Chapter 8

Middle School Boys' and Girls' Own Expressions of Aspirations for Their Mathematics Learning

Karina Joyce Wilkie

Abstract As an alternative approach to studying the affective dimensions of students' learning with normative surveys, pre-defined constructs, and Likert-scale response items, this study used a free-response format that sought students' views in their own words. Data were collected on over 3500 middle school students' aspirations for mathematics learning and generated a wide range of responses related to goals, interest, self-efficacy, and effort. The students also shared their perspectives on interactions with teachers, the classroom environment, and learning tasks. This chapter presents a comparative analysis of boys' and girls' responses at different year levels, to investigate the nature and frequency of their aspirations and to seek evidence of spontaneously generated goal orientations.

Keywords Affect gender · Goal orientations · Middle school mathematics · Motivation

8.1 Introduction

Prevalent research efforts to improve middle school students' engagement in mathematics (e.g., Attard, 2013; Grootenboer & Marshman, 2016; Middleton, 2013; Plenty & Heubeck, 2013; Turner & Meyer, 2009) highlight the importance of finding ways to plan, teach, and assess mathematics that align with students' own hopes for their learning. Students in the middle years (approximately 9–14 years old) have demonstrated less interest, less self-efficacy, and poorer achievement in mathematics over time (e.g., Gottfried, Marcoulides, Gottfried, Oliver, & Guerin, 2007; Rolland, 2012). This study¹ sought to explore the extent of this apparent negative attitude and reluctance to engage with learning, by seeking students' own perspectives in their own

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words, thus finding out more about what matters to students themselves, and allow teachers to respond in productive ways.

Researchers have investigated differences between boys' and girls' attitudes, engagement, and motivation in learning mathematics, and have drawn diverse conclusions (e.g., Chouinard, Karsenti, & Roy, 2007; Green, Martin, & Marsh, 2005; Leder & Forgasz, 2002). Yet there is consensus that both boys and girls experience decreased motivation in the middle years of schooling (e.g., Meece, Glienke, & Burg, 2006; Watt, 2004). This study provided an opportunity to compare and explore the self-expressed wishes of a large cohort of Australian girls and boys at different year levels as another way to investigate this issue. It was assumed that awareness of students' own desires for their mathematics learning might help teachers to reflect on and respond to students' voice, through understanding more about how students learn effectively (Robinson & Taylor, 2007). They could gain insights into how to broaden their repertoire for teaching mathematics in ways that positively influence boys' and girls' motivation and achievement.

The study addressed the following research questions: *What wishes for mathematics learning do upper primary and early secondary boys and girls express? What evidence of mastery or performance goal orientations do boys and girls spontaneously generate?* The term 'wish' was used to gain insights into the students' aspirations since it was assumed to be familiar and meaningful to this cohort of young adolescents. Its commonplace definition is "a desire or hope for something to happen." It is suggestive of wanting "something that cannot or probably will not happen" (Oxford Living Dictionaries, 2016). The psychology literature describes several studies exploring people's wishes as a projective method for researching motivation, desires, and related goal concepts (Ables, 1972; King, 1995; Tafarodi et al., 2012). In the following section theoretical perspectives from the research literature that framed the study are discussed.

8.2 Theoretical Framework

As with a learner's effort to reach particular achievement goals in any given domain, a student's motivation in mathematics can relate intrinsically to features inherent in his/her disposition, and also to extrinsic factors in the surrounding environment, such as the learning context and the activities provided for learning (Eccles & Wigfield, 2002). These internal and external factors both influence motivation (Middleton & Jansen, 2011).

In this study, it was anticipated that the students' expressions of aspirations might relate to intrinsic motivational features of their mathematics learning, such as their goals, interests, attitudes, and effort. It was also anticipated that they might refer to extrinsic aspects of their classroom environment, such as interactions with their teacher, preferred learning tasks, and working arrangements. The following two subsections review theoretical perspectives and research findings on these dimensions in the literature.

Fig. 8.1 Motivation variables in mathematics learning at the middle years of schooling. Adapted from Middleton (2013)

8.2.1 Perspectives on Intrinsic Motivation

Motivation is an important construct for theorising how learners manage themselves—their choice to engage or not in an activity, how much effort they decide to expend (Middleton & Toluk, 1999), their goals, and their choices in longer-term academic pursuits (Middleton, 2013; Pintrich & Schunk, 2002). An earlier large review of studies on student motivation in the mathematics education literature found that students evaluated their likely success in mathematics using their beliefs about mathematics itself and about how mathematics is learnt (the process of achieving success). This influenced the extent to which they then engaged (Middleton & Spanias, 1999). This relates to Hannula's (2006) finding from a longitudinal qualitative study that three aspects appeared to influence students' regulation of their motivation: their derivation of goals from their needs, their appraisal of the accessibility of their goals, and their automatic emotional reactions from earlier experiences that can create inertia against change. He conceptualised motivation as “a potential to direct behaviour through the mechanisms that control emotion” and which is “structured through needs and goals” (Hannula, 2006, p. 175). This definition highlights the close relationship between students' needs, goals, emotions, and motivation.

The literature highlights many interrelated and sometimes overlapping and confusing operational definitions of a range of intrinsic variables that relate to student motivation (Grootenboer & Marshman, 2016), such as beliefs, attitudes, emotions, values, self-efficacy, effort, and identity. Yet there is general consensus that alongside mathematical knowledge, such motivational factors directly influence students' academic achievement in mathematics (Eccles & Wigfield, 2002). A theoretical model linking several motivational variables with mathematics achievement was developed using structural equations modelling with an extremely large data set (24,000 US middle school mathematics and science students). It is presented in Fig. 8.1. The model emphasises the central role of interest in directly influencing achievement and also other key motivational variables such as utility, effort, and self-efficacy (Middleton, 2013).

Interest as a motivational variable has been conceptualised as relating to intrinsic goal-directedness, curiosity, and personal identity (Middleton, Lesh, & Heger, 2002). It can also be viewed as *situational*—related to extrinsic environmental characteristics at a particular moment in time, such as the “novelty, challenge, social interaction, or other hypothesised characteristics” (Middleton, 2013, p. 79). Student interest can therefore ebb and flow in different situations (Schweinle, Meyer, & Turner, 2006).

8.2.1.1 Students’ Goal Orientations

An extensive body of research considers the relationships between a learner’s particular goals and his/her likely motivational, behavioural, affective, and cognitive outcomes (Rolland, 2012; Urdan, 2001). One theoretical perspective conceptualises four different goal orientations based on a dichotomy of mastery and performance (e.g., Ames, 1992; Pintrich & Schunk, 2002) intersecting with another dichotomy of approach and avoidance. These four types describe how a particular goal orientation might influence a learner’s effort, self-efficacy, and identity (Elliot, 1999; Elliot & Murayama, 2008). An individual with a mastery goal orientation seeks to improve his/her own learning and achieve task-based outcomes. An individual with a performance goal orientation focuses on comparison with others to define achievement, such as having better test results or winning in competitive situations. The approach and avoidance dichotomy describes how competence is valenced: how a situation or experience involves inherent attraction, leading to approach, or aversion, leading to avoidance.

There is ongoing debate about whether or not it is possible for an individual to hold both mastery and performance goal orientations in the same domain simultaneously (Brophy, 2005; Hulleman, Schrager, Bodmann, & Harackiewicz, 2010; Martin, 2013). Hulleman et al. (2010) conducted a meta-analysis of 243 studies of achievement goals and concluded that there were discrepancies in how the studies defined and operationalised goal orientations. The studies also measured goals differently, leading to divergent, even conflicting results, and inconsistent implications for motivational processes. Hulleman and colleagues suggested distinguishing between achievement and performance goals so that there might be less confusion. They asserted that achievement goals are actually neutral in terms of how competence is defined. An achievement goal might be related to a mastery orientation (an “A” grade demonstrates mastering the content) or to a performance orientation (an “A” grade demonstrates outperforming others). Within the performance goal orientation, Hulleman et al. (2010) additionally distinguished three components: appearance (demonstrating competence), normative (performing better than others), and evaluative (being judged as demonstrating competence relative to others). These three performance components are all about being compared with others.

The resulting four goal-orientation types in a two-by-two framework, using Elliot’s original conceptualisations and Hulleman’s and colleagues’ further distinctions, is presented in Table 8.1. Three of the four goal orientations have been empiri-

Table 8.1 Conceptualising four types of student goals using mastery-performance and approach-avoidance dichotomies

Mastery-approach goal orientation	Performance-approach goal orientation
<ul style="list-style-type: none"> • <i>Interest and curiosity</i>: Learning something interesting • <i>Task</i>: Mastering a task • <i>Challenge</i>: Mastering a challenge • <i>Improvement or attainment</i>: Learning as much as possible; improving my knowledge; understanding the content as thoroughly as possible; acquiring new skills 	<ul style="list-style-type: none"> • <i>Appearance</i>: Demonstrating competence/ability • <i>Normative</i>: Performing better than other students • <i>Evaluative</i>: Demonstrating my ability relative to others in the class (as judged by authority figure such as a teacher)
Mastery-avoidance goal orientation	Performance-avoidance goal orientation
<ul style="list-style-type: none"> • <i>Task</i>: Avoiding forgetting what I have already learnt • <i>Improvement or attainment</i>: Avoiding losing my skills/abilities/knowledge; avoiding stagnation or lack of development 	<ul style="list-style-type: none"> • <i>Appearance</i>: Avoiding looking incompetent/'dumb' • <i>Normative</i>: Avoiding performing poorly in the class • <i>Evaluative</i>: Avoiding demonstration of lack of ability relative to others (as judged by authority figure)

Adapted from Elliot (1999, 2008), Hulleman et al. (2010)

cally supported by research over several years, and the mastery-avoidance orientation more recently (Elliot & Murayama, 2008; Jang & Liu, 2012).

Despite conflicting findings in the literature, there is evidence that students are more likely to demonstrate mastery than performance goal orientations, that “social comparisons exert less influence on engagement in academic tasks than the aspiration to understand and to learn academic content” (Chouinard et al., 2007, p. 514). Brophy (2005) raised the issue, however, that most studies using goal theory to date have relied on experimental induction procedures or Likert-scale response items, which use a priori constructs based on researchers’ definitions. These research methods do not allow investigation into the degree to which students *spontaneously* generate evidence of the four goal orientations. He suggested that there is very limited evidence to indicate that students actually do hold performance goals: “looking good in comparison with their classmates” (p. 171). This study provided the opportunity to seek evidence for the four goal orientations in the students’ spontaneously generated responses.

8.2.1.2 Studies on Boys’ and Girls’ Motivation and Goal Orientations

Historically and in a range of contexts, gender differences in mathematics achievement have been found (Grootenboer & Marshman, 2016) and have been attributed in part to affective factors (Leder, 1992). In recent years, researchers have paid attention to differences between boys’ and girls’ beliefs, attitudes, emotions, and dispositions. A review of studies found that overall, boys tend to report a higher interest in learn-

ing mathematics than girls (Meece et al., 2006). Chouinard et al. (2007) found that more girls reported mastery goals and higher effort than boys. A study of approximately 1200 German secondary students found that nearly half reported believing that boys achieve more, one fifth reported that girls achieve more, and the rest indicated no gender difference. Of those students who reported that they believe girls achieve more, the three most frequently cited reasons were effort, concentration, and ambition—not ability (Kaiser, Hoffstall, & Orschulik, 2012).

In the Australian context, which is relevant to this study, Watt (2004) found that boys maintained a higher interest in and liking for mathematics and a higher perception of competence (ability rather than effort) than girls throughout adolescence. In contrast to these findings, Leder and Forgasz (2002) studied over 800 lower secondary students and found that although the majority viewed mathematics as a gender-neutral domain in terms of ability or achievement, they reported believing that girls are more interested in mathematics and enjoy it more, whereas the boys are more likely to find it difficult and boring—that they need more help to learn it than girls. Another Australian study of 1800 secondary students found that the middle school girls demonstrated more mastery goals and more effort than boys (Green et al., 2005). An international comparative longitudinal study of secondary students found that Australian girls had significantly lower intrinsic value (utility) for mathematics than the boys, unlike those in Canada and the United States. Yet they did not demonstrate a lower perception of competence than the boys, as did the girls in Canada and the US (Watt et al., 2012). Plenty and Heubeck (2013) studied over 500 rural Australian students (Years 7–9) longitudinally and found similar trajectories of decreasing motivation, similar patterns of self-efficacy and utility, but that the girls expressed greater mastery orientation and also more anxiety about assessment tasks than the boys. Overall, these studies suggest that Australian girls in recent years are likely to believe they have similar competence to boys, but are more anxious about their learning.

In a recent study of over 1800 New Zealand middle school students, Grootenboer and Marshman (2016) found overall that the boys were significantly more positive in their attitude towards mathematics, believed mathematics was more useful (utility), and were less anxious than the girls. In comparing year levels, they found that the Year 7/8 students were more negative about mathematics, had lower self-efficacy, and were more anxious than the Year 5/6 students, supporting previously mentioned findings from other studies of a decrease in motivation as students move from upper primary to lower secondary school (Meece et al., 2006; Watt, 2004).

8.2.2 Extrinsic Motivational Factors in the Classroom Environment

Teachers who understand more about how students' motivation is influenced by both intrinsic and extrinsic dimensions can make choices in their teaching practice,

such as what types of tasks to use, how to design the learning environment, and teaching strategies to use, that help maximise students' opportunities to achieve in mathematics (Megowan-Romanowicz, Middleton, Ganesh, & Joanou, 2013). If it is true that "motivation and achievement are developmental, interdependent, and influenced by the design of educational experiences" (Middleton, 2013, p. 91), then it is worthwhile to examine how students describe the extrinsic characteristics of their classroom environment and relate them to their motivation and goals for learning. Middleton's (2013) analysis of the previously mentioned data set of US middle school students indicated that extrinsic influential factors are likely to be present and appear to influence interest and effort. Factors that were suggested included: the classroom environment, learning strategies and resources, teacher attitude, and family environment. It was proposed that teacher actions, setup of the classroom environment, choice of mathematical tasks, and use of tools could influence students' interest and therefore effort and achievement (Middleton, 2013).

In recent years, researchers have begun to examine the potential influence of external factors in specific achievement environments on an individual's internal goal orientation. There seems to be consensus that extrinsic factors in a specific context may play a role in influencing an individual's goal orientation by promoting a particular view of achievement or competence (Allen, 2003; Rolland, 2012; Urdan, 2001). Urdan (2001) asserted that the achievement goals an individual pursues in a given situation depend both on his/her intrinsic goal orientation and on extrinsic messages received in that environment that make certain goals salient to him/her. A context in which progress in learning, persistence, and effort are promoted can influence learners to adopt more mastery-oriented goals whereas a context emphasising competitive performance can promote the adoption of more performance-oriented goals (Dweck, 2007; Elliot, 1999; Elliot & Murayama, 2008; Jang & Liu, 2012). In a large review of research on the relationships among student-perceived classroom goal structures, teacher support, and student motivational variables, Rolland (2012) found that teachers' (socio-emotional and instructional) support and emphasis of mastery goals in the classroom promoted positive affective outcomes for secondary middle school students, but not with younger cohorts (Year 6), suggesting more direct teacher effects for older students. In particular, teacher support was strongly related to student interest in learning tasks.

The study discussed in this chapter was conducted with Australian students in the context of a recently introduced national curriculum for mathematics (Australian Curriculum Assessment and Reporting Agency, 2015) emphasising learning tasks that promote reasoning, understanding, problem solving, and fluency (Kilpatrick, Swafford, & Findell, 2001). Yet it has been reported that typical teaching approaches for middle school and secondary mathematics in Australia tend to focus on procedures and computational processes rather than concepts and problem solving (e.g., Hollingsworth, Lokan, & McCrae, 2003). There is little in the literature on how students themselves view particular teaching approaches and how they might relate these to their engagement and motivation.

In a study of Australian middle school students' views after attempting a challenging task, Sullivan et al. (2014) found that a majority of both the primary and

secondary students preferred to work on tasks at least as difficult as the challenging task. They also found a variety of preferences for working arrangements: one third indicated they preferred working individually, one third reported that they liked working with another student, and a third preferred to listen to explanations from the teacher first. Although small-group work for mathematics learning is widely advocated in mathematics education policy and curriculum, little is known about its use in Australian settings. A large-scale survey in the United States found that slightly less than 25% of middle school students experienced regular collaborative opportunities (Banilower et al., 2013).

These studies posit an influential role for the external environment in which students learn, and suggest that the choices teachers make in their teaching practice and interactions with students influence students' affect and motivation. This study was an opportunity to examine Australian students' spontaneously generated responses for evidence of preferences for different extrinsic environmental features, for example, particular teacher actions, different teaching approaches, and independent or collaborative learning. The following section provides details on how the research was designed to elicit students' spontaneous expressions about their aspirations.

8.3 Research Design

Much of the research literature describes attempts to define and to measure different aspects of the affective dimensions of students' motivation for learning—their attitude, self-efficacy, beliefs, values, and other variables—to theorise causal relationships among motivation, behaviour, and academic achievement. Structured surveys and Likert-scale response items are typically used in large-scale studies, which aim to measure pre-defined aspects of motivation (Hannula, 2006) and approach relationships from a normative view (di Martino & Zan, 2010). As discussed earlier in the chapter, Brophy (2005) expressed concern that pre-defined surveys suggest to students goal orientations they may not have produced on their own, and also that they limit the range of possible responses to those conceptualised by the researcher. He highlighted the lack of research that explores what students might say about their goals in their own words. This study was designed to address the need for research in the affective domain that seeks students' own views and expressions (Grootenboer & Marshman, 2016).

The issue of 'voice' in research is discussed extensively in the literature: how to give participants greater voice about issues that directly and indirectly affect them, especially those whose voices are not often heard (Flutter & Rudduck, 2004). There seems to be an increased valuing of consulting learners about their views, thoughts, feelings and experiences, for making teaching and learning more effective (Flutter & Rudduck, 2004; Robinson & Taylor, 2007). This study was an opportunity to seek middle school students' voice specifically about their wishes for mathematics learning.

As a complementary approach to pre-defined quantitative studies on motivational aspects, this study used an open-ended response item to investigate the different facets of students' aspirations as expressed by the students themselves, without any a priori motivation constructs. It enabled interpretive content analysis of their spontaneous responses (Lieblich, Tuval-Mashiach, & Zilber, 1998; Mayring, 2015). The students were asked: "If you had one wish for your mathematics learning, what would it be?" As previously explained, the word 'wish' was chosen for the wording of the survey question because it was likely to be familiar to students from everyday usage (e.g., 'I wish I could...', 'three wishes', 'make a birthday wish'), and is also suggestive of desiring something that may not necessarily happen—something hoped for but perhaps ordinarily unattainable.

The purpose of the study was not to infer causal relationships between motivational variables but to understand more about what students themselves choose to focus on when articulating their aspirations and how these might relate to different aspects of their experiences, goals, and motivation in mathematics learning. An interpretive approach and avoiding "heavy-handed, intrusive analysis" was an aim of the study (Wolcott, 2009, p. 33). It was also considered important to provide anonymity so that the students were not obliged to say what they thought was expected of them (Robinson & Taylor, 2007). They could describe critical or negative or nonsensical ideas or not respond at all.

8.3.1 *The Participants*

Although seeking qualitative data, the research generated a large amount of data from 3562 middle school students in 2015 (93% response rate) from three Australian states: Victoria, New South Wales, and Tasmania. The students were from 31 government and independent schools of varying sizes and socioeconomic status. They were at the beginning of their participation in a larger project² that is studying the types of tasks that can encourage students to persist in their learning, and strategies teachers can use for increasing student effort (see Sullivan et al., 2014). The students typed their own responses to the question via an online survey, and these ranged from a few words to a long paragraph. They did not appear to have any technical difficulty with the process of typing their responses or intellectual difficulty with understanding the question. The shorter responses tended to be a phrase expressing one aspiration whereas the longer responses often included an explanation for why the student wished for something or expressed more than one aspiration. Examples of different responses are presented in the Discussion of findings section.

²The Encouraging Persistence Maintaining Challenge (EPMC) project was funded through an Australian Research Council Discovery Project (DP110101027) and involved collaboration between Monash University and the Australian Catholic University. The views expressed are those of the author. The generous participation of project schools is acknowledged.

8.3.2 Coding the Students' Responses

The research team (author, research assistant, and overall project chief investigator) employed a process model for forming codes and grouping them conceptually in categories. Researcher-driven line-by-line coding was used rather than automated software counting procedures, despite the large data collection, because there was the perceived need to make nuanced interpretations of the phrasing that the students used, not only individual words. The students' own words and phrases were incorporated in the node labels to provide a sense of how they were interpreted and grouped conceptually. The use of the NVivo 10 software program supported this process and enabled the team to make cyclical comparisons of coding frequencies and adjustments throughout the process to improve intra- and inter-coding reliability.

The author initially developed a coding scheme by analysing a set of 500 student responses. A research assistant then used the initial coding scheme for the same 500 responses; the coding was then compared node by node and the scheme refined and re-arranged after discussions with the team. Two members then coded another 400 responses and repeated the process of comparing and refining to maintain inter-coder reliability. A set of nearly 2000 responses was then coded by one team member and examined by another; only minor adjustments were needed by this stage. The coding of the rest of the responses then occurred and was double-checked. Table 8.1 presents the final coding scheme for the study with percentage frequencies for year levels, students overall, and genders by year level and overall.

A student's response was sometimes found to relate to more than one category and was therefore coded at more than one node and holistically, to avoid data fragmentation and the use of data out of context (Bazeley, 2007; Lieblich et al., 1998). Some of the codes in the fifth category 'About being taught' appeared similar in nature to those in other categories, but were deliberately coded separately, even though it made the framework bulkier. The intent was to distinguish explicit references to the role of the teacher in their wish, for example, *teachers making maths fun or interesting* (more suggestive of the extrinsic motivational dimension) and *more enjoyment, fun* in the category 'Type of task' (perhaps more suggestive of an intrinsic view about mathematics itself or the process of learning mathematics).

8.4 Discussion of Findings

The following discussion focuses on the nature of the students' self-expressed aspirations and also on evidence of different goal orientations in their use of language. Comparisons are made between upper primary (Year 5/6) and lower secondary (Yr 7/8) students' responses, as well as between those of girls and boys. The coding framework, presented in Table 8.2, demonstrates the diverse range of students' responses to being asked about their wishes for mathematics learning. Although there are many ways the data could have been analysed, in this study the codes were

grouped into five main categories, presented in order of overall frequency: 'About learning or achievement', 'Type of task', 'About affect or motivation' (explicit reference), 'Working arrangement, and 'About being taught'. Overall, the responses were noticeably worded in positive terms. Each code contains responses from both upper primary and lower secondary students and from both boys and girls, suggesting that the types of wishes expressed by this cohort were salient across different ages and genders. Less than 2% of the responses were unclear or irrelevant.

8.4.1 *The Nature of Students' Aspirations*

Overall, the most frequent category for the students' responses was 'About learning or achievement' (60%). A higher percentage of Year 7/8 students (67%) made a response in this category compared to Year 5/6 students (53%). A noticeably larger percentage of Year 7/8 girls, compared to younger girls or the boys, expressed a desire for greater fluency: being able to learn or answer quicker or more easily or efficiently (10%). The desire for fluency was also evident from many of the students expressing the wish to know their times Tables (8% overall; 12% of Year 5/6 students). A higher percentage of Year 7/8 girls also expressed a desire to learn multiple strategies, ways to solve, how others solve (8%). A study of secondary teachers highlighted their mistaken perception that the students would resist learning multiple strategies (Leikin, Levav-Waynberg, & Mednikov, 2006) so it is interesting that nearly 10% of the Year 7/8 girls spontaneously expressed their desire for this type of approach.

The percentage of Year 5/6 students who expressed the desire for more challenge in their learning (8%) was nearly double that of the Year 7/8 students, for example:

I wish that we could do harder things in class because everything in math is so easy. Maths isn't fun anymore because it's so easy. I want a challenge. (Yr 5/6 boy #641)

To be given harder maths tasks to work on during class, because I find the work we are doing lately is a bit too easy. (Yr 5/6 girl #280)

It has been argued that teachers expect students to dislike more challenging tasks (Sullivan et al., 2014) so it is also interesting to find that the younger students in this cohort, at upper primary levels, raised their desire for *more* not less challenge. Less than 1% of the overall responses contained a wish for less effort or doing easier work.

The percentage of girls' responses (5%) that related to *retaining* (*not forgetting, remembering, memorising, off by heart, revising*) was more than double that of the boys' responses, and were also more frequent at the Year 7/8 level. This perhaps suggests some anxiety for this cohort about having to remember what they have learnt so far in mathematics, perhaps because of the considerable amount of content to be covered at secondary levels. This result resonates with quantitative studies that found maths anxiety to be higher among girls (Grootenboer & Marshman, 2016; Plenty & Heubeck, 2013).

Table 8.2 Codes with percentage frequencies for students by year levels and overall, and then for genders by year level and overall

Categorisation of response	% Yr 5/6 overall (<i>n</i> = 1749)	% Yr 7/8 overall (<i>n</i> = 1813)	% Students overall (<i>n</i> = 3562)	% Yr 5/6 Boys (<i>n</i> = 926)	% Yr 7/8 Boys (<i>n</i> = 684)	% Boys overall (<i>n</i> = 1610)	% Yr 5/6 Girls (<i>n</i> = 823)	% Yr 7/8 Girls (<i>n</i> = 1129)	% Girls overall (<i>n</i> = 1952)
About learning or achievement	53.11	67.06	60.22	52.6	59.5	55.53	53.7	71.66	64.09
About understanding: being able to understand, knowing or having knowledge	9.09	14.78	11.99	8.96	12.87	10.62	9.23	15.94	13.11
About performing: marks/grades/standard, good/smart at maths	9.83	11.03	10.44	11.45	11.84	11.61	8.02	10.54	9.48
About improving: becoming smarter or better (in general)	6.8	8.38	7.61	6.05	8.77	7.2	7.65	8.15	7.94
About fluency: being able to learn or answer quicker or more easily or efficiently	5.72	8.6	7.19	4.64	6.14	5.28	6.93	10.1	8.76
About more challenge: being challenged, doing harder work, being in higher class	7.95	4.08	5.98	7.88	4.82	6.58	8.02	3.63	5.48
About appropriate learning: at my level, more or new or useful things, choice	4	4.91	4.46	3.89	3.95	3.91	4.13	5.49	4.92

(continued)

Table 8.2 (continued)

Categorisation of response	% Yr 5/6 overall (<i>n</i> = 1749)	% Yr 7/8 overall (<i>n</i> = 1813)	% Students overall (<i>n</i> = 3562)	% Yr 5/6 Boys (<i>n</i> = 926)	% Yr 7/8 Boys (<i>n</i> = 684)	% Boys overall (<i>n</i> = 1610)	% Yr 5/6 Girls (<i>n</i> = 823)	% Yr 7/8 Girls (<i>n</i> = 1129)	% Girls overall (<i>n</i> = 1952)
About wanting to learn multiple strategies, ways to solve, how others solve	1.54	6.84	4.24	1.19	4.53	2.61	1.94	8.24	5.58
About retaining: not forgetting, remembering, memorising, off by heart, revising	3.26	5.07	4.18	2.38	2.92	2.61	4.25	6.38	5.48
About thinking: using mental faculty well, improving ability to think	2.23	2.32	2.27	2.16	2.49	2.3	2.31	2.21	2.25
In comparison with others: being better than, the best	2	0.39	1.18	3.35	0.73	2.24	0.49	0.18	0.31
About explaining my understanding, showing what I know	0.69	0.66	0.67	0.65	0.44	0.56	0.73	0.8	0.77
Type of task	57.34	30	43.46	51.53	25.15	40.37	63.91	32.96	45.95
Better at a specific topic or concept	-51.11	-23.38	-37	-44.61	-17.98	-33.3	-58.44	-26.67	-40.01
Fractions/Decimals/Percentage	20.7	7.83	14.15	18.14	5.99	12.98	23.57	8.95	15.11
Times tables	11.78	4.85	8.25	9.72	2.63	6.71	14.09	6.2	9.53
Division	9.32	2.21	5.7	8.86	1.9	5.9	9.84	2.4	5.53
Algebra or equations	0.91	4.74	2.86	1.19	4.39	2.55	0.61	4.96	3.07

(continued)

Table 8.2 (continued)

Categorisation of response	% Yr 5/6 overall (<i>n</i> = 1749)	% Yr 7/8 overall (<i>n</i> = 1813)	% Students overall (<i>n</i> = 3562)	% Yr 5/6 Boys (<i>n</i> = 926)	% Yr 7/8 Boys (<i>n</i> = 684)	% Boys overall (<i>n</i> = 1610)	% Yr 5/6 Girls (<i>n</i> = 823)	% Yr 7/8 Girls (<i>n</i> = 1129)	% Girls overall (<i>n</i> = 1952)
Other (operation, measurement, geometry etc.)	8.4	3.75	6.04	6.7	3.07	5.16	10.33	4.16	6.76
More creative/visual/hands-on tasks, games	3.26	1.65	2.47	3.46	1.46	2.67	3.04	1.77	2.31
More technologies	1.77	1.93	1.85	2.27	2.78	2.48	1.22	1.42	1.33
About set exercises/homework	0.91	1.99	1.46	1.08	2.34	1.61	0.73	1.77	1.33
About problem solving tasks	0.23	0.61	0.42	0.11	0.44	0.25	0.36	0.71	0.56
Less technologies	0.06	0.44	0.25	0	0.15	0.06	0.12	0.62	0.41
About affect or motivation	10.18	13.85	12.61	9.72	11.26	10.81	10.7	15.68	14.09
Emotional response: feelings, engagement, interest, confidence	4.06	4.63	4.35	2.7	2.05	2.42	5.59	6.2	5.94
Wanting to make more effort—working/studying harder, not giving up	2.12	6.18	4.18	2.05	5.26	3.42	2.19	6.73	4.82
More enjoyment, fun	2.86	1.99	2.5	3.24	2.05	2.73	2.43	2.21	2.31
Wanting to make less effort—not working harder, doing easier work	0.91	0.72	0.81	1.3	1.46	1.37	0.49	0.27	0.36

(continued)

Table 8.2 (continued)

Categorisation of response	% Yr 5/6 overall (<i>n</i> = 1749)	% Yr 7/8 overall (<i>n</i> = 1813)	% Students overall (<i>n</i> = 3562)	% Yr 5/6 Boys (<i>n</i> = 926)	% Yr 7/8 Boys (<i>n</i> = 684)	% Boys overall (<i>n</i> = 1610)	% Yr 5/6 Girls (<i>n</i> = 823)	% Yr 7/8 Girls (<i>n</i> = 1129)	% Girls overall (<i>n</i> = 1952)
Not study mathematics at all	0.23	0.33	0.28	0.43	0.44	0.43	0	0.27	0.15
Working arrangement	9.2	10.21	9.74	6.94	9.06	7.95	11.67	10.89	11.22
More work with others, pairs	5.66	7.12	6.43	4.97	5.99	5.47	6.44	7.79	7.22
More individual work	1.83	1.05	1.43	0.86	0.44	0.68	2.92	1.42	2.05
With others on same level	0.91	0.66	0.79	0.76	0.88	0.81	1.09	0.53	0.77
Need quiet or spacious environment	0.29	0.83	0.56	0.11	1.17	0.56	0.49	0.62	0.56
Needs to be at my own pace	0.51	0.55	0.53	0.24	0.58	0.43	0.73	0.53	0.61
About being taught	6.17	10.42	8.34	3.46	8.77	5.71	9.22	11.44	10.5
About being helped in general, individually or in small group, topic-specific	2.57	2.26	2.42	0.87	1.02	0.93	4.5	3.02	3.64
Teachers explaining more or in depth or clearly	1.83	2.7	2.27	1.4	1.61	1.49	2.31	3.37	2.92
Teachers using particular or different approach or teaching strategy	0.63	1.65	1.15	0.32	2.05	1.06	0.97	1.42	1.23
Being given more time in class, on tests, for revision, more lessons	0.17	1.16	0.67	0.11	1.02	0.5	0.24	1.24	0.82

(continued)

Table 8.2 (continued)

Categorisation of response	% Yr 5/6 overall (<i>n</i> = 1749)	% Yr 7/8 overall (<i>n</i> = 1813)	% Students overall (<i>n</i> = 3562)	% Yr 5/6 Boys (<i>n</i> = 926)	% Yr 7/8 Boys (<i>n</i> = 684)	% Boys overall (<i>n</i> = 1610)	% Yr 5/6 Girls (<i>n</i> = 823)	% Yr 7/8 Girls (<i>n</i> = 1129)	% Girls overall (<i>n</i> = 1952)
Teachers giving harder or more work or more strategies	0.11	0.88	0.51	0	0.73	0.31	0.24	0.97	0.67
Teachers giving encouragement, empathy	0.17	0.5	0.34	0.11	0.58	0.31	0.24	0.44	0.36
Teachers giving easier work	0.34	0.06	0.2	0.32	0.15	0.25	0.36	0	0.15
Teachers making maths fun or interesting	0.06	0.22	0.14	0.11	0.44	0.25	0	0.09	0.05
Other	0.29	0.99	0.65	0.22	1.17	0.62	0.36	0.89	0.67
Utility for the future: higher year level, career, scholarship	0.97	1.77	1.38	0.97	2.49	1.61	0.97	1.32	1.18
Nothing to wish for—everything is fine	0.11	0.33	0.31	0	0.15	0.19	0.24	0.44	0.41
Unclear/irrelevant response	1.26	1.71	1.49	1.62	3.07	2.24	0.85	0.89	0.87

Only 1% of the students' responses overall explicitly contained some sort of reference to comparison with others (suggestive of a performance goal orientation). The percentage of Year 5/6 boys' responses in this code (3.35%) was much higher than that for the older boys' (0.73%) or the girls' responses (0.49% and 0.18% respectively). For example, a Year 5/6 boy wrote his wish to be: "the smartest in the school because I want people to ask me questions" (#256). Of course, this does not imply that other students don't hold this type of goal, only that they chose not to express it in this survey.

The next most frequent category overall was 'Type of task' (43%) but in this group a much higher percentage of Year 5/6 students (57% compared to 30% for Year 7/8) chose to make reference to type of task, and more particularly about a specific topic or concept. *Fractions/decimals/percentage* was the most frequent topic referred to by students, with *times tables* (multiplication tables) the next most frequent, for example:

To learn all of my x's tables and be the best I can at all of the maths work we do here in year 5 and at school. I want to learn this because I usually love maths so much when I was in year 4 but now I don't seem to like it anymore. I WANT TO LEARN THESE THINGS :) :) :) :) :) (Yr 5/6 girl #711)

To get better at maths because even though I try hard doesn't mean I'm any good at it. I would especially like to get better at fractions and times Tables (6, 7, 8) (Yr 7/8 girl #740)

The percentage of girls' responses referring to these two topics at both the primary and secondary levels was slightly higher than the boys', but both genders at Year 5/6 and Year 7/8 highlighted these two topics in their responses. In all of the specifically mentioned topics or concepts, except *algebra or equations*, a higher percentage of Year 5/6 students made responses. It was intriguing that fluency with times tables seems to be a pervasive aim across year levels and genders. Does times tables proficiency hold a particular meaning of success in mathematics for this cohort?

Similar proportions of students at upper primary and lower secondary levels made explicit references to the affective dimension. Yet one code, *wanting to make more effort—working/studying harder, not giving up*, contained a higher percentage of responses from Year 7/8 students (6% rather than 2% for Year 5/6). This suggests that the issue of effort or motivation is perhaps more salient to the older students in this cohort. There was a higher percentage of references related to the emotional dimension in the girls' data set (nearly 6% compared to 2%), but perhaps still quite a low percentage overall, which was surprising given similarly aged students' apparent negative attitudes to mathematics in the literature. It was expected that more students would respond in this survey with affective language. A slightly higher percentage of Year 5/6 boys expressed an explicit wish for more *enjoyment or fun* in their mathematics learning.

Nearly 10% of the students overall made reference to their working arrangement, with a similar spread across year levels and genders; the most frequent code was a wish for *more work with others* in pairs or groups. A slightly higher percentage of Year 7/8 students than Year 5/6 referred to this wish in their responses, but both boys and girls at upper primary and lower secondary levels made a response about wanting

more opportunities to work together. Some students explained the reasons for their desire to work more in groups, such as finding out how others solved problems (suggestive of learning multiple strategies):

I would want to work in groups more often because you get other people's methods of working problems out as well as solving the problems together. (Yr 7/8 boy #154)

To be able to work in partners or small groups so I have many different ways to learn things (e.g. I can see how other students work out their problems) and it would also make maths a little more fun which for me makes it easier to concentrate, compared to if I'm bored in class. I tend to lose concentration and doze off, not helping with my learning. (Yr 7/8 girl #550)

A higher percentage of Year 7/8 students explicitly referred to the role of the teacher in meeting their expressed wish (10% rather than 6% for Year 5/6). This resonates with the review of studies finding more direct teacher effects for older middle school students (Rolland, 2012). There was a wide range of codes that related to the teacher, but with a relatively small frequency of responses in each. The most frequent code was *about being helped*, with nearly four times as many girls than boys expressing this wish, but interestingly with more Year 5/6 girls than the older girls and the boys. The Year 7/8 boys made slightly more frequent references to wanting teachers to use *a particular or different approach or teaching strategy*, but these still represent a small percentage overall (2%). A higher percentage of Year 7/8 students than Year 5/6 students expressed a wish for *being given more time in class, on tests, for revision, or more lessons*. This also might relate to a perceived increase of pace and content at secondary school.

A higher percentage of Year 7/8 boys (2.5%) than younger boys (1%) or the girls (1 and 1% respectively) expressed a wish for their learning that related to their future aspirations, such as their achievement at a higher year level or their career. Yet the percentages were all low, suggesting that this cohort of middle school students were more focussed on their experience of mathematics in the present than their perceived utility of mathematics for the future. The next sub-section discusses the five most frequent codes overall for each gender.

8.4.1.1 Girls' and Boys' Five Most Frequent Codes

The students' responses demonstrate a wide range of aspirations, and there were responses from boys and girls in every code. Most were about learning or achievement (60% overall—56% of the boys and 64% of the girls). The next most frequent type of aspiration was about types of tasks, with most referring to a specific mathematics topic or concept. Fractions/decimals/percentage, and times tables were key areas of mathematics highlighted by both genders. The next three most frequent types of aspirations were about affect or motivation, working arrangements in lessons, and being taught (explicit reference). A slightly higher proportion of girls made responses in most of these codes, suggesting that they were more likely to have made survey responses that required coding in more than one code.

Fig. 8.2 The five most frequent codes for boys (shaded in grey)

Fig. 8.3 The five most frequent codes for girls (shaded with diagonal lines)

Figures 8.2 and 8.3 present the five most frequent codes for boys and girls alongside comparative percentages for the other gender. It can be seen that two codes relate to specific topics and the other three to learning or achievement.

Four out of the five codes are common to both genders yet are in a different order. The girls’ fifth code—*about fluency*—does not appear in the boys’ list. The

boys' fourth code—*about improving (in general)*—does not appear in the girls' list, even though relatively more girls' responses were coded here. The two previously mentioned topic-specific codes appear in both lists, highlighting these areas of mathematics as of concern to both the boys and girls in this cohort. The next section examines the codes that seem to indicate a particular goal orientation, based on the language used by students in their responses.

8.4.2 *Evidence of Goal Orientations in Boys' and Girls' Spontaneously Generated Responses*

The framework of four different types of goal orientations (Table 8.1) was initially used in looking for evidence among the five most frequent codes for each gender. Wanting to improve in a particular topic or concept was the focus of two codes for both genders and is suggestive of mastery-approach goals because the intent is on acquiring new knowledge or skills. For the girls, the most frequent non-topic-specific code was *about understanding: being able to understand, knowing, or having knowledge*. This is also suggestive of a mastery-approach goal because of the focus on “understanding the content as thoroughly as possible.”

The second most frequent (non-topic-specific) code for the girls was *about performing: marks or grades or standard, good or smart at maths*. As previously discussed, this could relate either to mastery or performance goals, depending on whether or not an individual seeks validation through performing well that they have *mastered* a task and acquired new skills (mastery) or that they have *demonstrated* competence and *appear* to have ability compared to others (performance). Hulleman et al. (2010) emphasised the need to distinguish between these reasons for wanting to perform well; even though on the surface such language about grades and results might look like performance goals, it is important to look explicitly for the desire to be *compared* favourably against *other people*. Some students used language that was suggestive of a link between good grades and a mastery goal, for example, “to get better and better at it and get really good marks; to be a fantastic learner and to understand hard maths in other years” (Yr 5/6 girl #124), or “I would wish to become better at it and have a better understanding so I get above 80%” (Yr 7/8 boy #160). Some explicitly linked good grades to a performance goal because they described comparison to others e.g., “to get a higher score than Caitlyn on a math test” (Yr 7/8 girl #723). This type of response was additionally coded under *in comparison with others: being better than, the best*, which is suggestive of performance-approach goals.

The girls' third most frequent (non-topic-specific) code was *about fluency: being able to learn or answer quicker or more easily or efficiently*. The language used by the students for responses in this code did not clearly differentiate between a wish for fluency for improved learning (suggestive of mastery-approach), or for not wanting

Table 8.3 Codes evidencing particular goal orientations with percentages of boys' and of girls' responses

Mastery-approach goal (% boys, % girls)	Performance-approach goal
<p><i>Interest and curiosity:</i></p> <ul style="list-style-type: none"> • About appropriate learning: at my level, more or new or useful things, choice (3.91, 4.92) • More creative/visual/hands-on tasks, games (2.61, 2.31) • More enjoyment, fun (2.73, 2.31) • Teachers making maths fun or interesting (0.25, 0.05) <p><i>Task/Challenge:</i></p> <ul style="list-style-type: none"> • About wanting to learn multiple strategies, ways to solve, how others solve (2.61, 5.58) • About more challenge: being challenged, doing harder work, being in higher class (6.58, 5.48) • Teachers giving harder or more work or more strategies (0.31, 0.67) <p><i>Improvement or attainment:</i></p> <ul style="list-style-type: none"> • About understanding: being able to understand, knowing or having knowledge (10.62, 13.11) • About thinking: using mental faculty well, improving ability to think (2.30, 2.25) • Better at a specific topic or concept (33.29, 40.01) 	<ul style="list-style-type: none"> • <i>Normative:</i> In comparison with others: being better than, the best (2.24, 0.31) • <i>Appearance:</i> About explaining my understanding, showing what I know (0.56, 0.77)
Mastery-avoidance goal	Performance-avoidance goal
<ul style="list-style-type: none"> • <i>Improvement or attainment:</i> About retaining: not forgetting, remembering, memorising, off by heart, revising (2.61, 5.48) 	<ul style="list-style-type: none"> • <i>Appearance or evaluative:</i> Emotional response—explicit reference to feeling embarrassed, left out, left behind, less smart than others (0.19, 0.72)

to appear incompetent or dumb to others by being slow to understand or answer (suggestive of performance-avoidance).

In the boys' list of five most frequent codes, *about performing* was more frequent than *about understanding*—the reverse of the girls' list. Their third most frequent learning code was *about improving: becoming smarter or better (in general)*. It does not appear on the girls' list. It was unclear from the students' responses whether or not the reason for wanting to improve related to a comparison with other people and therefore could not be used as evidence for one particular goal orientation.

The framework of different types of goal orientations (Table 8.1) was then used to look for evidence of particular goal orientations among the other codes. Those codes where students' spontaneously generated language evidenced a link to a particular orientation are presented in Table 8.3 along with the percentage frequencies of boys and girls.

It can be seen that many more codes evidenced mastery-approach goals than any other type. Within the mastery goal types, it appears that interest, curiosity, and challenge were key foci for many of the boys' descriptions of their wishes, whereas learning different strategies and retaining knowledge were key foci for the girls. Yet both genders spontaneously generated responses that were coded in all of these codes.

8.4.2.1 Evidence of a Mastery-Avoidance Goal Orientation

The code that provided evidence of a mastery-avoidance orientation was *about retaining: not forgetting, remembering, memorising, off by heart, revising*. Just over 4% of students overall made such a response, but the girls' responses were more than twice as frequent as the boys' and also more frequent in the Year 7/8 data set. Examples include:

Being able to remember methods of working out things. I seem to forget methods after an amount of time. (Yr 7/8 boy #44)

I want to be able to remember things that we learn and never forget them. (Yr 7/8 girl #227)

Although this type of orientation has only recently been empirically validated (e.g., Elliot & Murayama, 2008) this study provides some evidence that in a cohort similar to those in this study, more girls than boys may experience this type of goal orientation. Is this concern about forgetting what they have learnt related to the higher levels of maths anxiety found among girls in several studies?

8.4.2.2 Evidence of a Performance-Avoidance Goal Orientation

There was not one particular code that as a whole seemed to evidence a performance-avoidance goal orientation, but within the emotional response code, a number of responses related explicitly to the emotion of embarrassment or a negative affective response to being perceived unfavourably by others. When counted separately, the boys' responses represented 0.19% and the girls' 0.72% frequency. Although these were relatively small percentages, the nature of the students' use of language was examined more closely to seek further insight into this particular goal orientation and its relationship to negative affect and motivational issues.

The following responses highlight students' experiencing embarrassment in class through having to ask for help, not knowing the answer to a question, or being teased by peers:

My wish for learning my maths would be to not have as much students that will distract me and my learning and to not have people that think they're better than everyone and when we need help from other students they always say "oh that's easy" and when I ask for help from other students I feel embarrassed. (Yr 5/6 girl #275)

For my teachers to help me clarify my work without feeling less smart than other people. (Yr 7/8 girl #93)

To be able to work with a group of people I am comfortable with and that I am able to ask questions without feeling embarrassed. (Yr 7/8 girl #562)

To know everything in maths since I had such a hatred for maths in my previous years and now I am growing to like it. I feel embarrassed when the teacher asks me something and I don't know and I need Mrs *'s assistance. (Yr 5/6 boy 306)

To be the best in maths but not so smart that people start teasing me. (Yr 5/6 boy #176)

These examples highlight that, for some students, their aspirations for mathematics learning relate to the avoidance of experiencing embarrassment in class. In terms of goal orientation they could be viewed as about any of the three aspects of *performance-avoidance*: avoiding looking incompetent or dumb (appearance), avoiding performing poorly in class (normative), or avoiding demonstration of a lack of ability relative to others and as judged by an authority figure (evaluative) (Elliot, 1999; Hulleman et al., 2010). Yet the last quote in the selection above highlighted that, for some students, being perceived by others as *smart* raised the fear of being teased about *that*, suggesting an influential role for peer expectations and social needs in students' mathematics learning.

Other emotional responses appeared to relate a mastery goal orientation to a motivational aspect of their learning. These are discussed in the next sub-section.

8.4.2.3 Students Relating Mastery Goals to Affect and Motivation

The desire for understanding, expressed by many of the students, can be related to a mastery-approach goal orientation, of wanting to learn as much as possible to improve their knowledge, to understand the content as thoroughly as possible, and acquiring new skills (Elliot, 1999; Hulleman et al., 2010). Some responses in the *emotional response* code further linked this desire, to understand mathematics, to various motivational variables. The desire for being able to understand the mathematics and the experience of confusion leading to a subsequent lack of motivation are illustrated by the following responses:

My one wish is to understand math much more and to get it a lot more. My only weakness in learning is math. My wish is to stop getting frustrated when I do it all the time. If I understand math more then I would enjoy math a lot more. It would be my dream to get math and to understand it more. I have difficulty a lot in math and like I said I would really really REALLY LIKE MATH A LOT MORE if I UNDERSTAND! (Yr 5/6 boy #892)

To try a lot harder and focus more. I seem to doze off a bit when I get really confused. (Yr 7/8 boy #606)

Is to try and understand what I'm trying to learn and to always keep my head up and not to give up when I'm stuck on a question. (Yr 7/8 boy #167)

It would be that I could understand more that the teachers tell me and that I could understand fractions a bit better, I would also like to concentrate more in maths because sometimes I don't get what the teachers are saying. I think I learn differently to other people because sometimes I need to be told it in many different ways to understand. I think that I know how to do it but I just need the teachers to tell us in different ways. (Yr 5/6 girl #183)

These quotes illustrate that some students struggle to maintain their motivation when experiencing a negative emotion, such as confusion, in response to a task. As with the last quote above, some students also suggested a teaching approach for helping them to understand mathematics, such as being given multiple ways to solve a problem, suggesting their perception that a greater understanding will lead to increased motivation.

Some of the students' responses highlighted their desire for interesting and challenging tasks to engage them and to motivate them to learn:

To always be able to always do maths all day and for it to stay really fun and to get harder and harder so I can learn a lot about maths. (Yr 5/6 girl #23)

To be able to have more interactive, interesting and fun math activities for both me and the school. (Yr 5/6 boy #36)

My wish would be to make things more interesting in maths. It can get very boring sometimes and you don't really feel motivated to work. So maybe try and mix it up and try using the computers more or having breaks and letting us talk a bit more. (Yr 7/8 girl #312)

To be able to choose what I want to learn in class. I think this would help my learning a lot because I would have the motivation and energy (not that I don't) to do more work especially when I'm learning something I'm interested in. I would also like it if we could work in groups and partners more so we could work together in hard (or easy) problems. (Yr 7/8 girl #442)

These types of responses also evidence a mastery-approach goal orientation in terms of interest and curiosity—learning something interesting—as well as mastering a challenge (Elliot, 1999; Hulleman et al., 2010). In the third and fourth quotes above, the students explicitly referred to their self-motivation as being influenced by their level of interest. The first and fourth quotes also referred to hard or harder work, suggesting that some students do value challenge in learning mathematics. They can be related to Middleton's (2013) central motivational variable of *interest*, specifically situational interest from tackling a novel task that is interesting and challenging.

Overall, it can be seen that analysis of the large data set generated by an open-response question provided a variety of insights into the expressed wishes of middle school students. A wide range of codes was created interpretively to capture the more subtle differences between the students' use of language in their responses. Qualitative analysis of the codes provided insight into how some middle school students related their experience in the mathematics classroom to their goals, affective responses, effort, and motivation for learning.

8.5 Conclusion

This study provided the opportunity to learn more about middle school students' motivation and engagement in mathematics from their perspectives, by inviting them to write their aspirations in their own words as a complementary methodology to pre-defined surveys. The high response rate and the low incidence of irrelevant responses suggest that when consulted, students similar to this cohort are likely to be willing to

share their views sincerely. Some students referred to intrinsic aspects of their aspirations for learning such as their own interest, attitude, effort, and self-motivation. Some students described extrinsic aspects of their environments that are perceived by them to influence their engagement in learning, such as challenging or interesting work, learning multiple strategies, collaboration with peers, help from their teacher, or not being embarrassed by others in class. As previously discussed, the overall percentage of references to emotions was lower than expected. It is possible that an additional survey question requesting the *reasons* for their wish might have elicited more references to affective factors including emotions. Those students who did provide unsolicited explanations often included emotional references, which linked their goals explicitly to particular emotions. This resonated with Hannula's (2006) conceptualisation of motivation as "a potential to direct behaviour through the mechanisms that control emotion" and which is "structured through needs and goals" (p. 175).

Although there are conceivably many ways to analyse such a data set from over 3500 free-format responses, this study used a framework of wishes related to: learning or achievement, being taught, affect or motivation, specific task types, and working arrangement. It examined the students' responses using theoretical perspectives on intrinsic motivational variables and goal orientations, and extrinsic learning environments. Comparisons between year levels and genders at upper primary and lower secondary levels provided evidence that particular aspirations were more salient for particular groups of students. For example, more students from Year 7/8 expressed their wish to make more effort, compared to younger students. The Year 7/8 girls made more frequent references to the desire for fluency and for learning multiple strategies. Previous research found a mismatch between secondary teachers' negative predictions and students' positive attitudes about learning multiple strategies (Leikin et al., 2006). In Japanese secondary classrooms, a problem-solving oriented lesson involves students demonstrating and discussing a variety of solutions to one problem (Ohtani, 2014). There is more to learn about secondary students' views about learning this way (Lynch & Star, 2014), but it appears from this study that they may be more open to it than teachers predict.

The Year 5/6 students expressed more frequently their wish for more challenge in their learning. The Year 5/6 cohort also made more frequent reference to improving their knowledge or skills in a particular area of mathematics, such as fractions/decimals/percentage and times tables, yet both genders at Year 5/6 and at Year 7/8 referred to these areas. These topics also appeared in the list of five most frequent categories for girls and for boys. This suggests that for many students, targeted support to improve their understanding in a particular area of mathematics would be motivating. It would be worth investigating further why times tables is of particular importance to students, a finding Grootenboer and Marshman (2016) also highlighted with New Zealand middle school students.

The Year 7/8 cohort made more references to wanting to work in small groups, perhaps because they had experienced fewer opportunities in secondary school (Banilower et al., 2013). A recent study found that secondary teachers were able to broaden students' learning opportunities by using collaborative learning (DeJarnette & González, 2015); this study suggests that it might also be motivating for some

students. More Year 7/8 students referred explicitly to teacher support (both socio-emotional and instructional aspects) than those in Year 5/6, resonating with studies that found teacher support more strongly related to affective outcomes for older middle school students (Rolland, 2012). Overall both girls and boys and upper primary and lower secondary students made responses that were categorised across the full range of codes, suggesting that within one class of students similar to this cohort, a teacher is likely to find a diverse range of individual aspirations.

Evidence for all four goal orientations was found in the students' responses across several different categories, but with evidence that mastery goals are expressed more frequently than performance goals. This resonates with other studies on student goals (Brophy, 2005; Chouinard et al., 2007) but extends that work by suggesting that students do *spontaneously* generate evidence of performance goal orientations—that it is not survey items on this particular goal that suggest to students goals they don't actually hold. A mastery-avoidance goal orientation was evidenced in the small percentage of responses about *retaining: not forgetting, remembering, memorising, off by heart, revising*. More girls than boys evidenced this orientation, and this concern may relate to one possible reason why girls also have demonstrated higher maths anxiety in other studies (Grootenboer & Marshman, 2016; Plenty & Heubeck, 2013). A performance-avoidance goal orientation was evidenced in the small percentage of emotional responses that related to students' wishes not to be embarrassed.

It appears that a methodological approach giving students the opportunity to share their voice using a free-response format can provide worthwhile insights into the affective and motivational dimensions of a particular cohort of students' engagement and goals in learning mathematics. Individual and often detailed responses from the students provided further insight into the foundational desire for *understanding* mathematics, the influence of external features in their learning environments on their effort, and the key motivational factor of *interest* (Middleton, 2013), in particular *tasks* that are interesting and challenging.

There is more to understand and other conceptual lenses with which to view the students' aspirations for their learning. Because the data represent a snapshot in time, it was not possible to investigate the stability of students' expressions of wishes longitudinally. Perhaps a conclusion that can be drawn from the work to date is that seeking students' own voice on affective and motivational issues is valuable and may challenge some deficit theorising about middle school students' attitudes. Both the boys and girls expressed a wide range of hopes, which are overwhelmingly positive and often focussed on mastery-approach goals. Their language was often quite specific, suggesting that similar students to these are likely, when asked, to explain willingly and in detail what they desire in their learning and how teachers might support them. An implication for teachers is that rather than generalising these findings to other cohorts of middle school students, they might view their classes as comprised of many and varied individuals, to seek information about their specific wishes, and to find ways to incorporate students' own suggestions for promoting their engagement, learning, and achievement.

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