducted with a whole cohort of pupils in year 9 (pupils aged 15 to 16 years) in a typical UK secondary school. This preliminary study provided contextual datafor a larger mixed methods investigation into disaffection. The study offers interesting insights into the incidence of affection/disaffection within this group. Further, since the school grouped pupils by ability, the study offered the opportunity to look at the distribution of aspects of affect and disaffection across the ability range. Results not only provide contextual data on the incidence of disaffection with mathematics amongst school pupils of this age, it also suggests some interesting tentative conclusions.

INTRODUCTION

Concern about disaffection with school mathematics is not new. There has been a widespread appreciation that it presents a problem for individuals and for society. The State of the Nation Report into Science and Mathematics Education by the Royal Society notes the widespread nature of current concern: "no decade since the 1970's…has seen so much being written about the disaffection young people appear to have for science and mathematics." (The Royal Society, 2008 p.171)

Many of these concerns relate poor attitude or disposition to mathematics to poor outcomes and achievement. In this way, the study of affect in mathematics education becomes important. In her own report, Vorderman (2011) talks about the corrosive effect of frequent failure, and the damage that this causes. The report espouses an approach to mathematics education that goes wider than the purely utilitarian. It talks about 'entitlement', and mentions not just achieving success, but also of 'satisfaction' and of 'increased confidence and motivation' (p.22). This wider rationale for studying mathematics in schools is endorsed by The Royal Society who suggest one of the purposes of learning mathematics is:

> To enable as many students as possible to participate in the scientific and mathematical elements of the conversation of humankind, in as many settings as possible. (The Royal Society, 2008, p. 21)

Considering the importance of the issue of disaffection as outlined here, there is not the volume of research that would seem appropriate to the social and individual impact that has been reported. The Royal Society State of the Nation report (2008) into mathematics points out that there has not been enough quality of research into this area, and cites only three studies (Brown, Brown, & Bibby, 2007; Mathews & Pepper, 2005), (Nardi & Steward, 2003) in relation to mathematics. Much of this evidence is

2014. In Liljedahl, P., Oesterle, S., Nicol, C., & Allan, D. (Eds.) Proceedings of the Joint Meeting of PME 38 and PME-NA 36,Vol. 4, pp. 121-128. Vancouver, Canada: PME.

concerned with progression, and thus with the incidence of disaffection, and is framed as the quantitative study of attitude or related constructs. The study by Nardi and Steward is the exception in that it goes further than other studies in addressing disaffection directly as an issue of significance, and in trying to characterise the construct in research terms.

In international terms, one of the starting points of the study by Zan and Di Martino (2007) is what they called an 'alarming phenomenon': the perceived negative attitude of students of mathematics to the subject. Three core themes emerged from the study, and these related to emotion ('I like/don't like maths), competence or efficacy ('I can/can't do maths') and belief ('Mathematics is…..'). Strong associations were found between liking and being able to do mathematics.

Other trends have also emerged more recently from the quantitative study of attitude. For instance, Noyes (2012) has remarked on the significant inter-group as well as inter-school differences found in data on affective variables studied in UK schools, suggesting that the teacher is a key influence in pupil's experience of school mathematics. Further evidence of the important influence of individual teachers was also evident in a study I conducted with a colleague (Lewis & Forsythe, 2012). Other researchers, such as Boaler (2000) have pointed out that it is not necessarily the case that just low attaining pupils have negative attitudes to mathematics, since she also observed this with pupils in higher sets.

METHODS

My doctoral study was an investigation into the nature of disaffection with school mathematics. It was primarily a qualitative study into the subjective experience of students and pupils who report disaffection. It was conducted within an interpretivist and constructivist frame, and was focussed on issues of motivation and emotion as being central to young peoples's experience of school mathematics. Preliminary results have been reported elsewhere (Lewis, 2013).

However, I had the opportunity to conduct a brief preliminary and quantitative study of a whole school cohort, in order to provide contextual data on the incidence and nature of aspects of affect. Since it was necessary for the study to be simple and bounded, I devised a simple instrument based on the core themes identified in the Zan and Di Martino study (2007), as described above.

The school is a comprehensive foundation 11-19 school in the UK with approximately 1300 pupils. The proportion of pupils who take free school meals is described as 'average' in the 2011 Ofsted report, and only 6% of pupils are from ethnic minorities. The school was rated as 'good and rapidly improving'. In just two visits to the school I was able to survey the whole of the year 9 population of this school (n = 208).

Students were asked to rate the degree to which they agreed with these three statements, on a 4-point Likert scale (the points representing 1-'not at all'; 2 - 'a bit'; 3 - 'sometimes'; 4 - 'a lot'):

I like mathematics; I can do mathematics; I am satisfied that I get what I want from mathematics

RESULTS

Table 1 shows the number (and proportion) of students in each response category, for each question.

	Not at all (%)	A bit (%)	Sometimes (%)	A lot (%)	Mean
Like	32 (15)	60 (29)	95 (46)	21 (10)	2.5
Can do	7 (3)	31 (15)	116 (56)	53 (26)	3.0
Satisfied	9 (4)	56 (27)	90 (43)	52 (25)	2.9

Table 1: survey responses for whole cohort

How these figures are evaluated depend to some degree on the perspective. Only 10% of these pupils like maths a lot, but even that might be more than expected. 44% (29% + 15%) hardly seem to like it at all, with an additional 46% only liking it sometimes. More students appear to feel they can do mathematics than like it, with 26% reporting that they can do it 'a lot'. But that still leaves 74% who can do mathematics at best only sometimes. The 25% of pupils who are satisfied 'a lot' is encouraging, but this also leaves 75% of pupils with at least a degree of dissatisfaction.

Since the school sets groups by ability in mathematics within each half year (labelled 'K' and 'S'), we can address the question of whether, or to what degree, pupils in lower sets did (or did not) experience negative affect more than those in higher groups. This is an interesting question since it is sometimes assumed that lower attainment will lead to more disaffection, even though it is known that students in higher-attaining groups can also be disaffected with mathematics. A comparison can be made between the data from the groups in each half year. The scores below represent the percentage of pupils who reported '1' (not at all), or '2' (a bit) to the three items. This can be viewed as a blunt measure of negative affect.

	S1	K1	S2	K2	S3	K3	S4	K4	S5	K5
Don't like	64	24	67	29	27	60	50	43	36	50
Can't do	14	0	33	7	18	15	25	29	18	33
Not satisfied	59	7	33	4	18	40	38	48	45	58

Table 2: Percentage of pupils in each group reporting negative affect

K1 and S1 are groups at the same level, but they have very different scores. A higher proportion of students in S1 and S2 don't like mathematics than in any of the other groups. Apart from groups K1 and K2, lack of efficacy ('can't do) appears to be evenly

spread across the ability range. Also, whilst only 14% of S1 pupils report low efficacy, 59% report dissatisfaction suggesting a non-simple relation between these two variables.

It can be seen that the most negative affect in terms of attitude ('like') are in groups S1 and S2, with groups K1, S3 and S5 having the least. In terms of efficacy ('can do'), S2 and K5 score the highest (from the perspective of negative affect). For the satisfaction scale (where low scoring suggests dissatisfaction) pupils in K1 and K2 seem to be much more satisfied than other groups. S3 and S5 seem to have less negative affect than one might expect, but S1 and S2 seem to have significantly more than one would expect.

We can conclude that all three measures appear not to decline according to level of attainment. But since parallel groups at the same attainment level can have very different scores, this suggests that it is the class or group itself that is the major determinant of pupils affective experience of mathematics. The scores seem to relate to teacher/group more than level.

Qualitative data

Whilst administering the questionnaires I had the opportunity to ask the students to write briefly their answers to two questions:

> The most frequent or strongest emotion that you feel in mathematics classes
>
> One sentence that sums up your feelings about mathematics

The questions were not 'leading', since the pupils were only told that I was interested in their opinions about school mathematics. Since the number of students was 208, and all students in the year responded, the results can be said to be representative of mathematics students of this age. This data is useful in gaining an understanding of how prevalent aspects of disaffection with mathematics are within the population of that age.

For the single emotion-word response data, care had to be taken in organising and analysing the data. For instance, board, bord, bored, boredom and boring were all taken to refer to the single emotion of boredom. Multiple variations on other terms were also similarly consolidated. The words were then classified in a simple 'positive', 'neutral' or 'negative' manner. Although this is a fairly simplistic way to organise the data, it does have meaning within the context of this study. The results are shown below:

positive	neutral	negative
37	29	135

Table 3: Emotion word responses

This is a dispiriting result, and even more so since the cohort includes the full range of ability. It suggests, at the very least, that mathematics is not a pleasant experience for many students, for much of the time. Nonetheless it is also important to point out that it is not necessarily the case that pupils who report boredom are disaffected. To be

strongly disaffected a pupil would have to report experiencing a whole range of negative or adverse affective responses.

Individual results include: Anger 11, Boredom 68, Confusion 10, Stressful 8, Depressing 5

On the other hand, 'Happy' was chosen 21 times, but 'Fun' only once.

The 'boredom' score here is consistent with boredom being the highest scoring negative emotion on another instrument used in the wider study, although the population there is very different. Such results confirm data presented in the literature on the incidence of negative affect in the school population as a whole.

In the two top groups (labelled K1 and S1) 30 pupils (17 +13 respectively) out of 51, which is well over half of pupils, reported negative emotions, of which 19 were 'bored', whilst 20 pupils (5 +15) reported positive or neutral emotions. It is worth noting the very different numbers of pupils in the two classes reporting positive emotions, suggesting that classroom climate is an important factor influencing students' affective experience of mathematics.

In the two bottom classes (labelled S5 and K5) 13 pupils (2 + 11) out of 23 reported negative emotions (about half) of which only 7 were 'bored', whilst 9 pupils (8 + 1) reported positive or neutral emotions. Note again the very different proportions of pupils choosing positive and negative emotions in the two classes.

Some caution needs to be applied in generalising from this data, however, due to the simplicity of the data, and the small numbers in each group. On the one hand, the cohort represents the full range of ability. On the other hand since only 208 pupils were surveyed, no attempt is made to underwrite the statistical significance of the results. In addition, a single one-word response does not represent a full examination of these pupils affect in relation to school mathematics.

The descriptive passages were also analysed by group, using the same categories as the quantitative data. Groups differ in the relative proportions who appear to 'like' and 'don't like' mathematics (and in terms of which one predominates in that group). Like the quantitative data, the evidence doesn't support the assumption that higher or lower groups like or don't like mathematics more than the other. Positive or negative affect (liking, not liking) and competence (can or cannot do) do not appear to be related to the level at which one is achieving. Put another way, students in higher groups appear to be as likely to not like, or feel they cannot do mathematics as students in lower groups.

Although the primary focus in this study is disaffection, it is worth examining evidence of genuine affection. In class K1 (a top group) there are only 4 responses that can be interpreted as indicating a condition of such affection for mathematics:

> It can be quite exciting in some lessons
>
> Maths is good for making you think (reported emotion – happy)
>
> Maths can be exciting and I learn a lot from it

Maths is a tool we can use to solve problems (reported emotion – happy, relaxed)

Of course, it could be argued that this evidence is thin, and may not represent strong enough evidence to fully support a generalised claim. Nonetheless, what evidence there is in this study suggests that affection for school mathematics is very much the exception. Overwhelmingly, the comments of these pupils are negative, except in terms of utility. In the data, 6 statements use the word 'help' (as in the sense 'will help me'). A further 5 statements use utilitarian words like 'useful', 'essential', or 'important'. In class S1 this recourse to utility is mainly absent, and the picture that remains there is broadly negative. In the absence of utility, duty and coercion are mentioned:

I have to do it

I try to do the best I can to impress my parents

If this is the picture in the two top sets, it hardly gets any better in the lower groups. It can only be concluded that genuine affection for mathematics is a rarity.

The nature of mathematics

In most cases it was quite easy to identify those descriptive statements that related to the nature of mathematics rather than to affect or competence. These statements were split evenly between positive and negative. In terms of positive statements, the most common were about the general utility or value of the competence:

It helps in life in some situations

I think maths is life changing and it can help you in the future

A subset of these related directly to the exchange value of a good qualification in mathematics:

It's an important subject and you need a good grade to succeed in further education

There were also some comments about mathematics being of value in its own right:

Maths is good for making you think

Maths is a tool we can use to solve problems

Maths isn't very useful later in life but it challenges me which is a good thing

The negative statements include those that reflect the nature of mathematics as experienced by them. These include descriptions like 'hard', 'complicated', 'confusing', 'lists of tedious questions'.

Other negative statements related to the perceived lack of importance or utility:

80% of the time completely useless for my future (presumably said without irony!)

It isn't the primary purpose of this study to investigate in depth the epistemological beliefs about mathematics held by pupils, and no claim is made that this data represents a comprehensive examination in that way. However, pupils' views also influence their

affective landscape, and it is interesting to have some idea of this broader picture, as exists in year 9.

DISCUSSION

The evidence from school K offers some insights into the incidence of negative affect in a whole-year population. This shows just how widespread the experience of negative emotions is. Boredom was identified as the single most common negative emotion. The data on disposition ('I like/dislike mathematics') and efficacy ('I can/cannot do mathematics') is broadly consistent with data from other studies (e.g. Zan & di Martino, 2007).

The evidence suggests that the experience of aspects of negative affect does not appear to relate in a simple way to ability grouping or attainment. Pupils in 'top' sets for mathematics exhibit dissatisfaction and aspects of disaffection with school mathematics as much as pupils in lower sets. The data here suggests that a key determinant of pupil's affective experience of mathematics is the classroom climate (or 'microculture' to used Hannula's (2012) term). There is very little data that relates such grouping to affect, but the data here is consistent with the finding of Noyes (2012). This is an important finding, and one that suggests that further research needs to be done to understand this phenomenon better.

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