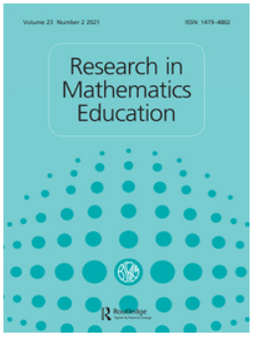

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# "My parents are pretty pleased with my maths": students' navigation of identity stories about mathematics

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# "My parents are pretty pleased with my maths": students' navigation of identity stories about mathematics

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**ABSTRACT**

Although it is assumed that parents influence their children's lives, little is known about how students navigate between their own expectations and their parents' views of mathematics and how this navigation affects mathematical learning. Using an exemplary case of Philip, we illustrate how he made sense of his father's high expectations related to his engagement with mathematics. There were three tensions evident in Philip's stories about mathematics related to these expectations: the utility of mathematics for his future career; his expectations of doing well in mathematics; and the value of mathematics teachers. The results, elaborated on by the perspectives of the other students in Philip's Year 10 class, shed light on the complexity and fluidity of secondary school students' identities, in relationship to their mathematical engagement.

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## Introduction

Through their roles as caregivers, parents[1] attend to their children's general and educational needs (Allexsaht-Snider & Marshall, 2008). Within mathematics education, support for children's educational needs is often discussed in relation to positive outcomes. For example, parental attitudes, expectations, and involvement in students' mathematical experiences are considered to positively influence students' motivation (Fan & Williams, 2010), engagement, achievement (Sirvani, 2007), and participation in mathematics courses (Miller, 2010). In particular, it has been found that

> parents who are able to model a strong and positive interest in mathematics when assisting with homebased mathematics activities such as homework, even if it contrasts with their own experience of mathematics, tend to have children with strong confidence in their mathematical ability. (Bartley & Ingram, 2018, p. 282)

However, by suggesting that parents only have to change their attitudes or skills to achieve these positive outcomes, such findings simplify the complex relationship between parents and their children's mathematics engagement. In this paper, we

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analyse how parents are one of a multitude of influences on students and how combinations of these influences affect their engagement with mathematics over time. Mathematical engagement has been taken to mean the in-the-moment engagement with a particular task (Middleton, Jansen, & Goldin, 2017). Here, we extend the definition of engagement to a student's involvement in the mathematical activity of the classroom and their willingness to learn mathematical content, both within the classroom and out-of-school (Ingram, 2009). Students' learning is linked to their engagement in that it enables them to "actualise their identity through participation in activities situated in a specific context" (Op 't Eynde, De Corte, & Verschaffel, 2006, p. 194).

One of the issues with previous research on parents' contribution to children's mathematics learning is that it is mostly restricted to a specific focus or a snapshot from a particular period of time. For example, researchers have highlighted parents' views of mathematics (e.g. Pritchard, 2004), how parents and their children co-construct conceptual knowledge (e.g. Newton & De Abreu, 2011), and how parents' affective responses to mathematics are related to the help they provide their children (e.g. Díez-Palomar, Ortín, & Roldán, 2012). Other studies, without collecting parent input, discussed parents' contributions from their children's perspectives (Alrø, Skovsmose, & Valero, 2009; Lange & Meaney, 2011). Towers, Takeuchi, and Martin (2018) had children between 4 and 9 years old provide mathematical autobiographies, where the children told stories of past events. In several of the children's stories, parents' opinions were included in discussions about engagement with mathematics.

Nevertheless, Kleanthous and Williams (2013) suggested the importance of parents' views might wane as students became teenagers and when other influences became more important. The need for longitudinal study was also identified by Cao, Bishop, and Forgasz (2007), who indicated that students may not directly nominate their parents as affecting their willingness to engage with mathematics. In Graue and Smith's (1996) research, children often repeated the views of their parents, even if they did not attribute the comments to their parents. In their interviews, parents and their children used the same or similar language to describe mathematics. Graue and Smith (1996) linked this to Bakhtin's (1981) notion of ventriloquation "which describes how individuals appropriate others' words for their own use" (p. 294). Bakhtin (1981) wrote about how a person's ideas may be situated within historical time but could be expressed to specific audiences outside that time. In other words, what a student says may reflect their family's views, but be oriented towards their classmates or the researcher, making it difficult to identify their parents' influence. By collecting information from students and parents over time it is possible to note not just if students replicate their parents' views in a particular moment, through ventriloquation, but how those views may appear over time.

Parents' own relationships with mathematics, from their experiences both in and outside school may influence their children's engagement with mathematics. As Civil, Díez-Palomar, Menéndez, and Acosta-Iriqui (2008) stated, "experiences parents have had as students filter their perceptions on the education their children receive and shape the type of interactions parents have with their children when it comes to mathematics education" (p. 48). For example, Bartley and Ingram (2018) investigated the relationship between parents' mathematics anxiety and their willingness to help their children (12 and 13-year olds) with homework. Parents who reported experiencing

mathematics anxiety were less willing to help their children with homework and, correspondingly, children seemed less willing to ask for help from parents who exhibited mathematics anxiety.

Parents' wider experiences have also been noted as having an influence on their children's willingness to engage in mathematics. Kleanthous's (2014) study, which sought to contrast the perceptions of parental influences of middle-class, local students and immigrant students in Cyprus, found that the parental voice was present for both groups of students, although, for the middle-class students, the students less explicitly referred to their parents' influence. In an Israeli study, Sfard and Prusak (2005) noted that different groups of students told similar stories about their parents' agreement with their choices about mathematics courses and about their careers. The choices differed depending on whether the parents were new immigrants to Israel or had grown up there. Having generations of experiences as being part of a Jewish minority, where being good at mathematics was a way to overcome an outsider status, featured in the stories of the "newcomers" but was not included in the stories of the "old-timers" whose parents had grown up in Israel. The stories of these students included the importance of making decisions for themselves about future careers and taking mathematics courses only to enter those careers. The re-use of their parents' stories to justify their own choices can be considered examples of ventriloquation.

Nevertheless, parents are only one influence on whether or not students engage in mathematics. In Hand's (2010) research in a low-track secondary classroom, non-engagement or active resistance to engaging in mathematics developed over time and was actively supported by some students in order to gain status. Therefore, tensions may arise not just between parents and their children's views about engaging in mathematics, but also when the influence of parents may be in conflict with other influences, such as expectations of peers.

Consequently, in this article, we explore: How do tensions arise between parents and students about engaging in mathematics? And, how do students attempt to resolve them over time? To respond to these questions, we use a case study of a father/son pair, while including longitudinal data from 30 other students in a Year 10 class.

## Identities and affect

To identify the tensions between parents' and students' own views of their engagement with mathematics, we take an identity approach to learning, as suggested by Op 't Eynde et al. (2006). Specifically, we use Sfard and Prusak's (2005) narrative approach, which recognises the fluidity of identities, to consider how students' identities may change over time. The stories told by parents and others, such as teachers and their peers, are discursive resources that students can draw upon when telling stories about themselves. Tensions become evident when the stories told by the parents and the students about the students' engagement with mathematics are not in alignment.

Sfard and Prusak defined identities as stories that fulfilled three criteria:

- *Reifying* – the story has the power to transform an action into a state which suggests repetitious behaviour through the use of the verbs *be, have, can*, and the adverbs *always, never, usually*.

- *Endorsable* – the person the story is about endorses that the story reflects the actual or expected state of affairs.
- *Significant* – the story is significant if any change in it is likely to affect the storyteller's feelings about the identified person particularly with regard to membership of a community.

Viewing identities as stories means that a person has multiple identities that draw on a range of discursive resources which the person takes as being reifying, endorsable and significant, such as: a person's self-dialogue (thinking); spoken-out-loud stories about themselves or other people; stories about them told by other people; interactions with other people; reactions to events; and extra-discursive stories, such as examination results.

Sfard and Prusak (2005) highlighted two sets of identities that affect the learning process. Actual identities are factual assertions about a person and can be identified by the use of I-am or he-is sentences told in the present tense, such as "I am bad at maths" or "He is a good mathematician". The other set of identities, designated identities, are related to expectations. They are "I should be" stories. These stories have the potential to become part of one's actual identity, but generally require students to act to achieve them. A designated identity may not be particularly desired, but is accepted because:

> the person thinks that what these stories are telling is good for her, because these are the kinds of stories that seem appropriate for a person of her sociocultural origins, or just because they present the kind of future she is designated to have according to others, in particular to those in the position of authority and power. (Sfard & Prusak, 2005, p. 18)

Sfard and Prusak (2005) indicated there is likely to be a sense of unhappiness when there is a perceived and persistent gap between a person's actual and designated identities. This sense of unhappiness may be amplified when identity stories are especially significant. This conceptualisation of designated identities has similarities with affective notions of self-directive constructions (Malmivuori, 2006) and needs (Hannula, 2006). A student's emotions and feelings when doing mathematics and their resulting motivation and engagement, are described as dependent on whether a student considers the situation to be in alignment with their needs, goals and beliefs related to mathematics (Hannula, 2006). However, affective constructs, such as these, are generally discussed as being individual to the student and relatively static. Sfard and Prusak's view of narratives as identities, is both social and dynamic, in that it situates students' affective responses as also changing over time, which can then affect their engagement with mathematics.

Although Sfard and Prusak (2005) only discussed unhappiness, students have a full range of positive and negative feelings of different intensities and stability, which could have an impact on their engagement with mathematics (McLeod, 1994). For example, students may feel anticipation or anxiety about engaging in a problem, or they may feel interested, or satisfaction when they have solved it.

The identities that students project in stories about themselves and that their parents project in stories about them provide opportunities to see the circumstances in which tensions arise and how students decide to resolve them. Such an approach provides a

more nuanced understanding of how parents may influence their children's engagement with mathematics.

## Background

The data set used to respond to the research questions came from a study that explored the nature of 31 students' relationships with mathematics intensively over two years, when they were in Years 10 and 11 (approximately 13–15 years old). The students attended a co-educational secondary school in New Zealand, were of New Zealand European ethnic origin and came from households of average income where at least one parent worked. In this school, students who had been high achieving in a variety of subjects in earlier years were placed in one class for Years 9 and 10. The students in this study were in this *achievement class* when the study began. From Year 11, in the senior school, classes were mixed depending on the students' choice of subjects and the students were spread across eight mathematics classes.

Access was made available to a wide variety of institutional data, which included school records, absences, prizes, reports, subject choices and interview notes made at the school enrolment meetings in Year 7 between the dean, parents and students. The students' teachers in Years 9–11 were asked for feedback on each student. Parents completed a questionnaire about how comfortable they were helping with homework and concerns they had about their child's mathematics. They were also asked about their own mathematical experiences at school, their feelings about mathematics, and the ways they used mathematics in their daily lives.

When the students were in Year 10 and Year 11, 56 observations of mathematics classes were conducted. Students completed questionnaires in Year 10 and 11 about their views of mathematics. In Year 10, students were asked to provide metaphors about mathematics and to draw a mathematician. In the middle of Year 11, students were asked to construct personal journey graphs, where they described their feelings about mathematics over time. They were asked directly about the help they received for mathematics outside of class, their parents' views of mathematics as subject and their parents' views of how they were progressing in mathematics. Each student participated in semi-structured interviews at least twice, either individually or in groups. Within these interviews, aspects of students' identities and affect were gathered using questions including "when you think about doing maths, what do you feel?" and "what do people in your family think about your maths?" The interviews were also an opportunity to clarify students' experiences of mathematics identified through other research instruments.

The initial analysis consisted of separating the 31 students' endorsable, reifying and significant stories into actual and designated identities, based on the features described by Sfard and Prusak (2005). The adapted features are provided in Table 1, with examples from the student data. Following each example is information about who told the story, the source of the data, and the time period it was told. For example, ($\text{AnnMother}_{\text{QuestionniareYear10}}$) indicates that Ann's mother told the story in the parent questionnaire that was completed when Ann was in Year 10.

Within the data, students mentioned their parents many times, often without prompting. In the narratives describing their actual and designated identities, those with a connection to parents were located by the students either explicitly mentioning their parents

**Table 1.** Actual and designated identities.

| Type of identity | Definition | Determining features | Examples from data |
|---|---|---|---|
| Actual identities | Assertions or objectifications about a person about what is actually happening at the time | • I am<br>• She/he is<br>• May be context dependent<br>• Often present tense<br>• Always, never, usually | • Maths has never been Ann's strongest subject ($AnnMother_{QuestionniareYear10}$)<br>• Maths is my worst subject ($Ann_{InterviewYear10}$)<br>• I think Dad thinks I underestimate how good I am … I know I am not excellent at maths, but I work hard and get satisfactory results most of the time ($Robyn_{EndofYear10}$) |
| Designated identities | A state of affairs expected to be the case now or in the future | • May be less context dependent than actual identities<br>• Future tense<br>• Words that express wish, commitment, obligation or necessity: should, ought, have to, must, want, can/ cannot | • Everyone else in the class is fine. I should find [maths] easier ($Carol_{InterviewYear10}$)<br>• Dad wants me to be a high achiever ($Philip_{InterviewYear10}$).<br>• [My parents] think I should be doing more … I've hardly done anything … when I tell Mum that, she thinks I should be making more effort and trying to get more work in ($Jill_{GroupInterviewYear10}$). |

or implicitly by using similar phrasing to their parents to describe their engagement in mathematics.

Philip (see Figure 1) is used as an exemplary case because he mentioned his father more frequently than the other students, indicating that Philip's father was a significant discursive resource for Philip's designated identities. Philip's stories highlighted tensions as he navigated between his father's expectations and his own wishes about engaging with

**Figure 1.** An artist's impression of Philip.

mathematics. Similar stories appeared in the stories of the other students and so we include some of these to illustrate that Philip's experiences were typical of those other students.

Our analysis identified three themes connected to the tensions that Philip faced related to his designated identities. These were to do with: The utility of mathematics for future careers; his expectation of doing well in mathematics; and the value of mathematics teachers. We discuss each theme over time, showing when tensions arose and when and how they were resolved.

## The utility of mathematics for future careers

Philip's stories of his designated identities about future employment varied over time and with them his expectations about the value of learning mathematics. In contrast, his father, John, had more consistent views about his son's future career and engagement with mathematics. However, even when there were differences in the perceived designated identities between father and son, there did not always appear to be a need for Philip to resolve this potential tension.

At aged 11, Philip stated that he wanted to be a doctor ($\text{Philip}_{\text{EntranceInterviewYear7}}$). Perhaps this was what he genuinely wanted to be, or because he was complying with what he thought the school wanted to hear, or knew to be his parents' expectations, as they accompanied him at this interview. Three years later, at the beginning of Year 10, Philip's plans had changed.

> My dream is to become an All Black [rugby player] and also a rock star, and then become a physiotherapist and own my own clinic and then hopefully open an institute for free learning for music … I'll probably only see maths in currency. ($\text{Philip}_{\text{InterviewYear10}}$)

> If I had a choice, I would not take maths because in the career I want to take it looks non-important. ($\text{Philip}_{\text{AutobiographyYear10}}$)

At this stage, Philip did not see school mathematics as useful for fulfilling his designated identities relating to his career choice as a rugby player (or rock star or physiotherapist or the owner of an institute for free music). Nevertheless, he made a small acknowledgement of the usefulness of mathematics, as he described it as being similar to classical music – old but still useful ($\text{Philip}_{\text{MetaphorsYear10}}$).

Simultaneously, Philip recognised his father's wish for him to be a high achiever and not wanting him to end up a "bum". In New Zealand "being a bum" means someone without a job or career and with few aspirations of getting one.

> Dad wants me to be the high achiever … I don't want to be a bum. ($\text{Philip}_{\text{InterviewYear10}}$)

In this quote, John seemed to provide discursive resources (Sfard & Prusak, 2005) for Philip's identity narratives. Yet, John may have provided mixed messages to Philip about the usefulness of learning mathematics at school:

> [In secondary school] I never grasped the [mathematics] concepts at all – failed entirely through to school's end. Yet I now have a background in Accounting!!! I have no problems with basic topics i.e. multiplication etc. discounts, taxes … everyday use! ($\text{PhilipFather}_{\text{QuestionnaireYear10}}$)

> Students should learn mathematics through school. Maths is everyday. [They need] exposure right throughout. Education is paramount. … I have to use maths every day. (PhilipFather$_{\text{QuestionnaireYear10}}$)

While implicitly indicating he had learnt mathematics elsewhere, John still situated it as something that should be learnt in school because of its importance. Yet, John was consistent in his expectations about Philip's future career and the need for mathematics.

> All my three sons have shown strengths in the sciences fields. … Philip is considering his career plans at the moment and is looking at science-based plans, so will give maths a serious consideration! (PhilipFather$_{\text{QuestionnaireYear10}}$)

At this point, there was apparent tension between what Philip stated he wanted as a career and what John wanted for him. Although earlier research has noted how students often voiced the same career ambitions and valuing of the usefulness of mathematics as their parents (Alrø et al., 2009), this was not the case with Philip and his father. Although aware of the misalignment, there seemed no urgency for Philip to resolve the tension.

Similar tensions appeared in stories of other students in the class. They were aware of their parents' views about the importance and usefulness of mathematics and re-voiced these views in connection to getting a good job. However, they seemed obligated and perhaps unconvinced by the idea that mathematics was useful in its own right.

> I am a Diesel Engineer. This is why I feel strongly about the basics in maths, because, in my business, if you can't do the basic maths you will never get to a trade position of my kind. (DebbieFather$_{\text{QuestionnaireYear10}}$)

> Dad … doesn't care about any other subject but he wants me to do like well in maths … because he said that you need maths once you leave school and stuff … and I'm like, yeah, I know that so I try my hardest and stuff. (Debbie$_{\text{InterviewYear10}}$)

Rather than being useful in its own right, Philip and many other Year 10 students seemed to see mathematics as an entrance ticket to their chosen career (Sfard & Prusak, 2005).

Yet, by the end of Year 11 at 16 years old, according to his teacher, Philip had focussed on a career in health sciences, requiring a continuation with mathematics in Year 12. His father's expectations seemed to have been one spur to support him to engage with mathematics and this led to the achievement and career goals his father expected and that Philip indicated that he now wanted (a desire to be an international rugby player or rock star disappearing from his stories about his future). Although his career goals were now aligned with those of his father's and consequentially his designated identities, the resolution of the tension between their different views was more an outcome of resolving other aspects of his identity to do with the themes of achieving well and the role of the teacher.

## An expectation of doing well in mathematics

Philip's and his father's expectations of Philip achieving at a high level in mathematics soon became a source of tension when Philip's desire to have fun and not work too hard meant that a gap appeared between his designated and actual identities. Until the end of Year 10, there had been no gap between Philip's designated and actual identities. In Year 9, Philip scored in the 91st percentile for his age level across New Zealand in a

standardised mathematics assessment, and he was placed in the top-stream, achievement class. Before Year 10, he had consistently got mathematics prizes and had strong assessment grades. Philip endorsed these institutional narratives and believed he was achieving the marks he was capable of ($\text{Philip}_{\text{AutobiographyYear10}}$).

Although his career choices did not seem to invoke strong emotions, Philip's stories about achieving or otherwise in mathematics did. For example, Philip told stories about two mathematical experiences, from when he was much younger, shown in Philip's personal journey graph, in Figure 2.

> In Year 2, I aced a problem-solving question. I've still got that test in the drawer! ($\text{Philip}_{\text{GroupInterviewYear11}}$)

> That "couldn't do something" was in Year 6 when we had to find the missing numbers and I just couldn't figure it out. Then the teacher marked someone else [correct] in front of me and I got really annoyed with that. ($\text{Philip}_{\text{GroupInterviewYear11}}$)

Philip rated the first experience as giving him the most positive feelings about maths he had ever had. The second memory about not being able to do mathematics, in comparison to his classmates, showed the unhappiness that Sfard and Prusak (2005) suggested could lead to willingness to engage more with mathematics.

Philip's parents contributed discursive resources to his stories about being successful in mathematics.

> [Philip is an] independent … energetic worker [with an] inquiring mind. ($\text{PhilipFather}_{\text{QuestionnaireYear10}}$)

> Philip has always appeared to be competent at maths. ($\text{PhilipMother}_{\text{QuestionnaireYear10}}$)

> I think my parents are pretty pleased with my maths. … I can do it in my head … because they need to write it down. ($\text{Philip}_{\text{Year10}}$)

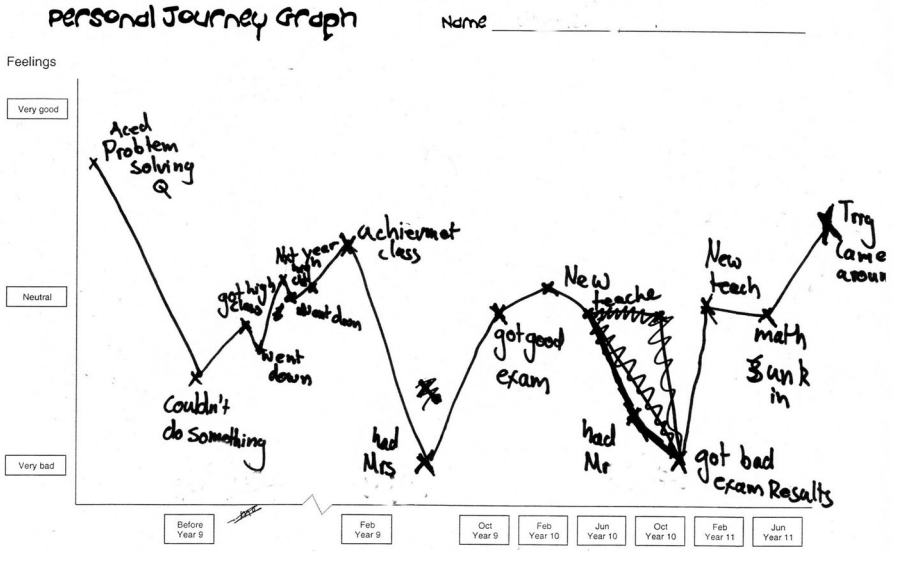


**Figure 2.** Philip's personal journey graph.

The stories that his parents, especially his father, told seemed to have been absorbed by Philip.

> [Dad] wasn't a high achiever [at school] so I think he wants us … me to be the high achiever because my oldest brother … didn't do well at school … so [my father] didn't want that for me. ($\text{Philip}_{\text{InterviewYear10}}$)

However, Philip was expected to reach his father's designated identity by his own initiative. Philip never asked his father for help and only occasionally asked his mother, because he and his mother "both end up confusing each other" ($\text{Philip}_{\text{AutobiographyYear10}}$). Philip's father did not feel able or willing to support Philip.

> No [I can't help Philip with his homework]. Maths sucks! And I can't do it! … [I] hated [maths]!! ($\text{Father}_{\text{ParentQuestionniareYear10}}$)

Only ten out of the 31 children stated they had at least one parent who could help with their mathematics homework. As had been noted in other research (Bartley & Ingram, 2018), there were similar stories to those of Philip's father about a lack of confidence in supporting students with mathematics homework.

> I can't help her with her homework. I'm no good at maths myself. ($\text{AnnMother}_{\text{QuestionnaireYear1}}0$)

> [At home] I try and work it out by myself. I think she tries to help but it worries her … it makes her feel kind of bad. ($\text{Ann}_{\text{InterviewYear10}}$)

For Ann, her willingness to protect her mother's feelings meant she had to take responsibility for her own learning.

For 17 of the students in the Year 10 class, feelings about not being able to able to do mathematics affected their willingness to engage in the subject. Sometimes, as was the case with Robyn, the connection between feeling confident in doing mathematics and willingness to engage in mathematics seemed to be shared with parents.

> I enjoyed [maths] very much at primary but lost my confidence at secondary level. I was in the top class so compared myself to other, more able, students and felt dumb at times. Art and music are my strengths, not maths. ($\text{RobynMother}_{\text{QuestionnaireYear10}}$)

> If I don't understand something, sometimes I do or feel like giving up because it feels like maths is not my strength. It takes quite a logical way of thinking, so not all personalities of people are suitable to say they find maths really easy. ($\text{Robyn}_{\text{MetaphorsYear10}}$)

In this case, the similarities in how they both expressed their view that mathematics was not their strength suggests that Robyn was using her mother's description of herself and reflecting it on to her own situation. Thus, the acceptance of struggling when doing mathematics by both Robyn and her mother, and the affective responses these struggles invoked, seemed to result in designated identities for Robyn of being someone who did not need success at mathematics. Perhaps similar stories about it being okay to not be good at mathematics also provided discursive resources for Philip because, as Year 10 progressed he became less willing to engage in mathematics.

In Years 7–9, Philip was described as having a high level of engagement in mathematics. Philip acknowledged this early work ethic ($\text{Philip}_{\text{InterviewYear10}}$), but described himself as becoming "less interested as the years went by", with increasingly frequent feelings of

boredom when he was "not having fun and couldn't be bothered" ($\text{Philip}_{\text{QuestionnaireYear10}}$). By Year 10, Philip's willingness to engage with mathematics was limited.

> Philip won't shut up … oh my goodness he drives me crazy. He's … the class clown … I often have to pull him up for inappropriate behaviour just being silly when he shouldn't be and talking when he should be doing his work … Easily distracted. Very easily distracting … he could set the whole class up. ($\text{Teacher}_{\text{InterviewYear10}}$)

> Late getting out his equipment and starting the mathematics lesson compared to his classmates. Doing answers to the starter as close to the end of the time-limit as he can or in the time the teacher took to sweep around the classroom checking work. ($\text{Observation}_{\text{Year10}}$)

> Because I usually get the work and so that's why I get bored and be like, "oh I know this" … just distract others … I just slack off when I can. I can't be bothered. Also, I don't want to go insane over too much work. ($\text{Philip}_{\text{InterviewYear10}}$)

Of the 31 students in the research class, 21 directly referred to experiencing increasingly strong social needs in Year 10 that affected their willingness to engage ($\text{Students}_{\text{InterviewsYear10GroupInterviewsYear11}}$). Although Hand (2010) noted students in low-streamed class gradually disengaging from mathematics, it seems that students in this achievement class also developed a shared expectation about disengaging from mathematics learning.

Some parents showed awareness of their children's desire to balance their social and academic needs and, like the parents of old-timers in Sfard and Prusak's (2005) research, tried to accept the need for their children to make their own decisions. For example, Colin's parents indicated that a gap was opening between what was expected of him, his engagement, and what he was achieving.

> His interest in maths extension opportunities has decreased in direct relation to the increase in his music interest/social activities. ($\text{ColinFather}_{\text{QuestionnaireYear10}}$)

> Over the past two years his energy for maths has decreased as he concentrated more on his music. ($\text{ColinMother}_{\text{QuestionnaireYear10}}$)

> [My parents] don't want to push me, but they end up pushing me because I've achieved all the time and they get a bit worried when I don't. ($\text{Colin}_{\text{InterviewYear10}}$)

For Philip, the tension arose when Philip was unable to meet his father's expectations when the mathematics "got a little more complicated".

> [I enjoyed the] early stuff … but once it got a little more complicated, I got a little less interested … it's … like the harder, the more you think … making you think. ($\text{Philip}_{\text{InterviewYear10}}$)

Sullivan, Tobias, and McDonough (2006) found that high achieving students did not think they would get better by trying, and Sullivan et al. (2006) suggested these students would be "vulnerable when they begin to experience difficulties in learning mathematics" (p. 89). Philip seems somewhat different, because he talked about his potential not being achieved because of his "slackness", or as discussed in the next section, he accounted for his difficulties by blaming the teacher.

Philip's father was aware that Philip needed to engage more, but like Philip attributed this not to a lack of mathematical ability but to a lack of engagement.

> Philip needs to apply himself more to [maths] and he would find it easier! Just knuckling down and getting on with it! ($\text{PhilipFather}_{\text{QuestionnaireYear10}}$)

> [My father] probably thinks I'm slack, but I do think he does know that I do get the knowledge when I need it. ($\text{Philip}_{\text{InterviewYear10}}$)

However, as Year 10 continued, Philip's engagement with mathematics changed as his designated identity of having fun took precedence over his designated identity of achieving in mathematics. When Philip experienced difficulty, he only sometimes continued working on the problem. Often, he became frustrated and annoyed because his fixed set of rules did not work and then he disengaged ($\text{Philip}_{\text{InterviewYear10}}$). Philip did not request help from his classmates, his teacher, or his parents when he became stuck. Furthermore, Philip no longer felt he belonged in the top group.

> I feel like there are … people like Colin and Angela that just get down to it. I probably don't feel like [I'm in the top group] because I just slack off when I can. ($\text{Philip}_{\text{InterviewYear10}}$)

As Philip's designated identities about achieving in mathematics became less visible in class, he increasingly described feelings of boredom. This could have signalled that Philip was becoming more vulnerable to non-participation in mathematics. In Csikszentmihalyi's (1988) research, students, who described themselves as bored most of the time, even though they seemed to have the same potential as the group which did not describe themselves as bored, disliked mathematics and seemed to be on their way to giving up on the subject. Yet Philip remained aware of his father's expectations that did not include the possibility to give up studying mathematics:

> If I don't get the results he wants I'll get screamed at which is not pleasant. ($\text{Philip}_{\text{QuestionnaireYear10}}$)

The tension that arose when Philip could not meet his father's designated identity for him produced a strong emotion, as "not pleasant" could be a euphemism for dislike or even fear. Such feelings could have led to increased engagement in mathematics. Yet, Philip did not study for the end-of-the-year examination.

> When you're in an exam it feels really stressful. My hair was falling out in [last year's] exams. I thought I was going to fail man. It's because I don't study. I was thinking about it and then they came up and I was oh, I'll be fine. They'll be as easy as last year. But they were harder and I think crap! ($\text{Philip}_{\text{GroupInterviewYear11}}$)

In the school report sent home to parents, the teacher held Philip accountable for his poor results.

> He is often distracted in class and more focus would ensure more pleasing results … If you want to do well next year in mathematics then you need to focus more on the job at hand and less on what is going on around you. ($\text{Teacher}_{\text{ReportDecemberYear10}}$)

Philip's personal journey graph (Figure 2) showed that his exam results at the end of Year 10 produced one of his worst feelings about mathematics. Sfard and Prusak (2005) described stories related to grades as having a powerfully reifying effect on the student

with "a particular capacity to supplant stories that have been a part of one's designated identities" (Sfard & Prusak, 2005, p. 18). For Philip, the exam results would have been strongly reifying actual identities and evidence of a gap between these and his father's designated identities about mathematics achievement.

In Year 11, it was clear that Philip could no longer ignore the tension between his actual identities and his father's designated identity for him of achieving in mathematics. However, the resolution of this tension happened in relationship to a change in how he considered the teacher contributed to his engagement with mathematics.

### *The value of mathematics teachers*

The final theme was about teachers and how they could contribute to students' willingness to engage with mathematics. Philip initially blamed his mathematics teacher for his lack of engagement, which allowed Philip to maintain his view that his lack of achievement was due to limited effort. This was reinforced by stories his father told about the uselessness of mathematics. However, in Year 11 when a friend of his parents became his mathematics teacher, Philip changed the ways he engaged with mathematics.

In Year 10, Philip seemed to draw on his father's views of mathematics teachers to make a case for them being responsible for his inability to meet his designated identity of being able to mathematics quickly and easily. Philip's father view of mathematics teachers was that, as a group, they were ineffective, if not detrimental to a student's success in mathematics.

> [In Year 9] the maths teacher was diabolical … All teaching depends on the teacher! And how they impart information as long as minds are eager to learn!! … My only memories of school are how I disliked maths!! Even after 30+ years! Maths teachers are as useful as paper boats! ($\text{PhililpFather}_{\text{ParentQuestionniareYear10}}$)

Although John acknowledged the importance of students' willingness to learn, it seemed he did not think teachers were always competent in supporting students' learning.

Philip seemed to echo his father's views. When a relieving teacher had trouble controlling the class over one term, Philip' concern was that he was prevented from meeting his father's expectations, despite his own contribution to the disruptions.

> I actually thought it was quite slack [of the teacher]. … I don't actually like being in a class where there's too much mayhem. I was kind of happy I didn't do the work, but I was kind of worried because [of] my Dad. ($\text{Philip}_{\text{InterviewYear10}}$)

In this quote, Philip expressed both happiness in his actual identity of being social during the mayhem as well as apprehension if his father's expectations were not met.

As well as being responsible for the control of his behaviour, Philip viewed the teacher as the provider of tasks he should be able to do quickly and easily. When Philip experienced difficulty, Philip blamed the teacher:

> The worst maths experience I had was … Mr Toomey just put … an equation on the board and he told us to do it and no explanation at all … tonnes of people were complaining. … I think he just had high expectations of us … the [achievement] class. … We haven't been taught that kind of algebra before. ($\text{Philip}_{\text{InterviewYear10}}$)

The use of "we" suggested that Philip drew on the discursive resources from others in the class in telling this story. His feelings of unhappiness at the outcome did not result in him trying to meet the teacher's expectation of his designated identity. Instead the use of "we" indicated that it was expected that the teacher should change his designated identities related to the students' ability, and provide them with something they could do, perhaps by teaching them "that kind of algebra" or by lowering the difficulty of the tasks to match the students' actual identities.

Philip's feelings about mathematics were often linked to who his teacher was. In his personal journey graph in Figure 2, Philip referred directly to his mathematics teachers four times, either naming his teacher or scribbling on the graph "new teach" and "new teache". On two occasions, the naming of specific teachers was related to having very bad feelings about mathematics.

Of the 122 comments written on the personal journey graphs of the other 30 students in the class, 42% of them were about their teachers, many directly connecting their feelings to who their teacher was. These responses to teachers are not unusual as Averill (2009) found that teacher-student relationships were considered by both teachers and students to be influential on students' motivation and achievement in mathematics. If a student "liked" a teacher, they were more likely to engage and more likely to feel confident the teacher would support them when they needed assistance, although this was not the case for Philip up until Year 11 as he never asked for help, even if he liked the teacher.

Philip was in a new class in Year 11 that was working towards the first year of external examinations. His teacher was a friend of Philip's parents.

> The teacher that we have now, she's [a] friend of my parents and so I knew I couldn't slack off because I knew I'd get in trouble. … I'm nervous before our results come back. … I'm worried when [I]'ve got to tell [my] results to [my] father. ($\text{Philip}_{\text{Group InterviewYear11}}$)

His father's continued influence, the new teacher and her relationship to his parents, and perhaps the expectations related to the examination year, led to a change in Philip's engagement in mathematics, shown in his teacher's comments and school reports.

> Happy-go-lucky, a little slack at times; aiming for health science [course at university] but cruising … until recently. Tends to talk in class and so he is not getting as much done as he could. Very scruffy note taking. He keeps up with work and shows promise. ($\text{Teacher}_{\text{FeedbackMayYear11}}$)

> Philip has had consistent success this year, achieving in every topic. He can be a little too social in class, but usually manages to complete his work despite this. ($\text{Teacher}_{\text{ReportJuneYear11}}$)

> Philip has continued to achieve in class. He takes an interest in his work and likes to discuss difficult problems with others. He asks questions when he needs to and revises well for assessments. Philip is often social as he works. If he develops the capacity for silent work, he will get a lot more done. ($\text{Teacher}_{\text{ReportSeptemberYear11}}$)

Although Philip is still noted as being social, he was clearly meeting his designated identity of achieving highly in mathematics. The teacher had become someone who Philip could ask for help if he could not solve the task himself. He also discussed difficult tasks with classmates. By discussing the mathematics more, he perhaps was able to meet some of his social needs. Philip no longer blamed his teacher, rather, he wrote:

> I'm just not working hard enough or I'm not [Philip has crossed out the words 'try' and 'paying'] studying. ($\text{Philip}_{\text{AutobiographyYear11}}$)

In his new class, there were students with a wider range of achievement levels and none of the top group from Year 10. Therefore, his designated identities related to achieving well in mathematics in comparison to his classmates were often met. This produced strong positive emotions.

> [You feel happy] when you're getting it and no one else is getting it (Philip laughs) … Sometimes I feel joyous (both other boys splutter with laughter) … [Joyous is] when you find out you're top of the class. ($\text{Philip}_{\text{GroupInterviewYear11}}$)

As a consequence of no longer being able to blame his teacher, accepting his father's view of his future career and achieving highly in mathematics, in Year 11, Philip's father's designated identities for his son had become Philip's actual identities. The gap shown in the Year 10 exam results had been closed through increased engagement. Consequently, Philip's feelings about mathematics began to improve (see Figure 2), which produced feelings of joy when he came top of the class, which then led to him being more willing to continue to engage.

## Conclusion

Philip and his father's case study illustrated the tensions that arise in relationship to differences in students' designated identities. Earlier research into why students stop engaging with mathematics have viewed the decision making almost entirely as an individual choice (e.g. Sullivan et al., 2006). Our research has shown that the situation is much more complex. Philip's engagement with mathematics changed over time as he sought to negotiate his way through the tensions he experienced when his identities were not in alignment with those of his father. Sfard and Prusak's (2005) conceptualisation of actual and designated identities, and the gap between them, provided a useful lens for identifying tensions and if and how they were resolved through their engagement with mathematics. It also provided a way of understanding how students draw on a range of discursive resources for formulating their identities leading at times to misalignments between actual and designated identities.

John was very influential and a significant contributor to Philip's designated identities related to mathematics and his engagement in the subject. John wanted Philip to embark on a mathematical-related career and had high expectations for his achievement and engagement in the subject. In some ways John appeared to act in ways similar to those of middle-class parents in other research (Kleanthous, 2014). Yet, John did not support Philip with his homework, voiced his own negative feelings about mathematics, and did not consider mathematics teachers as useful for Philip's progress. As occurred in Graue and Smith's (1996) research, Philip shared the ideas and language of his father – revoicing his father's views about the importance of mathematics, both explicitly, to a small degree, and implicitly in how he situated the teacher as being responsible for his learning in Year 10. Philip's designated identities of doing well in mathematics while being social, seemed to draw on different discursive resources. As has been the case in previous research (Lange & Meaney, 2011; Takeuchi, 2018), it became Philip's responsibility to resolve these tensions in a way that both he and his father could live with.

This exploration of John's influence on Philip's mathematical journey illustrates the importance of longitudinal study. As has been noted in previous research with younger children (e.g. Towers et al., 2018), Philip's mathematical journey at secondary school was a journey of change and negotiation. Philip's stories about himself, and also those from teachers, were generally in alignment in regard to noting Philip's need for social interaction. What changed over time is Philip's increased engagement in the management of the tension between needing high achievement in mathematics and being social.

John's influence on Philip is somewhat troubling in that some of Philip's statements suggested that he was worried about getting into trouble and it was fear of his father's anger that made him resolve the tensions that he faced. The tensions related to navigating between school and home expectation appeared in the identity stories of the whole cohort. However, students who did not face such situations at home may well have had easier choices about resolving tensions connected to being successful in mathematics by choosing to stop studying the subject when it became non-compulsory in Year 12.

Yet, the findings of the analysis indicate that students' identity stories are complex as they have to make sense of a range of discursive resources about themselves, presented to them in a multitude of ways. Often the navigation they had to do to make sense of them provided the students with simultaneous designated identities, such as being social and a high achiever in mathematics, which when compared with actual identities brought a range of affective responses. Although Sfard and Prusak (2005) suggested that unhappiness about the gap between a designated and actual identity could result in increased engagement in mathematics, this was not always the case for Philip. He described a range of emotions, only some of them seemed to have a direct impact on his engagement with mathematics, apprehension or fear of his father as well as intense joy when he found himself at the top of his class. Philip's stories in conjunction with those of his classmates provide nuanced insights into how parents influence their children's engagement with mathematics.

This study has a number of implications in addition to these research insights and understandings. Schools, teachers, parents and students need to be made aware of students' dynamic tensions in negotiating between home and school and negotiating between their actual and designated identities. They also need to be aware of the impact of parents on these tensions, and the impact of these tensions on engagement. Careful and regular communication between home and school is vital and schools would do well to review their policies with regard to communication and reporting generally. Identifying that a student's feelings can signal that a gap exists between students' actual and designated identities is a powerful tool. When identified, with careful communication, the students' parents and teachers can provide support for the student to close the gap, so that possibilities for achieving in mathematics do not rely on fear but from having an alignment of support structures between home and school.

## Note

1. We use the term "parent(s)" to include all adults who play caretaker roles in a child's life.

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