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Video Diaries to Investigate Attitudes and Emotions Towards
Mathematics in Year 3 and Year 6 Students**

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“I HATE MATHS: WHY DO WE NEED TO DO MATHS?” USING VIDEO DIARIES TO INVESTIGATE ATTITUDES AND EMOTIONS TOWARDS MATHEMATICS IN YEAR THREE AND YEAR SIX STUDENTS

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Accessing children’s feelings and attitudes towards mathematics is a challenging proposition since methods for data collection may be fraught in terms of bias and power relations. This article explores a method of collecting information from young students about their attitudes towards mathematics using iPads, and a video diary technique not dissimilar to the ‘Big Brother’ room, with which many children are familiar. We describe the development of the tool and process when implemented in a primary school setting. We allude to both the enabling prospects of the technique as well as some of the limitations we found when implementing the method. We then discuss the implications of the largely negative attitudes and emotions that the students recorded and suggest that these negative attitudes are well-formed by the end of the early years of schooling.

Key Words: Anxiety, Attitudes, iPads, mathematics education, Primary School mathematics, Video diaries

Running Head: Investigating Primary school students’ attitudes towards mathematics.

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In this article we explore student attitudes and emotions towards mathematics at two junctures (year Three and year Six) in an urban, state government, primary school. Up until this point, much of the research into student attitudes has investigated secondary schooling contexts where students have the option of physically opting in or out of mathematics (Attard, 2011). Research to date suggests that students are often opting out, as participation in secondary education mathematics continues to fall (Sullivan, Tobias, & McDonough, 2006) and this issue has been identified as a significant concern by a range of governments (Reiss & Ruthven, 2011). The primary school context investigated here is different to secondary contexts in that students have no option to physically opt out of mathematics but may well be psychologically opting out by distancing themselves emotionally and attitudinally from mathematics. In terms of this article, we are unable to confirm any formal “opting out” of mathematics since the students are compelled to remain studying mathematics in the primary years. However, we contend, that having negative emotions or attitudes towards mathematics in these formative years, may be creating potential for students to create a mathematics habitus that is not conducive to positive experiences of mathematics. From other studies, it has been documented that many students demonstrate negative attitudes and emotions to mathematics and that these negative experiences of mathematics are associated with anxiety, shame, inadequacy, anxiety and hopelessness (Frenzel, Pekrun, & Goetz, 2007; Prawat & Anderson, 1994). The overall effect of this negativity can be manifested in poor achievement in mathematics (Hemmings, Grootenboer, & Kay, 2011) as indicated in PISA and TIMSS results for Australian students over the past decade (Tulis & Ainley, 2011). These findings prompted the initial research question outlined in the methodology.

A compounding issue in addressing the initial research problem is the difficulty mathematics researchers experience in authentically accessing student attitudes towards mathematics, particularly of younger students. This project develops a methodology that

enables learners to recount experiences, feelings, emotions or thoughts in relation to their mathematics learning rather than researchers making judgements regarding student thinking from observations. Similarly, many of the interview techniques used to assess students' feelings and experience are fraught methodologically with a power differential between the student and the interviewer where questions may be asked of the authenticity of the students' responses. To this end, the second focus of this article is developing a method that may help alleviate some of the potential limitations in traditional approaches to understanding students' experiences and reactions to mathematics education. Modifying a 'Big Brother' methodology by using iPads, students were able to enter a neutral space set up in the school to talk freely (to the iPad) about their experiences of mathematics. This method sought to elicit the experiences of young learners in ways that would allow researchers (and teachers) access to their "true" feelings, at least insofar as they were prepared to discuss them. Recognising that interviews or surveys can produce biased results, and mindful of the power differential existing in school environments, the video diaries approach may offer a more robust and reliable account of students' lived experiences (Buchwald, Schantz-Laursen, & Delmar, 2009; Sewell, 2006) and provide greater opportunity for students to discuss any aspect of mathematics they chose (Di Martino & Zan, 2010). This research prompted our second research question.

What is novel in this research is the use of iPad videos as a mechanism for students to record their videos. This technology allows the students total control of the data collection process. We suggest that accompanying this control is an increased likelihood that students will record authentic videos of their attitudes towards mathematics.

LITERATURE REVIEW

As indicated, much of the research investigating student attitudes focusses on secondary schooling where students, to some degree, have the option of opting in or out of mathematics. In a primary school context, students have no option to opt out of mathematics (physically) but may well be opting out (psychologically) by distancing themselves emotionally and attitudinally. The purpose of this short literature review is to: synthesise research into attitudes and emotions in mathematics which are important as a key component of overall well-being and psychological health; assess the impact of attitudes and emotions on students' learning and achievement in mathematics (Hemmings, et al. 2011) and; determine the efficacy of iPads as a tool to collect information regarding student attitudes.

Student Attitudes

We present here a brief snapshot of the literature on student attitudes towards mathematics. We recognise that this is very well-researched area in mathematics education and thus it is not our intent to provide a synthesis or critical analysis of this large field. Rather, our purpose is to provide some background to our study, recognising that there are important differences and nuances in this research field that are relevant to our work. As noted, a key focus of this article is a novel method to collect such data.

Research into beliefs, attitudes and emotions has indicated an important, and inseparable, relationship between cognitive and affective mathematical domains. Ma and Kishor (1997) note that "there is a cognitive component to every affective objective and an affective component to every cognitive objective" (p.26) and this suggests that any investigation into reasons for non-participation in mathematics must include an examination of both affective and cognitive domains. McLeod (1992) suggested that

student beliefs about mathematics could be categorized in four ways: the difficulty and rule-based nature of mathematics; the self and self-confidence in learning mathematics and attributions for failure or success; how mathematics should be taught; and the social context for learning mathematics. Student feedback in our study strongly reflected the veracity of the first two beliefs, particularly the suggestion that mathematics is difficult (See Köğçe, Yıldız, Aydın, & Altındağ, 2009).

An equally-strongly reported emotional response towards mathematics is that of mathematical anxiety (Ma, 1999). Anxiety has been shown to have negative effects on mathematics achievement as a consequence of an associated reduction in working memory (Maloney, Schaeffer, & Beilock, 2013) with obvious impacts on performance in high stakes testing. Although significant research into beliefs and attitudes on mathematics has been conducted, much of this reported research concerns older students (Vanayan, White, Yuen, & Teper, 1997), despite the fact that negative attitudes towards mathematics appear to have their genesis very early in formal schooling. What is needed is a deepened investigation into when the first signs of mathematical withdrawal occurs to determine “how the ‘curiosity machine’ (the student) turns into a ‘mathematical idiot” (Di Martino & Zan, 2010, p. 28) and how this aversion to mathematics may be avoided or at the very least minimised. It is at this juncture, that the research reported in this article makes a contribution to the literature as the tool that was developed offered us responses from very young children that provide valuable insights into when students are beginning to develop negative responses to mathematics, and what may be the catalyst for these responses.

Collecting Authentic Data on Student Attitudes

In this research we use iPads as a mechanism for collecting information, from students, about attitudes towards mathematics. Although we used iPads in a novel way in

this project, the device shares many of the affordances and limitations of video recordings in collecting information from students regarding disengagement from mathematics (Author, 2014). It is therefore important to ground this research in the findings of earlier research regarding the use of videos to collect student responses. Proponents of using video research, itself a relatively novel research methodology (Buchwald, Schantz-Laursen, & Delmar, 2009), argue that using videos enables researchers to collect data of a more profound, compelling quality than the data normally collected in interviews, surveys, or observations (Lundström, 2013; Noyes, 2004a). In this critique we consider: notions of student voice and narrative; students as central agents in the data collection process; student comfort with technology and; ethical issues of personal privacy and self-disclosure. In the body of the article we argue that the use of iPads enables a researcher to more authentically establish when the first signs of mathematical withdrawal occur. While our focus was to access information regarding mathematical disengagement, this does not limit the possibilities of this method for researching other aspects of students' mathematical behavior and thinking.

The purpose of this research was to gain knowledge concerning the students' thoughts, feelings and emotions as they engage with school mathematics and thus we relied heavily on student voice, mathematics talk regarding the context of learning mathematics (Kotsopoulos, 2010), and ongoing narratives regarding their experiences of mathematics. The limited literature available suggests that the use of videos encourages students' voice and the telling of personal narratives (Buchwald, et al., 2009) and that student voice is critical as it can often be problematic for adult researchers to understand the world view of students. Di Martino and Zan (2010) suggest that narratives are an interpretive approach that gives students the opportunity to articulate their relationship with mathematics more

fully than via the data usually collected in classroom based research via observations, surveys, inventories and the like (Noyes, 2004a).

A common research concern involving children is the asymmetrical balance of power between them and the adults with whom they interact. Children are largely conditioned to this adult-child dynamic and have developed strategies to deal with adult intervention whereby 'honest' responses are minimal and 'correct' responses are offered instead (Bogdan & Biklen, 2007). The use of videos may be a mechanism to reduce the power imbalance and minimise the tendency of children to seek to please adults. Lundström (2013) suggests that video diaries can be a means of empowering participants to speak authentically of the experience under investigation and to thereby "create representations of their own experiences" (p. 7). This opportunity to create accurate representations is particularly relevant in research on early years' school students whose means of written self-expression may be limited. The removal of the requirement to express their feelings in written format (written diaries, short answer questions, surveys etc.) provides these students with an increased opportunity to more effectively communicate their experiences of mathematics.

In the initial research work of Noyes (2004a), the students were able to video themselves whenever they chose; however, they were not able to delete their videos. Therefore, the use of the iPads to self-record video diaries adds an additional degree of freedom to the students in our research as they are in complete control of the entire recording process. In practice, as was reported in the work of Buchwald et al. (2009) and Lundström (2013), this meant that students had control over creating a video or not; determining what they would like to say; and then deleting the material afterwards if they were not satisfied with the result. By virtue of this facility, the students, and the subsequent data, are less influenced by the agenda of the researcher (Lundstrom, 2013). In addition,

the act of recording a video demonstrates a degree of comfort in the process and a willingness to share personal narratives (Buchwald et al., 2009). It was evident in the data collected in this project that the majority of students were comfortable with using the iPads to record and share their stories. This supports the research of Noyes' (2004a) who noted that students came to view the camera as a confidant, a listening ear, a third party with whom they can share their experiences. In one sense, the camera appropriated the various roles of audience, friend or adviser (Buchwald et al., 2009).

We have indicated earlier in this critique that the use of videoing offers a richer body of information than can be collected from surveys, observations or interviews. As was the case in the research of Olive and Çağlayan (2008), the ability to revisit video recordings is of obvious benefit to the researcher as the videos can be replayed as many times as necessary to closely scrutinise the data, thus avoiding possible misconceptions more likely to be present in other forms of data collection. In addition, it is a relatively simple task to translate the video material into text for analysis using tools such as Leximancer or NVivo (Buchwald, et al., 2009). However, the very richness of the data can itself be a challenge in terms of analysis and interpretation (Lundström, 2013) particularly in instances where non-verbal data is also being analysed as the video footage places greater demand on the researcher's knowledge of the context, the students, and on non-verbal cues and gestures (Kim, Roth, & Thom, 2011; Noyes, 2008). Noyes (2004a) suggests that, due to the increased complexity of the analysis task, there is a heightened onus on the researchers to bring a high degree of reflexivity to the analysis task and "to understand this filtering/translating process so as to reinterpret, as thoroughly as possible, the original contribution and how it forms a part of the considerably bigger picture that is the child's habitus" (p. 203). This process can be hampered in that the opportunity to further probe the data is limited (Buchwald, et al., 2009) without a follow up interview with the students

which negates the advantages of videoing in the first instance. Nevertheless, Noyes (2004b) indicates that “despite the epistemological challenges of constructing and interpreting video data, there is considerable value in using this medium as a means for exploring children's broader social history” (p. 207). In addition, in this research, the iPad allowed students to share their work more easily via the photograph function on the device.

The body of research presented here suggests that video data collection, cognisant of the provisos noted, is a highly appropriate methodology for researching the thoughts, feelings and emotions of young students. It is apparent that this form of data collection can encourage them to offer data that is unlikely to be gathered using more traditional methods of classroom data collection. The suggestion is that video diaries provide a mechanism for a deepened investigation of the experiences of students over an extended period of time (Buchwald et al. 2009) and affords the researcher the privilege of being privy to “otherwise inaccessible aspects of the students experience” (Noyes, 2004b, p. 207). This is of particular import if we are to a) uncover more clearly student attitudes towards mathematics and b) improve the teaching of mathematics as a consequence of an increased understanding of the attitudes and emotions students bring to, or experience, whilst completing mathematical activities.

METHODOLOGY

Focus of the study

A critique of the literature identified two areas of fruitful research that have generated two research questions.

1. What attitudes and emotions towards mathematics were reported; and are there any patterns in this self-reporting that coincide with two junctures in primary schooling?
2. How can the use of the inbuilt iPad video camera contribute to the collection of authentic data regarding student attitudes and emotions towards mathematics?

Method

Using video diaries as a means of identifying students' experiences in primary mathematics, we sought to develop the method using modern technology, an iPad, rather than a digital video camera. Two classes of year 3 and year 6 students, in one school, participated in the study. Four teachers participated in the study. The Principal of the school was approached by the researchers to be involved in the study as the school is a 'feeder' school for a secondary school involved in a State Government funded initiative to improve mathematics teaching. The school is a 'typical', urban, government operated, co-educational primary school. Once approval to conduct the research had been received, teachers in the lower and upper areas of the school were invited to meet with the researchers. At this meeting the proposed research was explained and four teachers agreed to take part in the project. Informed consent materials were then sent to the parents / guardians of students in these four classes. The total number of students involved in the study was 105 and data collection took place over a ten week period in 2013.

One of the researchers met with the teachers and students on a weekly basis over the ten week period so that a rapport could be developed with them. During these meetings the students were encouraged to record a video. These regular meetings were an opportunity to reinforce the awareness that diary conversations were with the researchers and not with their teachers or parents so that students would feel comfortable recording their diary entries. . In addition, regular email and phone correspondence occurred with the teachers and a regular component of these conversations was a reminder to encourage students to record videos. Written prompts with colourful illustrations (e.g. “What would I tell my mum and dad or my Principal about what I did in maths today?” or “If maths were a food what type of food would it be?”) were also placed within the tent so that students could be focused on the task.

Two tents were erected, one in each year 3 and year 6 shared space, to create a “mathematical thinking space”. Students were able to enter the tent to record their video as they chose, within the boundaries of the usual classroom teaching requirements. This was usually during the times when students would be seated doing individual work or when they had completed set tasks; however, there was no requirement that all students must record a video. Students were able to use the video camera that comes standard with any iPad, to record their musings, and if they needed, they could also use the camera to take photographs of mathematics work relevant to their conversations. 116 individual video entries were recorded. The video entries were collected and downloaded each week and they were transcribed by a Research Assistant. The raw data was then analysed by both researchers and key themes were extracted. Comments were coded as either positive or negative according to the use of language – e.g. “hatred”, “confusion”, “it sucks” were deemed as indicating a negative attitude towards mathematics and language such as “exciting”, “fun”, and “it thrills me” were deemed as indicating a positive attitude towards

mathematics. As the students were reporting their feelings about mathematics, there were no comments that could be considered neutral. This is not to say that some students did not hold neutral views of mathematics; however, these students did not record a video expressing neutral views. In terms of the analysis for this article, we have drawn on the most frequently occurring responses from the different data sets and then used exemplars from those categories to provide illustrative examples for the different categories that were identified. In analysing the data, we have broadly used a ground theory approach (Strauss & Corbin, 1997) to analyse the data. Using this approach, we were able to sort through the responses, and apply key words that best described the responses. From this we were then able to identify the most frequently occurring responses that provided insights into the lifeworlds and interpretations being made by the students.

In analysing the video experiences, we followed the approach established by Noyes (2004a) and focused on critical incidents that “provide significant insights into the object of inquiry” (p. 205) over the course of the ten week data collection phase of the research. We thus draw upon illustrative videos that demonstrate the affordances and limitations of the use of the iPads to collect relevant data concerning students’ experience of mathematics and we also provide illustrative student comments where appropriate. We took heed from Noyes’ (2004b) doctoral work where students in his study talked about quite personal (out-of-school) matters and for ethical reasons we needed to alleviate this possibility. The strategy appeared to be successful since minimal videos of a personal, non-school nature were recorded. For this article, we draw on illustrative critical moments, and in recognition of the fact that the majority of critical moments recount largely negative experiences of mathematics for both year levels, these accounts form the bulk of the data to which we refer.

FINDINGS

Presented initially (Table One) is a descriptive account of the data recording numbers of total entries categorised by gender and by year level. In terms of percentages of students to record a video, of the 105 students involved in the study, (67/105 or 64%) recorded at least one video. In terms of gender, (42/67 or 63%) of the entries were from female students and in terms of year level (40/67 or 60%) of the entries were recorded by year 3 students.

Table One – Total number of video entries by gender and year level

Year Level	Male Entries	Female Entries	Total Entries	No of individuals recording a video
3	25	53	78	40
6	19	19	38	27
Combined	25	42	116	67

These data suggest that students were comfortable using the iPads to record a video as approximately 64% of the students did so. We take this as evidence for the success of the iPad as a means of accessing student thoughts about mathematics. The high relative percentage of female students recording a video, as compared to male students, goes some way in accounting for the overall largely negative response towards mathematics. Whilst some Year 6 female students displayed negative attitudes towards mathematics, the trend of more negative than positive attitudes being displayed is primarily caused by a number of Year 3 female students who recorded videos indicating a negative attitude towards mathematics. Although it is not possible for us to distinguish whether or not this higher percentage is a result of female students being more capable of expressing feelings as opposed to being more likely to hold negative views about mathematics, these findings are in line with much of the current research suggesting higher levels of negativity towards

mathematics by female students (Frenzel, et al., 2007). Whilst it is perhaps not surprising to see that the year 3 students were more willing to discuss their thoughts than the year 6 students; the fact that many of the year 3 videos were negative has implications in terms of the teaching of mathematics in the early primary years as it suggests that the withdrawal from mathematics occurs earlier than perhaps is generally thought.

It is immediately apparent from the data (116 videos from 67 students) that a number of individuals recorded multiple videos. To ensure that a small number of students did not skew the data in terms of positive or negative attitudes towards mathematics, we also sorted the data according to number of entries per student (Table 2). Pseudonyms are used in the description of any particular students in the study and S3, S29 etc. indicate that the student did not use their name in recording the video.

Table Two – Frequency of individual students with three or more separate video entries

Student	Year level	Gender (M/F)	No of diary entries
Beatrice	3	F	11
Paul	3	M	10
Sonia	3	F	6
Charlie	3	F	4
S3	3	F	3
Jane	3	F	3
Joseph	3	M	3
Hank	6	M	3
S29	6	M	3
S20	6	F	3

There were a further 10 students who recorded two videos each. Despite these multiple recordings, by far the greater number of students (47) only recorded a single video during the ten-week period. In terms of percentage, of the students who recorded a video, 70% of them only recorded a single video, and this percentage remains consistent when separate year level data are examined. The data indicates that Beatrice, Paul and, to a lesser

extent, Sonia were very willing to share their thoughts about mathematics. It is beyond the scope of this article to determine why this was the case; however, future research will examine the experiences of Beatrice and Paul as two case studies. In terms of this article, the large number of videos from a few individuals did not distort the proportion of positive or negative comments overall as Beatrice was largely negative, and Paul was largely positive, about mathematics.

DISCUSSION

The remainder of the article will focus on the themes identified in the literature review to determine whether our findings match or challenge previous findings. These findings will be discussed under two broad themes; namely, the efficacy of iPad videos as an appropriate methodology to investigate student attitudes and emotions to mathematics; and what students were recording in terms of their relationship to mathematics.

RESEARCH QUESTION TWO: IPADS AS A METHODOLOGICAL TOOL

A number of themes emerged in relation to the use of iPads to collect data from students. These themes are students in control of the technology; student voice and personal narrative; irrelevant data; and personal disclosure of data.

Students in control and comfort with technology

Overall our data suggests a significant level of comfort with the research design. This comfort is partially a result of establishing a private space (the tent) where students could discuss their attitudes but more specifically a direct consequence of the use of the iPad video camera. The students were very confident in their use of the technology and did not require any assistance from their teachers and from our interrogation of the data, this facet

contributed significantly to the authenticity of this methodology. This is a point of divergence from the Noyes (2004a) study as our research participants were in total control of the process. They could record as much or as little as they liked, and also had the opportunity to delete and re-record their work at their discretion. The iPads also had improved functionality for young students for them to easily record their attitudes and emotions towards mathematics and also for them to take photos or videos of the mathematics they were completing. Indicative student comments regarding the research design include

I love this place...what can I talk about today? With maths you can count sheep, you can count other stuff. (year 3 student).

Hi, I like working in groups because I like co-operating with other people and it is funner than sitting at your desk writing things out. So that's all I feel like saying at the moment, thanks. Bye. (year 3 student).

Sometimes maths is blah – I don't really want to talk. I don't like mathematics. Goodbye. (year 3 student).

In addition, it was clear that while recording their videos, many students felt as if they were directly talking to the lead researcher. This replicates the finding of Noyes (2004a) who also indicated that students were using the videoing process as a means for speaking “directly” to the researcher. Indicative comments include

(Researcher's name), tell me, why do we have to do maths it's just so hard and boring. Like my times and my takeaway and my division and my plusses. Why are they all hard? I don't really know (Researcher's Christian name). (year 3 student).

Bye (Researcher's name). And if you know someone called Vanessa, tell them I said hi. Have fun watching this video. (year 3 student).

Thank you for my diary visit. Amen. (year 3 student).

This phenomenon was much more prevalent with the year 3 students. The researcher's name was mentioned on 12 occasions by year 3 students but not once by the year 6 students. However, although the year 6 students did not address the lead researcher by name, they appeared to be speaking directly to the researcher in terms of the various salutations at the end of their transcripts including

So that's how I feel about math and what we have been doing, so hope you enjoy it, bye. (year 6 student).

I've got to go finish it in my book now so see ya. (year 6 student).

Just so you understand, I'm doing this (photo of work included). (year 6 student).

Student voice and personal narrative

One of the primary reasons for using the iPads was to encourage authentic student reflection on their experiences of mathematics. The high degree of comfort that the students displayed in using the technology indicated to us that they felt comfortable in discussing their thoughts. Although it is difficult to verify the veracity of the student videos, the range of positive and negative responses suggests a certain level of integrity in the process. We suggest that this is the case because the students felt they did not need to be telling us what they thought we wanted to hear. Indicative student comments include

And it's just a big blob of confusion and it makes me frustrated that I can't understand it. I want to understand so I can do good in the rotations but it's just like a big blank. It makes no sense at all. It's really confusing. (year 6 student).

Hello, Yah! I got everything right. I got everything right. I love math. See, see, I knew all the answers (shows workbook). I'm so excited, Yah. And everyone is angry with me because I got everything right. Yeah, but I did really well today so I'm really happy. (year 6 student).

It absolutely sucks. And it sucks because it's hard and you have to do it every single day. Most people just have to do math all the time and I don't like doing math all the time. (year 6 student).

Non relevant data / reflect on data

We did not experience the potential complication of dealing with students recording non-relevant information as occurred in Lundström's (2013) study as there were minimal occurrences of non-mathematical content being recorded. Two students each individually recorded a series of comical faces; however, both students then proceeded to record a

thoughtful video. We also experienced minor examples of non-mathematics entries including

Oh, one more thing. Do you want to see my nose hairs? (year 6 student).

Like I'm good at doing the splits, I'm not lying. My friend Josh, he can't do the splits. (year 6 student).

As indicated earlier, although we provided students with approximately a dozen prompts for them to use when they were in the diary tent, these prompts were largely unsuccessful in encouraging student reflection. When students did use the prompts, they often responded with abbreviated, one sentence answers such as “I would tell mum I don't like maths” or “Maths is like pizza – you can cut it up”. This was more of an issue with the younger students so perhaps they took the questions literally rather than as a prompt for discussion.

Ethics - Personal disclosure and privacy of data

As foreshadowed in the critique of the literature, there are a number of unique ethical concerns in using iPads to collect and store data. An initial concern was that students would disclose personal issues, not related to mathematics, as reported by Noyes' (2004a) and Lundström (2013). Whether the ability to delete videos was a factor or not, we did not encounter any experiences whereby personal, non-school related videos were recorded. However, this is not to imply that the students did not self-disclose as they recorded highly personal videos concerning mathematical self-identify, self-esteem and affective responses relating to their experiences of mathematics. Indicative student comments include

I feel embarrassed because people laugh at me because they're smarter than me and then I feel sad. (year 3 student).

I don't like maths and maths makes me want to feel sick. (year 6 student).

Doing maths just thrills through me and I just can't get it out. (year 3 student).

We did encounter a small number of comments indicating that students were concerned that other students or teachers might be listening to their work

What is most annoying is when I'm videoing myself, people come and put their ear to the tent and listen to me and I hear them and I see their shadow. (year 3 student).

I don't want them to know what I feel when I'm doing maths cause they'll tell Mr (Class Teacher) and I'll have to go to tutoring and I don't like it. (year 3 student).

In addition, some students were concerned that other students or their teachers may watch their video before it was downloaded and deleted

I prefer her (student teacher) to Mr (Class Teacher), sorry Mr (Class Teacher) if you're watching this, but she's good at teaching it better. (year 6 student).

This may have been a factor in the skewed distribution, in terms of year level, of the number of recorded videos. Although there appears to be an overall level of comfort with the process, the year 3 students recorded twice the number of videos as the year 6 students. We suggest two possible reasons for this difference. Firstly, in the year 3 classrooms, the tent was located in a corner of the double teaching space where teachers could see it; however, the year 6 tent was in a separate room between the classrooms. It could be the case that the year 3 teachers were more comfortable than the year 6 teachers with students using the tent in terms of student safety and time on task and this encouraged greater use of the tent space in year 3. Secondly, the year 6 students perhaps had an increased awareness that others (including their teacher) may be listening to or later viewing their work and an increased understanding of the potential consequences if their privacy was breached.

RESEARCH QUESTION ONE: STUDENT ATTITUDES TOWARDS MATHEMATICS

The findings presented above clearly indicate that the students were comfortable with the process of recording videos using the iPads and that their use is an important addition to the arsenal available to researchers interested in student attitudes to mathematics. The remainder of this article examines what it was that the students were saying about mathematics. Before delving more deeply into particular themes, we provide a brief overview of the attitudes of the two separate cohorts.

We anticipated finding negative attitudes from the year 6 students and this is largely what we found though we were surprised at the level of feeling that the students expressed towards mathematics. They used highly emotive language such as hatred, boredom, frustration, wanting to cry, feeling sick; to express their attitude towards mathematics. Primarily, this negative feedback was from female students. This warrants further investigation as it reflects the increasingly negative attitudes, confirmed in the latest PISA data, that many female students demonstrate in relation to mathematics (Tulis & Ainley, 2011). Student feedback included

I feel sad when I have to do math. Because it's so boring and there's nothing to do. I hate math. I mean I hate math because it's always so boring and we don't really do much and when we do it we already know. (year 6 student).

And it's just a big blob of confusion and it makes me frustrated that I can't understand it. I want to understand so I can do good in the rotations but it's just like a big blank. It makes no sense at all. It's really confusing. (year 6 student).

I don't like maths and maths makes me want to feel sick. (year 6 student).

Although we anticipated negative attitudes from the year 6 students, our thesis was that we would find more positive attitudes towards mathematics in the year 3 students. We

expected to reflect the findings from PISA and TIMMS that Australian students had positive attitudes towards mathematics (around 66% in year 3/4 then dropping away to around 30% in year 7/8) (Brown, 2009). This is not what we found. The attitudes towards mathematics from these year 3 students were very similar to those attitudes expressed by the year 6 students. Again strong emotive language was used and again, this language was primarily used by female students. Example comments included

I don't like maths. I don't like maths. I do not like maths. I don't, don't really don't like it and I find it hard. (year 3 student).

I hate maths, like I hate maths. Why do we have to do maths, that's my trouble, like why? Why all the time? Like why, why, why, why...Tell me, why do we have to do maths it's just so hard and boring? (year 3 student).

Having painted a broad picture of student feelings, we now tease out some of the reasons for the negative attitudes towards mathematics. The themes we explore are largely consistent across the four classes with whom we worked so we deal with them together. Where important, we will highlight the particular year group those comments were from. Therefore, unless indicated otherwise, it can be understood that the problem, issue, concern, or emotions expressed are generic across the student sample. There were some positive emotions in the comments made about mathematics in some areas:

- When the mathematics was related to the world beyond schools and the students could see some purpose in doing the mathematics.
- Where mathematics was activity based. Students spoke positively of the experience of mathematics when they did not have to do worksheets or copy and complete exercises from the blackboard.
- Students spoke positively of the support they received from their teachers.

We will not discuss these positive attitudes to mathematics any further as these are commonly reported themes in the literature in relation to how mathematics should be taught.

The common negative themes that emerged from the student videos are:

- Generic difficulty of mathematics as a subject;
- Specific difficulties with content areas (e.g. division, co-ordinates);
- Hatred (including the associated language of dislike and anger);
- Frustration or confusion; and
- Sadness or boredom as the manifestation of the feelings described above.

Generic difficulty with mathematics as a subject

There was a significant level of commentary from students regarding the difficulty of mathematics as a subject with the most repeated word being “hard”. A frequency count indicates that the word “hard” was used on 112 occasions (and the related words of difficult or difficulty on a further 16 occasions). Sometimes the “hardness” was associated with a specific conceptual or content area (this will be discussed in the next point) but more often than not it was a reflection on mathematics as a subject. Further work is needed on the notion of “hard” in terms of how it becomes operationalized within learners’ ideas of learning and progress. Indicative student comments include

It absolutely sucks. And it sucks because it’s hard and you have to do it every single day. (year 6 student).

It’s really hard. It’s really tricky. I just think maths is my hardest thing to do and it’s really hard because when we do it, it’s really annoying and hard because I get most things wrong. (year 3 student).

I find it my hardest thing to do at school and I just find it really hard (year 3 student).

Some students identified themselves as “non-mathematics” students. This was more commonly articulated in the year 6 student comments with one student commenting, “*I’m just more of an English kind of person*”. However, the genesis of this attitude towards mathematics was evident in the comments from many year 3 students as well. In some cases the teaching of mathematics was identified as negative in that there was an over-reliance on students copying work down from the board and on the overuse of worksheets to be completed during mathematics lessons or for homework. There were also student reports of teachers shouting during mathematics lessons which students identified as a contributory factor towards their difficulties with mathematics – e.g.

I don’t like it (Maths) and I need to go to a place in the school where it’s all quiet where there’s no talking and no (teacher’s name) yelling (Year withheld)

Of course our data do not allow us to say whether such occurrences occur more frequently in mathematics than in other subjects.

Content specific difficulty with mathematics

It was often the case that once students identified that mathematics was hard, they went on to associate the difficulty with specific mathematical content. For example, a student indicated that mathematics is hard and particularly “takeaway” is hard; and another that mathematics is mostly easy but it is “hard when I have to do my times tables”. There were some understandable differences, given the different content they learn, between the year levels in terms of the specific content difficulty described.

I find difficult in maths is probably the, I forgot what it’s called, negatives and positives because I don’t get where the symbol goes. I don’t really find what to do with them. (year 6 student).

This difficulty is worthwhile to note as some of the students' difficulties may have been caused by the method that the teachers used to teach the Cartesian plane. It appeared to be the case that there was some teacher confusion between positive and negative integers on a number line (indicating cardinality) and the use of positive and negative numerals in the Cartesian plane (indicating location). Despite some specific year level differences, it is worth noting that students, in both years, identified difficulty with the basic operations (addition, subtraction, multiplication, and division – with division reported as being the most difficult). It is also interesting to note that the language students used was “plusses”, “takeaways”, “minuses, and “times” rather than more mathematically accurate terminology such as subtraction or multiplication. We expect this may have been a deliberate teaching strategy used by the teachers but more research is needed here to confirm this proposition. A further point to note was that most of the reported difficulties were from the number and place value sub-strand. There were very few mentioned difficulties with the measurement and geometry strand or the statistics and probability strand. We suggest that this reflects the main teaching that occurred during the research involved number and place value rather than indicating a student preference for, or greater understanding of, the other strands.

Hatred and anger towards mathematics

The difficulty with mathematics as a subject, and difficulty with particular content if identified, manifested itself in highly emotive language and the rest of our discussion concerns how students expressed themselves using highly emotive language. We were very surprised, across both year levels, at the number of times students reported a hatred for mathematics. The word “hate” was used on 24 occasions. In slightly less emotive language, the word “dislike” (or “don’t like”) was used on 67 occasions. Also associated with hatred and/or a dislike of mathematics was anger towards mathematics (13

occasions). There were a number of reasons offered by the students for these expressions of hatred, dislike, and anger. Firstly, they linked back to mathematics as a subject. Secondly, other students reported that they liked elements of mathematics but there was hatred and anger towards specific content. Thirdly, some students reported hatred, dislike, or anger towards the method that was used in teaching mathematics (including as mentioned earlier, an overreliance on worksheets or copying from the board).

The only bad thing is that we do normally is that we have to write it down. All the sums on the board, we have to write them all down. (year 6 student).

There was a mixed response to individual vs. group work in mathematics. For some students, working individually was a cause of negative attitudes in mathematics. One particular year 3 student continually commented on the fact that her hatred towards mathematics was because she couldn't understand it and because she wasn't allowed to work with other students who would be able to help her understand. We do not yet know how representative this view is. Alternatively, there were students who reported that they disliked having to do group work as it was actually distracting them from their work.

Frustration, annoyance, or confusion with mathematics

Students who did not go as far as to say they hated or disliked mathematics, often used words indicating frustration, annoyance, and confusion. Again these words were used generically towards mathematics as a subject area and also more specifically to particular content they were finding difficult. Most of the frustration related to the difficulty of mathematics. Clearly, and understandably, 'difficult mathematics' caused feelings of frustration, annoyance, and confusion. Some of these feelings related to the amount of mathematics they had to complete in a given time. Some students indicated annoyance at

the fact that they had to do mathematics every day as they felt there were other subjects that they liked that they didn't get to do as often.

It absolutely sucks. And it sucks because it's hard and you have to do it every single day. Most people just have to do math all the time and I don't like doing math all the time. (year 6 student).

Sometimes the annoyance and confusion was related to the “trickiness” of mathematics e.g. the number of specific sub-steps in an algorithm was mentioned. There was also annoyance related to, as conveyed earlier in terms of hatred or dislike, whether mathematics should be done in groups or individually and also around the attitudes of peers to mathematics. Again feelings were split on this issue; some students felt annoyed or frustrated because other students in the class were better than them and were teasing them. Other students felt frustrated because they felt they were better than other students at mathematics and they were getting teased because they enjoyed, and were good at, mathematics.

Manifestations in sadness or boredom

These difficulties concerning mathematics, be that at a subject level or with particular content, generated feelings of hatred, anger, frustration, annoyance, and confusion; attitudes which seemed to manifest themselves for these students in one of two ways - sadness or boredom. These were prevalent in year 6, and contrary to our thesis, were also evident in year 3. Whilst not wanting to minimise our concern with year 6 negativity, it is of significant concern to us that year 3 students were reporting feelings of sadness or boredom about mathematics. Overall, there were 13 occasions when students spoke of feeling sad. In addition, there were video accounts of students crying, feeling sickness, or complaining of headaches when doing mathematics. This is indicative of a strong physiological response to the experience of mathematics for these students.

And maths is kind of difficult for me because I don't like to use my brain because my head hurts. It gives me a massive headache and it makes me feel sick. (year 6 student).

An alternate, but related response to sadness, was boredom (boring, bored) with a frequency count for these terms of 25. A number of students repeatedly used the word “boring” when they were discussing their feelings towards mathematics and some students reported of mathematics making them go to sleep

I hate it, I do. It's so bad. It gets boring and I guess that's why I sleep and don't do anything and ask for people's help. (year 3 student).

Reasons given for the boredom include: the overreliance on worksheets; significant levels of copying work from the board; lack of adequate instruction; and repeatedly completing work they already knew how to do. As mentioned earlier, one of the common statements was that they liked mathematics when it was easy. For these students, easy mathematics was equated with good mathematics. Many comments indicated that when maths was hard they didn't like it, but the same mathematics, once they understood it, was good mathematics. However, a contrary view was expressed by some students who commented that mathematics is boring because it is too easy. It therefore appears that a challenge exists for teachers to maintain differing levels of difficulty in mathematics classrooms to fully engage the range of students in their classroom. Unfortunately, there were no student comments indicating that such an attempt was made.

IMPLICATIONS AND CONCLUSIONS

This article set out to answer two research questions.

1. How do students report attitudes and emotions towards mathematics; and are there any patterns in this self-reporting that coincide with two junctures in primary schooling?
2. In what ways can the video functionality of an iPad be appropriate for collecting data regarding student attitudes and emotions towards mathematics?

We turn to question two first as the ability to answer question one hinges on the validity of iPads as a methodologically robust tool for collecting information on student attitudes and emotions.

We suggest that the use of iPads to collect the video diaries was highly successful and the honesty of the student responses suggests that the use of iPad video diaries is an appropriate methodology to use in research involving young students. The students in this research appeared very comfortable with their use and no specific iPad training was required. Students had full control of whether or not to record their thoughts about mathematics. Having decided to record their thoughts, they then had the option of easily watching what they had recorded and, if necessary, deleting and re-filming their diary entry. The use of iPads is therefore considered to be an effective and practical tool for classroom based research. The familiarity of the students with the iPad technology meant that there was very little student training needed, and they very easy for the teachers to maintain. The overall positive report on the use of iPads is tempered slightly by the following points regarding their use:

- *Privacy* – Although there were only minimal concerns reported, a mechanism to make the videos more private is required. Use of the iPads in ongoing projects will

investigate measures to further improve student confidentiality and may include emailing videos to a secure storage site so they can be deleted from the shared iPad immediately after recording.

- *Student Engagement* - As reported, there were 105 students involved in the study with 64% of them recording a video. Whilst this is an acceptable level of engagement, the range of data collected was further reduced by the fact that 70% of the students who recorded a video, only recorded one during the 10 weeks of the study.

In future research, the balance to be struck is between encouraging more students to record a video and being overtly coercive in this process. The more coercive the process, the more likely it will become that students will record what they think the researchers want to hear, or will record negative videos more to do with the process than with mathematics. Attending to the privacy concerns noted above may be a more positive way to encourage increased numbers of students to record videos in future research.

In relation to Research Question 1, what we found most alarming was the strong negative reports from the students in year 3. The degree of negativity concerning mathematics expressed by the students indicates that mathematics education may be in troubled times. We found that there were both generic and specific difficulties with understanding some of the content that these students were exposed to. For some students this was expressed at a global level with mathematics itself seen as hard or difficult; for other students there were positive perspectives offered overall for mathematics with specific topics being identified as problematic – e.g. basic operations or symbolic misunderstanding. This is perhaps to be expected; although it is troubling that some of the mathematical explanations provided by teachers were contributing to student misunderstanding.

What is of greater long-term concern is the negativity towards the subject as expressed in emotive or attitudinal ways by these students. For many of them, mathematics was seen as something that had to be endured, not enjoyed. Rather than seeing mathematics as the authors see it, as a way of understanding and interacting with our world, the students saw it largely in terms of hatred, anger, frustration, boredom and sadness. These are much more difficult to overcome than a temporary misunderstanding of a mathematical concept or skill. Of particular concern is that these attitudes towards mathematics are being formed at a much younger age than we had predicted. This augurs poorly for a positive experience of upper primary and secondary mathematics for many of these students.

Further research is required to determine whether the attitudes expressed by these students are symptomatic of a wider phenomenon in primary schools such that younger students than previously thought are turning away from mathematics. The authors are currently extending this research with a mixture of interstate and independent schools to further answer this question. What is clear is that, if we are to address the decline in positive attitudes towards mathematics, apparent at earlier year levels than previously thought, we need to continue to listen authentically to student voice.

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