OBSERVATIONS ON THE NATURE OF QUIET DISENGAGEMENT IN THE MATHEMATICS CLASSROOM

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Research often focuses on disaffection in the mathematics classroom as evident in disruptive behaviour, absenteeism or special needs: thus it ignores a group of students whose disaffection is expressed in a tacit, non disruptive manner, namely as disengagement and invisibility. Ignoring this often large group implies that the mathematical potential of these learners may remain defunct. We have been awarded a 12-month research grant to study quiet disaffection in secondary mathematics classrooms, to uncover the reasons for student disengagement from school mathematics (1) and suggest re-engagement strategies (2). Here we focus on (1): we review relevant literature, discuss methodological constraints and introduce a preliminary set of themes that have emerged from our initial classroom observations.

In the UK, as well as other countries, an increasingly smaller percentage of students appears to be pursuing the study of mathematics at upper secondary level and beyond (ICMI 1998). Evidently the number of students who pursue mathematical studies affects the supply of teachers for this core National Curriculum subject area. The students' choice is seriously influenced by their attitudes towards and performance in mathematics which in turn are deeply shaped by their school mathematical experiences (Johnston 1994), and, in particular, by the mathematics teaching they have experienced in school (Dick & Rallis 1991).

Since the publication of the Cockcroft Report in 1982 attitudes seem to have slightly improved (Brown 1999) but performance is at unsatisfactory levels as evident in recent international comparisons (Jaworski & Phillips 1999). In sum, given the strong links between attitude, performance and choice of further study and career, research on attitudes towards mathematics at school level, and in particular on disaffection in the mathematics classroom, is essential.

Disaffection is defined often in research as disruption or truancy (Elliott 1997) and disaffected students are often seen as a subcategory of students with special educational needs (e.g. Tattum 1986). In these studies two major theoretical perspectives seem to frame current discourse on the origins of disaffection: cultural transmission theory (e.g. Reid 1987) (disaffection as faulty socialisation into local and familial cultures: so, for example, regular school non attendance is accounted as parentally condoned absence) and process theory (e.g. Cooper 1993) (disaffection as a result of the experience of schooling). Research however also suggests that schooling can compensate for faulty local and familial socialisation and thus can reinforce or ameliorate culturally transmitted attitudes (Reynolds and Sullivan 1979). Therefore curriculum and pedagogy can be employed towards modifying student attitudes.

Moreover, recently emerging perspectives view disaffection as rational choice rather than deviant behaviour (e.g. Dorn 1996). These works suggest that a pathology of absence from school can be studied in terms analogous to a pathology of presence: in a world outside school which offers increasing access to knowledge that is independent of adult authority, education through schooling may seem less and less relevant (e.g. Schostak 1991). In attempting to explain what actually motivates students to attend school and conform to its conventions, Schostak and others contend that it is not curricular provision but an unthreatening environment for self discovery and development that maintains school attendance.

This new perspective implies a modified definition of disaffection beyond truancy and disruptive behaviour that includes the quietly, invisibly disaffected (Rudduck, Chaplain & Wallace 1996): those with low engagement with learning tasks, those who perceive these tasks as lacking in relevance with the world outside school and their own needs, interests and experiences, those who routinely execute but do not get substantially involved with the tasks. These students attend school but often underachieve. Re-engagement of these learners is then of strategic importance and the role of curriculum and pedagogy in this is central.

Quiet disengagement is a relatively under-researched type of disaffection. Our study aims at examining students' experiences of quiet disaffection in the mathematics classroom and at suggesting re-engagement strategies. It thus intends to highlight the needs of an often large group of learners whose mathematical potential may at the moment remain inert. This integration of cognitive and affective perspectives on mathematical learning, namely one that merges the study of students' attitudes towards and achievement in mathematics, has been highlighted in the relevant literature as a potentially fertile ground for research in an area where traditionally the distinction between cognition and affect has been dominant (McLeod 1992). Arguably this distinction has been counterproductive as studies of mathematical cognition have tended to miss important characteristics of performance as they failed to gather crucial data on students' affective responses. Furthermore studies of performance, unlike affective studies, have had a stronger influence on curriculum development and teacher education, and an integrated perspective is likely to enhance the influence of findings relating to affective issues.

Since the early 1990s there has been a growing realisation that the classical divide between cognition and affect in mathematics education, traced back in 1956 and Bloom's two volume Taxonomy of Educational Objectives, is not particularly helpful. In fact the interrelatedness of the two domains emerged as early as the 1960s (e.g. Simon 1967). Nowadays non cognitive predictors of performance (House 1995) are seen as pertinent in studies of learning: beliefs, attitudes and emotions towards mathematics are an inextricable component of general mathematical performance (Reynolds & Walberg 1992; Wong 1992; Jones & Young 1995; Ma 1997; Hensel & Stephens 1997) as well as particular mathematical skills (e.g. abstract mathematical thinking (Iben 1991); problem solving (Kloosterman & Stage 1992, McLeod 1993)). Reflecting tendencies in the general literature on disaffection, various studies address the relationship between attitude and performance as a function of the individual's self concept (Jones & Smart 1995; Maqsud & Khalique 1991; Williams 1994; Norwich & Jaeger 1989; Norwich 1994; Skaalvik 1994) as well as of the students' experience of mathematics teaching in the classroom (e.g. the role of 'interesting' class activities (Schiefele & Csikszentmihalyi 1994); the role of teachers' attitudes towards error making (Brown 1992)). In general, disinterest in mathematics generated by certain pedagogical approaches seems strongly linked with underachievement (Boaler 1997).

Non-mathematically specific research (e.g. Keys and Fernandez 1993) suggests that it is likely that, as students proceed to the later years of their schooling, they often become more disenchanted with the education process. In their work 'teaching and learning practices' ranked highly in the students' questionnaire responses to what made them positive towards school and school work. In considering implications for mathematics lessons, the students expressed a general preference for 'working with their friends', 'making' and 'discussing things'.

The above resonate with the findings in Jo Boaler's comparison of two schools with different approaches to mathematics teaching (1998): in the first school, which used a traditional text book approach, despite being 'repeatedly impressed by the motivation of the students who would work through their exercises without complaint or disruption', the students' three most frequent descriptors of mathematics lessons were 'difficult', comments related to the teacher and 'boring'. Students believed that mathematics just involved memorising and routine execution of rules. In the second school which used an open-ended project approach despite having 'very little control, order, and no apparent structure to lessons' students were expected to be responsible for their own learning and the three most frequent descriptors of mathematics lessons were 'noisy', 'a good atmosphere' and 'interesting'. Elsewhere (1997b) Boaler discusses also gender related differences on the same issues.

In the study mentioned earlier, Keys and Fernandez refer to disillusionment with and dislike of school; lack of interest and effort in class and homework; boredom with school and schoolwork; dislike of certain teachers or types of teachers; resentment of school rules; belief that school would not improve career prospect; low educational aspirations; low self-esteem and poor academic performance, as factors associated with disaffection or disengagement. They also discuss the concept of motivation as intrinsic (arising from interest in the subject being studied) or extrinsic (depending on the availability of external rewards). Norwich (1999) adds to these reasons two more categories: identified (e.g. recognition of the importance of mathematics) and introjected (e.g. parental pressure). In his work, introjected reasons were the stronger influences on satisfactory learning and behaving whilst intrinsic reasons were the stronger influences on unsatisfactory learning and behaving. This substantial reciprocal relationship between attitude towards and achievement in mathematics has been made in another recent quantitative study in the United States (Ma 1997) with the three attitudinal measures being 'Importance', 'Difficulty', and 'Enjoyment' and with 'Achievement' as the outcome. Significantly Ma contends 'making difficult content easy to learn is barely enough to improve mathematics achievement. It is more important to ensure that difficult mathematical content is presented in an interesting, attractive and enjoyable way'. And: 'It is inappropriate to assume that high achievers in mathematics have few attitudinal problems.'

Our study originates in the first author's previous involvement with a study of disaffection in secondary education and the second author's previous school-based research and teaching experience in the area. Results from the now concluding study that the first author has been involved in indicate that there is a wealth of evidence specific to mathematics to be explored with regard to this form of disaffection. Therefore research which offers an extension of this study and addresses this rarely explored, but significant, topic is timely.

Methodology. Participants of the research are mathematics teachers and students based in 3 Norwich schools, involved with the previous study (e.g. (Oakley 1999)). This previously established contact and willingness to participate (all schools were approached but our selection was based on school response, pilot lesson observations and timetable constraints). The field of the research are Year 9 mathematics lessons. This is a one-year project and is funded by the Economic and Social Research Council (Award No R000223451) .

We are currently completing Phase 1 (October 2000 - January 2001). The second author observes students in mathematics lessons in which the participating mathematics teachers are involved and, also through consultation with the teachers, is now engaged with identifying a group of mathematically disengaged students.

In Phase 2 (January - April 2001), this extensive observation of the mathematically disengaged students will be supplemented with interviews of the observed students (these will be interviews of the whole class cohort in groups of approximately two to five students to avoid the implication of the observed students noticing their 'singling out' for observation): these will be semi-structured interviews in which the researcher will draw the students into an exploration of particular classroom incidents (Disengagement Incidents) as well as their general attitudes towards mathematics and its teaching. This process will be supported by occasional interviews with the teachers and supplemented quantitatively by an attitudinal survey administered to the students.

The researcher keeps fieldnotes of the lesson observations - the interviews will be audio-recorded. She then passes her fieldnotes on to the project director, the first author, who annotates them with comments of a substantive and of a methodological nature. This commented upon document is the Observation Protocol and there is one such document for each lesson. In this document there is preliminary identification of Disengagement Incidents. This process is carried out on a weekly basis so that the researcher's technique is constantly informed by these comments. Also in a weekly meeting we discuss the researcher's response to these comments. As an example, in the Appendix, we provide an Observation Protocol from one lesson (a preliminary analysis of the Disengagement Incident in this lesson is available in (Nardi and Steward 2000). Also: see Endnote for the plan regarding our conference presentation).

A note on methodological constraints. During Phase 1 and the seven weeks of classroom observation, we encountered, and partly resolved, several obstacles of a methodological nature: while engaging with identifying the 'subjects' of our study, the quietly disaffected in the mathematics classroom, or, to use another term that has grown to be of common use amongst us, the 'invisible' ones, we may have not 'seen' them; in other words they are perhaps the ones that are not present in the researcher's fieldnotes. The occasional hesitation of the researcher to approach some of these students was due to her concern that, by focusing on them she would actually render them 'visible' or her focus would actually result in re-engagement because the students would believe this is what she wants or expects to observe. We are currently resolving this by trying to foster an image of the researcher to the children that is completely dissociated from that of a teacher or that of an assessor of their work or some sort of ‘authority’ figure. This has been a complex task given this researcher's long-term experience as a teacher and the internal struggle between her identity as a teacher ('insider') and her identity as a researcher ('outsider') (Elliott 1991). Another methodological constraint is a certain transience in the nature of invisibility that we observed: over the seven week period we have identified episodes of 'invisibility' for some students who, in a following lesson, sought help from their teacher or peers and appeared engaged with their mathematics. Of course there have also been a number of students that are 'permanently invisible'. We intend our fieldwork to be as inclusive for both groups as possible. Finally, there seems to be a type of invisibility *as far as engagement with the mathematics is concerned* that is, paradoxically, deeply embedded in extreme, disruptive behaviour; in other words disruptiveness seems to cover up feelings of inadequacy towards the mathematics. Often these loud students *choose* not to engage in the mathematics and the manifestations of this can take various forms - for these students it is very apparent, for 'invisible' students it is not; yet the underlying reasons for their disengagement may be the same. We feel that our observation and interviewing techniques need to allow the evidence from these 'visible' students to inform the main body of data.

Phase 1 Preliminary Themes. Within Phase 1, where examples of students' lack of engagement in tasks they are expected to do has been observed we have sometimes been able to attribute these examples to a number of tangible reasons. We stress that this attribution is tentative. We offer this list of themes but, for want of space, the grounding of these themes to the data and the relevant literature (e.g Norwich's extrinsic reasons for engagement have repeatedly appeared in our observations) is omitted here but is available in current (e.g. Nardi and Steward 2000) and in-preparation publications: **(i)** students may react positively to a change to the normal routine of their mathematics lessons especially if these are textbook based however if the format of this change is too different and students are not given enough time to adjust then, what is assumed to be a re-engagement strategy, may potentially disengage them even more or disengage a different group (this does not include puzzles but includes the often perceived as strong on re-engagement activities such as 'investigations', where the otherwise welcome open-endedness of the task can be puzzling) **(ii)** Students can be re-engaged through using information technology and, in particular, subject specific software. However if students rarely use computers in mathematics, are unfamiliar with the software or the software is not well written this has been observed to lead to frustration and a lack of interest **(iii)** the impact of setting, and in particular of placing the students in a set that is beyond/below their ability, as well as the teacher's perceptions and expectations of individual students, is significant **(iv)** a pedantic, procedural or mechanistic approach to mathematics teaching (and/or a teacher personality with these features) has a clearly alienating impact on the students despite the teacher's aspiration for clarity and precision **(v)** conceptual difficulties within particular topics as well as certain uses of mathematical jargon have an immediate effect on the student's emotional response to the task and ensuing engagement. Extension and further refinement of these themes is to follow in the subsequent phases of the study.

ENDNOTE: In the conference presentation we intend to **discuss samples** of the Observation Protocols, the Disengagement Incidents and Associated Interview Extracts in order to **exemplify** the Analytical Themes that will have emerged in a more elaborate and refined manner from Phase 2.

APPENDIX: An Observation Protocol

<table>
<tr><td colspan="2">**Lesson [name of school]1.2**: 01/11/00 Wednesday, Period 4, Time: 1.25 – 2.25</td></tr>
<tr><td>**Researcher 1 Field-Notes**</td><td>**Researcher 2 Comments**</td></tr>
<tr><td>I sat at back opposite the door. In class also (male) student teacher from university (not introduced) and support teacher for the Portuguese speaker. Students carry on work on circles. Teacher began by recapping work on algebra in Year 8. On board: “ 4 r = 16, r = 16 / 4 [several students called out 4], r = 4 , 4 t = 22, t = 22 / 4, r = 5.5 ”. Teacher: “If anyone has problems with that now is the time to say so”. NOT SURE MOST STUDENTS WOULD OWN UP IF THIS WAS THE CASE .

On board “ π x diameter = circumference, radius 4.2. Teacher asks what the diameter is. Hannah answered 8.4, “ pi x 8.4 = circumference”. Students asked another question “π x diameter = 42”. Verbally “what’s the diameter?”. Boy at front + Zebedee + Anna put up hands. On board: “diameter = 42 / π” Verbally: “you divide by π”. Hannah: “I don’t understand”. Teacher: “I’ll come and talk to you”. Hannah: “ I never understand”. Girl on table near me asked someone else who also shook her head. Teacher on board: “a circle with circumference of 72.6cm, the radius of this circle to the nearest 0.1 cm is π x diam = circ, π x diam = 72.6, diam = 72.6 / π, [diam = 72.6 / 3.14]. Teacher asks girl at back to work this out using her calculator. Teacher wanted all the digits shown on the calculator. Even though girl tried to give answer accurate to 0.1cm. “You **do** have to write down the whole calculator display”, teacher says. “diam = 23.12101911, radius = 23.12101911 divided by 2 = 11.5605… = 11.6 to nearest 0.1cm”. Teacher asked who didn’t have a calculator. A girl owned up – was asked how good her long division was. Anna who had moved to back table near me said: “I really don’t understand”. Teacher: “But you always say that”. Teacher went to help Hannah. Teacher came back to Anna – the whole table seemed to listen.

I WASN’T SURE ANY OF THEM UNDERSTOOD WHAT TO DO. *WHEN THE TEACHER WENT AWAY THEY DISCUSSED THE FIRST QUESTION - THEY WERE NOT SURE WHAT TO WRITE DOWN FROM THE QUESTION – THEY TRIED TO FOLLOW THE RULES FOR SETTING OUT ON THE BOARD. THEY HAD LOST SIGHT OF THE PROBLEM – THEY WERE BOGGED DOWN WITH DETAIL – NO FLUENCY IN SOLVING THESE PROBLEMS HAD BEEN DEVELOPED.*</td><td>Speculative comment about the students' response to teacher's general calls for assistance.

Evidence of disenchantment with own performance.

Evidence of teacher trying to achieve too much: learning on circles etc. AND decimal place (and how calculators deal with decimal place)? Evidence of teacher dismissing student's call for help or of teacher encouraging student to overcome usual hesitance about her performance? Anna is not an invisible child in this sense because her potential disenchantment is visible.

On Researcher 1 comment: Speculation or based on evidence?</td></tr>
<tr><td>I sat next to Jade, Charlotte and Ellie. I talked to Jade who seemed to confidently start the first question but then couldn’t believe she could do it. *She didn’t want me to sit next to her*. Jade: “I’m no good at maths. I’ve never been any good at maths”. Me: “What about last year or in Middle School?”. Charlotte: “It was alright last year with Mr. J”. Jade: “He didn’t make you work”. Jade gave up completely when she thought her two friends had a different answer to her – looked at her watch and sighed. Charlotte and Ellie were too bound up with setting out of problem – *they seemed to lose sight of what they were doing.* Jade approached by student teacher – body language suggested that she just wanted to be left alone. She could not believe she had done it right especially when it was pointed out that only the diameter was needed in this question. And she had worked out the radius. She started drawing margins in her book and writing down question numbers – *avoid maths activities.* Charlotte and Ellie started to understand what they had to do. Charlotte was more vocal than Ellie but Ellie seemed reasonably quietly confident. At 2.10 the teacher stopped the lesson to explain rounding. Charlotte and Ellie could do rounding. Charlotte (to Ellie) **“Oh no she’s going to explain it all”**. Teacher made students go to the back of their books to write. On board: “**When asked to correct to n decimal places you always look to the <u>next</u> digit to see whether it affects the nth decimal place. It will only matter if the value of that “n + 1” decimal place is 5 or more in which case you add one to the nth decimal place,** then e.g. 1.989898...'. Ellie and Charlotte got on with the exercise. *THIS INTERRUPTED THE FLOW OF THE LESSON, LOST THE FOCUS OF CIRCLES AND WAS AN UNINTELLIGIBLE PIECE TO WRITE FOR ME LET ALONE YEAR 9 STUDENTS.* Student teacher went back to Jade: “I really don’t like maths”. Me: “What do you do when you don’t understand?”. Jade: “Wait till she’s free and ask her”. Me: “ Do you put up your hand?”. Jade: “Sometimes or otherwise I ask them (friends on table) – she’s too scary”. Teacher gave answers at end of lesson at which point everyone gave up. ***IS MATHS JUST ABOUT ANSWERS?*** The 3 girls talk about their next lesson. Ellie: “He (another subject teacher) sent me out for saying his jokes are rubbish. ” *c.f. maths where she never says anything to the teacher.* Jade:” I don’t like any teachers”.

IS THIS AN EXPRESSION OF DISENCHANTMENT OF SCHOOL IN GENERAL NOT JUST MATHS IN PARTICULAR? *AT THE END OF THE LESSON I SPOKE TO THE TEACHER WHO SAID SHE HAD HAD TO ASK A GIRL’S NAME BEFORE SHE COULD GIVE HER A CREDIT – AN ACKNOWLEDGEMENT THAT SOME STUDENTS ARE INVISIBLE AND UNKNOWN EVEN AT THIS POINT IN THE TERM.* ***MY IMPRESSION IS THAT TEACHER'S PEDANTIC APPROACH AND EXCESSIVE ATTENTION TO DETAIL IS INHIBITING LEARNING***.</td><td>**DISENGAGEMENT INCIDENT: Distilled (after 'irrelevant' facts are removed or summarised), this episode is perhaps the first here to directly address the development of disengagement (Jade starts from a confident point but then her confidence deteriorates?) and a certain denial from the student on tackling it.**

END OF INCIDENT

Teacher's assistance in identifying invisible children is invaluable. However bringing their attention to potentially invisible children their attitude towards them maybe will change. Will this affect our data?

Conjecture about the impact of teaching style on learning</td></tr>
<tr><td colspan="2">**Researcher 2 'Preliminary Verdict':** Disengagement Incident. Also disperse evidence.</td></tr>
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