

Exploring Student Engagement with Mathematics Homework as Self-Assessment

by

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Abstract

Homework is a highly debated topic. Overall, research indicates that effective homework can improve achievement. However, little research exists on how students can engage with homework in meaningful ways. I have implemented a variety of homework systems in my mathematics classes, but always felt that many students were not learning from their homework. Reviewing the literature, self-assessment presents itself as an option for improving learning. The current study explores how students engage with autonomous mathematics homework promoted to them as self-assessment. Students were surveyed and interviewed concerning their engagement with the homework. Motivation, autonomy, goals, adaptation to change, and marks influenced student engagement. For the students who deeply valued both their learning and the self-assessment, the homework became a powerful learning tool. Yet, because the system required a high level of engagement and responsibility, other students lacked sufficient motivation to engage at a level where they could benefit at all.

Keywords: homework; self-assessment; autonomy; motivation; marks and grades; goals

*To my family, who have endlessly supported me
throughout my education. They believed in me when I
did not believe in myself.*

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Table of Contents

Approval.....	ii
Ethics Statement.....	iii
Abstract.....	iv
Dedication.....	v
Acknowledgements.....	vi
Table of Contents.....	vii
List of Tables.....	ix
List of Figures.....	ix
List of Acronyms.....	ix
Chapter 1. Introduction.....	1
Chapter 2. Related Literature.....	5
2.1. Homework.....	5
2.1.1. Definition, Purposes, and Effects.....	5
2.1.2. A History of Public Opinion.....	6
2.1.3. The Case for Homework.....	8
2.1.4. The Case against Homework.....	11
2.1.5. Characteristics of a Good Homework Assignment.....	13
2.1.6. Teacher Strategies to Maximize Homework Effectiveness.....	15
2.1.7. How Students Engage with Homework.....	17
2.2. Assessment.....	18
2.2.1. Assessment, Evaluation, Marks, Grades, and Points.....	18
2.2.2. History of Assessment and Evaluation in North America.....	19
2.2.3. A New Purpose: Assessment for Learning.....	20
2.2.4. Self-Assessment.....	23
2.2.5. Student Motivation, Goals, and Autonomy.....	26
2.3. Research Question.....	32
Chapter 3. Methodology.....	34
3.1. Setting: Collaborative Learning Environment in Two Foundations of Mathematics and Pre-Calculus 10 Classes.....	34
3.2. Setting: The Homework System.....	36
3.2.1. Elements of the Homework System.....	36
3.2.2. Rationale for an Autonomous Homework System.....	38
3.3. Setting: Standards Based Assessment.....	39
3.4. Participants.....	43
3.5. Surveys.....	44
3.5.1. Survey Administration.....	44
3.5.2. Survey Analysis.....	45
3.6. Interviews.....	46
3.6.1. Interview Administration.....	46
3.6.2. Interview Analysis.....	47

3.7. Field Notes	48
3.8. Dual Roles as Teacher and Researcher	49
Chapter 4. Results and Case Analysis	50
4.1. Jason.....	50
4.2. William.....	55
4.3. Amanda.....	60
4.4. Sarah.....	65
4.5. Erin	72
4.6. Joshua.....	77
4.7. Summary.....	83
Chapter 5. Results and Cross-Case Analysis.....	84
5.1. Self-assessment of Work Habits versus Conceptual Understanding	84
5.2. Behaviour and Value of Homework as Self-assessment.....	86
5.3. Benefits and Detriments of Autonomy.....	89
5.4. Student Goals and Past Experience	92
5.5. Resistance and Adaptation to Change.....	97
5.6. The Influence of Marks and Grades	100
5.7. Summary.....	106
Chapter 6. Conclusions	108
6.1. Answering the Research Question.....	108
6.1.1. Varying Student Experiences with the Homework System	108
6.1.2. Why Did Some Students Have Such a Positive Experience?.....	109
6.1.3. Why Did Some Students Have Such a Negative Experience? ...	110
6.1.4. Summary	111
6.2. Research Considerations	112
6.3. How I've Grown.....	114
6.3.1. As a Researcher.....	114
6.3.2. As a Learner.....	114
6.3.3. As a Teacher	115
6.4. Living with Tensions.....	117
References	119
Appendix A. Homework Tracking Sheets for Measurement and Polynomials Units and Instructions	126
Appendix B Mathematics Study Habits Survey.....	129
Appendix C Mathematics Questionnaire #1	131
Appendix D Mathematics Questionnaire #2	133

List of Tables

Table 1.	Behaviour and Value of Homework as Self-assessment.....	86
Table 2.	Autonomy as Beneficial or Detrimental	89
Table 3.	Marks as Extrinsic Motivators.....	100

List of Figures

Figure 1.	Sarah's homework tracking sheet for the radicals and powers unit37	
Figure 2.	Screenshot of teacher mark book in ActiveGrade (names removed)	42
Figure 3.	Screenshot of student view in ActiveGrade (name removed).....	43

List of Acronyms

LO	Learning Outcome
M	Mastery
NI	Needs Improvement
PM	Partial Mastery
SDT	Self-Determination Theory

Chapter 1. Introduction

Starting from when I was a student teacher, and throughout my entire teaching career, I have felt tension and dissatisfaction both with how teachers implement mathematics homework, and with how students engage with it. This stems from experiences in classrooms I have observed, from conversations with colleagues about their experiences, and from experiences in my own classroom.

My tension first began during my student teacher practicum. The homework system in one of the mathematics classes I observed and taught was as follows: for each term, students would choose any five completed homework assignments to hand in for marks. I presume the rationale behind this system included saving the teacher the work of collecting and marking homework assignments on a daily or regular basis, and yet still encouraging the students to complete their homework, as some of it was, in fact, being collected and marked.

As a brand new teacher, I initially thought this sounded like a good system, especially since a very experienced teacher was implementing it. However, at the end of the term, I identified one major flaw with the system. Current BC educational policy states that a student's grade is supposed to reflect mastery of learning outcomes, not work habits (BC Ministry of Education, 2009, 2014). Because of this, many teachers do not deduct late marks and accept assignments until the very end of a term; such was the case in this class. With report cards looming, many students were scrambling to get their five homework assignments handed in to boost their final mark; and in fact, several students needed those marks to boost them to a passing grade. The teacher had me chasing after these students to get them to hand in their assignments so that we could give them the marks they needed to pass the course. Reflecting on this at the time, something seemed inherently wrong with the situation. At that time, I viewed the purpose of doing homework as being for students to learn and practice material, and prepare themselves for quizzes

and tests. Handing it in at the end of the term when the tests had already been taken seemed pointless; students were simply doing it (and very likely copying it) to collect points. With this, my tension began, and I knew that when I became a teacher I would do things differently.

In my first two years of teaching, I did collect homework and mark it for completion. I assumed that I needed to do this in order to ensure that students would actually do it. And, for the most part, it worked. If I informed students that they would be handing in their homework, most of them would do it. Yet, something did not feel right here either: I was overwhelmed with marking and I felt that I was not assessing the students' understanding with integrity. I was simply handing out points for completion, with little consideration of students' actual understanding of the material and no assurance whatsoever that they had engaged with the assignments in a meaningful way. And so my tension continued.

Influenced by what I saw other teachers doing, I then shifted from collecting and marking homework, to doing a simple, random, walk-around homework check at the beginning of class. I believed that this would remove the problem of meaningless completion marks, yet would still apply pressure to students to complete the homework on a regular basis. I also assumed it would be a lot less work for me. However, new problems emerged. As I walked around talking to students, I began hearing all kinds of excuses. Students would say they had a dance recital/sport event/funeral/uncle's birthday/etc. the previous night and had no time to do it; or they would insist they forgot their textbook at school and could not do it; or they would maintain that they did not know how to do any of it; or, a very common excuse, they would claim they had not even known that there was homework. As I tried to investigate the legitimacy of each excuse, I realized that while a few of the students were telling the truth, most were not; often I could not tell the difference. I was now not only a teacher, but a detective as well. Additionally, I also began to notice that students would use other tricks for the homework checks. For example, students would change the date on an old homework assignment, or they would pretend they had to get their homework from their locker and hope that I would forget to come back to them. It seemed that my students were cleverly finding any reason they could to not engage sincerely with their homework.

As my frustration grew at trying to determine whether students were actually doing their homework or cheating, I changed my approach to neither marking nor checking daily homework at all. Instead, I would give students regular lectures about how doing homework consistently was vital to their success, and how they should be responsible enough to do it of their own accord. Yet, this did not seem quite right either. I suspected that students were still not doing it. And, of the students that were doing it, I felt that many were still not engaging with it to the level that I desired. I expected that students would come to class the next day with many questions and would seek out help from their peers and myself. Yet, except for a few very self-motivated students, that was not happening. So, my tension remained unresolved: how could I get my students to engage with their homework in a meaningful way that would help them learn?

Conversations with colleagues confirmed that I was not alone in this dilemma. Teachers would consistently lament the fact that many of their students simply would not do homework. Or, they would complain bitterly about how they had given students a lengthy mathematics assignment as review for final exams, and had gone to the trouble of marking the assignments in great detail as feedback to help students to study, only to discover that many students had cheated.

So, regardless of the system I used, I was unhappy with how the majority of my students were engaging with their homework. Students were not using it to enhance their learning or to test their understanding of material. Simply put, I was seeing neither engagement nor authentic learning from homework, and this troubled me. However, still believing that homework is valuable and possibly even necessary, especially given the restrictions of instructional time in academic mathematics courses, I kept searching for new and different ways to implement homework in my classes.

During my masters' courses, I was introduced to two compelling ideas. First, upon reading Pink's book, *Drive* (2009), I learned of the idea from Deci and Ryan's (1985) Self-Determination Theory (SDT) that autonomy is a basic, psychological human need that must be fulfilled in order for student learning to be authentic. Thus, in order for students to engage meaningfully with homework, they must be autonomously motivated. Second, I was introduced to standards-based grading (O'Connor, 2002). These ideas influenced

the development of an autonomous homework system where students could use the homework to check their own understanding of learning outcomes. In this thesis, I present research that was aimed at finding out how students would engage with this new kind of homework.

In Chapter 2, I review the literature regarding homework, assessment and self-assessment, and conclude with my research question. Chapter 3 describes the methodology used to address the research question, which includes descriptions of the classroom environment, the assessment and homework systems, the participants, as well as data collection and analysis. Chapters 4 and 5 present the results of my research, first describing the individual engagement of six students, then analyzing themes present in some or all of the students' behaviour and reactions. Finally, Chapter 6 provides some conclusions, addresses my research question, and offers considerations for future research.

Chapter 2. Related Literature

In this chapter I begin by reviewing the literature on homework. I then review recent literature on assessment in general and self-assessment in particular, with the aim of finding more meaningful ways for students to engage with their homework. Finally, I review the literature concerning motivation, including goals, Self-Determination Theory and autonomy.

2.1. Homework

In this section I present a definition of homework as well as its purposes and effects. I then review the history of homework in the USA, the cases that have been made for and against homework, as well as the attributes of an effective homework assignment and teacher strategies to improve homework. Finally, I note the gap in the literature concerning how students themselves actually engage with homework.

2.1.1. Definition, Purposes, and Effects

Homework has been defined as

tasks assigned to students by school teachers that are intended to be carried out during non-school hours. The word *intended* is used because students may complete homework assignments during study hall, during library time (sanctioned by teachers), or even during subsequent classes (not sanctioned). This definition explicitly excludes (a) in-school or out-of-school guided study (e.g., test preparation classes) or tutoring; (b) home study courses delivered through the mail, via television, on audio or video cassette, or over the Internet; and (c) extracurricular activities such as sports teams and clubs” (Cooper, 2007, p. 4).

Teachers give homework for a variety of reasons. Instructional purposes may include practice of previously learned material; preparation for future lessons; extension of in-school lessons; or integration of separately learned skills into a single project (Lee & Pruitt, 1979). Epstein (1983 as cited in Cooper, 1989a) proposed three non-instructional purposes for homework, including enhancing communication between parent and child;

adhering to directives from school administrators; and punishing students. Cooper (1989a) added a fourth purpose of informing parents what is going on in school.

A variety of both positive and negative potential effects of homework have been proposed. Positive effects include immediate achievement and learning (for example, better retention of factual knowledge and improved understanding); long-term academic benefits (for example, learning during leisure time and better attitude towards school); nonacademic benefits (such as better self-discipline and organization of time); and finally, parental and family benefits (such as increased parental appreciation of school and interest in child's academic progress.) Negative effects include satiation (such as loss of interest in academic pursuits and fatigue); denial of leisure time or access to community events; parental interference (such as pressure to perform or confusing instructional methods); cheating (such as copying or inappropriate help); and finally increased differences between high and low achievers (Cooper et al., 2006). Any of these effects may occur simultaneously. For example, homework may increase a student's comprehension of curriculum while at the same time denying him from participating in an extracurricular activity (Cooper, 1989a).

2.1.2. A History of Public Opinion

Cooper (1989a, 2001b) and Gill and Schlossman (2000) have provided excellent overviews of the history of public opinion of homework in the United States. I believe the fluctuation of public opinion observed in the United States reflects similar occurrences in Canada. A summary of the authors' overviews follows.

Homework has been a controversial topic during the last century and public opinions in the United States concerning its merits have been cyclical. At the beginning of the 20th century, the mind was viewed as a muscle that one could improve through mental exercise and memorization. Thus, homework was viewed as beneficial, since memorization and rote practice could easily take place at home (Cooper, 1989a).

During the 1940's, a reaction against homework set in, led by educational reformers. Problem solving and learning by doing replaced rote drilling and recitation as the central focuses of education, and so the use of homework for punishment or for

enhancing memorization was called into question (Cooper, 1989a; Gill & Schlossman, 2000). Homework was also viewed as harmful to the family and ineffective in improving academic achievement (Gill & Schlossman, 2000). Epitomizing the sentiments of the day, Henry Otto wrote in the 1941 edition of *Encyclopedia of Educational Research* that “the benefits of assigned homework are too small to counterbalance the disadvantages” (Otto, 1941, pp. 444-45 as cited in Gill & Schlossman, 2000).

In the late 1950’s, opinions changed again after the Russians launched the Sputnik satellite. People became concerned that a lack of rigor in the education system was not preparing children for a complex technological future and would leave them unable to compete with other countries. Homework was then viewed as a useful method for accelerating the acquisition of knowledge (Cooper, 1989a).

By the mid 1960’s, the trend reversed again. People began to view homework as putting unnecessary pressure on students and again, educational theories of the day questioned the value of current homework practices and also raised the possibility that it might have a detrimental effect on mental health (Cooper, 1989a). Wildman (1968) highlighted further negative effects of homework when he wrote, “Whenever homework crowds out social experience, outdoor recreation, and creative activities, and whenever it usurps time devoted to sleep, it is not meeting the basic needs of children and adolescents” (p. 203 as cited in Cooper, 1989a).

In the 1980’s, homework again returned to favour, largely influenced by the report *A Nation at Risk* (National Commission on Excellence in Education as cited in Cooper, 2001) that claimed that homework was a legitimate defense against a lack of rigour in the American education system.

And finally, a backlash against homework set in again at the turn of the 21st century, fuelled by parental concern over students’ stress. However, a national survey gave evidence that it may have been a vocal minority, rather than the majority, that held these opinions (Cooper, 2001). Today, public opinions seem to be mixed.

2.1.3. The Case for Homework

As with public opinion, the education community has been, and still is, far from reaching a consensus on the merits of homework. Homework is a difficult topic to research because it involves a very complex interaction of numerous factors. Cooper (1989a) proposed that the following factors may influence the effectiveness of homework: (1) exogenous factors (such as student characteristics, subject matter, or grade level); (2) assignment characteristics (such as purpose, amount, deadlines, or degree of student choice); (3) Initial classroom factors (such as provision of materials or links to curriculum); (4) home-community factors (such as competitors for student time or home environment); and, (5) classroom follow-up (such as feedback or testing). Any number of these factors may simultaneously influence which of the positive and negative effects mentioned above are produced by homework.

The main focus of the research conducted in the twentieth century was determining the effect of homework on academic achievement. Studies came to a vast array of conclusions. Thus, reviews and syntheses of the literature could be written to support either the author's opinion or the public opinion of the day, simply by including certain studies and omitting others (Cooper, 1989b). Cooper (1989a) did a review of sixteen previous literature reviews on homework, and showed that the conclusions of the reviews varied greatly because they were selective as to which studies were included. Some reviews claimed that the research showed that homework was harmful while others claimed that the research showed it to be beneficial. Still other reviews concluded that the homework research was flawed or inconclusive (see Cooper, 1989a, pp. 26-27 for details).

Fortunately, rigorous attempts have been made in the last thirty years to comprehensively synthesize the research on homework. Harris Cooper is widely regarded as the United States' leading researcher on homework. Although other recent research exists regarding the positive effects of homework, almost without exception the literature cites two meta-analyses done by Cooper. Thus, to avoid redundancy, I will follow Cooper's work in reviewing the case for homework.

In 1989, Cooper published his first meta-analysis, reviewing the results of almost 120 empirical studies on the effects of homework, conducted with English-speaking primary and secondary students. These studies were found through computer database searches; examination of reference lists of previous reviews of the literature; examination of research convention programs of the American Educational Research Association; and requests sent to researchers, deans of various schools of education, state agencies, and directors of research and education in a selection of North American School districts. Cooper included three sets of studies. The first two sets were experimentally manipulated studies, with one set comparing homework with no homework and the other set comparing homework with supervised study. The third set of studies correlated the amount of time students spent on homework with their achievement levels. Looking at the data as a whole, he came to several important conclusions regarding academic effects of homework. He found that homework does have a positive effect on achievement but that the effect varies greatly with grade level. Homework is highly beneficial for high school students, moderately beneficial for junior high students, and not beneficial for elementary students. Furthermore, for high school students, it appeared that the more homework they do, the higher their achievement.

Cooper et al. (2006) produced a second meta-analysis that reviewed studies from 1987 to 2003. They were all studies conducted in the USA that in some way measured the relationship between homework activity and academic achievement on unit tests, and included kindergarten through grade 12 students. Again, the studies comprised three sets. The first included studies that externally manipulated the presence or absence of homework explicitly for the purposes of the study, and thus explored a causal relationship between homework and achievement. It is important to note that, taken as a whole, these studies explored homework in a diverse range of structures and controlled for many alternative hypotheses, in many different combinations. Overall, the authors felt confident enough to make a bold conclusion.

With only rare exceptions, the relationship between the amount of homework students do and their achievement outcomes was found to be positive and statistically significant. Therefore, we think it would not be imprudent, based on the evidence in hand, to conclude that doing homework causes improved academic achievement (Cooper et al., 2006, p. 48).

The second set of studies included natural causal models, where the researchers asked students how much homework they do and then related this to an achievement measure. They attempted to statistically control for other variables that might confound the homework-achievement relationship, such as ability or parental involvement. These studies tended to include larger samples, several of them nationally representative of the USA, and utilized a variety of achievement measures, including class grades, GPAs and standardized test scores (Cooper, 2007). Cooper et al. (2006) found a strong positive link between homework and achievement (11 of 12 studies had a positive link), and while this did not warrant a confident conclusion about a causal relationship between homework and achievement, it supported the experimental evidence of the first set.

Finally, the third set of studies simply correlated time spent on homework and achievement, without an attempt to control for other factors. Although these studies could say nothing about a causal relationship, the results were consistent with the previous evidence (27 samples of 35 showed positive links between homework and grades or standardized tests). These studies looked at a wide range of students in a broad array of circumstances, and so provide increased confidence in the authors' conclusions from the other evidence. As with Cooper's first meta-analysis (1989a), these studies suggested a grade level influence; the link between homework and achievement was much stronger for grade 7 through 12 students than for kindergarten through grade 6 students. The evidence also suggested that time spent on homework and achievement are positively associated for high school students until they start doing more than two hours per day, at which point their achievement is no better and may even be worse (Cooper, 2007).

So, this recent meta-analysis (Cooper et al., 2006) is consistent with the findings of the earlier analysis (Cooper, 1989a) that homework positively affects achievement. In fact, the exogenous intervention studies actually provided much stronger evidence with an average effect size of $d=.60$ in the 2006 synthesis, as compared to an average effect size of $d=.21$ in the 1989 synthesis.

While much of the research has focused on achievement versus time spent on homework, Cooper, Lindsay, Nye, & Greathouse (1998) found that achievement was in fact positively related to amount of homework completed instead of time spent on

homework. They also found evidence for positive effects of homework with young children. However, as mentioned, it is worth noting again that it is difficult to completely isolate a positive relationship between homework and achievement. For example, students who report completing more homework may be students who are highly motivated to succeed, which in and of itself would result in higher achievement. Recent authors have utilized this argument, as well as highlighting homework's negative effects, to present a case against homework.

2.1.4. The Case against Homework

Despite the evidence that homework is positively related to academic achievement, articles and entire books that attack the utility of homework have recently been written. First, in *The End of Homework: How Homework Disrupts Families, Overburdens Children, and Limits Learning*, Kralovec and Buell (2000) argue that homework is a burden on children, disrupts families, deprives students of other valuable opportunities, and is inequitable to children from economically disadvantaged homes. The authors tell countless anecdotes of stressed out students suffering under the burden of too much homework. The authors imply that research does not provide strong support that homework benefits achievement. They cite Cooper (1989a) as finding that previous reviewers' results showed great variability, that many homework studies have been poorly designed, and as pointing out that correlation does not imply causation. They fail to mention that he found a strong relationship between homework and achievement for high school students when he synthesized the research himself.

Similarly, in *The Case Against Homework: How Homework is Hurting Our Children and What We Can Do About It*, Bennett & Kalish (2006) argue that homework causes excessive stress in children, allows for less free time to play or socialize, is hard on families, and causes children to get less exercise and sleep. They posit that teachers are largely untrained regarding homework and give poor homework assignments, and also that few school administration and districts have homework policies in place. They cite references that support their assertions and avoid mentioning research that has shown the positive effect of homework on achievement. In a research fact sheet at the end of their book, they point out that the Cooper (1989a) and Cooper et al. (2006) meta-analyses

found little and moderate correlations between homework and achievement for elementary and middle school students, respectfully, and quote Cooper (2001) as saying that too much homework for high school students is not beneficial. However, they also do not mention that the meta-analyses found strong, causal, positive relationships between homework and achievement for high school students.

Most recently in *The Homework Myth: Why Our Kids Get Too Much of a Bad Thing* (2006), one of the most vocal homework opponents, Alfie Kohn, not only highlights the negative effects of homework, but also claims that the homework research does not actually show that homework is beneficial in any way. He argues this by criticizing the research methods of those who have found positive effects. However, Marzano and Pickering (2007b) assert that Kohn's book is based on misunderstandings and misrepresentations of the research. Another article by Marzano & Pickering (2007a) describes Kohn's misuse of the research in detail, addressing accusations made against studies cited in their book, *Classroom Instruction That Works* (Marzano, Pickering, & Pollock, 2001). They respond to Kohn's case against homework by saying,

in effect, if Kohn is trying to win a battle regarding massive amounts of homework for homework's sake, he has already won. Indeed, he has no opponents we are aware of in the world of educational research... it appears he is not aware of or is not willing to address the distinction between proportion of homework completed and amount of homework assigned... the research on homework supports its use even at the elementary level, but not its improper use (Marzano & Pickering, 2007a, pp. 512-513).

Furthermore, it appears that Kohn's case against homework improving achievement is largely based on opinion and anecdotal accounts of students, teachers, and parents experiencing various negative effects of homework.

Highlighting other negative effects of homework, articles have bemoaned the emotional effects that mathematics homework can have on children. Lange & Meaney (2011) found that emotional and mathematical trauma could arise when students attempted to do procedural mathematics homework with family help, while Grootenboer (2009) describes how emotional trauma is caused by lengthy mathematics assignments. These are valid concerns, yet perhaps they result from an improper use of homework.

Cooper (2007) points out that since both positive and negative effects of homework can potentially occur, perhaps the issue that actually needs to be addressed is how to implement homework so as to produce the positive effects and avoid the negative ones.

2.1.5. Characteristics of a Good Homework Assignment

The literature has thoroughly addressed the characteristics of an effective homework assignment, although there is not complete consensus. It is generally agreed that homework should be purposeful (Carr, 2013; Cooper et al., 2006; Cooper, 1989a; Fisher & Frey, 2008; Garrett, 2007; Marzano & Pickering, 2007b; Sullivan & Sequeira, 1996). For example, homework should benefit student learning: “It makes good sense to only assign homework that is beneficial to student learning instead of assigning homework as a matter of policy” (Marzano & Pickering, 2007b, p. 75). Yet, it is not entirely clear what the specific purposes of homework should be. Cooper found that preparation for future lessons and review of old material were more effective purposes of homework than simply practicing the current day’s lesson (Cooper et al., 2006; Cooper, 1989a). Marzano and Pickering (2007b) agree, but add that extension and exploration are also effective purposes of homework. And, although homework may be used as preparation for future material that will be taught in school, it should not actually be used to teach new material (Cooper, 1989a; Protheroe, 2009). Fisher and Frey (2008) posit their own categorization of four effective homework purposes as (1) fluency building (multiple application of specific skills to improve efficiency); (2) application (applying learned skills to problems and new situations), (3) spiral review (review of previous skills as related to current material) and (4) extension (a new project or innovation that might lead to new understanding). Protheroe (2009) emphasizes that punishment is not a valid purpose of homework, as this communicates to students that teachers view school work as aversive.

It is agreed that lengthy homework assignments are less effective (Carr, 2013; Cooper, 1989a, 2007; Grootenboer, 2009; Marzano & Pickering, 2007b). Cooper et al. (2006) found a positive relationship between the time high school students spent on homework and achievement, but only up to two hours per night. They concluded that, “even for these oldest students, too much homework may diminish its effectiveness, or even become counterproductive” (Cooper et al., 2006, p. 53). Cooper (2007) suggested

specific homework time allotments that increase as grade level increases. For high school he proposed that assignments, on average, should last thirty minutes per academic class each night. (See page 94 for proposed times for lower grades). Cooper et al. (2006) also found some evidence that frequent short assignments are more effective than long assignments.

Level of difficulty of assignments is not agreed upon. Cooper (1989a) says that homework comprised of less complex material that students have already seen is more effective. Complex homework assignments should only involve integration of skills that students already possess. Marzano & Pickering (2007c) argue that a homework assignment should be designed to maximize the chances that students will complete it; this means it must not be so simple as to be trivial, yet also must not be so difficult as to be impossible. Grootenboer (2009) agrees, saying that mathematics homework should be accessible but require more than just recall of knowledge. Carr (2013) suggests that assignments' difficulty should be differentiated according to student ability. Yet, Cooper et al. (2006) found that assignments were more effective when differentiated by learning styles and not by difficulty level.

Some authors argue that a homework assignment must not allow students to practice mistakes, as the mistakes will then become engrained in their learning (Fisher & Frey, 2008; Grootenboer, 2009; Protheroe, 2009). Protheroe (2009) even argues that students must fully understand all applicable concepts and skills before they attempt any homework assignments.

It is also suggested that an effective homework assignment should be interesting. This might be achieved by assigning homework that is hands-on or related to real world problems (Grootenboer, 2009; Sullivan & Sequeira, 1996).

Carr (2013) suggests that an effective homework assignment should be aesthetically appealing. If the assignment is visually uncluttered and has graphics or clip art, it will look more inviting to the student.

Grootenboer (2009) addresses mathematics homework specifically, saying that effective assignments should have mathematical integrity and include problems having multiple solution pathways.

So it seems that, although there is not complete consensus regarding specifics, effective homework assignments should be purposeful, should be of an appropriate length and difficulty, and should not allow students to engrain mistakes in their learning. Homework assignments that are appealing to students, through aesthetics and interest, are also more effective.

2.1.6. Teacher Strategies to Maximize Homework Effectiveness

The literature also addresses the procedures and strategies that a teacher should employ in order to maximize the effectiveness of homework. Promoting parental involvement is effective, especially if parents are involved in appropriate ways, such as acting as a sounding board for what students have learned, and not as a teacher or homework police (Marzano & Pickering, 2007b). Parents should be involved from the beginning of the year and can be trained how to help their children effectively with homework (Carr, 2013). Specifically for mathematics homework, parents' confidence needs to be built. It also must be ensured that teachers and parents have a shared agenda regarding the strategies used on assignments; parents must realize that mathematics is dynamic and may be done differently today than when they were in school (Grootenboer, 2009).

Homework is more effective when teachers provide some type of feedback. Paschal, Weinstein, & Walberg (1984) and Cooper (2007) found greater effects on student achievement when teachers put comments or marks on homework.

Teachers should support students' self-management skills to increase the rate of homework completion. Carr (2013) suggests reinforcing the use of management tools such as calendars or agendas while Sullivan & Sequeira (1996) propose sending home weekly or monthly summaries of homework assignments.

It has been suggested that punishment and rewards for homework completion may be effective. Carr (2013) recommends clearly communicating the consequences of not completing homework to parents and students, while Cooper (2007) found that providing incentives for homework completion was effective with students with learning disabilities.

Vaughn and her colleagues (N.A, 2001) explored students' perceptions of effective teacher strategies regarding homework. The students found it helpful when teachers assigned the homework at the beginning of class, explained how to do the homework, let students start the homework in class, checked for understanding, and offered help before class was over. Interestingly, Zhu, Koon, and Leung (2012) found that allowing students to start homework in class had a negative effect on learning.

Other strategies have been proposed. Carr (2013) suggests that teachers should coordinate the assignment of homework with each other so that students are not overwhelmed with many assignments and projects at the same time. Garrett (2007) argues that teachers must make a conscious effort to communicate to students the purpose and value of homework assignments to their learning.

Fisher & Frey (2008) argue that teachers must prepare students to work individually on homework by gradually releasing responsibility over learning to them through a four stage instructional strategy. In the first stage, the focus lesson, the teacher communicates the purpose of the learning and provides an example. In the second stage, guided instruction, the teacher uses prompts, cues, and questions in order to get students to do more of the work. In the third stage, collaborative learning, students work together in groups but are held individually accountable. In the fourth stage, independent tasks, students work individually on homework assignments related to the first three stages.

So, there are a variety of teacher strategies that may increase homework effectiveness. Teachers can work to increase positive parental involvement; they can provide some type of feedback to students on homework; they can support students' self-management skills; they can offer rewards or punishment for homework completion; they can work with other teachers to avoid overburdening students with too much homework from various classes simultaneously; and finally, they can gradually prepare students to work individually on curriculum.

2.1.7. How Students Engage with Homework

While “it is the teacher’s responsibility to create effective homework assignments and to provide students and parents with the tools necessary for the process to be as successful as possible” (Carr, 2013, p. 179), how students do their homework is equally important. Yet the literature is surprisingly sparse concerning how students themselves engage with their homework. Two researchers, Liljedahl & Allan (2013) examined how students actually do their homework and found that the majority of the participants, 65%, displayed studenting¹ behaviours that subverted the teachers’ intentions for the homework. These behaviours included incompleteness, cheating, inappropriate help, and mimicking in-class notes. All of the teachers in the study “stated that the purpose of homework was for students to test their understanding of, and abilities with, new content” (Liljedahl & Allan, 2013, p. 492). The teachers intended for the homework to lead to rich learning, yet this was not happening for the majority of their students. Landers (2013) also found that some students consider cheating on their homework to be a legitimate option for completing it. Schmitt (2000) conducted a study on the effects of homework on student commitment, growth, and performance and found that homework affected some students positively and other students negatively. She concluded that it was “likely that those students who *chose* to make homework meaningful benefited more than those who just completed regular homework as purposeless ‘busywork’ ” (p. 49). Yet, she did not specify what it actually looks like for students to make homework meaningful. This is important to consider. How can students themselves engage with their homework in meaningful ways that promote rich learning? Furthermore, Liljedahl & Allan (2013) mentioned that when they told the teachers in their study that the majority of the students were not learning from the homework, the teachers “all [began] to explore alternatives to their current practices vis-à-vis homework” (p. 492). Yet there was no mention as to what these alternatives were. This is also important. Can educators implement a homework system that would encourage their students to engage with homework in ways that provide rich learning? What might such a system look like?

¹ Studenting is taken to mean all actions and behaviours (helpful towards learning or not) that students exhibit in their role as students (Liljedahl & Allan, 2013).

2.2. Assessment

Assessment has recently been championed as a powerful way to improve student achievement (Marzano, 2000; O'Connor & Wormeli, 2011; O'Connor, 1995, 2002; Reeves, 2011; Wiggins, 1998). In this section I review the literature on assessment, including its history in North America and the more recent literature that calls for assessment to be used to promote, instead of simply evaluate, learning. I then review the literature on self-assessment in particular, with the aim of exploring its potential to allow students to engage with homework in meaningful ways that could improve how they learn from homework. Finally, because students must be sufficiently motivated in order to participate meaningfully with their learning, I review two theories of motivation.

2.2.1. Assessment, Evaluation, Marks, Grades, and Points

Assessment has been defined as “the process of gathering information about students or program(s)” (O'Connor, 1995, p. 93). Evaluation has been defined as “the process of integrating information from many sources and using it to make judgments about students or program[s] ([it] answers the question ‘How good?’)” (O'Connor, 1995, p. 93). Throughout the last century, assessment has traditionally taken place primarily for the purpose of evaluation (McTighe & O'Connor, 2005). This is typically done through the use of marks and grades. The terms “marks” and “grades” are often used interchangeably for two different meanings, so for the sake of clarity, O'Connor's (2002) definitions for each term are adopted for this study. Grade(s) or grading is taken to mean “the number or letter reported at the end of a period of time as a summary statement of student performance” (p. 3). Mark(s) or marking are taken to mean “the number, letter, or words placed on any single student assessment (test, performance task, etc.)” (p. 3).

The system currently used almost ubiquitously in North America for assessment and evaluation is a percent and points system (Marzano, 2000), where the teacher ascribes points to all assessments and gives students a numerical mark out of the total number of points possible for each assessment. Larger assessments are normally worth more points. At the end of a reporting period, the teacher determines a percent for each student by calculating a weighted average based on the total number of possible points

for all the assessments combined. This percent is usually matched to a letter grade, based on a pre-determined scale. This percent or letter is reported as the student's grade. However, it has been suggested that this system is fraught with issues (Marzano, 2000; O'Connor, 2002; Reeves, 2011; Wiggins, 1998). If that is true, where did it come from and why is it so widely accepted?

2.2.2. History of Assessment and Evaluation in North America

In North America, the history of marks and grades is largely centered on events that occurred in the United States. The precise history is a matter of some debate, but several important events are agreed upon (Marzano, 2000). Prior to the late 1700's, students were only given feedback on their performance through narrative comments; there were no marks or grades. Universities were the first to switch to more quantitative assessment methods. Yale University began using a four-point scale in 1780. Gradually, other universities also shifted to more quantitative approaches. In 1830, Harvard University began using a 20-point scale, and in 1877, began classifying its students into "divisions" based on their grade on a 100-point scale. For example, Division 1 was a grade of 90 or more, Division 2 was a grade of 75 through 90, and so on. One can see the beginnings of the letter grade approach in Harvard's divisions; in fact, soon after, Mount Holyoke College started using letter grades (Marzano, 2000).

The history of grades in primary and secondary schools follows a similar timeline, albeit slightly later. Before 1850, students of all ages and backgrounds were taught in the same room with one teacher. In the late 1800's, schools began grouping students according to their age, and new teaching methods were tried, including progress evaluations. Teachers simply wrote down which skills each student had mastered and which skills still required work (Guskey, 1996). Once laws were passed requiring attendance in elementary schools, the numbers of students entering high schools greatly increased. Subject areas became more specific and teachers began to use percentages to indicate students' achievement levels in each subject. The use of percentage grades happened gradually and was rarely questioned. It was an efficient system for teachers attempting to deal with the growing demands of larger classes (Guskey, 1996).

The practice of assigning points to individual student assessments has had its origin linked to World War I. Faced with the issue of placing thousands of newly recruited soldiers into work roles that suited their abilities, the U.S. Army developed the Alpha Test. As the test would be administered to a massive number of soldiers, it relied heavily on multiple-choice questions that were given a mark of 1 if answered correctly, and 0 if answered incorrectly. Because the Alpha Test was administered efficiently and effectively, it was viewed as a success and so multiple-choice questions grew in popularity in a variety of assessment situations. In the early 1940's, Carl Bingham developed the Scholastic Aptitude Test, which, by 1947, consisted primarily of multiple-choice items. From there, marking correct or incorrect responses as 1 or 0 expanded to true/false, matching, and fill-in-the-blank questions. Eventually, teachers also began to assign points to items that could not be marked as correct as incorrect, such as essays or presentations (Marzano, 2000). To this day, this system is often seen in schools across North America, and even around the world.

2.2.3. A New Purpose: Assessment for Learning

One can see from their beginnings that points, percentages, and letter grades were primarily developed for sorting and ranking, and researchers argue that this has been the effect in schools. Cross and Frary (1999) argue that “for most teacher-made tests, percentage scores provide no more than a basis for ranking students” (p. 66) while Black and Wiliam (1998) contend that “the giving of marks and the grading function are overemphasized... Approaches are used in which pupils are compared with one another, the prime purpose of which seems to them to be competition rather than personal improvement” (p. 142).

Current assessment literature calls this sorting and ranking into question, and insists on a new purpose for assessment. “Classroom assessment and grading practices have the potential not only to measure and report learning but also to promote it” (McTighe & O'Connor, 2005, p. 11). “A carefully developed grading system can help us *improve* student performance over time rather than simply label it at periodic intervals” (Marzano, 2000, p. 122). It is now widely agreed that the primary purpose of assessment should be

to further student learning (Black & Wiliam, 1998; O'Connor & Wormeli, 2011; Guskey & Bailey, 2001; McTighe & O'Connor, 2005; Neill, 1997; O'Connor, 1995; Wiggins, 1998).

The issue then shifts to determining how to implement assessment so that it promotes learning. Educators use marks and grades to serve numerous functions, such as,

(1) for administrative purposes, (2) to give students feedback about their progress and achievement, (3) to provide guidance to students about future coursework, (2) to provide guidance to teachers for instructional planning, and (5) to motivate students (Marzano, 2000, p. 14).

Of these, the literature contends that, by far, the most effective function for improving student learning is feedback (Black, Harrison, Lee, Marshall, & Wiliam, 2004; O'Connor & Wormeli, 2011; Guskey & Bailey, 2001; Marzano, 2000; McTighe & O'Connor, 2005; Reeves, 2011; Wiggins, 1998). Wiggins (1998) writes, "one cannot improve or learn to improve unless one knows how one is doing in performance" (p. 44). True learning is a process of many performance-feedback-guidance cycles (Wiggins, 1998). Studies and meta-analyses have provided empirical evidence confirming the positive effects of feedback on achievement (Hattie, 1992; Hattie, 2009; Page, 1958). Reeves (2011) concludes that "the clear preponderance of the evidence is not only that feedback is important in influencing student achievement, but also that feedback is relatively more important than almost any other student-based, school-based, or teacher-based variable" (p. 19). So, assessment has been redefined as,

all those activities undertaken by teachers – and by their students in assessing themselves – that provide information to be used as feedback to modify teaching and learning activities. Such assessment becomes *formative assessment* when the evidence is actually used to adapt the teaching to meet student needs (Black & Wiliam, 1998, p. 140).

However, the traditional assessment system of points, numerical marks and grades that is still pervasive throughout North America, is fraught with issues concerning its effectiveness for promoting learning through feedback. First, in order for feedback to be effective, it must be received in a timely manner so that students will be able to respond accordingly to improve their performance (Reeves, 2011). Often, feedback is not provided until it is too late, as marks on a summative test or assignment. Wiggins laments that "as

long as assessment is viewed as what we do ‘after’ teaching and learning are over, we will fail to greatly improve student performance, regardless of how well or how poorly students are currently taught or motivated” (1998, p. xvi). Assessment and feedback must become an integrated part of curriculum and instruction, something that is continually happening throughout the learning process. Reeves (2011) contends that students should receive feedback daily, in every single class. Realizing the challenges this may present in overcrowded classrooms, he presents self-assessment as one solution. When educators teach students to assess their own performance, students can provide feedback for themselves. This will be discussed further in section 2.2.4.

Another issue is that, as Marzano puts it, “grades are so imprecise that they are almost meaningless” (2000, p. 1). In order for feedback to be meaningful, it must be accurate (Reeves, 2011). Percentage and letter grades are not accurate means of feedback because they often encompass a “hodgepodge” of factors, such as academic achievement, effort, attitude, conduct, growth, or attendance (Cross & Frary, 1999). “To allow other factors to influence grades or marks misrepresents students’ learning attainment” (Guskey, 2000, p. 27). Because so many factors are often included in grades, it is unclear whether a student who receives an A on his report card displayed exemplary academic achievement, or whether he displayed only satisfactory academic achievement, but exemplary work habits. Since grades on a report card may include a wide variety of unknown factors, they can hardly be considered as meaningful feedback for students and parents. Thus, there is now widespread consensus that grades should only reflect academic achievement, and that non-academic factors such as behaviour and work habits be evaluated separately (Cross & Frary, 1999; Marzano, 2000; O’Connor & Wormeli, 2011; O’Connor, 2002; Reeves, 2011).

Another issue with traditional marks and grades as feedback is that they are not specific.

Too many educators consider [marks] and scores as feedback when, in fact, they fail the specificity test. Pinning a letter (B-) or a number (82%) on a student’s work is no more helpful than such comments as “Nice job” or “You can do better.” Although good [marks] and positive remarks may feel good, they do not advance learning (McTighe & O’Connor, 2005, p. 16).

Feedback must specifically show learners what they have done well and what they should do next time in order to improve. Standards-based assessment has been proposed as an alternative system that provides students, teachers, and parents with feedback that is specific enough to improve learning (O'Connor & Wormeli, 2011; Marzano, 2000; McTighe & O'Connor, 2005; O'Connor, 2002; Reeves, 2011; Wiggins, 1998). In this system, student understanding and performance is assessed, evaluated, and reported according to learning standards or outcomes. ("Learning outcomes" (LO's) will be used for this study.) That is, a teacher's assessment plan is organized according to LO's instead of assessment methods, such as tests, quizzes, or homework (O'Connor, 2002). This requires that a teacher match all assessment, whether formative² or summative³, to learning outcomes and provide students with feedback about their performance on each outcome. In this way, "grading [and marking] can become a tool for all to use in pinpointing strengths and weaknesses in students' understanding" (Marzano, 2000, p. 122). Assessment researchers have proposed various systems for practical implementation of standards-based assessment (Guskey & Bailey, 2001; Marzano, 2000; O'Connor, 2002; Reeves, 2011; Wiggins, 1998). The particular system implemented in this study will be described in detail in Chapter 3.

2.2.4. Self-Assessment

Although good teacher feedback is highly effective, feedback that students provide for themselves through self-assessment may be of equal or higher value to their learning. Self-assessment is defined as "a process of formative assessment during which students reflect on the quality of their work, judge the degree to which it reflects explicitly stated goals or criteria, and revise accordingly" (Andrade & Valtcheva, 2009, p. 13). In contrast, having students determine their own grades is *not* self-assessment, it is self-evaluation (Andrade & Valtcheva, 2009; Panadero & Alonso-Tapia, 2013).

² Formative assessment is taken to mean "assessment designed to provide direction for improvement and/or adjustment to a program for individual students or for a whole class" (O'Connor, 2002, p. 241).

³ Summative assessment is taken to mean "assessment designed to provide information about a student's achievement at the end of a period of instruction" (O'Connor, 2002, p. 242).

Researchers widely agree that self-assessment is one of the most effective elements of formative assessment; some contend that it is absolutely the most important element. Marzano writes that self-assessment is a powerful but rarely utilized tool in the classroom: “Although the most underused form of classroom assessment, student self-assessment has the most flexibility and power as a combined assessment and learning tool” (2000, p. 102). Wiggins argues that “if the goal of an assessment system is to educate, to improve performance on difficult tasks, then getting students to self-assess and self-adjust their performance effectively is key” (1998, p. 13). Black et al. (2004) contend that it is crucial that students understand learning goals: “Students can achieve a learning goal only if they understand that goal and can assess what they need to do to reach it. So self-assessment is essential to learning” (p. 14). Furthermore, self-assessment provides unique benefits to students: “...Peer and self-assessment make distinct contributions to the development of students’ learning. Indeed, they secure aims that cannot be achieved in any other way” (Black et al., 2004, p. 15). Finally, Black and William posit that self-assessment is a necessary requirement for any effective assessment system: “Self-assessment by pupils, far from being a luxury, is in fact *an essential component of formative assessment*” (1998, p. 143).

Effective self-assessment provides benefits for learning that may not be possible otherwise. As mentioned, continuous feedback plays a crucial role in effective learning. Yet, due to time constraints and overcrowded classrooms, “few teachers have the luxury of regularly responding to each student’s work” (Andrade & Valtcheva, 2009, p. 12). Fortunately, students can provide themselves with continuous feedback through self-assessment (Andrade & Valtcheva, 2009; Reeves, 2011).

It is theorized that self-assessment allows students to work at a metacognitive level by monitoring their own learning and responding accordingly (Black et al., 2004). If students clearly understand their own strengths and weaknesses, they can have strategies in mind for improving (McMillan & Hearn, 2008; Panadero & Alonso-Tapia, 2013; Reeves, 2011). In order to learn, students need to know where they are (their current performance), where they are headed (learning outcomes and criteria), and how to get there (learning strategies) (Heritage, 2009; Marzano, 2000). Black and William (1998) point out that these are the essential elements of feedback and that “all three must

be understood to some degree by anyone before he or she can take action to improve learning” (p. 143). This argument is consistent with recent research on how people learn, in that new ideas must be assimilated in relation to existing ideas. New and old ideas may be inconsistent or even conflicting, but they may be resolved through thoughtful reflection by the learner (Black & William, 1998; McMillan & Hearn, 2008). Effective self-assessment involves a clear understanding of the learning outcomes one is aiming for, judgment as to how one’s performance or level of understanding measures up to these outcomes, and appropriate revision as necessary (Andrade & Valcheva, 2009). Students will be able to own their learning when they are “encouraged to keep in mind the aims of their work and to assess their own progress toward meeting these aims as they proceed. Then they will be able to guide their own work and so become independent learners” (Black et al., 2004, p. 15).

Self-assessment further promotes learning by increasing student communication with the teacher and with peers. “[Students’] own assessments become an object of discussion with their teachers and with one another, and this discussion further promotes the reflection on one’s own thinking that is essential to good learning” (Black & William, 1998, p. 143).

Researchers describe the conditions necessary for students to self-assess effectively. Learning goals and criteria must be explicitly clear so that students understand what they are expected to learn (Andrade & Valcheva, 2009; Black et al., 2004; Heritage, 2009; Marzano, 2000; McMillan & Hearn, 2008; Panadero & Alonso-Tapia, 2013; Reeves, 2011; Wiggins, 1998). Black and William write that “Pupils can assess themselves only when they have a sufficiently clear picture of the targets that their learning is meant to attain” (1998, p. 143). It is also necessary for effective self-assessment that students are aware of the value of self-assessment, are given cues as to when it is appropriate to self-assess, and have opportunities to revise and improve their learning according to the self-assessment (Andrade & Valcheva, 2009).

Furthermore, students must be trained how to self-assess and be given opportunities for guided practice. As Reeves (2011) points out,

once [students] know the rules of the game, they can evaluate their performance... and they can improve at a rapid pace... [But some students] have become dependent upon the feedback of teachers to affirm their performance, because they have not developed the ability to accurately assess their own work (p. 86).

Teachers must explicitly teach students how to self-assess and provide some type of scaffolding so that students will learn to self-assess effectively. Authors provide suggestions, such as modeling self-assessment, providing rubrics with clear criteria for students to judge their work against, and utilizing “traffic lights⁴” where students can indicate what they believe their understanding is of a certain topic (Andrade & Valtcheva, 2009; Black et al., 2004a; McTighe & O’Connor, 2005; Panadero & Alonso-Tapia, 2013).

However, this level of engagement and responsibility will require students to be highly motivated to participate in their learning. Two theories of motivation are now reviewed.

2.2.5. Student Motivation, Goals, and Autonomy

Motivation concerns what moves people to think or act (Deci & Ryan, 2008a). It is “the inclination to do certain things and avoid doing some others” (Hannula, 2006, p. 165). Dweck’s (1999) Achievement Goal Theory and Deci and Ryan’s (1985) Self-Determination Theory (SDT) are two widely researched theories of motivation. These theories draw strongly on goals and autonomy, and so each of these concepts is considered below. Both theories are used in the cross-case analysis in Chapter 5.

In 1999, with her Achievement Goal Theory, Dweck presented two types of achievement goal orientations: performance goals and learning goals. Students who hold performance goals are primarily concerned about their levels of intelligence; “they want to look smart (to themselves or others) and avoid looking dumb” (p. 15). In contrast, students who hold learning goals are concerned with increasing their competence; “it reflects a desire to learn new skills, master new tasks, or understand new things – a desire to get smarter” (p. 15). These goal orientations stem from two self-theories that students hold

⁴ “Traffic lights” is an activity where students flag either their understanding of concepts or their performance of skills as red (weak), yellow (emerging) or green (strong) (Black et al., 2004).

regarding their own intelligence: either an entity theory or an incremental theory. “In the entity theory, intelligence is a fixed, concrete, internal entity, whereas in the incremental theory, intelligence is a more dynamic quality that can be increased” (Dweck, 1999, p. 20). Because entity theorists believe they only have a fixed amount of intelligence, they are oriented towards performance goals – validating and displaying their intelligence. Because incremental theorists believe that their intelligence can be increased, they are oriented towards learning goals – tackling difficult tasks in order to learn. Most students hold both types of goals to some extent, and both can positively contribute towards achievement, so ideally students would be able to pursue both goals simultaneously. In reality, performance goals and learning goals are often in conflict with each other, and students must choose between them. Dweck (1999; 1986) found that students oriented towards learning goals responded resiliently to failure, regarded mistakes as learning opportunities, viewed effort positively, and were more likely to choose challenging tasks. In contrast, students oriented towards performance goals gave up when faced with failure, regarded mistakes as indictments of their intelligence, viewed effort negatively, and were more likely to choose easy tasks. As a result, when given challenging material, students with learning goals displayed higher achievement than students with performance goals.

However, Hannula (2006) argues that students actually pursue multiple goals that interact with each other. “Goals are hierarchically arranged in a structure and one goal may be inhibitory, necessary, or sufficient to reach another goal” (p. 167). In fact, “some students may pursue multiple goals simultaneously, navigating elegantly between them, while others approach their goals serially” (Hannula, 2006, p. 168). Although learning/mastery and performance have often been seen as competing goal orientations (e.g. Dweck, 1999; Lemos, 1999; Linnenbrink & Pintrich, 2000), in two case studies Hannula (2006) found that these goals could support each other:

 Maria was driven by her need for competence and mastery of mathematics was her primary goal. However, performance in mathematics tests was an important subgoal for her evaluation of reaching that goal. Laura, on the other hand, was primarily driven by her desire to gain a high status in the class ‘hierarchy’. Performance was her main goal, while mastery of mathematics was an important subgoal (p. 170).

It is also important to consider the origin of goals. Goals are derived from needs, specifically the psychological needs for competence, relatedness and autonomy. Goals and needs differ by level of specificity. For example, a need for competence may manifest itself in a goal to perform tasks efficiently or a goal to thoroughly understand the curriculum (Hannula, 2006).

Goals are pursued through means. For example, a student might pursue a goal of performing tasks quickly by immediately employing a calculator when needed. Depending on the means that students believe to be necessary to reach their goals, they may be able to pursue multiple goals simultaneously (as shown above) or they may be forced to choose between their goals. For example, in order to satisfy a need for competence, a student might have a goal of understanding challenging mathematical material; a means to achieving this could be to stop and think about difficult problems. And, in order to satisfy a relational need, the same student might also have a goal to be a good student in the eyes of the teacher. The student might believe that a means to achieving this goal is to solve problems fluently without stopping. Although this student's goals do not necessarily conflict, the means that the student perceives as necessary to achieve each goal do conflict and the student must choose between them (Hannula, 2006).

Furthermore, perceived accessibility of a goal greatly affects how the student pursues the goal. In order for a student to actively pursue a goal, he must possess sufficient self-efficacy and believe that the goal can actually be reached (Hannula, 2006).

Self-Determination Theory (SDT), a theory I will discuss in more detail below, has recently offered its own conceptualization of goals by categorizing them as either intrinsic or extrinsic, according to their content (Vansteenkiste, Lens, & Deci, 2006).

Intrinsic goals, such as community contribution, personal growth, and affiliation... are satisfying in their own right and they provide direct satisfaction of basic psychological needs... Extrinsic goals, such as fame, financial success, and physical appearance... [are] concerned with external manifestations of worth rather than with basic need satisfaction. (Vansteenkiste et al., 2006, p. 22).

It is theorized that individuals have a natural tendency to focus more on intrinsic goals because they are related to basic need satisfaction.

Goal content (intrinsic or extrinsic) is different from goal motive (intrinsic, autonomous, or controlled, which will be described below). For example, a student might have a part-time job in order to earn money, which is an extrinsic goal. However, various motives might drive the student to pursue this goal. Perhaps the student is being pressured by her parents to do this (controlled motive), or maybe the student values receiving a post-secondary education and needs the money to do so (autonomous motive) (Vansteenkiste et al., 2006). One study (Timmermans, Vansteenkiste, & Lens, 2004 as cited in Vansteenkiste et al., 2006) has provided initial evidence that valuing intrinsic goals is more conducive to adaptive academic behaviour and positive outcomes, presumably because these goals are related to the satisfaction of the three basic psychological needs, which are also described below.

Goals aside, autonomy also plays an important role in motivation and is the foundation of Deci and Ryan's conceptualization of motivation, Self-Determination Theory (SDT) (1985).

SDT has been widely researched in many domains, including education (Deci & Ryan, 1985). While other theories view motivation as a single entity and focus on quantity, SDT maintains that there are different types of motivation and focuses on quality (Deci & Ryan, 2008a; 2008b). SDT began by categorizing motivation as either intrinsic or extrinsic (Deci, 1971).

Intrinsic motivation involves doing a behaviour because the activity itself is interesting and spontaneously satisfying... Extrinsic motivation, in contrast, involves engaging in an activity because it leads to some separate consequence. The clearest examples of extrinsically motivated behaviours are those performed to obtain a tangible reward or to avoid a punishment (Deci & Ryan, 2008a, p. 15).

SDT maintains that human nature in its most natural, ideal state is curious, self-motivated, interested, and driven to learn new things and master new skills (Ryan & Deci, 2000). Intrinsic motivation is the prototype of this ideal of human nature to "seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn" (Ryan &

Deci, 2000, p. 70). Intrinsic motivation is completely self-determined, that is, completely autonomous. Autonomy is one of three psychological needs that SDT maintains are basic and intrinsic to all individuals, and must be supported for optimal functioning and well-being. The other two are the needs for competence and relatedness (Deci & Ryan, 2008a, 2008b; Ryan & Deci, 2000).

Autonomy is considered to be the most important psychological need (Ryan & Deci, 2000). It is crucial to understand how autonomy is different from independence: "Autonomy means to act volitionally, with a sense of choice, whereas independence means to function alone and not rely on others" (Deci & Ryan, 2008a, pp. 15 - 16). An individual can certainly choose to work with others. Deci and Ryan (1987) further explain that,

autonomy connotes an inner endorsement of one's actions, the sense that they emanate from oneself and are one's own. Autonomous action is thus chosen... The more autonomous the behavior, the more it is endorsed by the whole self and is experienced as action for which one is responsible (p. 1025).

And, while intrinsic motivation is important, it is not the only type of motivation that is autonomous. SDT developed a more refined conceptualization of motivation where extrinsic motivation was differentiated into autonomous and non-autonomous types (Deci & Ryan, 1987). Thus, the focus shifted from intrinsic versus extrinsic motivation, to autonomous versus controlled motivation (Vansteenkiste et al., 2006). Extrinsic motivation becomes self-determined through the processes of internalization and integration (Ryan & Deci, 2000).

Internalization refers to people's "taking in" a value or regulation, and integration refers to the further transformation of that regulation into their own so that, subsequently, it will emanate from their sense of self (Ryan & Deci, 2000, p. 71).

Thus, extrinsic motivation is controlled when people act purely out of compliance to external or internal controls, whereas extrinsic motivation is autonomous when people value the activity for themselves (Ryan & Deci, 2000).

A continuum of motivation was developed. At one extreme of the continuum lies amotivation, which is a complete lack of motivation, and is non-self-determined. At the other end lies intrinsic motivation, the prototype of self-determined motivation. Between these extremes there are four types of extrinsic motivation, which increase from non-self-determined to completely self-determined as follows: external regulation, introjected regulation, identified regulation, and integrated regulation. With external regulation, the least autonomous extrinsic motivation, people engage in activities to satisfy an external reward or punishment contingency, such as money. With introjected regulation, people engage in activities to satisfy an internal reward or punishment contingency, such as avoiding guilt or attaining ego enhancements. With identified regulation, a more self-determined extrinsic motivation, people consciously value an activity and accept it as personally important. Finally, with integrated regulation, the most autonomous extrinsic motivation, people evaluate identified regulations and bring them into congruence with their other values and needs (Ryan & Deci, 2000).

As mentioned, the experience of choice is central to autonomous motivation. However, this choice is taken to be a motivational concept, not a cognitive concept. Choice as a cognitive concept happens whenever an individual makes any decision. However, choice as a motivational concept occurs only when an individual experiences a sense of freedom regarding the decision (Deci & Ryan, 1985). That is,

a behavior is truly chosen only if the person could (whether intuitively or deliberately) seriously consider not doing it. The inflexibility of a person's having to do a behavior and not being able to seriously consider other options suggests that the behavior does not represent true choice, even if it was decided on (Deci & Ryan, 1985, p. 155).

In an educational study, Reeve, Nix, and Hamm (2003) differentiated between option choices and action choices. Option choices involve choosing from a selection of mandated options, whereas action choices involve choosing whether or not to initiate behaviour. Option choices do not take into account whether an individual even wants to engage in the activity at all. In this way, only action choices are consistent with Deci and Ryan's (1985) motivational conception of choice that is central to autonomy. And indeed, Reeve et al. (2003) found that only action choices increased perceived autonomy and,

consequently, intrinsic motivation. So, it seems that the provision of action choices rather than option choices supports students' perceived autonomy in the classroom.

So, one can see that goals and autonomy are both important concepts in analyzing motivation. Both of these concepts are used in Chapters 4 and 5 to analyze the six students' motivation to engage with the homework system.

2.3. Research Question

It is clear then, that if students are sufficiently motivated, self-assessment has the potential to be a powerful tool for improving student learning. Although there is not an abundance of empirical research, there are several studies specifically concerning mathematics that have found positive results from utilizing self-assessment with students. Black, Harrison, Lee, Marshall, and William (2003) found a strong relationship between formative assessment (including self-assessment) and achievement. Other studies have focused on utilizing self-assessment with a particular component of classroom instruction or mathematics learning. For example, Stallings and Tascione (1996) found benefits from utilizing self-assessment on chapter tests, while Brookhart, Andolina, Zuzza, and Furman (2004) found that self-assessment of rote memorization of mathematics facts improved achievement. Ross, Hogaboam-Gray, and Rolheiser (2002) found that students who were trained to self-assess out-performed other students on word problems.

Yet there seems to be a gap in the research concerning the use of formative assessment with homework, including self-assessment (Strandberg, 2013). Utilizing self-assessment with homework could potentially provide students with valuable feedback and help them engage with it in more meaningful ways. As Black et al. (2004) point out, "the effort that many teachers devote to grading homework may be misdirected. A numerical score... does not tell students how to improve their work, so an opportunity to enhance their learning is lost" (p. 13). Instead, homework should be treated "as a way to obtain formative feedback about learning, not as a final assessment of learning" (Vatterott, 2014, p. 40). There is one study (Newby & Winterbottom, 2011) which found that integrating formative assessment techniques with homework, including self-assessment, supported student learning. However, self-assessment was only one aspect of the formative

assessment techniques employed, and the study focused on science research homework projects that were completed over several weeks. The study called for further research on whether formative assessment techniques could enhance student learning with other types of homework. So, could self-assessment be utilized with daily mathematics homework in order to improve student learning and achievement? How would students engage with their homework as self-assessment? Because students will cheat on homework if it counts for marks or is collected (Landers, 2013; Liljedahl & Allan, 2013), such a system would have to be autonomous in order for self-assessment to be authentic. Thus, my research question is:

How do students engage with mathematics homework in an autonomous setting where homework is promoted as a form of self-assessment?

Chapter 3. Methodology

In order to explore the research question from the previous chapter, I collected qualitative data through surveys and interviews within two mathematics 10 classrooms. What follows is a description of the prominent features of the classroom context, the assessment system, the homework system, and the participants, as well as data collection and analysis methods.

3.1. Setting: Collaborative Learning Environment in Two Foundations of Mathematics and Pre-Calculus 10 Classes

The setting for this research was two Foundations of Mathematics and Pre-Calculus 10 (FMP 10) classes that I taught in the first semester⁵ of the 2013-2014 school year. The two classes were taught in the same manner, usually with identical lessons given each day. FMP 10 is an academically rigorous course, which is meant for students who intend to take Pre-Calculus 11 or Foundations of Mathematics 11. Both of these are academic streams that allow entrance to university directly after high school, the former as a pathway to study sciences and the latter as a pathway to study arts. The alternative to FMP 10 is Apprenticeship and Workplace Mathematics (AW) 10, which is meant for students who will then enrol in AW 11. This stream is meant for students who intend to enter the trades or the workforce directly after high school and does not allow entrance to university. Because of this, one would expect that the majority of students in an FMP 10 course would have experienced some degree of academic success and would be motivated to succeed. However, this is often not the case. Some parents will insist that a student enrolls in FMP 10, despite clear indications that the student would be best suited for AW 10. Or, other students who are capable but did not apply themselves in

⁵ In a semestered high school the academic year is split into two parts. During semester one, students begin classes in September and write their final exams at the end of January. During semester two, students begin new classes in February and write their final exams at the end of June.

Mathematics 9 enrol in FMP 10, and lack the necessary prerequisite skills. Taken together, there can be a very wide range of abilities and motivations in a FMP 10 course.

I have always been concerned with implementing student-centered teaching, as this was a salient part of my teacher training. However, influenced by courses I took during my master's program at SFU, I have significantly changed my teaching methods. My goal is now to develop thinking classes in which students are not dependent solely on me for their learning, but where they can learn from each other and discover new things on their own. Thus, collaborative learning is a central feature of my teaching. Almost every single day, students either work in random groups writing on whiteboards and windows, or in partners at their desks. The discovery method is also a prominent feature of my teaching. I believe that given the right tools, the appropriate background knowledge, and a good learning task or problem, students can discover much of a lesson's content on their own. I believe that this usually leads to better learning than direct instruction. These FMP 10 classes were no exception; while I do still employ direct instruction on occasion, the students in these two classes experienced more alternative teaching methods in a mathematics class than was common for them.

Thus, class time consisted of a combination of collaborative activities, content discussions, individual work periods, and assessment. On occasion students were given time in class to work on their homework assignment, but more typically it was assigned at the end of class to be completed at home. In addition to the homework as self-assessment, formative assessment was provided in various forms, including exit slips⁶, daily practice quizzes, and in-class activities and assignments. Summative assessment consisted of quizzes, chapter tests, chapter re-tests, midterms, and a final provincial exam.

⁶ Exit slips typically consist of a few questions based on the day's lesson that students answer individually and hand in as they leave the classroom. These do not count for marks, but allow the teacher to gauge the class's understanding of the lesson and to provide individual feedback to each student.

3.2. Setting: The Homework System

3.2.1. Elements of the Homework System

As mentioned in Chapter 2, the foundation of the homework system employed in this research consists of two salient principles: autonomy (Deci & Ryan, 1987; Ryan & Deci, 2000) and self-assessment (Andrade & Valtcheva, 2009; Paul Black, Harrison, Lee, Marshall, & Wiliam, 2004; Black & Wiliam, 1998; Heritage, 2009; Marzano, 2000; Reeves, 2011; Wiggins, 1998). At the beginning of the semester, I informed students that I would not be checking their homework. I explicitly told them that it was completely their own choice as to whether they completed the homework, how much of it they completed, and when they completed it. However, I did strongly encourage the students throughout the whole semester to engage meaningfully with the homework, as I believed this would increase their chances of success.

In addition to this, I also provided the students with homework tracking sheets for each chapter. These were intended for students to track how they were progressing with their homework. There was one tracking sheet for each chapter, on which there was a table with numerous rows and columns. The first column contained the chapter's learning outcomes. The subsequent blank columns were for students to write in their homework assignment for each evening; they wrote the date along the top row of each column. I matched each assigned homework question to the learning outcome that it covered, and the students were to write the questions in the appropriate row for each learning outcome. After completing the homework, students were to track how they had fared with each question (see figure 1). If they did the question on their own and got it correct, they were to put a check mark underneath the question on the tracking sheet (see A in figure 1); if they got help with the question, they were to put an "H" (see B in figure 1); if they got the question wrong, they were to put an "X" (see C in figure 1); and finally, if they did not do the question, they were to put an "O" (see D in figure 1). As the chapter progressed and students completed additional questions for each learning outcome, they could look at their tracking sheets and see which outcomes they were consistently getting right, which they were getting wrong, and with which they were receiving help. In this way, the homework, through the use of the homework tracking sheets, became self-assessment

for the students; it allowed them to clearly identify which specific mathematical concepts they were struggling with in each chapter.

Name: Sarah Foundations and Pre-calcul '10

Homework Tracking Sheet Unit 4: Powers and Radicals

✓ = Completed independently and correctly H = completed with help X = Got it wrong O = did not complete it

Learning Outcome / Date → / can:	OCT. 17 TEXT BOOK P. 3-8 P. 158	OCT. 18 QUIZ	OCT. 18 WORKSHEET	OCT. 20 QUIZ	OCT. 21	OCT. 22 HW TEXT BOOK
4-1. Use prime factorization to evaluate and identify perfect squares/cubes and square roots/cubes.	3, 4, 5, 6, 7, 8 O	1 a b x x		1, 2a, b x		P) 169
4-2. Identify integers and rational/irrational/natural numbers.	D	C	1, 9, 16, 19, 27 H H H H		3, 4, 25, 28 H H H H	
4-3. Simplify expressions with integer exponents.		2 abcd x x x x		3a, b, c x x	A	
4-4. Simplify expressions involving negative exponents (easy).						2d, e, f x x
4-5. Simplify expressions involving negative exponents (hard).						4g, i, s, a, b, e, f x x x x
4-6. Convert between powers and radicals.						6c, f H H
4-7. Convert between whole radicals and mixed radicals.						B
4-8. Simplify and evaluate expressions with rational exponents						✓ H H x O 1, 9, 10, 11, 20
4-9. Solve problems involving powers and radicals	10, 17, 19					1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 210

Figure 1. Sarah's homework tracking sheet for the radicals and powers unit

I actively promoted the use of the homework tracking sheets throughout the semester. I encouraged the students to use them, explaining explicitly on numerous occasions how the sheets could greatly contribute to their success in the course. During the first few months of the semester, I made an effort to give students time in class to fill out their tracking sheets if they so chose. As the semester progressed and students became more accustomed to the system, I gradually stopped doing this. I also improved the format of the tracking sheets to encourage more students to use them. First, I added a separate space underneath where the questions were written for students to put the check marks, X's, H's and O's. I also added a quiz section. I decided to start giving daily practice quizzes to students as additional self-assessment. So columns on the new tracking sheets alternated between homework assignments and practice quizzes.

Appendix A shows this difference with the tracking sheets for the first and fifth chapters of the course. In this way, students could mark their achievement on the practice quizzes on their tracking sheets and directly see how they did on each outcome as compared to their homework.

In addition to merely filling out the tracking sheets, I encouraged the students to respond appropriately to the feedback. If students were consistently getting all of the questions for an outcome incorrect, the appropriate response would be to seek help with that concept. If students were getting help with all of the questions for a particular outcome, the appropriate response would be to attempt some new questions on their own. And, if students were consistently getting all of the questions correct for a certain outcome, then they could probably focus less on that outcome while doing homework or reviewing for a test.

Finally, I encouraged students to also use the self-assessment provided from the homework tracking sheets to guide their review for tests and the final exam. I pointed out that instead of simply trying to study everything we had done and complete massive review packages, they could instead use their tracking sheets to focus their studying on the learning outcomes with which they were still struggling.

3.2.2. Rationale for an Autonomous Homework System

As mentioned in Chapter 2, the rationale for giving students complete autonomy over their homework was to maintain the integrity of the self-assessment that I was hoping the homework would provide. If the students had been forced to do the homework and tracking sheets, it is highly probable, as shown by Liljedahl & Allan (2013), that many of them would have cheated. Landers (2013) argues that as long as schools emphasize scores and grades, “it is not surprising that students will copy and cheat to complete homework” (p. 388). And indeed, early in the semester I caught a student trying to quickly fill in his tracking sheet with false information because he thought I was collecting them for marks (I only collected them to see who had completed them, and then handed them back unmarked). Making the homework and tracking sheets worth marks would have compromised the integrity of the self-assessment, as students would be doing it primarily

to satisfy my requirements and not to self-assess their own understanding. Indeed, I would have had much more difficulty in determining which students had sincerely used the homework as self-assessment.

Furthermore, as mentioned, SDT posits that an individual's perception of autonomy improves the quality of their motivation (Ryan & Deci, 2000) and that choice is central to autonomy (Deci & Ryan, 1985). Yet, the type of choice is important; action choices, as opposed to option choices, increase perceived autonomy (Reeve et al., 2003). The present study provided action choices, as students were able to initiate whether or not they completed the homework and also whether or not they treated the homework as self-assessment.

3.3. Setting: Standards Based Assessment

Instead of using a traditional points based assessment system as described in chapter 2, I utilized standards based assessment (O'Connor & Wormeli, 2011; Marzano, 2000; McTighe & O'Connor, 2005; O'Connor, 2002; Reeves, 2011; Wiggins, 1998) for this research. As mentioned, with standards based assessment a teacher directly assesses students' understanding of standards (or, in other words, learning outcomes) that are based on the course curriculum. Summative assessment tools, such as tests for example, have the appropriate learning outcomes matched to each question. The teacher marks the test by assessing how well the student understood each learning outcome using some kind of scale, numerical or otherwise. I chose to use a three-step, non-numerical scale for the sake of simplicity and also to hopefully draw students' focus away from numerical marks and towards their actual understanding of specific learning outcomes. The scale was as follows: if students did not understand the learning outcome at all, they were given an "NI" for "Needs Improvement." If students seemed to partially understand the concept, or had employed the right procedure but made many mistakes, they were given a PM for "Partial Mastery." Finally, if students got the question perfect or made an insignificant mistake, and clearly seemed to fully understand the learning outcome, they were given an M for "Mastery." This was the only feedback that they were given on all quizzes, tests and assignments; there was no numerical, summative mark.

The rationale behind choosing standards based assessment was that the self-assessment which students would gain from completing the homework and tracking sheets would be more meaningful and have a greater impact if the summative assessment done by myself was also based on direct assessment of learning outcomes. Consider the following two hypothetical situations: first, perhaps a student notices on his tracking sheet that he has all X's for a certain learning outcome. For whatever reasons, he does not get help with the outcome before the test. When he receives his marked test, he discovers that his assessment for that specific outcome was NI. More clearly than a summative points mark, 11/20 for example, would have done, this specific feedback reinforces to him that the information from the tracking sheet was important and that he should have done something about it. On the other hand, perhaps a student sees at the beginning of a unit that she is getting all X's for a certain learning outcome. She receives an NI for that learning outcome on the practice quiz the next day. She seeks help from a friend and receives a PM for the learning outcome on the next practice quiz. She seeks more help, tries additional questions on her own, and focuses more of her review time on that outcome. Her efforts pay off and she receives an M for the outcome on the chapter test. Thus, she can clearly see that the self-assessment from her homework and her response to it were both extremely valuable. These two situations demonstrate how standards based grading was essential for reinforcing the value of the self-assessment attained from the homework. This connection was explicitly explained to the students.

One salient asset of my particular version of standards based assessment was that the students were not penalized for early mistakes, because retries were allowed and encouraged. Current assessment literature supports this practice (Guskey, 1996; O'Connor, 1995, 2002; Reeves, 2011). O'Connor and Wormeli (2011) point out that "it's unethical and inaccurate to include in a grade digressions in performance that occur during the learning process, when a grade is supposed to report students' mastery at the end of that process" (p. 41). With a traditional points system, if a student does not understand a concept soon enough, she might score poorly on a quiz. That same student might work hard, learn the concept, and do much better on a subsequent quiz or chapter test. Yet, the poor mark from the first quiz remains a blemish on her overall class grade, despite the fact that she now understands the material. In my assessment system, re-tests were given for every chapter test, and near the end of the semester I also allowed students to come

in outside of class time to retry learning outcomes they had not yet mastered. If, on the retest or retry, the student performed better than he had previously (for example, he earned an M on the retry whereas he had gotten a PM on the first try), the new mark completely replaced the old mark. However, if a student did worse on the retry, that mark would also replace the first mark, because the student had not retained his understanding of the concept. In this way, my assessment system was based on a student's current level of understanding, and was meant to encourage continual improvement.

Nevertheless, as the BC Ministry of Education does require that I give students a final class percentage (BC Ministry of Education, 2009, 2014), I did calculate an average. Each learning outcome was marked out of one point, with M earning the full point, PM earning half a point, and NI earning zero points. I added up the points each student earned and divided by the total possible number of points, and that was their class percentage. This class grade was worth 80% of their final grade, and the provincial exam was worth 20%.

In order to efficiently track student progress, I used an online program called ActiveGrade ("ActiveGrade," 2013). This program allows the user to enter multiple learning outcomes for various classes and then assess students on each particular learning outcome. Setup options allow the teacher to customize the scale that is used for assessment of each outcome (as mentioned, I chose a three point scale). A teacher also chooses how a student's mark for each outcome is calculated; in other words, does the latest assessment of an outcome (the re-test for example) replace all previous assessments (such as quizzes and the original test), or is some type of average of all the assessments calculated, with more weight given to the most recent assessment? I decided that the latest assessment would replace all previous assessments, for the reasons mentioned above. While the scale for marking each learning outcome must have numerical values (mine being 0, 0.5, and 1) in order for the program to calculate a final grade, the teacher can choose how the scale appears on screen when either teacher or students log in. I chose to hide the numbers, again to encourage students to move away from focusing on numerical marks; instead the program simply showed their assessment with colours. M, PM, and NI were shown with the colours green, yellow, and red,

respectively. The result was very visually appealing and allowed the user to see at a glance a student's overall progress.

Both teacher and students can log in to ActiveGrade online. When the teacher logs in, she sees the assessment of all of the students in her class, with each student having a row showing the colour of his or her current mark for each particular learning outcome. Across the top is a row showing the colour of the average class mark for each learning outcome; this was particularly useful for seeing which concepts more students had struggled with throughout the semester and informed my lesson plans for review for the final exam. Beside each student's name is his or her current letter grade based on the calculation described above. One limitation of the program was that I could not get it to calculate and display an overall percentage, because I had opted to use a customized grading system instead of the program's default system. It would only display students' letter grade. Thus, in order to calculate students' percentages, I had to export the data into Excel. Excel displayed the numerical marks for each learning outcome, so I simply added a calculation of each student's average of all the learning outcomes as a percent. Below is a screen shot of what the teacher sees in ActiveGrade's mark book:



Figure 2. Screenshot of teacher mark book in ActiveGrade (names removed)

Furthermore, the students could also sign in to ActiveGrade. Each student would simply see a coloured bar graph displaying his or her own progress for each learning outcome. No overall grade, (neither letter grade nor percent) was shown to the student. Below is a screen shot of what a student would see in ActiveGrade:

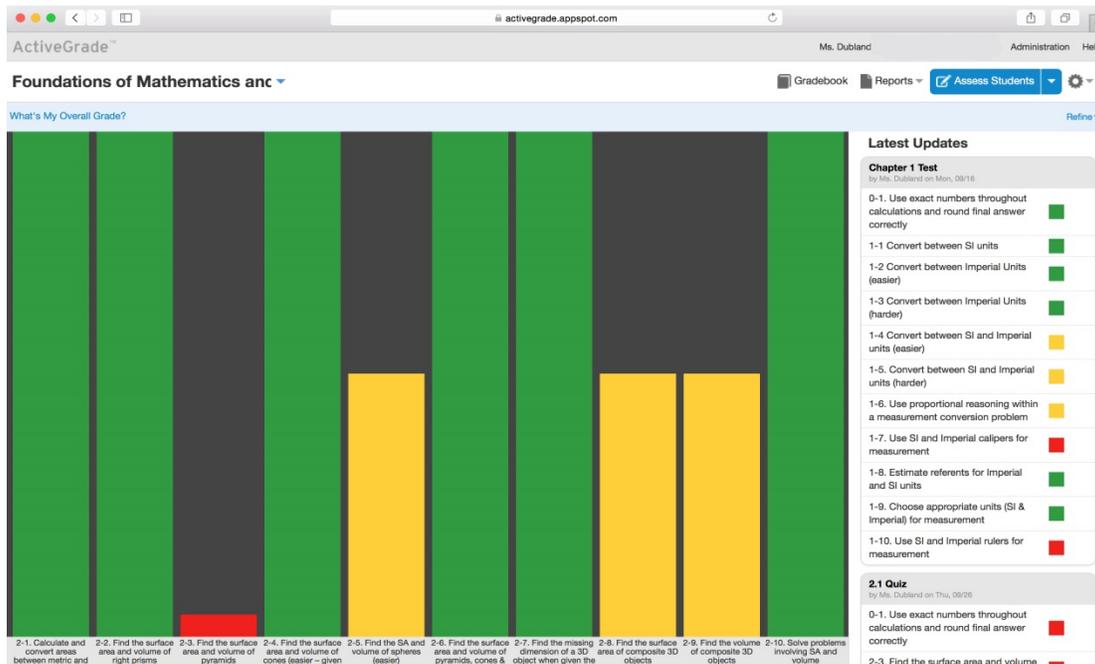


Figure 3. Screenshot of student view in ActiveGrade (name removed)

3.4. Participants

The research was conducted in a high school in the Greater Vancouver area. The participants were the students in my two FMP 10 classes. I chose to use my FMP 10 classes because, as mentioned, they tend to include students with a wide range of motivation and work ethic. I chose to recruit students from both classes to ensure I would have enough participants. All students in both classes were recruited to participate; the students and their parents were informed of the nature of the study and given the opportunity to decline participation. They were assured that declining to participate in this research would have no effect whatsoever on the student's grade, status, or participation in the course. Students whose parents gave consent and also gave their own consent were taken as participants. Out of 58 students between the two classes, 32 students gave consent to participate (15 students from one class and 17 from the other). Of these, six

students agreed to be interviewed. I will describe below in section 3.5 how I chose these students.

3.5. Surveys

I administered surveys with the aim of collecting initial data from all of the participating students regarding how they engage with homework in general and, how they were engaging with this autonomous system specifically, where homework was promoted as self-assessment.

3.5.1. Survey Administration

I administered three surveys to the two classes throughout the semester (see Appendices B-D). The first, Mathematics Study Habits, (Appendix B) was given to students on the first day of class. This survey was given to all of the students, because it is simply a regular part of my teaching. I have given this survey to classes both prior to and following the semester of data collection, and will continue to do so, as it is a good instrument for assessing students' attitudes and work ethics towards mathematics. However, only the surveys of those students who consented to participate were retained and utilized as data. This survey also contains items pertaining to mathematics, mathematics class, learning, and homework. It provided important initial information about my classes overall and also drew my attention to certain students as potential interview candidates.

The second survey, Math Questionnaire #1 (Appendix C), was administered halfway through the semester to the 32 students who consented to participate. This survey consisted of questions aimed at determining to what extent the students were engaging with the homework system. Were they doing the homework? If so, how much were they doing? Were they using the tracking sheets? Why or why not? It also consisted of questions aimed at determining the students' views and attitudes towards the system. This survey was used, in combination with classroom observations, to select the six students for interviews. I will describe this process in greater detail in section 3.5.2.

The third survey, Math Questionnaire #2, (Appendix D) was administered to all of the participating students on the final day of the semester before the provincial exam. This survey was populated with questions concerning the students' overall experiences with the homework system throughout the semester; for example, I asked the students to describe positive and negative aspects of the homework system for themselves personally. This survey also contained items generated from the previous surveys and the six interviews that I conducted. For example, William mentioned in his surveys and interview that he prefers that homework not be for marks, because otherwise he would cheat on it. So, I asked the students what they think of this and whether it also applies to them.

3.5.2. Survey Analysis

Analysis was ongoing throughout the entire data collection process. As mentioned, I utilized the Mathematics Study Habits survey to inform my classroom observations. I read through all the surveys from both classes (58 in total) with the purpose of identifying interesting responses and students whom might be good interview candidates. This survey prompted me to observe numerous students more closely, including Joshua, William, and Jason, who became interviewees.

As mentioned, I utilized Math Questionnaire #1 in combination with my classroom observations to choose the six students for interviews. I read these surveys numerous times with a twofold purpose. First, I aimed to choose six students who represented the full spectrum of engagement levels with the system, from fully engaging to not engaging at all. I sorted the surveys into three categories: those students who were fully engaging, those who were partially engaging, and those who were not engaging. I chose two students from each category who differed from each other in other significant ways so that I would have a rich variety of case studies. For example, both William and Jason were not engaging with the system at all, but their opinions of the homework system differed greatly. William was quite happy with the autonomous system, while Jason strongly preferred that the homework be for marks. Second, as I read through the surveys in each category, I aimed to choose students who made interesting comments on their surveys, as this would provide good questions and prompts for the interviews. I also presumed

that students who wrote interesting comments on their surveys would give more interesting interviews. I chose Joshua and Erin for the fully engaging category, William and Jason for the non-engaging category, and Amanda and Sarah for the partially engaging category. I will describe in detail in Chapter 4 why I specifically chose each student.

Finally, I analyzed Math Questionnaire #2 for several purposes. First, I used it to make general conclusions about what kinds of experiences the 32 participating students had with the homework system. I also analyzed this survey with the purpose of gaining additional insight into my interviewees' experiences with the homework system. These surveys prompted more questions, and so I ended up conducting a follow-up interview with each of the students in order to clarify and dig deeper into certain responses they had given.

3.6. Interviews

I chose to interview select students with the aim of exploring how they were engaging with the homework system in more depth. The interviews allowed me to clarify unclear comments on students' surveys and also to probe students as to why they were engaging with the homework system in certain ways.

3.6.1. Interview Administration

I prepared questions as a guide for each interview, and also asked new questions during the interviews in response to what students said. All interviews were audio recorded. There were three types of questions I used for the initial interviews. First, there were general questions that I asked of all the students, such as "What is the purpose of homework?" and "Compare how you engage with homework this year to how you engaged last year." I also asked all of the students to define and explain self-assessment, and to give me some examples. I wanted to see if the students would identify the homework as self-assessment.

I also crafted questions specifically for each student according to their level of engagement with the homework system (which I had ascertained from Math Questionnaire #1). My questions for Joshua and Erin (the fully engaging students) focused on how and why they were fully engaging with my system, and what differences they noticed, as compared to homework systems in their previous classes. Also, since they had both already stated that they really liked the system, I asked questions to determine what specific aspects they appreciated. My questions for Amanda and Sarah (the partially engaging students) focused on determining what level they were currently engaging with the homework system, whether their levels of engagement had changed since the beginning of the semester, and whether they liked the system. My questions for William and Jason (the minimally engaging students) focused on determining why they were not completing the homework or the tracking sheets, and how this lack of engagement compared to their experiences in previous mathematics classes.

Finally, I asked the students questions based on their responses to the Mathematics Study Habits Survey and Math Questionnaire #1, in order to glean insight regarding interesting comments and to clarify what I did not understand.

The follow-up interviews consisted of general questions about the students' overall experience with homework in my class and specific questions regarding comments they had made in their initial interviews and Mathematics Questionnaire #3.

I found that the responses given during the interviews were much richer and seemed more authentic than the responses given on the surveys. Because of this, I chose to focus my data analysis for this study on the interviewed students.

3.6.2. Interview Analysis

I transcribed both the initial and follow-up interviews in their entirety, with the exception of Joshua's initial interview, as part of it concerned educational topics unrelated to this thesis. I read through the transcriptions many times, highlighting comments relevant to my research question, and making explanatory notes in the margins. I aimed to glean specific information about each student's unique experience with the homework

system. A case was written for each student from this information (see Chapter 4). I analyzed the six cases using the principles of analytic induction.

Analytic induction offers a specific form of inductive analysis that begins deductively, by formulating propositions or hypotheses, and then examines a particular case in depth to determine if the facts of the case support the hypothesis. If it fits, another case is studied and so forth (Patton, 2002, p. 94).

Similar to grounded theory, the analyst recursively codes the data, looking for themes to emerge; however, analytic induction allows for *a priori* propositions or theories to be used as a lens to view the data and to either verify, refute, or build upon (Glaser & Strauss, 1967, as cited in Patton, 2002). For this study, one *a priori* theory used during the deductive phase was Self-Determination Theory's principle that satisfying the basic need for autonomy improves quality of motivation (Deci & Ryan, 1985; Ryan & Deci, 2000). Another *a priori* proposition used comes from the assessment literature, which is that increasing feedback improves achievement (Black, Harrison, Lee, Marshall, & William, 2004; O'Connor & Wormeli, 2011; Guskey & Bailey, 2001; Marzano, 2000; McTighe & O'Connor, 2005; Reeves, 2011; Wiggins, 1998).

"After or alongside this deductive phase of analysis, the researcher strives to look at the data afresh for undiscovered patterns and emergent understandings (inductive analysis)" (Patton, 2002, p. 454). In addition to elements concerning the *a priori* theories, I also made notes on anything I found particularly significant or recurring. As I went through the first few cases, I began to notice crossover of certain ideas between students, so I categorized my notes and the students' comments. In the subsequent cases I looked for evidence of ideas that had emerged in the first cases. Once I had analyzed each individual case, I reviewed all of my notes in order to extract common themes between the interviews.

3.7. Field Notes

Throughout the semester I took field notes of my observations of the students' classroom engagement and also of pertinent interactions I had with students both during and outside of class time. These notes complemented the data I collected through the

surveys and interviews. Some of these observations are included in the cases in Chapter 4.

3.8. Dual Roles as Teacher and Researcher

There were advantages and disadvantages to being both the teacher and the researcher for this study. One advantage is that I got to know the students much better by seeing them every day in class than if I had only come in a few times to observe and collect data. Another advantage is that I had complete control over what took place in the classroom; how the homework system was implemented and promoted to the students.

Yet, as the students' teacher I was ultimately in a position of power over them; this may have affected what they were willing to disclose to me in their surveys and interviews. I dealt with this limitation by repeatedly telling the students that I simply wanted to know what they thought of the system, because it was something new that I was experimenting with. Negative reactions to the system were helpful feedback for me; I told the students they would not offend me. Furthermore, I worked to build rapport with students and tried to make them feel at ease during interviews. Another limitation of the study is that I took everything the students told me to be true. There are reasons to believe that this may not always have been the case; however, as engagement with homework is a private occurrence, there were no alternatives to researching it. However, for the most part, the interviewed students tended to be quite forthcoming and frank with what they told me; they did not always talk about themselves in a positive manner. One final limitation of the study is the participation rate; 32 of 58 students opted to participate, that is about 55 percent. So, it might seem that only certain types of students were willing to participate, providing a sample of participants with a narrow range of characteristics and attributes. However, as I got to know the students better, I felt confident that my participants included a broad range of students with varying motivations, effort levels, academic capabilities, and approaches to homework.

Chapter 4. Results and Case Analysis

As mentioned, I chose to interview the following six students because they represented the full spectrum of engagement levels with the homework system from not engaging to fully engaging, and also because they each gave interesting responses on their first two surveys. What follows is a description of the salient elements of each student's experience with the homework system throughout the semester. I start by describing my own observations, then explain in detail why I picked each student, and conclude with a thematic analysis of the results of the student's interviews. In each case I will present the student first from the perspective of a teacher, and then as a result of analysis. All names are pseudonyms to maintain student anonymity.

4.1. Jason

From my observations, Jason is a pleasant but very social student. He does not have much work ethic and seems to require extrinsic rewards and consequences to motivate him to do almost anything, including homework. He did very little during class, regardless of the activity. During group work he would simply socialize, and during individual work he would often be distracted and would be lucky if he got even one or two questions completed. Furthermore, Jason failed almost every chapter test from the beginning of the semester. It also became clear through conversations I held with him in class regarding his lack of success that he was not doing the homework.

Jason was also not completing the homework tracking sheets. After I handed them out at the beginning of each chapter, I never saw him in possession of them again. He never filled them out when the students were given time in class, and he never had them with him when I asked the students to use them for activities. He confirmed this by writing on his Math Questionnaire #1 that he does not do the tracking sheets.

Jason seems to be very lazy regarding homework. I met with him and his grandmother during parent teacher interviews and learned that he had exhibited very similar behaviour in his grade 9 mathematics class. He told me that in grade 9 he had

exerted minimal effort throughout the semester and had not been doing well. However, right before the exam he said that he studied hard, memorized all the formulas, and ended up doing quite well on the exam. Because of this, his grade 9 teacher raised his grade to a B. Despite his grandmother's and my own consternation about this behaviour, Jason seemed just fine with how things had transpired in his previous class and with how they were transpiring in my class.

I chose to interview Jason for several reasons. First, he was a clear choice to represent one extreme type of student, since he was not completing the homework or the homework tracking sheets, was doing very little during class, and was failing almost all of the tests. Furthermore, Jason gave some very interesting responses on his surveys. On the Study Habits Survey he wrote that "help" with his homework means that someone "supervise[s] and make[s] sure I do it." On the Math Questionnaire #1, when asked whether he was doing the homework and why or why not, he wrote "no, there's no reason for me to do it but I do some." He wrote that he would prefer a class where he is forced to do the homework because, "it gives me a reason to do the work." When asked if he was doing the homework tracking sheets, he wrote, "no, I don't remember to write down the learning outcomes." From these responses, it seems clear to me that Jason is a student with little motivation; in order for him to do his homework, he must be motivated by extrinsic rewards or punishment.

I learned a lot about Jason from his initial interview; he elaborated on things he had written in his surveys and he also provided entirely new information, some of which contradicted what he had written. First, Jason confirmed that, indeed, he does not see any reason to do homework unless it is for marks. He explained that "if there's, like, no purpose for me to do it, then I don't have, like, the feel to do the work." When pressed on what he meant by "purpose", he replied "like, if I was getting marks for it, then, like, I would want to do it more."

Furthermore, for his mathematics courses in grades eight and nine, Jason had had the same teacher who utilized a strict, regimented homework-for-marks system. For each chapter, she would give the students a sheet on which they had to write down each night's homework assignment. At the end of each chapter, they would attach this sheet to all of

the homework they had done and hand it in for completion marks. Jason prefers this homework system, explaining that “it helps you keep yourself organized, and you get, like, marks.” He told me that he did, in fact, do all or most of the mathematics homework in these grades. However, he did reveal that, at times, he had copied the homework to get it done. The most he would admit was that he would copy it if he forgot to do it; he did not divulge how often he would copy.

Through further conversation, it began to seem unlikely that Jason had actually learned much from doing homework in this way. He said that he had not made any effort in his mathematics nine class during the semester and then had studied hard and done well on the final exam. He told me about his grade 9 year, saying,

Jason: Like, uh, last year, I didn't really do anything like at the beginning, and then at the end I got like a really good mark cuz I studied, like, from the textbook. Just like, going over the questions [...] And I've got good memorization, so I basically remembered every, like, the formulas, or whatever. And then I just [...] those [...]

Interviewer: And you did ok on the exam?

Jason: Yea [...] well, my mark just got boosted up a lot because, umm, of the difference.

Interviewer: Ok.

Jason: Cuz I was getting a C+ at the beginning, and then I got a B at the end.

Interviewer: Because of the exam?

Jason: Yea.

When I asked how it could be that he was not trying much at all during the semester, even though he had said earlier that he was doing all of the homework, he initially was unsure of an answer. As I pressed him, it became clear that he had simply been doing the homework to get it done – because he had to – and was not actually learning from it. We had the following conversation:

Interviewer: Why did you wait, now why the, now, I guess though, this doesn't jive, like it doesn't fit quite with what you said earlier, that you were doing the homework regularly in this class, because it was for marks, yet, you weren't trying. How does that fit?

Jason: Ummm [...] I'm not sure [...]

Interviewer: Ok [...] so you were [...] *Were* you doing the homework regularly?

Jason: Yea.

Interviewer: But you weren't trying?

Jason: No.

Interviewer: So you're kinda just? [...]

Jason: Just finishing it, just doing it.

Interviewer: Umm, ok, so you were just doing it to get it done?

Jason: Yea.

Interviewer: Ah, ok. So, in a class for marks, where homework's for marks, uh, more it's like, you're doing the homework just, just to get it done, cuz you have to get it done?

Jason: Yea, umm, like my science teacher, I was doing the same thing this semester.

In fact, it seems like Jason views most, if not all, of his classes as a series of hoops he has to jump through in order to pass. We talked at length about his science class, for which he did complete his homework. He revealed that there were two reasons he completed the homework for that class: to receive marks and because he was afraid of the teacher. When asked if he ever completes homework because he wants to learn from it, his answer was an immediate, resounding, "no." He explained that, "Umm, unless like, unless it's something I wanna learn, then I won't really pay attention." He wants to pass his classes, but he does not care at all if he learns much from them. He is not interested in mathematics, so he does not care if he learns mathematics. I asked Jason why he thinks I bother assigning homework since it's not for marks, and he replied, "so we can... understand it for ourselves." Because he had told me earlier that he did not care to learn much from his classes or from homework, I clarified with him, saying, "but you don't want to understand it for yourself?" and he said, "no." Thus, he does not do the homework.

When I asked Jason about what things do interest him and what he is passionate about, he replied, "I don't really like doing anything." He said he likes to stay home and watch television. He did admit that he likes Physical Education class.

I also learned through the initial interview that Jason was planning to do exactly the same thing in my class as he had done in his previous mathematics class. He figured

that he could do almost nothing during the semester and then study really hard at the very end for the provincial, do well, and pass the course. The only difference is that since the homework in my class was not for marks, he did not bother to do it, whereas in his previous class, he did it for the marks but claimed to have learned nothing. I pointed out that since the provincial is only worth twenty percent, even if he excelled on the exam, it could still be hard to pass the class. He replied that it would depend on what his class grade is going into the provincial as to whether he would pass. I responded by asking if he had any plans then to improve his class grade before the provincial, and he replied that no, he did not.

Jason also divulged more about his engagement with the homework tracking sheets in his interview. Although he had written on his Math Questionnaire #1 that he did not do them because he forgets, he said in the interview, it is “not that I don’t think it’ll help, it’s just, I just don’t want to do it.” He simply did not care. He did think the tracking sheets might help him learn the material, but he did not want to learn the material.

I also learned several interesting things about Jason from his follow-up interview, which occurred after the semester had ended. I learned that he had, in fact, tried doing the homework tracking sheets at one point. On his Math Questionnaire #2, he circled the following statement to describe himself: “At the beginning of the semester, I did homework but not the homework tracking sheets. At some point in the semester I began doing the homework tracking sheets.” This seemed inconsistent with what I had already learned about him, but his follow-up interview brought clarity. Jason confirmed that he had tried fully completing the homework and tracking sheets for a week and half in the beginning of January. When asked why he did this, he said, “cuz it was coming close to the provincial” and “I thought it’d make a difference”. With the provincial exam only a few weeks away, it seems that Jason finally realized that something needed to change if he was going to pass the course; he was desperate and willing to try anything, including doing the homework and tracking sheets. He said, however, that it did not make a difference and so he stopped.

Jason told me that he did not actually end up studying for the provincial exam at all. He thought he could get a better grade in science, and so he focused on studying for his science provincial. He said that his plan for the math provincial was to just “wing it”, but that by then he did not have any real hopes of passing.

As mentioned above, Jason had made it clear that marks motivate him to do his homework. In the follow-up interview, he added that it would also help if the homework was interesting. When I asked him how I could make it interesting, he replied, “it’s math, I don’t really know how to make that interesting.” So although he would like the homework to be interesting, he seems to have a preconceived mindset that mathematics cannot be interesting.

Finally, I learned that Jason’s knowledge of self-assessment is extremely limited. He defined self-assessment as “[judging] ourselves on how we’re doing in the class”. However, beyond this he didn’t seem to know much else. He could not remember if we had done any self-assessment during our mathematics class; he claimed that he had not done any self-assessment in other classes; and he said that did not even know what self-assessment would look like in a classroom.

4.2. William

From my observations, William is a bright and pleasant student. However, his behaviour regarding the homework was complex. At the beginning of the semester I assumed that William was doing at least some of his mathematics homework on a regular basis, because at that time he was doing well in the class and also because on one occasion he told me that he feels guilty if he does not do all of it. I was confident from the beginning, however, that William did not do the homework tracking sheets at all; he never filled them out during class, and he usually did not have the sheets with him when I asked the class to use them for various activities. One day I also observed him trying to hide his sheet so that I would not see that it was blank.

It slowly became apparent that William did not do as much of the homework as I initially assumed. In classroom conversations, he usually cited his busy hockey schedule as the reason that he did not complete homework. However, it became apparent as the semester progressed that this busyness was often not a legitimate excuse; it was certainly not the only reason that William did not do his homework or the tracking sheets. One reason William identified himself; he wrote on the Mathematics Study Habits Survey at the beginning of the semester that he believes he will deserve a C- in the class because

sometimes he is lazy. From observing him in class, I would agree with his self-assessment; William had many days in class when he simply did not feel like doing any work. On these days he did not get much of anything done, even with prompting. I assumed this carried over to his homework as well. I learned through his surveys and interviews that there were numerous reasons, including laziness, that William did not complete his homework; these are described below.

I chose to interview William because he was extremely honest with his questionnaire answers, and because he seemed to be quite aware of his own behaviour. As mentioned above, he wrote on the Study Habits Survey that he is lazy. Furthermore, of all the students participating in my study, he was the only one to admit on Math Questionnaire #1 that he would probably end up copying in a class where he is forced to do his homework.

As I suspected, William was very sincere in his initial interview, and I learned a lot about him. First, he revealed that, from the very beginning of the semester he had not been doing much homework at all. He procrastinated, and often he only did the review package on the night before a chapter test; on rare occasions he would also try the regular homework. In addition to busyness and laziness, he revealed another reason he did not do his homework; there was always something more enjoyable that he could be doing, such as “laying on the couch, watching TV, [and] eating ice cream.”

William also admitted that he did not complete his homework if he felt that he had understood my explanation or the group work. I asked him, “sometimes you just don’t do the homework cuz you understood it in class?” He replied, “yea, like if I think it’s really easy, I won’t do the homework, like [...]”

However, William also did not do the homework if the material was too difficult. Shannon (2009) found similar results with a student who avoided questions if they were too easy and also if they were too hard. Despite a seemingly easygoing personality in class, William revealed that he stresses about many things, including homework. He told me,

But, umm, I, I just stress about homework, and like I even stress about stuff that like, I don't get, like, even if, honestly, if I try something, like, say I don't get a math chapter, and then I try it and I still don't get it, that'll stress me out even more. Cuz, like, I already tried, and I, I don't get it, what am I gonna do? That stresses me out more, so [...]

I pressed him saying, "so then, if you don't even try it? [...]" and he replied, "I just try not to think about it." It seems that there had to be an ideal degree of difficulty for William to even consider attempting the homework, as he told me:

Interviewer: So, would it be correct for me to assume then that there has to be like some like happy medium? Like [...]

William: Yeah, like, like, I understand it but I, I, like, I know I can get it [...] If I work at it. But, ummm, if I know I can't, like, I just try to forget about it [...] But if, umm, if I know I can get it, then yea, I, I actually, I'll try a little bit.

If this was the case, and he had time, William would try the homework and work persistently on it. This only happened a few times during the semester.

William does care a lot about his grades, largely because of a desire to please his parents. He admitted that he would probably do much better in mathematics class if he did the homework regularly, and also admitted that he might do better if he completed the tracking sheets. And yet, despite all of this, he did not do much to remedy the situation. William owned responsibility for his low grade in his follow-up interview, admitting that "obviously I'd like it to be higher, but I gotta, I gotta work harder if I want it to be higher, that's, that's on me." He knows what it takes to get a better grade – what he should do – but he simply does not do it.

Furthermore, during the interview William admitted that he often cheats on homework that is for marks in other classes. This includes copying it from a picture of a friend's homework, or writing random words into fill-in-the-blank homework. He claimed that teachers do not notice when he does this.

Yet William made an interesting distinction regarding cheating on homework. If at all possible, he does not copy homework if the teacher actually marks the content, saying "if she's gonna mark it, I'm kind of like, stealing their work, because this is actually for marks, and it's reflecting how I understand this." For example, he does not copy his

science labs, since the teacher marks whether his answers are correct (although he did admit that on rare occasion, he had copied one when he felt he had no other option for completing it).

On the other hand, William does not see anything wrong with copying homework that is only checked for completion, saying, “if [the teacher is] just gonna check it, like, this is just me, I don’t see the harm in that.” Perhaps he figures that the teacher only cares about whether the homework is completed, and not how it is completed. It does not matter whether his answers are correct or even his own, since she is not checking the actual answers. Perhaps he feels that if the teacher does not exert much effort to check his homework, he likewise does not need to exert much effort to complete it. Landers (2013) revealed similar thinking from a student. Implying that teachers do not care if students copy homework, the student said,

yeah, I mean, okay, [copying is] showing that you have a technique of getting it done. Basically all [teachers] really care about is you getting it done. You just get it done, you could do like a HALF job, like you don’t even have to get everything correct (p. 386).

However, if his homework is for marks, regardless of how busy he is, it is not an option for William to not finish it, because he “doesn’t want a zero.” When I asked him, “k, so, you have a lab one day, and then, you have a crazy night with hockey, you have no time, what do you do?”, he replied,

That’s when it gets hard, cuz like, if it, I always gotta find, well, I always gotta find a way to get it done, I dunno, like, if I get to [...] if it’s like, if it’s after lunch, I’ll spend my spare or lunch working on it, and if it’s like, if it’s before, that’s when, that’s when I might have to ask someone, like, my partner or someone to copy theirs because, uh, I won’t have time to finish it.

Marks drive him to do his homework, even if it means cheating on homework that is marked for completion or for content on rare occasions. But, just as with Jason, when homework is not directly for marks, the indirect effect that homework may have on his class mark is not enough to motivate William to do it. However, unlike Jason, who prefers that homework be for marks so that he can collect easy marks by completing or copying

the work, William prefers that homework not be for marks because the guilt he feels when he cheats on homework is not worth the easy marks he receives.

Despite the fact that William did not do the tracking sheets, I did learn more about his views on self-assessment. Paradoxically, although he admitted that he might do better if he completed the homework tracking sheets, he also thought that he did not need the tracking sheets because he already knew what he was good at and what he struggled with. He relied mostly on self-assessing himself during class, based on whether he understood the lesson.

It became apparent that William did not actually identify the homework tracking sheets as self-assessment. When I asked him, “do you think we do any self-assessment in this class?” he said “no.” He revealed a narrow view of self-assessment as only being self-marking: it is a survey where he has to answer questions and mark himself based on how he thinks he is doing in a class. Since the homework tracking sheets did not fit this definition, he did not think there was any self-assessment in our class. Finally, on the second Mathematics Questionnaire, he revealed that he does not see any difference between homework as self-assessment and homework as practice. This is very interesting, since on several occasions I explicitly explained to the class how the tracking sheets were meant to be used as self-assessment, and that using homework as self-assessment is the focus of my masters’ study.

Yet, I discovered during his follow-up interview that William actually did unknowingly use the homework tracking sheets for a type of self-assessment. He did not use them in the way I intended, but revealed that he used them at the end of the course to study for the provincial, saying, “I looked over the learning outcomes for studying purposes, just to see if I remembered what I didn’t get and what I got.” In fact, William told me that he really liked having learning outcomes in the class. He said, “if I got a class without learning outcomes, I, I think it’d be a lot harder to assess how I did in those out-like, uh, like I guess outcomes. Just cuz, then it, it [...] outcomes made it a lot easier to study too. And if I didn’t have that, ummm, I guess, uh, I dunno, it’d be, I’d be a lot more lost studying.” This sounds like a description of self-assessment, and yet when asked

specifically about self-assessment done in our class, William did not make the connection with the homework tracking sheets.

4.3. Amanda

During my experience with her in my mathematics class, Amanda was a polite, quiet, hardworking student. I was confident that she regularly completed all of the mathematics homework throughout the semester because she regularly asked questions about it, and also because I would often see her working on it or asking other students for help at the beginning of class. Indeed, I discovered that Amanda is a student who will complete her homework regardless of whether it is for marks, or even whether it is required. For example, just before Christmas she requested that I not give the class any homework over the winter break, even optional homework, because then she would have to complete it, as she said she feels guilty if she does not.

However, I was unsure about how often Amanda was completing the homework tracking sheets. I suspected she was doing them because she seems like the kind of student who will do something simply because an authoritative figure tells her she ought to. Furthermore, I also observed her filling them out during class from time to time. Several weeks into the course, she confirmed for me during parent-teacher interviews that she was indeed filling them out diligently. However, by the end of the semester, I discovered through her second survey and her interviews that her diligence had waned, and that she was no longer filling them out on a regular basis.

I chose to interview Amanda because of her answers on Math Questionnaire #1. When asked whether the feedback she gets from the homework tracking sheets affects what she does next, she wrote, "I feel like it helps me in the moment, but while studying for an exam it doesn't help me too much." Furthermore, when asked to explain why I suggest that students mark and track their homework according to the learning outcomes, she wrote, "[the teacher] suggests that we do that because she want[s] us to look back and study off the ones we got wrong. I think it can help but for some reason it doesn't help me." So, Amanda was using the homework tracking sheets but felt that they were not helping her. I wanted to know why; was she not using them properly? Was she not

getting help with the learning outcomes she struggled with? Was she not trying questions on her own that she got help with? Why did she feel that they did not help her study for tests? Was her grade simply not what she wanted it to be and so she felt they were not helping her?

The interviews provided answers to these questions, plus many new insights. I asked Amanda whether she was still doing the tracking sheets consistently, fully expecting her answer to be yes. However, she replied, “No, I do it like whenever we get... we have time in class, like write it down. Then I’ll do it.” There were several reasons that she was not doing them consistently. First, she would forget to do it; she told me that it was something that she’s never had to do before, and she had trouble getting into the habit of doing it. Second, if she did not take the time in class to write the homework questions down on her tracking sheet and simply took a picture of the whiteboard, she would not end up transferring the questions onto her tracking sheet. Finally, I discovered during her interviews that she actually did not think she needed the homework tracking sheets; she felt that she already knew in her head where she excelled and where she struggled, as shown in our conversation about her weaknesses:

Interviewer: How did you figure out though in the first place which ones [LO’s] you need to work on the most?

Amanda: Well, in, you kinda just like, be like, like the quizzes or something. Kinda had that in your head and you know you’re struggling but it’s never like [...]

Interviewer: So you didn’t look at the tracking sheet?

Amanda: It’s kinda like, you know like the questions you’re getting wrong *all* the time.

Interviewer: You just know in your head?

Amanda: Yeah.

Ultimately, Amanda’s use of the tracking sheets went from consistent at the beginning of the semester to non-existent at the end of the semester. By then she was only using them to write down the homework assignment for each night; she would never track how she did on each question.

I then asked Amanda why she thought the homework tracking sheets did not really help her when she did use them. She answered that it was probably because she was not consistently doing them, saying:

Umm, well, like, I think if someone really, I dunno, was like dedicated to it, I guess... it'd probably help them, but, I dunno, I just, it's not something, I've never done before, so it's just kind of hard to get in the habit of.

However, I also believe that, as mentioned above, she assumed the tracking sheets would not provide her with any new information because she believed she already knew where she was strong and where she struggled. From in-class conversations and further questioning in the interviews, it did seem to me that she had a reasonable grasp of her strengths and weaknesses. However, during the follow-up interview we had the following conversation regarding questions on tests:

Amanda: Like, I think, I think I get it, but on tests I'm like, I get it wrong. And I think like, "oh yeah, I got it right." And I think I got it right, but I don't.

Researcher: Why do you think that happens?

Amanda: I dunno. I think – maybe it's because I think I'm doing [it] right the entire time, but I'm actually not, maybe?

This seems to indicate that either Amanda was less aware of her strengths and weaknesses than she thought, or that she succumbed to nervousness during tests and made mistakes (or possibly both).

Amanda also explained why she thought the tracking sheets helped her in the moment but not with tests and exams (when she had been using them consistently). She said that while doing her regular homework, at times she would notice from the tracking sheets that she had gotten both a homework question and a quiz question wrong for the same learning outcome. She then knew she needed to work on that outcome. Thus, the tracking sheets helped her "in the moment." However, for tests and exams Amanda preferred to just study all of the material and complete the whole review assignment. She wanted to be sure that she remembered how to do everything, even those learning outcomes that she felt she had mastered in the homework and quizzes. She did admit to cutting down on the work by completing alternating letters for questions. For example, if

a question had 2 a b c d e f, she might complete b, d, and f, assuming that a through f were all similar kinds of questions. As mentioned above, she also felt confident that she knew where she was struggling, and would spend more time on those kinds of questions, typically word problems. So, to her there was no reason to use the tracking sheets when studying.

Amanda also divulged two reasons why she faithfully completed all of the mathematics homework every night. First, she revealed that she feels guilty if she does not. She believes this guilt stems from growing up in a school environment where she would get in trouble if she did not complete her homework. Second, Amanda is very driven by marks. She wants to do well in all of her courses, and she believes that doing her homework consistently will help her learn the material, which will ultimately result in a better grade. Amanda cares about learning, but not for learning's sake. For her, learning is simply a means to an end of achieving a high grade.

Concerning whether homework should count for marks, Amanda said during her first interview that she did not care because she would complete it regardless. Yet, during her follow-up interview after the semester was over, her response was very different. At first she replied that she thinks people overall would prefer that homework is checked because that will force them to actually do it. However, I pressed her on what she personally prefers:

Interviewer: Ok, so, you personally, do you prefer, do *you*, forget about the other kids, do you prefer it for marks or not for marks?

Amanda: Ummm, I think it helps cuz if you're just doing it off like tests and quizzes, and that's not really your strongest part [...] then it does help. Like to... boost up your mark or whatever [...] Like, for completion.

Through further conversation, it was clear that since she had completed all of her homework diligently and had worked very hard, she felt she should have gotten some credit for it. I highly suspect this change of perspective was influenced by the fact that she got a lower grade in my course than she was hoping for, and she lamented the possibility that she may have obtained a higher final grade if there had been homework completion marks.

Furthermore, Amanda also changed her mind about students cheating on homework. In her Mathematics Questionnaire #1 and first interview, she initially said that students would just cheat if I were to make the homework for marks, and admitted that checking homework does not necessarily solve the problem of students not doing it. Yet, in her follow-up interview, Amanda said that she had thought about it more and she actually thinks that it is hard to cheat on mathematics homework. When asked why she thinks this, she replied, “Cuz, there’s, there’s so much work to do.... You show all your work and everything.” She said that she believes copying mostly happens in other classes such as science or English, when it is fill-in-the blank homework. She did admit that kids use other methods to cheat in mathematics class, such as showing the teacher a previous assignment and changing the date. However, it was quite clear that she now preferred that the homework be assigned completion marks, and believed that cheating would not be an issue.

Finally, Amanda’s understanding of self-assessment was more limited than I first thought. When asked if we had done any self-assessment in our class, she replied that we had done a questionnaire, and she also said, “[...] I think the people that [are] really into the, umm, homework tracking sheet [...] that probably helps them. Be like, yeah, ‘I really need to start doing my homework’ or [...]” From this answer, I initially concluded that she had a strong understanding of how the homework tracking sheets were meant for self-assessment. In her follow-up interview, I pressed her to explain how the tracking sheets were self-assessment. She replied,

Like if you got a zero, like, the zero, and you, you look back, if you look back and you’re like, “ok, I didn’t do any of my homework, that reflects my grade, like, I didn’t do well on the test or I didn’t do well on this.”

Through analyzing this response, I realized that Amanda only saw the tracking sheets as self-assessment because they could remind students that not completing homework is detrimental to success. Although she had talked about how the tracking sheets could specifically show students which learning outcomes they had mastered and which they still struggled with, she did not identify this as self-assessment. As with William’s view of self-assessment, this points to an interesting distinction between self-assessment of

students' work habits in a class, and self-assessment of students' understanding of course content. I will elaborate on this in Chapter 5.

4.4. Sarah

From my experiences with her in class, Sarah is a creative, bright, outgoing student who speaks her mind. She said she does well in her school subjects, except for mathematics, which she finds to be more of a challenge. In the first half of the semester, I was unsure as to how much of the homework she was completing and I also did not know whether she was completing the homework tracking sheets. If she was given time in class, she would often work hard on her homework, and on occasion she would ask questions. I did know that she was getting help with the homework from a friend in the class who was an "A" student; however, I did not know how regularly this occurred. Also, I did not really notice whether she filled out the tracking sheets in class, and the ones that she handed in seemed only partially complete.

During the second half of the semester, something seemed to change. I noticed that Sarah had started to copy down the homework onto her tracking sheets every day. One day I was in a rush because class was almost over, so I quickly wrote the homework up on the board without the learning outcomes. She immediately asked if I could put it up on the homework board with the matching learning outcomes. It seemed like she had become more serious about her homework and the tracking sheets. These observations were confirmed through her surveys and interviews.

I chose to interview Sarah because she seemed like a student who fell in the middle of the spectrum. According to her surveys, she was doing the homework maybe three to five days a week, not always completing all of it, and she had started to do the tracking sheets. Sarah also gave very interesting answers on her Math Questionnaire #1. When asked if she marks and codes her homework according to the tracking sheets, she replied "yes, I do, because I find that it's useful as long as I complete all questions." Also, when asked whether she would prefer a class where she is forced to do homework, she replied "no, because everyone has days where they just don't have the time to do it, and [homework] is to help yourself, not the teacher." Finally, when asked to explain why I was

giving her freedom over her homework, she replied “[because] we should understand that practice is how you get better, and that homework helps you and isn’t just something that’s annoying.”

Through her interviews, I discovered that Sarah has many strong ideas about homework, both about homework in general and about the homework in my class. First, I discovered that although she dislikes homework (she was very vocal about this), she does, in fact, value it. She told me,

Well, of course, first, it's a pain, but I totally understand how like, you need practice to, to learn how to do it, like way more than just doing it in the classroom. I get why we have homework, because you have to be able to do it on your own [...] for me homework is important.

She understands that it is important that she does her homework because, as she told me, “if I don’t do the homework, it means I’ve had no alone practice time”, and she believes that alone practice is valuable for her learning. She has also come to recognize that although she may have understood the lesson during class, this does not necessarily mean she will be able to do the questions at home. She candidly described this to me, saying,

Even if you think you know the notes, I swear like, the, the way your brain works is different at school than at home because you'll get it at school and it's all good and as soon as you're sitting at home in your room, it just, it just doesn't work and [...] like I, I don't know, so even if you do get it on the notes or in school, I think it's still important to practice at least a couple at home.

However, I also realized that Sarah had very strong adverse opinions of my homework system at the beginning of the semester. She told me, “at first I didn't like it cuz it was different” and said that she constantly complained about the system to her mom. So, perhaps partially because she was not thrilled with the homework system, she did not fully engage with it in the beginning of the semester. There were numerous issues with how she was initially using it. To begin, she said she was only semi-regularly completing the homework assignments, and when she did complete them, she would often skip questions. Or, she told me, “I would get lazy near the end of the questions, so I wouldn't do any of the last learning outcomes.” She later realized this was a problem because,

explaining to me, “I don’t know if I know that stuff.” However, other times she was not lazy, she simply overestimated her own understanding of certain concepts. Talking about the beginning of the semester, she said “that’s where I did the [overestimating] of myself, because I wasn’t seeing the sheets and I was like, ‘I don’t need to practice it.’ So, then, I wouldn’t do it because I didn’t have to, but it wasn’t because I was lazy; I thought I was ok with it.”

In addition to not completing all of the homework, how Sarah was utilizing the tracking sheets was also problematic. First, she would often not bother to get help with the learning outcomes that she was struggling with. Second, she was not keeping track of where she received help. “When I did get help, with [my friend] and stuff, I didn’t mark that I was getting help a lot of the time [...] I would just do the check mark, and then I found those ones were the ones that I, like, didn’t get as right on the test.” She assumed she was good to go because she got them right with help, so she put a check instead of an H, and did not bother to try any additional questions on her own.

However, Sarah did not hold these attitudes toward the homework system and engage with it in this manner throughout the whole semester; she stands out from the other students because she underwent a complete transformation in her opinions, attitudes, and behaviours regarding the homework system. In fact, she said numerous times during her interviews that she is going to miss this system next year: “I think [...] it’s gonna not be the best switch back to [the regular homework system], but I’ll get used to it. But yeah, if I could, I’d stay with this for next year.” When I later asked what her ideal homework system would be, she replied, “actually, I think, honestly, like, this is probably the best one I’ve had.”

It was ultimately her low overall class percentage and poor in-class quiz marks that triggered Sarah’s transformation. Although she was receiving many scores of Partial Mastery (PM) and Needs Improvement (NI), she did not fully realize how poorly she was doing. She said, “when I did see my mark, [meaning the overall percent grade], it was a good reality check, and I think if I hadn’t of seen my mark [meaning grade], I mighta stayed how I was.” Additionally, when I added the quiz section to the tracking sheets, she found that she was failing many learning outcomes on the quizzes and began to ask herself,

“how am I [...] gonna get better at this?” She realized she had not started off so well in the class and decided that if she wanted to improve, the homework tracking sheets were her best option. She told me about the first time the homework tracking sheets really helped her; she was working on questions concerning the surface area of a cylinder, which she had always struggled with in her previous mathematics classes.

I was like “oh, I can’t get this.” And then when I looked at the homework [tracking sheet] [...] to mark that I couldn’t get it, I was like “whatever” but then I looked and the whole learning outcome was “Surface Area of a Cylinder” and I got every one of them wrong. And I was like, “I still don’t know how to do that!”

She also realized that she had to fully engage with the homework tracking sheets in order to get any benefit from them:

I do them here and there but then I just [...] like it doesn’t work unless you do all of them, so then I was like, oh okay, I either put everything into this and stick to this style because I don’t think you can do like back and forth, you have to do everything and put it on the homework sheets, you just have to get into the habit of it basically [...] So then I stuck to that, and then the results I was getting were actually, like, accurate [...] so instead of doing [...] homework every couple days, if I did it all week, I knew exactly which learning outcomes I need to do and which ones I was getting.

If she did all of the homework, she did not miss any learning outcomes, and she knew exactly where she excelled and where she struggled.

Sarah began to respond to the improved feedback she was receiving from the tracking sheets and engage more meaningfully with her daily homework. “I try to make sure that when I’m doing my homework I have, I have everything completed now, every time. Like if I do an X, I’ll ask [my friend] about it later, and then replace it with an H.” She realized that it was very important to put H’s instead of checks, as she had originally done, so that when studying for the test, she could see which questions with which she’d received help. She also mentioned that, on the odd occasion where she did not complete all of the questions for a particular night’s homework assignment, she would complete those questions on a later day so that she would know how she was doing on those learning outcomes.

Furthermore, Sarah appreciated how the tracking sheets made her review more efficient. “If I needed to study, I know exactly what I need to do in the quickest time possible, like that makes it easy to study.” Studying was now completely different from what she was used to: “normally you think of studying as, like, cramming - doing the chapter review and nailing everything down. But this is more like [...] [it] points you in the right direction and you can pinpoint exactly what you need to study.” Not only did Sarah use the tracking sheets to determine *what* she should study, she told me she also used them to determine how *much* to study:

I basically base my performance on the learning outcomes sheet, to how I'm gonna do on the tests like, because [you] know how you improve, slot by slot? Basically, I look at my last slot and see how the test is gonna go, or if I have to, like, clean up my act the night before.

Sarah also found the tracking sheets exceptionally useful when studying for the final exam because they made it more manageable:

Studying for the final exam [...] that's probably when I used the homework charts the most. Cuz I got them all together and then I could see exactly what I had [...] cuz it seems like such a big thing, but then when you have it all in front of you that you can look at, it seems more like a task you can actually defeat [...] And then you remember where you struggled and then you can specifically find the pages. And, I think that really helped too.

She made a master list of all of the learning outcomes she'd struggled with and tried some extra questions for each outcome on her own. If she was still having trouble with one, she wrote down questions to do with her friend the next day. The tracking sheets also helped her to not overestimate her abilities, because they explicitly showed her that she had struggled with and received help for many learning outcomes.

Sarah pointed out that, unlike previous homework systems, this homework system promotes learning from mistakes, even mistakes made on tests. She compared it to other systems, saying, “[in previous years] it was never like ‘oh, I got this one wrong, let's work on that next time’ it was just, ‘I got three wrong, oh well.’ But now, with this, you see, ‘I got 8.5 wrong and 8.6, ok, so now I know for the provincial, 8.5 and 8.6 are what I'm gonna

work on.’ ” In contrast to math 9, Sarah felt like the homework in math 10 was a tool for learning and improving.

It’s more of like, I feel like it’s an opportunity more than a chore now [...] It’s an opportunity to get the next 8.5 question right, does that make sense? Instead of like, in grade nine, “oh, gotta get those 10 marks, you gotta get it”. This year, it’s, “I can get this learning outcome, and that’ll pay off on like the next question or next test.”

In fact, Sarah talked at great length about her experiences with homework in mathematics 8 and 9, making additional comparisons to mathematics 10. In mathematics 8, her teacher told the students to do their homework but she never checked it. So, Sarah did not do any of the homework. In grade 9 the teacher did not check it, but gave a sizeable quiz on the homework every single day at the very beginning of class. All of these quizzes were for marks, “so if you didn’t learn it in class, you’d teach yourself that night and understand, finish the homework, or you’d end up failing the quiz.” She did not like this because “it piled up” and she found it extremely stressful, telling me “you had to understand the homework, and if you needed extra help, there was nothing you could do.” Sarah feared that if she got too many zeros on the quizzes, it would pile up and affect her mark. She said that almost all of the students, including her, tried to cheat on the quizzes. She justified why she felt it was ok to do this, saying,

Like, you would wanna get the marks if you can, cause there’s no other way you can, you know? Like [...] I don’t think I’ve ever cheated on like a serious test, but when you have the same quiz every single day, it doesn’t become such a big deal, it just becomes ten marks you can get to bump up your mark.

She described her view towards homework in this class as “obligation – you just have to know what to do, to be able to get the 10 marks.”

In stark contrast to what she had experienced in grade 9, Sarah greatly appreciated the autonomy this homework system afforded her; she talked about it continuously throughout her interviews. She enjoyed being able to choose which questions she would or would not do, and described the system as “more flexible”; students who did not need to do the homework did not have to, whereas students who struggled could do extra questions. Although her math 9 teacher did not actually check

homework, Sarah still felt forced to do it because “if you wanted to get the 10 marks, you didn’t have a choice, you had to do the homework.” However, in mathematics 10, Sarah said that it actually felt like the homework was for her, “cuz I choose to do it.” She told me, “even teachers who make you do it, they’re like, ‘yeah, but it’s *for* you.’ Cuz, like, I’ve always understood it but now[...] I know it’s for [me] and now I *feel* like it’s more for me.” She clearly distinguished between the difference from grade 9, saying, “I needed those 10 marks [...] So it was for me but it was cuz I *had* to.” Again, this seems to clearly indicate that Sarah’s perception of autonomy was increased by the provision of action choices, in line with the research done by Reeve, Nix, and Hamm (2003).

However, as I will discuss in chapter 5, Sarah also realized that while autonomy can be a blessing, it can also be a curse. She explained, “I really like getting to choose the questions [...] at the same time [...] laziness can take advantage of me.” She appreciated having choice, but realized it also allowed her to slack off; this affected her the most during the first half of the semester. She told me she can be a very temperamental student and thus her mood can vary greatly from day to day. On days when she was not in the best mood and did not feel like doing anything, the autonomy provided her with the opportunity to opt out. Because she was not being forced, she chose not to complete her homework.

Thus, in addition to her transformation regarding her behaviour and attitudes toward the homework system, Sarah was also able to overcome the curse of autonomy and began to understand responsibility. She gradually realized during the semester that she could only blame herself for her poor performance, and that it was her job to fix it. She told me after the semester was over, “I did learn a lot of math, but I learned a lot about like, in the class, what it takes to [...] be a student and carry your own weight and be successful that way too.” So, it seems that the autonomous self-assessment encouraged Sarah to own her learning and actually promoted further autonomy. Heritage (2009) proposed exactly this, that self-assessment encourages students to take control over their learning, while Stallings and Tascione found in an empirical study with their own students that self-assessment indeed promoted learner autonomy (1996).

Finally, Sarah came to realize of her own accord during her first interview that the homework tracking sheets could be identified as self-assessment. When initially asked to describe self-assessment, she talked about having to reflect on her own work habits and responsibility. She said self-assessment is honestly thinking about how you're doing in a class and what you need to change (for example, study more or try harder). When asked if we had done any self-assessment in this course, she said, "yeah [...] That's what made me, like, start doing learning, using the homework sheet and then start studying, like basically, yeah. I've, I try to pay attention to how I'm doing." She believed that paying attention to how hard she was trying was self-assessment, but at that point seemed to think of the learning tracking sheets as only learning, not as self-assessment. When I pressed further, asking what specifically we had done in class for self-assessment, she originally talked about answering questions in her journal. However, she then paused and a light bulb seemed to go on. She continued, saying,

But, I basically, every time I look at the learning outcomes I self-assess myself, right? So, it's just not necessarily writing it down and handing it in to you. But I'm thinking, "ok, I'm alright, or I need to do something" you know? And I think, yeah, that's mainly the learning outcomes, all about self-assessment because it's all right there for you to know how you're doing.

Sarah came to fully realize that the tracking sheets were meant to help her use the homework as self-assessment of her own understanding.

4.5. Erin

From my observations, Erin is a bright, pleasant, hard-working student. She utilized the homework system in a manner close to what I intended, and she found it extremely helpful for her learning. From the beginning of the semester, I was confident that she was doing her mathematics homework because she was doing very well in the course and because she periodically would ask me very specific questions about the homework. Furthermore, I was also confident that Erin was doing the homework tracking sheets, because at times she would ask me which learning outcome matched a certain question. Also, if she could not see from her desk, she would come up to the homework

board and copy the homework questions into the appropriate learning outcome boxes on her tracking sheet.

I chose to interview Erin for a few reasons. First, as mentioned above, from my observations, she immediately stuck out as one student who had actually bought into the homework system and was benefiting from using it properly. She confirmed this in her Math Questionnaire #1, saying that she was doing the homework on a regular basis and that she was also doing the tracking sheets writing, “ I actually finds it helps me a lot.”

Second, she gave a very interesting response to another question on the Math Questionnaire #1. When asked to explain why she thought I suggest that she mark and track her homework according to the learning objectives, she gave the following response: “It tells us exactly what we need to work on, what [our] strengths and weaknesses are. I actually really like this system, it feels more organized.” I was very curious to know why she thought it felt more organized, and to find out with what she was comparing it.

I learned much about Erin through interviewing her. In her first interview, she confirmed that she was indeed completing the homework and tracking sheets regularly. In her follow-up interview, I learned that at the end of the semester she actually changed how she used the tracking sheets; I will discuss this in more detail below. For the majority of the semester, she fully used the tracking sheets in the manner I had intended.

Not only was Erin completing her homework and the tracking sheets, she was responding and engaging with the feedback it provided her. She told me that she often would do her mathematics homework right away when she got home from school because it was fresh in her mind. She would write key points from the lesson at the top of her homework page to help herself. Then, once she had done the homework and could see which questions she did not understand, she would either get help from a friend who had already done the course, or ask her classmates or myself for help the next day.

I learned that there were numerous reasons why Erin liked my homework system. First, learning outcomes are very important to Erin. She found my homework system “more organized” because of them. Speaking about her previous mathematics class, she said,

[That] system, I found it really unorganized 'cuz I didn't know exactly what to ask. Like, I know I'd get some questions wrong but I didn't know [why], like, it'd just be, like, a number six question or something, like, "oh, I keep getting number six wrong."

Whereas, with learning outcomes, if she got a question wrong, she could clearly see what topic she was struggling with. In fact, without realizing it, Erin had been asking for learning outcomes in her previous mathematics classes. She described an interaction with one teacher:

Like, a lot of teachers, like, I'd ask in grade 9 I think it was, this teacher, Mr. _____, and I'd ask him and be like, "is there, like, a name for these types of questions? Certain, like, a pattern or something?" He's like, "no, they're just [...] its math question[s], you gotta know them all." It's like, "ok." He's like, "it's either written or one answer, right?" It's like, "that's no information at all; I don't even know what you're saying."

The teacher simply told her the format of question, whether it was multi-step or one answer, yet she really wanted to know what learning outcome it covered. She told me that a lot of students just think questions are questions, but she finds it helps her a lot to know specifically which topic each question covers. She would always read through the learning outcomes for each chapter. Indeed, it was clear from the language she used during the interviews that she was very familiar with them. In fact, she told me that she could usually identify which learning outcomes were covered by extra questions in her textbook and could also use the learning outcomes to predict which kinds of questions would be on the tests.

Furthermore, like Sarah, Erin repeatedly stressed that because of my homework system, she knew exactly what to do when completing her regular homework and studying for tests. First, the tracking sheets informed her to either look over specific homework questions again in her textbook, try other similar questions on her own, or seek extra help from a friend or the teacher. Second, the homework system helped Erin know what to do when studying for tests.

And then, like same for, like, studying, like, I'll know exactly what to study so I'm not doing the whole review sheet and, like, just wasting time on questions I already know how to do [...] when you give us review

sheets, I like that you label them, like what learning outcome it is, so I know which one to go to first.

She compared this with her previous experiences studying for tests,

They used to give us, like, a review package, it was really, it was actually pretty thick but then, like, they'd just [be] like, "go at it. Whichever questions you need to do." But then, I wouldn't know which questions I have to do.

Although her previous teachers had given her the freedom to work on whatever she needed to review, she actually did not know what she needed to do. Thus, she would just end up trying to finish the whole package in one evening and become extremely frustrated. In my class, she knew exactly which learning outcomes she was struggling with, and focused her studying on those. Thus, her studying was much more efficient; she would often spend only an hour with her review sheet and be finished, whereas last year she would often spend three or four hours reviewing.

Third, because of this system, Erin felt that she knew which questions to ask in class. In previous years she would be frustrated and feel like she did not know how to do any of the homework, but then she realized that "actually, I knew how to do some questions, I just didn't know which questions, like the right questions to ask." When I asked her if she feels like she knows what to ask in my class, she replied, "Yeah. Like, umm, like, I'm asking a lot more specific questions." She attributed this to the tracking sheets.

Additionally, Erin immediately embraced the autonomy that my homework system afforded her. She made it work to her advantage concerning when she did her homework and also how much homework she did. Erin is a very busy student; she is involved in numerous extracurricular activities including school clubs, dance, and volunteering. She would try to do her mathematics homework every night, but sometimes simply did not have time. However, because this was an autonomous system, she was able to easily catch up on everything over the weekends.

Concerning how much of the homework she did, she said,

Well, at the beginning of the year, you said that we could, yea, just do as much of it as we need to until we understand it. And, yea, that's what I do [...] like, if I understand it in the lesson, then I know I'm good to go, but then, some questions, like the word problems, I have to keep going at them, until I understand them.

She told me she would cut down on the amount of homework she had to do in two ways: first, as with Amanda, if there were numerous exercises within one question, she would only do alternating letters. Second, if there were questions that covered learning outcomes she had mastered, she would skip those questions.

Erin stands out from the other students in an important way; from my observations and what she told me, it seems she is very cognizant of her own learning: knowing how she learns best, analyzing which learning strategies work well for her, and identifying tricks and tools within the curriculum and classroom setting that can accelerate her learning. She is receptive to feedback and willing to adapt when needed. She did this within the homework system. For example, Erin noticed that in multi-exercise questions, the latter exercises are usually the most difficult; for example, if a question had exercises a) through h), then g) and h) were likely the hardest. Thus, because the homework system allowed her to do so, she always made sure she tried those last exercises, but might skip some of the earlier ones if she was getting them right.

Another example is that, at the beginning of the year, Erin said that she completely skipped some learning outcomes in her regular homework because she was confident that she already knew how to do them. However, when she got those questions wrong on a quiz in class, she realized that she actually did not know how to do them and found that she had overestimated her own understanding. After this happened, she changed her strategy. She started completing all of the regular homework as an initial assessment of where she excelled and where she struggled. Then, once she saw that she had actually mastered certain learning outcomes in both her homework and in classroom quizzes, she felt comfortable to skip those learning outcomes when studying for the chapter test.

Near the end of the year, Erin again changed how she engaged with the homework system. She told me that she stopped fully using the tracking sheets; she would only track the questions that she struggled with and would not bother with the others. She would still

do all of the homework questions and would check all of her answers, but she would not put check marks on her tracking sheet by the ones she got right. At first she said that she changed how she used the tracking sheets because some classmates told her she did not need them. However, further prodding revealed what was likely the underlying reason; by now she was more aware of which questions she struggled with (usually the word problems), and decided that she need not bother tracking the questions she got right.

Yet ironically, although Erin was clearly using the homework tracking sheets for self-assessment and found the feedback extremely useful, when I asked her specifically whether we had done any self-assessment in the course, she did not identify the homework tracking sheets. She mentioned a summary survey I had apparently given that was supposed to show the students which outcomes were good or bad, and she identified that as self-assessment. In fact, when I went so far as to actually ask if the tracking sheets were self-assessment, she said “no”. So, despite using and appreciating them for self-assessment, Erin did not actually identify the tracking sheets as self-assessment. As with Jason and William, the question of why she did not identify them as such leads to an important theme concerning how students view and define self-assessment in the classroom. I will discuss this in greater detail in chapter 5.

Finally, when asked about how I could improve my homework system, Erin replied that she would not change the descriptions of the learning outcomes because, as mentioned above, she found that they really helped her. She did divulge that at the beginning of the course she had been very anxious about the homework system because it was so different. However, as she started trying it out and experiencing success, she completely changed her mind. She concluded at the end of her follow-up interview that she liked the homework system as it was, saying, “I just, yeah, I wouldn’t change anything.”

4.6. Joshua

From my experience with him in class, Joshua is a pleasant, mature, hardworking student. In many ways he exemplified how the homework system used in this study could be utilized to its full potential. I was confident from the beginning of the semester that Joshua was doing all of the homework that I assigned on a regular basis; he was doing

well on quizzes and tests, was engaged in classroom activities, and was periodically asking questions about the homework. I was also fairly certain from the beginning of the semester that Joshua was consistently completing the homework tracking sheets. Whenever I gave the students time in class to fill them out, I would see him working on them, and when I asked students to hand them in before a unit test, his appeared to be mostly complete and done sincerely. I later found out through interview that he actually had not used the homework tracking sheets for most of the first chapter, but had used them for every subsequent chapter. I will discuss this in more detail below.

I chose to interview Joshua for several reasons. First, his in-class behaviour exemplified another extreme type of student – the complete opposite of Jason. He seems to be an extremely mature, hardworking student, who not only engaged fully in all classroom activities, but also actually seemed to enjoy them. He was a leader during group work activities, helping students to stay on task and making sure that all members of his group were learning from the activity. In fact, he would regularly teach other students the concepts; later in the semester, students would flock to him during group work or review times and he would lead mini-tutorials sessions. Also, as mentioned above, Joshua exemplified an extreme type of student regarding his behaviour concerning homework. He fully utilized the homework system in the way that I intended. He confirmed this on his Math Questionnaire #1, saying that he tried to do all of his homework on the day that it was assigned, and that he also regularly completed the tracking sheets.

I learned quite a bit about Joshua from his interviews. First, I learned that he had actually not used the homework tracking sheets for most of the first chapter. As with Amanda, he explained that, “it was an extremely different system [...] And, it’s almost like I forgot, like I couldn’t remember. It was, it was like [...], it was very new.” However, in contrast to Amanda, who started using the tracking sheets at the beginning but then gradually stopped, Joshua began using the tracking sheets near the end of the first chapter and then continued using them for the duration of the course. When asked why he began to use them, he said that he saw the benefits of doing them. He tried doing them a few times and liked it, and so he began to make a conscious effort to remind himself to do them.

Furthermore, as with Erin, Joshua responded according to the feedback that he received from the tracking sheets. I asked what he would do if he looked at his tracking sheet and saw that he had gotten all X's or H's for a certain learning outcome. He replied,

I'll go into past worksheets and past textbook work and [...] maybe the questions that you didn't assign that are very similar, I'll do some of those [...] And then if I really don't get it at all, I'll ask my brother or I'll ask my dad to help me with it.

His brother and dad are good at mathematics, but if they did not know something, he would then ask me. This only happened a few times.

Joshua stands out from the other students in a very important way; ultimately, he cares most about learning. Although he does care about his grades, it was clear from his surveys, interview responses, and behaviour that learning is even more important to him. He talked at great length comparing his French 10 class to his French 9 class and said, "like, I'm not learning nearly as much as I used to. And that, like, I really enjoyed learning all that stuff. It was [...] I just really liked all that information, and I could apply it." He also said that he enjoyed my class because he had to use his brain a lot.

Indeed, Joshua truly enjoys learning. This greatly affects how he views and engages with homework. When asked if he would prefer a class where the teacher forced him to do homework, he gave the following response: "No, I would not prefer where the teacher forces you to do homework because it causes students (myself included) to stress and sometimes just do it to get it done, not learn from it." He explained that because of time restraints, and work from other classes, when forced to do his homework his attitude becomes, "ok, I'm just gonna get it done, I'm not gonna really pay attention to what I'm doing. I'm not gonna absorb it, I'm just gonna do it." He does not like this. He wants to learn from his homework. To him, that is the whole purpose of homework. He talked at great length about how the homework in my class really helped him learn the mathematics, in contrast to the homework in his previous mathematics classes. On his Mathematics Questionnaire #2 he wrote, "the fact that we used homework as a learning tool was much better than the standard approach of doing homework and never looking at it again." He explained that often in his other classes (including his previous mathematics classes), he would only look at his homework on the night that he did it, and did not use it to study for

quizzes or tests; he usually just completed the review assignment or looked up other questions in the textbook for practice. I asked him if he feels like homework is pointless at times, and he replied, “Yes. Sometimes I think we just do homework to do it [...] Like, we just, it’s sort of like we have to.” However, in this class, because he had all of his homework written out on one page, he found it very easy to go back to specific homework questions and review them when studying for a test.

This homework system also showed him exactly which learning outcomes he was struggling with, and allowed him to focus his studying on those areas. Joshua explained specifically how he would study in my class, which was similar to what Sarah was doing by the end of the semester:

I bring out my homework tracking sheet and I compare the quizzes on the homework tracking sheet and the [previous] tests and stuff, and quizzes in [my duotang]. I sort of make a list of what learning outcomes I really need to review and then ones that I’ll just quickly touch on just to make sure I, I know that [...] The steps and stuff [...] And then I’d focus on the ones that I don’t understand.

Joshua gave two other reasons why he appreciated the homework system so much. First, although he found he was spending about the same amount of time on his homework as in his previous mathematics class, he found that he used the time much more wisely in mathematics 10; he could do less or even skip questions for learning outcomes he had already mastered in previous homework and focus on the areas where he was struggling. He compared this to his previous mathematics classes, “[...] in like, previous years I find myself just doing stuff that I really know. And, the easy stuff! [...] And then maybe if I really don’t understand the hard stuff, I’d just skip it. So, in, because I feel like, ‘ok, I’ve done all this math now, now I have to do these!’ ” He would waste time working on easy questions he knew how to do and might give up by the time he reached the harder questions, whereas in mathematics 10 he focused his homework time on the harder questions.

Second, Joshua places great value on practicing everything he learns in class; he repeatedly talked about the necessity of practice throughout his interviews. He greatly appreciated that the homework in mathematics 10 could be used as practice, since it was

not collected for marks. He described to me the difference between two homework systems in French classes he'd been in, one where the homework was marked and one where it was not:

Like [...] always, in French 8 and 9, I'd always make my mistakes on my homework [...] And then I'd, I'd like, I'd be ready for the test because I knew what the mistakes I'd made but [...] [My French 10 teacher] takes it in for marks, so if you really screw up on something, then it's gonna bring down your mark.

He greatly lamented the homework being for marks because he was penalized for any mistakes he made, instead of simply being able to learn from them.

So, Joshua strongly believes that homework should not be for marks. As already stated, if homework is not marked, he finds he is able to focus on learning from his homework and not just rushing to complete it; additionally, he can use homework for practice since he is allowed to make mistakes without consequence. Furthermore, when I told Joshua that many students said they prefer that homework be for marks because then they will actually do it, he replied,

Yeah. But then they can just, if they're forced to do it, they, like I know that kids, if they're forced to do it, they'll just go in the back and [...] cheat. They won't learn anything from it [...] So, I almost think, like, that's just as bad as not doing it [...] They aren't absorbing anything [...] They'll just do it to get it done.

Thus, for Joshua there is no compelling reason that justifies homework being for marks.

As with Sarah, not only did Joshua fully use the homework tracking sheets for self-assessment, he also identified them as such. In fact, when I asked him in his initial interview what he thought my purpose was for homework, he actually differentiated between self-assessment and practice, saying,

Well, I think your approach to homework is more, you use it as, you're using it as a self-assessment tool. Compared to a lot of other teachers [...] Because I don't think there's, I don't think like some of my previous math teachers really looked at homework as a self-assessment [...] more just extra practice.

Without any kind of prompting, Joshua spoke of the homework as a tool for assessment several times throughout his interviews. He also mentioned that he appreciated that I added the quiz section to the homework tracking sheets. When asked why, he explained how it helped him: “I think that with the learning outcomes all separated on the homework tracking sheet [...] It’s nice to compare your homework and your quiz right next to each other [...] And it really helps you see, ‘ok, this is what I need to work on.’” He found that the daily quiz section enhanced the self-assessment that the tracking sheet provided.

As mentioned above, Joshua fully used the homework tracking sheets for self-assessment. He would first complete all of the regular homework. But, as with Erin and Amanda, he might only complete alternating letters for multi-lettered questions; he might also do more or less of a specific question or learning outcome, depending on how well he was understanding it. He would then track how he did on the whole homework assignment on his tracking sheet, and would respond accordingly if there were learning outcomes with which he had really struggled. Like Erin, he completely embraced the autonomy that my homework system afforded him and fully utilized it to improve his learning.

Like Erin and Sarah, Joshua greatly appreciated the self-assessment that the learning outcomes provided him, because when he would get questions wrong, he would “know what to do.” He compared this to his previous mathematics classes, saying,

[for] a lot of the tests in grade 8 and 9, you’d get things wrong but you didn’t, they weren’t classified, so you, you almost didn’t know what concept you weren’t understanding [...] and you didn’t really, exactly know what to study [...] It’d just be like, “ok, then I guess I have to study a little bit of everything.” And then you might be studying stuff that you really understand and you don’t need to study, instead of doing the stuff that you’re really struggling with.

Because of the learning outcomes, Joshua would then know exactly what to study.

Joshua had a very positive overall experience in math 10; he was one of only a few students who were able to fully embrace change, including the new instructional style, assessment scheme, and homework system. In his first interview he told me, “I actually enjoy math this year. And I’ve never really enjoyed math class, ever [...] Like this year I

find I'm actually wanting to *learn* math [...] Which I don't typically want to do [...] because I find it extremely boring." When asked about his ideal homework system, he said, "I actually like the [...] the [...] the option of [...] doing it. And, I like the choice that we get which, of which learning outcomes we really need to work on [...] And I think that's basically the ideal homework system." I pressed him further and asked if there would be any ways I could improve my homework system. He replied, "I was actually very happy with the way it was organized [...] I can't really think of anything that I'd recommend changing off the top of my head. Because, it really worked well for me."

4.7. Summary

As is evident from the above descriptions, the six students engaged with my homework system to varying degrees. Jason and William engaged minimally, whereas Joshua and Erin engaged fully. Amanda engaged fully near the beginning of the semester but began withdrawing her engagement, and by the end of the semester she was engaging minimally. Sarah engaged partially near the beginning of the semester, but she eventually realized that something needed to change and began fully engaging until the end of the semester. Each student's particular experience with the homework system stemmed from a unique amalgamation of academic and personal factors. Nevertheless, as already mentioned, several themes are apparent across the students' varying experiences; these will be described and analyzed in Chapter 5.

Chapter 5. Results and Cross-Case Analysis

While the previous chapter describes each student's unique, personal experience with the homework system, what follows is a description of six themes that were apparent across the different cases. These include self-assessment of work habits versus conceptual understanding, student behaviour and value of homework as self-assessment, benefits and detriments of autonomy, student goals and past experience, resistance and adaptation to change, and finally, the influence of marks and grades. Analysis of these themes sheds further light on understanding the varied levels of students' engagement with the homework system.

5.1. Self-assessment of Work Habits versus Conceptual Understanding

A few times throughout the semester, I explicitly explained to the students that the focus of my research was using homework as self-assessment. I assumed that the students understood this and would consequently identify the homework and tracking sheets as self-assessment. So, I was surprised to discover during the interviews that this was largely not the case. As already mentioned in chapter 4, only two students, Sarah and Joshua, actually identified the homework and tracking sheets as self-assessment of conceptual understanding, as was intended. Joshua completely understood this of his own accord; he grasped that the homework tracking sheets provided self-assessment because they could show him clearly which concepts he did or did not understand. Sarah also came to this realization during her interview, as described in chapter 4.

Yet all of the students except Joshua described self-assessment primarily in terms of work habits and not conceptual understanding. Jason defined self-assessment as "judging ourselves on how we're doing in class." Sarah, Erin, Amanda, and William all talked about questionnaires and surveys from other classes where they had to evaluate their own effort, attitude, and responsibility. Examples of questions on these surveys might be as follows:

How would you rate your effort in this class?

How often do you do your homework?

Do you come to class prepared?

How is your attitude towards this class?

How well do you work with other students?

Prior to her realization about the tracking sheets as self-assessment, Sarah only talked about self-assessment of work habits. Furthermore, I was most surprised that Erin did not identify the tracking sheets or homework as self-assessment at all, because she was fully utilizing them for self-assessment in the manner I intended. She mentioned a summary survey we had done about the learning outcomes, but not the tracking sheets or homework. As with the other students, it seemed that her previous experiences of self-assessment were a barrier to her identifying the homework as such. Amanda, however, did identify the homework tracking sheets as self-assessment, but only because they could be used to self-assess work habits. She described a situation where a student might be diligently filling out the homework tracking sheets but not completing the homework. If the student was not doing well on his tests, he might look at his tracking sheet, realize that his poor performance was due to not completing his homework, and decide to start doing it. Amanda never talked about the tracking sheets as self-assessment of one's understanding of specific mathematical concepts. Finally, William, also describing work habit surveys from other classes as self-assessment, responded that we had not done any self-assessment at all in this class. So, the majority of the interviewed students did not actually explicitly view their homework as self-assessment, even though it was actively promoted as such.

As described in Chapter 2, the literature largely describes self-assessment as students' judgment of their understanding or performance as compared to specified learning outcomes, that is, self-assessment of conceptual understanding (Andrade & Valtcheva, 2009; Black et al., 2004b; Black & Wiliam, 1998; Wiggins, 1998). Yet my students largely perceived that self-assessment is only used for work habits. This has implications for future research, which will be described in Chapter 6.

5.2. Behaviour and Value of Homework as Self-assessment

Although it is interesting to note that most of the six students did not actually identify homework as self-assessment, a student’s inability to identify the homework as self-assessment did not prevent the student from engaging with it as such. There are two prevalent factors with which the students can be classified regarding homework as self-assessment: behaviour and value. First, did the student behave as if the homework was self-assessment? That is, did the student use it as such? Second, did the student actually value this self-assessment? The following table categorizes the six students according to these factors. Note that because Sarah and Amanda changed from the beginning of the semester to the end, they appear twice in the table; the bracketed words “beginning” and “end” indicate their categorizations at the start and finish of the semester.

Table 1. Behaviour and Value of Homework as Self-assessment

	Behaved as if HW was SA	Did not behave as if HW was SA
Valued HW as SA	Sarah (end) Joshua Erin	
Did not value HW as SA	Amanda (beginning)	Sarah (beginning) Amanda (end) William Jason

Joshua and Erin both behaved as if the homework was self-assessment and also valued it as such. Disregarding the very beginning of the semester when Joshua forgot to use the tracking sheets, both he and Erin engaged with the homework as self-assessment throughout the entire semester. They used the tracking sheets in the manner intended and responded appropriately to the feedback they received for each learning outcome: either seeking extra help, trying extra questions on their own, or completing less questions in future assignments. Although, as described in chapter 4, Erin changed how she used the tracking sheets near the end of the semester, she still continued to use the homework as self-assessment. Furthermore, both Joshua and Erin communicated through their surveys and interviews that they highly valued the homework as self-assessment. They both talked very positively about knowing exactly what to do – which

concepts to get help with and which to skip, what questions to ask in class, and what to study – because of this homework system. The self-assessment enabled them to use their homework time more effectively by focusing more on areas where they struggled, instead of wasting time doing repetitive questions that they already understood. Through in-depth conversation, it was clear that they both realized that their learning had improved because of the self-assessment afforded them from this homework system.

In contrast, William and Jason neither behaved as if the homework was self-assessment nor valued it as such. They did not behave as if the homework was self-assessment because, barring the rare occasion, they simply did not do the homework or tracking sheets. First, William rarely completed the regular homework during the semester and he never filled out the tracking sheets. Second, Jason almost never completed the homework or tracking sheets, except for a brief, desperate attempt several weeks before the provincial to try to improve his grade. However, although Jason claimed that he tried fully completing the homework and tracking sheets for that week and a half, I do not know how or if he responded at all to any of the feedback he might have obtained from the tracking sheets. I suspect that he did not since he stopped using the tracking sheets because he said they did not help him. I do not consider this brief attempt to be true engagement with the homework as self-assessment. In fact, I am confident that if Jason had been passing the course, he never would have tried completing the homework or tracking sheets at all.

Furthermore, it was clear that neither student valued homework as self-assessment. William did not see any reason to use the daily homework as self-assessment because he actually did his own self-assessment at the end of class; he would decide then whether he needed to do the evening's homework based on how much he thought he had understood from the in-class lesson. However, as described in chapter 4, even when he intended to do the homework, he usually did not end up doing it due to a variety of reasons. Second, Jason did not value the homework as self-assessment because for him the main purpose of completing homework is to obtain marks. Self-assessment involves learning, but Jason did not care about learning. He simply wanted to exert the very minimum amount of effort necessary to pass his classes, and did not care if he learned anything in the process. In fact, because his effort in my class concerning

both in-class activities and homework was almost non-existent throughout the majority of the semester, we could not even progress to any kind of meaningful conversation about homework as self-assessment during his interviews.

Amanda also never valued the homework as self-assessment; however, her behaviour changed. At the beginning of the semester, she behaved as if the homework was self-assessment by using the homework system in the manner I intended, simply because I told her to. Yet, although she regularly filled out the tracking sheets, she did not think that they helped her very much. She said that, at times, they did help her “in the moment” as she did her daily homework to see a specific learning outcome she was struggling with. However, for tests and exams, instead of using the tracking sheets to focus on her weaknesses, she preferred to just study everything to make sure she remembered it all. Ultimately, however, she actually believed that she already knew where she excelled and where she struggled, and so she did not value the homework tracking sheets for self-assessment because they were not providing her with any new information. Because of this she eventually ceased using the tracking sheets all together, and stopped behaving as if the homework was self-assessment.

Finally, Sarah also changed from the beginning to the end of the semester. She began the semester neither behaving as if the homework was self-assessment, nor valuing it as such. She didn't behave as if it was self-assessment because she did not consistently complete the homework and the tracking sheets. Furthermore, when she did do the tracking sheets, she did not pay much attention to any feedback they provided. She also did not value the homework as self-assessment because, like William, she would self-assess herself before doing the homework; she would often not do it because she thought she already understood the concepts. However, by the end of the semester, Sarah both behaved as if the homework was self-assessment and highly valued it as such. She started completing all of her homework and the tracking sheets on a daily basis. As described in chapter 4, she realized that she had usually overestimated her abilities when she decided not to do the homework and that she actually needed to do it daily. She decided that she needed to complete all of the learning outcomes for every day's homework so that she would then be able to see from the tracking sheets whether she

understood each outcome or not, and would be able to respond accordingly by trying extra questions or seeking help.

Thus, Joshua and Erin both behaved as if the homework was self-assessment and highly valued it as such, while William and Jason did neither. Amanda changed from behaving to not behaving as if the homework was self-assessment, and never valued as such, while Sarah changed from doing neither at the beginning of the semester to doing both by the end. Joshua and Erin, the two students who both behaved and valued the homework as self-assessment throughout the whole semester were the most successful under this homework system.

5.3. Benefits and Detriments of Autonomy

As described in Chapters 2 and 3, an autonomous environment was crucial for maintaining the integrity of this homework system. It became clear during data analysis that the autonomy played a vital role in the students' engagement with the system. A polarization became apparent for most of the students involved in this study; for some the autonomy was extremely beneficial, while for others it was extremely detrimental. There were a few exceptions, such as Sarah, where certain students experienced the autonomy as *both* beneficial and detrimental. The following table summarizes how the autonomy affected the interviewed students:

Table 2. Autonomy as Beneficial or Detrimental

Beneficial	Detrimental	Both
Joshua Erin	Jason William	Sarah

First, note that Amanda is not included in the table. This is because she did not perceive the autonomy provided. Although she had been told that she was being given complete autonomy and seemed to be aware of this when we conversed, she still perceived regulation over her homework completion. She explicitly told me that she is a student who will always do her homework, regardless of whether it is for marks, because she feels guilty otherwise. She even feels compelled to complete optional homework. She did not behave any differently in this class than in previous mathematics classes

where homework was for marks. So, Amanda continued to exhibit controlled motivation towards homework completion, despite the provision of autonomy. The only way in which Amanda did, perhaps, perceive and engage with the autonomy was that she stopped completing the homework tracking sheets. Had they been for marks, I am confident that she would have completed all of them. However, because the tracking sheets were something Amanda had never done before, perhaps she did not have the same built-in regulation compelling her to do them as she did with the homework.

Joshua and Erin both benefited immensely from the autonomy that the homework system afforded them. From the very beginning of the semester they both embraced the autonomy: not to avoid completing their homework, but to complete it more effectively. They welcomed the autonomy because they were able to decide how much homework they would do and when they would do it; to their benefit, they both made wise decisions. When Erin realized that her initial inclination to skip the learning outcomes that she thought she already understood was not working, she adjusted and began completing all of the learning outcomes. She then, as did Joshua, cut down on the homework by completing alternating letters for multi-part questions, and also completed less questions for certain learning outcomes if she saw that she was consistently getting them all right. Furthermore, Joshua and Erin took advantage of doing the homework whenever they wanted. Although they both made every effort to complete their homework nightly, at times busy school schedules and extracurricular activities got in the way. Thus, Erin was elated that she could catch up with her mathematics homework on weekends if needed, and Joshua greatly appreciated that he could postpone it for a night if he had a lot of homework or studying due in other classes. They both said that this greatly reduced their stress. Furthermore, Joshua noted that the autonomy allowed him to actually learn from his homework, instead of doing it simply to get it done.

Yet, while the autonomy was an effective catalyst for learning for Joshua and Erin, in complete contrast, it proved to be a barrier to learning for William and Jason. Both students exhibited extrinsic motivation because they were primarily motivated to act by external rewards. Since the homework was not marked or checked, both boys consistently did not do it. William did acknowledge that he should have been completing the homework regularly and lamented that he would have had a higher grade in the course

if he had done so. He did understand why he ought to complete it even though it was not for marks, and he seemed to wish that he was more self-motivated and self-regulated to complete it. Yet, because it was not for marks, there were simply too many reasons for him to not do it (as described in Chapter 4). So, while William was aware of the value of the homework, his motivation towards completing it was primarily controlled.

Jason views homework differently; from what he said in the interviews and surveys, it seems that for him homework is only an opportunity to gather points. He said that he wished the homework in my class had been for marks because then he would have had a reason to do it. To him, if homework is not for marks, there is no purpose in completing it. He has not internalized or integrated any other value of homework. Of note, it might seem that Jason overcame the barrier of autonomy when he briefly tried completing the homework and tracking sheets at the beginning of January, but I would argue otherwise. The provincial exam was looming in the very near future, and so it had finally become an immediate enough external motivator for Jason to respond. The exam was his last thread of hope for passing the course; he was desperate to pass it and was willing to try anything, including the homework and tracking sheets. Thus, his motivation was still controlled and not autonomous.

Sarah, however, experienced the autonomy as both beneficial and detrimental. At times throughout the whole semester, but particularly during the first half of the semester, the autonomy was a barrier to her learning. Because she had the option of not completing the homework or tracking sheets, she often chose not to for various reasons (as described in Chapter 4). She admitted in one of her interviews that the autonomy could be detrimental to her learning because it allowed her to slack off. Yet, Sarah's transformation from hating the homework system to eventually loving it was fuelled by the fact that she was able to overcome this barrier of autonomy. In response to seeing her low grade, she came to realize that it was her responsibility to fix it and that she needed to engage fully with the homework and tracking sheets. She tried doing so, experienced benefits, and so she continued. Sarah realized how the autonomy could work to her advantage; she was able to choose which questions to spend more time on, she could focus her studying on the appropriate learning outcomes, and she could complete her homework when it was convenient for her to do so. As Sarah experienced the benefits of completing the

homework and tracking sheets, she internalized and integrated their value towards obtaining a good grade, and moved from controlled to autonomous motivation. Sarah then truly felt that the homework was actually for her and not for the teacher, because she chose to do it of her own accord. In other words, her perception of self-determination increased as a result of being provided with autonomy support through action choices.

Sarah greatly appreciated the autonomous system because it was less stressful than her previous mathematics class where there was a marked quiz every day. Sarah also felt that an autonomous system provides suitable differentiation for classes with learners of diverse abilities; some students do not need to complete any homework whereas other students need to do extra homework. By the end of the semester, Sarah realized that autonomy can be both a blessing and a curse; if one uses it appropriately there can be wonderful benefits for learning, but if one cannot handle the responsibility given by autonomy, learning can be extremely hindered.

Thus, the students who engaged at the highest levels with the homework system were those who were able to embrace the autonomy as a catalyst to efficiently completing and learning from their homework. Ironically, it was only the students who were either already autonomously motivated to complete homework (Joshua and Erin) or became autonomously motivated (Sarah) that were able to benefit from the autonomy provided. The students who engaged with the homework system at the lowest levels were those for whom the autonomy was a barrier to learning; these students exhibited controlled motivation over homework completion.

5.4. Student Goals and Past Experience

In addition to exhibiting autonomous or controlled motivation towards homework completion, an analysis of the students' goals, both academic and otherwise, also helps to explain their engagement with the autonomous homework system. The autonomous homework system worked well with some of the students' goals and not so well with others. Previous experiences with other mathematics homework systems also shaped the students' views and attitudes concerning this homework system, depending on

whether they believed those systems had helped or hindered them in achieving their goals as compared to this system.

Beginning with Joshua, his primary goal for mathematics class (and school in general) is to learn. Concerning his goal for my class, he wrote in his Mathematics Study Habit Survey, "I would like to get a good grade in this class but more importantly I would like to leave Math 10 feeling that I learned something." It was clear during his interviews and from his behaviour in class that he has a learning goal orientation. Getting good grades is important to him, but it is a sub-goal that, in his mind, is simply a reflection of whether he has obtained his intrinsic goal of learning. Furthermore, Joshua is intrinsically motivated to learn as he told me that he truly enjoys acquiring new information and being able to apply it. For example, he found that he was not learning nearly as much in his French 10 class as he had in his French 9 class, and said, "I really miss that."

Joshua found that this system allowed him to utilize his mathematics homework as a powerful learning tool in a way that he had never been able to before. He talked about mathematics homework in previous classes as if it was a chore, something he was obliged to do each night, but never looked at again. He did not feel like he learned much from it. In contrast, this homework system helped him to clearly identify his weaknesses and take action to do whatever was necessary to master those learning outcomes. Indeed, this homework system unequivocally helped Joshua achieve his goal of learning, and so he viewed it as the ideal system for him.

In contrast to Joshua, Erin and Amanda had extrinsic, performance goals for my mathematics class, as they were primarily concerned with achieving the highest overall grade possible, ideally, high A's. Learning was simply the means to this end, and, unlike Joshua, was not actually the goal itself. Yet, although they each held this same goal, their very different experiences with previous homework systems greatly influenced how they engaged with my homework system and their attitudes towards it. First, Erin had found the homework in her previous mathematics class to be extremely frustrating; like Joshua, she would waste time doing questions she already understood and would spend hours stuck on questions she did not. Although she put an incredible amount of work into that mathematics class, she still did not achieve the grade that she wanted. However, with the

autonomous homework system in mathematics 10, she found herself spending much less time on homework and yet completing it in a more constructive manner; she “knew what to do” – where to focus her efforts and what to get help with. Erin finished the course with 91%. She was very happy with this grade, as it was significantly higher than her mathematics 9 grade. Because this homework system helped her achieve her goal of attaining a high grade in the class, she preferred it, claiming that she would not change anything about it.

Amanda, however, had had a very positive experience in her previous mathematics 9 class. The homework had been checked randomly for completion marks, and because she always had her homework done, she always received those marks. She also claimed that she had much less homework in that class than in mathematics 10, and that it was more straightforward; she found mathematics 10 to be much more challenging. Amanda achieved her goal in math 9, as she did get an A. However, in mathematics 10, for whatever reasons, she struggled much more and ended up with a B. This was not good enough for her, and so she did not achieve her goal for the class. After the semester was over, she reflected on the homework system and wished that there had been marks awarded for homework completion. She implied that since she is not skilled at taking quizzes and tests, she believes it would be fairer if there were credit given for homework, especially since she works so hard on it. Although she was too polite to explicitly admit it, I believe that Amanda did not like the homework system because of this.

Sarah's goal for my mathematics class seemed to change from the beginning of the semester to the end. Like Erin and Amanda, Sarah's goal at the beginning was to obtain an A, as she wrote this on her Study Habits Survey. Sarah adapts the means that she views as necessary to attaining this goal according to the assessment system in which she finds herself. For example, in a previous mathematics class where there had been a marked quiz every day, Sarah realized that continual point accumulation was a key to obtaining a good grade in that class. Thus, she would make sure she continually got good marks on her quizzes whether that meant learning the material or cheating. In my class, because there were no points and the assessment system focused on mastery of LO's, she decided that learning the material would be key to attaining her original goal. As mentioned, at the beginning of the semester Sarah thought she was learning enough in

class to not do the homework, but when she found out otherwise, she adapted her strategy. She started doing the homework and tracking sheets in order to learn more so that she could obtain her goal. She finished the class with a 65% before the final exam. When I asked her in the second interview how she felt about her grade, we had the following conversation:

Sarah: Hmmmmmm. I was [...] content with it.

Interviewer: Would of liked if it'd been better, but [...]?

Sarah: Ummmm, yeah, like of course, but [...] I feel like, I, especially after this, like, this interview and, like, these interviews and things, I learned, I did learn a lot of math but I learned a lot about like, in the class what it takes to, like, be a student and carry your own weight and be successful that way too. So, I'm, I'm happy with my mark.

She realized that despite her grade being lower than what she had wanted, she had still learned a lot of math and she had also learned how to take responsibility for her own learning. She seemed to realize that perhaps these were more important outcomes than a number on a report card, so she was still happy with her experience in the course. This seems to signify a shift from only valuing an extrinsic goal of obtaining a high mark to valuing intrinsic goals of learning and personal growth.

William's goal for my mathematics class was an extrinsic goal; he wanted to achieve a grade of B. His motivation for achieving this goal was largely controlled, as he mentioned that he experiences parental pressure to be successful academically. He wrote on his Study Habits Survey that he would like to be better at math because, "then I can get better grades and make my mommy and daddy proud." As mentioned, he did seem to realize that learning the material would be the appropriate means for attaining this goal. Yet, in order to satisfy his need for relatedness, William also had non-academic intrinsic goals of developing his relationships with friends and family, and contributing to the communities he found himself in, such as school and athletics. He kept a very busy schedule of hockey, coaching, refereeing, volunteering, family events, taking care of his little brother, and hanging out with friends. He clearly enjoyed these activities and they were all very important to him. In line with SDT, these intrinsic goals ultimately won out over William's extrinsic goal of getting a good mark in mathematics class (Vansteenkiste et al., 2006). William liked my autonomous homework system, because it gave him more

time to pursue his intrinsic relational goals since he could choose to not complete the homework without fear of losing marks.

Furthermore, from an Achievement Goal Theory perspective (Dweck, 1999), William primarily exhibited a performance goal orientation towards mathematics class. He mentioned to me that he had gotten good grades in mathematics in elementary school and he wondered why he could not seem to get good grades in high school. He also mentioned that his friends and other people in the class did not think he is smart and so he enjoyed any opportunities to show them otherwise. For example, one day in class when he received a high mark on one of his tests, he immediately took a picture of it and sent it to his best friend. So, because of William's performance goal orientation and lack of learning goal orientation, he displayed maladaptive strategies towards learning, such as low persistence with challenging material, procrastination, and not seeking help. As a result, his achievement was lower than what he wanted, and he finished the course with a low C.

Finally, Jason's goal for my mathematics class became quite clear after his first interview. As mentioned, he seemed to view all of his classes simply as hoops that he had to jump through in order to eventually graduate; mathematics class was no different. His extrinsic, performance goal was simply to pass my class, while exerting as little effort as possible. He did not care how high his mathematics 10 grade was, as long as he passed; 50% was perfectly acceptable to him. Unlike the other interviewed students, learning had no part in either Jason's goal for mathematics class, or in the means to achieving his goal. For Jason, the means to obtaining his goal was simply to earn enough points, using whatever methods were necessary, in order to pass. As described in Chapter 4, in his mathematics 9 class Jason had exerted very little effort throughout the semester; he completed homework to receive marks but did not seem to learn from it. He then studied hard for the final exam and performed reasonably well on it. Because of this, the teacher boosted his overall mark. He intended to do the same in my class. However, it did not work. Because Jason wanted to exert minimal effort in achieving his goal, with the autonomous homework system he did not have to bother completing the homework at all. So, he did not have the help of homework completion marks. At the end of the semester he did not feel that he could cram enough to pass the provincial exam, so he did

not bother to study. He exerted as little effort as possible in mathematics 10 but he did not end up passing, and so he did not achieve his goal. Thus, he did not actually like the autonomous homework system and would have preferred that the homework count for easy completion marks.

So, it seems that this autonomous homework system either aided or restrained the six students from achieving their own personal goals for the class, depending on what their goals were, what the students deemed as the best means for achieving these goals, what kind of experiences they had had in their previous mathematics classes, and whether or not they had other goals that conflicted with this goal. Those students whose goal involved learning, either as the goal itself or as the means to achieving the goal, who did not have other conflicting goals, and who had also had some kind of frustrating experience previously with mathematics homework engaged with the system at the highest levels. Interestingly, with the exception of Joshua and Sarah who both (eventually) held learning goals for the class, the other students' goals were very different from my intended, ideal goal for them: to learn deeply and well. I will elaborate on this more in chapter 6.

5.5. Resistance and Adaptation to Change

Several of the interviewed students took some time to adjust to the new homework system, and some even expressed feelings of hesitation, trepidation, and resistance to change because it was so different from what they were accustomed to. This is not surprising. As Black and William (1998) point out,

Some pupils will resist attempts to change accustomed routines, for any such change is uncomfortable... Pupils cannot be expected to believe in the value of changes for their learning before they have experienced the benefits of such changes (p. 144).

To begin, when I asked Joshua why he did not use the tracking sheets for the first few weeks of the course, especially since he was so dedicated to them for the entire semester otherwise, he replied as follows: "I think that at the very beginning it was, it was an extremely different system [...] And, it's almost like I forgot, like I couldn't remember. It was, it was like, it was very new." Joshua expressed feelings of surprise and interest

regarding this homework system because it was unlike anything he had ever encountered before, but he did not exhibit feelings of fear or anxiety. He told me, “I do think I saw the benefits at the very beginning, but, I think it was so new and I just kept forgetting, because I’ve never had to do anything like that before.” Because it was such a new system, it simply took a little time for him to adjust, as is often the case when human beings encounter new situations (Van den Heuvel, Demerouti, Bakker, & Schaufeli, 2013). Once Joshua adapted and became accustomed to fully utilizing the system, there was no turning back, and he benefited from it immensely.

Like Joshua, Amanda also talked about forgetting to complete the homework tracking sheets. During her first interview she told me that when there was not time in class to complete the tracking sheets, she often would not do them. When I asked her why, if it was because she did not care, she replied, “Nah, it’s not that I don’t care, it’s just like, I dunno, other things come in, you kinda [forget].” However, as mentioned already, I believe the real reason that Amanda gradually stopped completing the homework tracking sheets is because she did not value them and did not think they were providing her with any new information. She tried them at the beginning because that was what she was told to do, but she never really bought in. I believe that as the course went on and she saw that her mark was not what she wanted it to be, she began to internally resist the system even more. She was never able to fully adapt to change and accept the new system.

In contrast, Erin started using the system immediately; her difficulties in adjusting and adapting to the system were not in the logistics of remembering to actually use the system, but were in overcoming her feelings of trepidation. She had had a frustrating experience in her previous year, and was coming into my class with much anxiety regarding mathematics in general. This new system initially compounded these feelings; nevertheless, she pushed through them and used the system anyway. She told me, “at first I was like, ‘oh, this new system, this is gonna throw me off more.’ But, I actually, like, it turned out [that] it helped a lot, cuz I knew exactly what to do.” As Erin began to see how the system was beneficial, her negative feelings evaporated. In fact, as already mentioned, she developed a very positive attitude towards the system, saying that it felt “more organized” and that it would actually be her ideal homework system.

Out of all the interviewed students, Sarah expressed the strongest negative feelings towards the system at the beginning of the semester. She told me that “at first [she] didn't like it cuz it was different” and that she constantly complained about it to her mom. She did not like it at all. However, as described in Chapter 4, once she started fully utilizing the system, like Erin, Sarah began to understand its benefits and saw how it could help her. She completely overcame her negative feelings and resistance to the point where she said that she would greatly miss this homework system next year.

Finally, William and Jason did not explicitly express any feelings of anxiety or resistance to change regarding the homework system. William seemed quite happy with the system; when asked on his Mathematics Questionnaire #2 what some negative aspects of the homework system were for him, he wrote, “for me there really wasn't any.” He was thrilled that he was allowed to choose to not do his homework, and he did not see that, as mentioned above, in many ways the autonomy was a barrier to his learning. He did not seem to think he would have done better in another class where homework was for marks; perhaps this was because he knew he would have cheated on much of the homework anyway, and may not have done better on tests. William did not display any resistance or negative feelings towards this system, as it allowed him to pursue personal goals that were more important to him, as described above. Furthermore, I am unsure as to whether Jason experienced any resistance or negative feelings towards the system, as he really never directly expressed any kind of positive or negative feelings towards it. As mentioned, I know he would have preferred a system where the homework was for marks, so that he would be motivated enough to complete it and could gain easy marks. Perhaps he simply did not express his feelings to me. Nevertheless, although neither William nor Jason actually expressed resistance or fear of change, both boys were still unable to adapt and utilize the new homework system.

So, the students had to acclimatize and accept change before the new system could benefit them; unfortunately, many students in both classes, including Amanda, William, and Jason, never achieved this. Those students who did, including Joshua, Erin, and Sarah, benefited immensely from the system. Because the system was so different from anything the students had ever experienced, the ability to accept and acclimatize to

change, whether immediately or gradually, was a salient factor in the students' engagement levels.

5.6. The Influence of Marks and Grades

Marks and grades influenced all six of the interviewed students' experiences with the homework system, albeit in very different ways. The complete absence of numerical marks throughout the course, except for an overall percentage grade, was a welcome reprieve for Joshua; it allowed him to focus on learning and increased his intrinsic motivation. However, the other five students remained highly extrinsically motivated by numerical marks in varying ways, which affected how they engaged with the homework system. The following table summarizes how these five students were motivated by marks:

Table 3. Marks as Extrinsic Motivators

Good marks as a Reward ("Carrot")	Bad Marks as Punishment ("Stick")	Both
Erin Amanda	Jason William	Sarah

First, Joshua, who engaged most fully with the system out of all the students, actually found the absence of numerical marks refreshing and was instead able to focus on mastering concepts when doing his homework. This is why he is not included in figure 2; he welcomed the opportunity to let go of marks as extrinsic motivators. Without any prompting from myself, he told me the following:

Joshua: And then I also have to say I really enjoy the marking system this year. Because, always, I know in previous math classes I'd be, I'd get my percent back and I'd be like "oooh, God!" and I'd just focus on the, like I'd always just care about the percent [...] Instead of, "Ok, am I actually *learning* anything? Am I getting something out of this course I'm spending half the year on?" [...] I'd always just really be like, "ok, I need to get an A. I need to get an A." [...] But this, you're sort of trying, "ok, I want to master this learning outcome or I wanna put either, or even partially master one that you're really struggling with." [...] Instead of like, "ok, let me just get an A and be over with it." [...] Like this year I find I'm actually wanting to *learn* math [...]

Which, I don't typically want to do [...] Because I find it extremely boring!

Interviewer: Ok, yeah, so, it's like, yeah, yeah. So, so, you're, [...] what I'm hearing from [what you're] saying [...] is that it's, the, this marking system has taken the weight off your shoulders in that, it's taken your focus off from the percent?

Joshua: Yeah, and then it's like, "oh no, I'm not, I'm getting this bad percent, I need to [...]" It's not that, it's more, ok, so I'm getting an N in this learning outcome, why don't I try to work on this learning outcome to master it instead of getting, uh, a low percent and then you not knowing, "ok, what do I need to work on, what type of main things I need to work on?"

The absence of numerical marks enhanced Joshua's ability to focus on learning from the specific feedback provided by the self-assessment of the learning outcomes. In fact, it seemed to increase his intrinsic motivation because he was able to enjoy learning and concentrate on mastering concepts, instead of having to constantly worry about his percent. This is supported by Dweck's assertion that performance goals, such as obtaining a good grade, may actually undermine the conditions necessary for intrinsic motivation (1986). It is also supported by SDT research which has found that rewards and punishment (including grades) undermine intrinsic motivation (Deci & Ryan, 1985; Deci, 1971; Pink, 2009). With his focus no longer split between marks and learning, Joshua actually ended up attaining a higher overall final grade than he ever had before in mathematics class. This seems to suggest that numerical marks may hinder authentic learning, which is supported by Vansteenkiste et al.'s argument that extrinsic goals, which would include obtaining a good grade, distract students from a learning task and interfere with absorption of the material (2006).

Joshua is very unique in that he was able to let go of numerical marks and embrace a very different assessment system from what he grew up with; to date, I have not come across another student quite like him. I talked at length with him about educational assessment practices, and he agreed that a much better system should be utilized than the current, nearly ubiquitous, points system. He mentioned that his mom is a Special Education Assistant (SEA) and that he discusses these topics with her. I was not surprised; it was clear that he had been exposed to these ideas previously. He pointed

out that the points assessment system was not designed for the purpose of learning, saying,

[...] I've always been told, "our educational system was made for the industrial era, to sort people who are going into more manual work and more of the management sort of stuff."

Joshua seemed to comprehend that the primary purpose of the points system really is to sort and rank students, not to enhance their learning.

In contrast to Joshua, Erin and Amanda, who engaged with the system to varying degrees, both view marks as a carrot; that is, they are extrinsically motivated by good marks as a reward (Deci & Ryan, 1985; Deci, 1971; Pink, 2009). They both wanted high A's in mathematics 10; thus, they were motivated by this potential reward to work hard on their homework in order to learn the material so that they would receive good marks. Throughout their interviews, both talked about wanting a high grade in the course. However, unlike Joshua, neither talked about learning for its own sake; anytime either girl mentioned learning, it was always connected to obtaining a good mark.

Yet, there was a nuanced difference between the two girls' interactions with marks. Erin did not seem overly bothered by the lack of numerical marks on assignments and tests. She told me that she was ok with it because I would give the students their percent grades from time to time. However, she did tell me the following:

If you waited till like the end of the semester to give my percent, I'd probably think differently, cuz I'd be like [...] I always want my percent... And like, you don't know if you're getting like M, and [PM] [...] Like, what kind... is that an A or a high B, or [...]

Despite the fact that the standards based grading was giving her very specific feedback about her progress on individual learning outcomes, it was clear that the information she cared most about was her final percentage. Like many of the students in the two classes, she felt that her final percent was more meaningful than M's (Mastery), PM's (Partial Mastery) and NI's (Needs Improvement); she understood what a percent meant – where she was ranked. Sarah felt similarly, as I will describe below. Yet, Erin was ok with the

alternative assessment system because I still gave her an update of her overall percent periodically, and because she was doing well under the system.

Amanda, on the other hand, seemed to struggle more with the lack of numerical marks, although she was too polite to tell me this explicitly. As already mentioned, she did not value the non-numerical feedback that the system afforded her in the manner that Joshua, Erin, and Sarah did. She also became rather frustrated with the lack of homework completion marks by the end of the semester. She did not achieve the final mark that she had hoped for, and I believe that she came to think that she would have fared better under a traditional marks system. While Erin indicated that she preferred this system as long as she still got a percent update from time to time, I believe that Amanda would be more than happy to return to a traditional marks assessment system in grade eleven.

In contrast, William and Jason, who both engaged minimally with the homework system, view marks as a stick; that is, they are motivated by bad marks as a punishment (Deci & Ryan, 1985; Pink, 2009). Thus, because they were not actually losing marks by not completing the homework, they were not motivated to do it. When asked on his Mathematics Questionnaire #2 whether he thought that the homework affected his mark in any way since it did not directly count for marks, William wrote, "I hope not." I was unsure as to what he meant by this, so I asked him about it in his follow-up interview, and we had the following conversation:

William: It's cuz, just mainly because I didn't do my homework a lot, so, if it did, ugh, that woulda been pretty, pretty bad. Pretty disgusting, honestly.

Interviewer: When you say, "if it did", what do you mean? If it hadn't affected, like, [...]

William: If it, if it affected, like, if the homework actually counted for marks [...]

It seems that William really only views homework as affecting his overall grade if it is actually for marks; he was not considering the indirect effect doing or not doing it might have had on his test marks. Thus, he wrote that he hoped the mathematics homework had not affected his grade in any way because he did not do most of it, and did not want to suffer the consequences of those lost marks. As described in Chapter 4, William would rarely fail to complete homework if it was for marks, even if it meant cheating, because he

did not want to lose those marks. Thus, he is primarily extrinsically motivated by bad marks as a punishment.

Furthermore, Jason seems to only care about passing his courses; they are hoops he has to jump through in order to graduate from high school. He does not really care about high marks; a 50% is good enough for him. Because of this, he is not motivated to complete his homework in order to obtain good marks; rather, he is only motivated to complete it if he might lose marks, because that might potentially prevent him from passing his courses.

Finally, Sarah's relationship with marks is complex. I believe she is extrinsically motivated by numerical marks both as a carrot and as a stick. During the first half of the semester, she did not complete much of her homework because she had the option to slack off since it was not for marks, and because she thought she already understood much of the material. However, had it been for marks, I am confident she would have completed it so as to not lose those marks. Thus, she is motivated by bad marks as a punishment. (Recall the mathematics class where she had a marked quiz every day on the previous night's homework, and so she would try to complete the homework, and would do whatever she felt was necessary in order to not lose those marks, which, at times, included cheating).

Yet, like Erin and Amanda and in contrast to William and Jason, Sarah really was motivated to attain a decent grade in Mathematics 10; she simply did not realize in the first part of the semester how poorly she was actually doing. Just like Erin, a percent was most meaningful to Sarah. As described in Chapter 4, it was not until she saw how low her overall percent was that she began to change her behavior, as she clearly told me:

When I did see my mark, it was a good reality check, and I think if I hadn't of seen my mark [...] I mighta stayed how I was. And if I'd seen my mark sooner, I would've started sooner. I think, that's, that's the only thing, and I think a lot of kids, that puts them off too, gets them kind of upset. "Oh, I don't even know my mark."

(Note that here Sarah actually means "grade" as it is defined for this study). Although Sarah was receiving many PM's and NI's on her quizzes and tests, ironically, this specific

feedback was simply not as meaningful to her as the percent system. As with Erin, this stems from familiarity. Both girls have been familiar with what a percent means (or is supposed to mean) throughout their whole educational career, and when given their percentages, they know where they rank and what letter grade they will receive. As mentioned, that was the case with many students in the two classes; they experienced frustration because the feedback from the standards based grading was unfamiliar and was not personally meaningful or important to them. Their attention was focused on their overall grade, instead of on responding to specific feedback which could further their learning. This too seems to suggest that numerical marks may actually hinder learning; again, I will elaborate on this in Chapter 6.

Sarah changed her behaviour when she realized that she was not attaining an overall percent that was as high as she desired. Motivated to achieve a better mark, as described in Chapter 4, she began to fully use the homework system because she decided that this would be the best strategy for improving her mark. She began to experience success with the system and realized it could help her. Therefore, Sarah is also motivated by good marks as a reward.

However, Sarah realizes that marks are often utilized as carrots and sticks to bribe students to work, in which case genuine learning may be pushed aside. When we were discussing her previous mathematics class with the daily marked quizzes, she told me the following:

It's kinda all just obligation; you just have to know what to do, to be able to get the 10 marks. Like, it's basically waving the 10 marks in your face, and that's your prize. And, if you can do it on the quiz, then you get the 10 marks.

She knows that marks are simply extrinsic motivators, and yet she is still highly motivated by them as such, both as punishment and as rewards.

In summary, numerical marks and grades were a salient factor in how the six students engaged with and viewed the homework system. Joshua found he was more intrinsically motivated with the absence of numerical marks, while the other five students remained highly extrinsically motivated by marks and grades. Joshua and the students

who were motivated by good marks as a reward tended to engage more fully with the system, with the exception of Amanda. The themes mentioned above in sections 5.1 through 5.5 explain Amanda's decreased engagement. Finally, those students who were motivated by bad marks as a punishment engaged minimally with the system because there were no immediate consequences for not completing their homework.

5.7. Summary

Regardless of whether they engaged with the homework system, all of the students except Joshua viewed self-assessment as something that is done primarily for work habits, and not conceptual understanding. Joshua, Erin, and Sarah, the students who engaged with and benefited from the homework system the most, talked about and treated it in several similar ways. First, they not only treated the homework as self-assessment, they also valued it as such. Second, because they were (or became) autonomously motivated to complete their homework, they were able to embrace the autonomy provided to them and use it as a catalyst for more effective learning. Third, their personal goals for mathematics class all involved learning, whether as the goal itself or as the means to their goal. Fourth, they were all able to (eventually, in Sarah's case), accept and adapt to the change involved with a very new homework and assessment system. Finally, they were either more intrinsically motivated by the lack of numerical marks (Joshua) or they were extrinsically motivated by marks as a reward for learning (Erin and Sarah).

William and Jason, the students who engaged with and benefited from the homework system the least also behaved towards the homework in several similar ways. They neither treated nor valued the homework as self-assessment; the autonomy was a barrier to their learning; their goals for mathematics class did not involve learning; they were unable to accept and adapt to change; and they were extrinsically motivated by bad marks as a punishment.

Like Joshua, Erin and Sarah, Amanda, who began the semester fully engaging with the system and ended the system minimally engaging, had learning as part of her goal for mathematics class and was also motivated by good marks as a reward. However, she was ultimately unable to adapt to change, did not value the homework as self-

assessment, and did not perceive or utilize the autonomy provided by the system. So, in the end she also benefited minimally from the system.

Chapter 6. Conclusions

6.1. Answering the Research Question

6.1.1. Varying Student Experiences with the Homework System

So, my students engaged with the autonomous, self-assessment homework system in a variety of ways, including full engagement through the entire semester (Joshua and Erin); minimal engagement through the semester (William and Jason); full engagement at the beginning changing to minimal engagement by the end (Amanda); and minimal engagement at the beginning changing to full engagement by the end (Sarah). The variety was due to numerous factors, as described in Chapters 4 and 5.

When the homework system worked, it worked amazingly well, as seen with Joshua, Erin, and Sarah. These three students each succeeded in ways unprecedented by their previous mathematics classes. For the first time, Joshua began to actually enjoy mathematics and he also earned the highest grade he ever had in a mathematics class. Erin's anxiety concerning mathematics decreased and she earned a higher grade than she had in her mathematics 9 class. Sarah learned what it means to take responsibility for her own learning. She identified and integrated the value of mathematics homework for herself and truly felt that the homework was for her, instead of the teacher.

Yet my homework system did not help Amanda, William, and Jason, as they did not engage with the system in ways that improved their learning from homework. Amanda did not reach her goal of achieving an A for the course, and she received a lower grade than she had in grade 9. William, although unsurprised at his grade, also did not achieve a final grade he was happy with. Jason, whose goal was simply to pass the course, did not end up passing.

6.1.2. Why Did Some Students Have Such a Positive Experience?

There were several salient reasons why the system helped Joshua, Erin, and Sarah succeed so tremendously. Throughout their interviews all three students stressed that with this homework system, they “knew exactly what to do.” That is, they knew how to focus their time and efforts – which concepts to study more, get help with, or try on their own. This was because they were continually receiving meaningful feedback from their homework and the tracking sheets, and also from the standards based assessment system. Like the assessment literature says, feedback can be a powerful pedagogical tool for improving student achievement (Black, Harrison, Lee, Marshall, & Wiliam, 2004; O’Connor & Wormeli, 2011; Guskey & Bailey, 2001; Marzano, 2000; McTighe & O’Connor, 2005; Reeves, 2011; Wiggins, 1998). And, as the self-assessment literature argues, because Joshua, Erin, and Sarah clearly knew their own strengths and weaknesses, and what they were aiming to achieve (the learning outcomes), they were able to greatly improve their own learning (Heritage, 2009; Marzano, 2000; McMillan & Hearn, 2008; Panadero & Alonso-Tapia, 2013; Reeves, 2011).

Furthermore, these three students utilized the autonomy for their own benefit and took control over their learning. This is in congruence with literature that contends that students should own their learning, including learning done through homework (Vatterott, 2014). In fact, the autonomous system seemed to promote further perceived autonomy, as exemplified by Sarah, who told me that with this system she actually felt that the homework was for her and not the teacher because she chose to do it. Indeed, the autonomy support provided through action choices over homework increased her perceived autonomy. As a result, her motivation seemed to change from controlled to autonomous (Reeve et al., 2003; Ryan & Deci, 2000).

Finally, this system turned the homework into a learning tool that these students consistently returned to throughout the semester. Instead of simply completing the homework on the night it was assigned, and never looking at it again, these students continually used the homework and tracking sheets to identify and address their weaknesses in order to study for quizzes, tests, and the final exam.

6.1.3. Why Did Some Students Have Such a Negative Experience?

Yet it seems that utilizing homework as self-assessment is very different in practice than in theory. This homework system clearly did not work well for all of the students, as seen with Amanda, William, and Jason. Numerous complications and tensions became apparent. The system was predicated on the assumption that students actually want to learn, as it required a high level of engagement and responsibility. Unfortunately, not all students want to learn, and the system was unable to change that. This was exemplified by Jason's response when I asked him why he did not complete the tracking sheets: "Umm, not that I don't think it'll help, it's just, I just don't want to do it." He realized the sheets might help him learn, but he did not want to learn, and my system did nothing to actually improve his motivation to do his mathematics homework and learn from it.

Also, while the literature says that meaningful feedback is a powerful tool for promoting students' learning (Black, Harrison, Lee, Marshall, & William, 2004; O'Connor & Wormeli, 2011; Guskey & Bailey, 2001; Marzano, 2000; McTighe & O'Connor, 2005; Reeves, 2011; Wiggins, 1998), this presumes that the students will actually care about the feedback they receive and will do something about it. The feedback from the homework only helped Joshua, Erin, and Sarah because they valued it and responded appropriately to it. Amanda did not believe that the self-assessment could help her, so she did not effectively respond to the feedback it provided and did not benefit from it. At the beginning of the semester, Sarah also did not value the feedback from the homework nor did she respond accordingly, so, at that time, she did not benefit either. Because William and Jason simply did not care enough about the feedback to even do the tracking sheets, they also did not benefit.

And, while it may be that specific feedback on learning outcomes is more effective in promoting learning than a traditional points system with numerical marks and grades, many of my students valued what was familiar. They had been given numerical marks and grades throughout their entire education, so this kind of feedback was most meaningful, and thus, most important to them. Instead of paying attention to qualitative feedback that could help them improve their learning, many students cared most about their percentage marks on tests and their final percentage grade in the class. This is important because it suggests that numerical marks and grades may, at times, hinder

further learning opportunities. Joshua's experience in my class certainly supports this assertion, as he found that the absence of numerical marks actually allowed him to focus more on learning and mastering concepts. And, ironically, in the end he attained a higher grade than he ever had before in mathematics. Indeed, this points to a tension between marks and learning.

Finally, there was a strong tension between autonomy and self-assessment in the study. As mentioned, without autonomy, genuine self-assessment could not happen. However, when given autonomy, many students did not complete their homework, and self-assessment still did not happen. In order for homework as self-assessment to work well for the majority of students, this tension must somehow be resolved. This leads to considerations for future research, which will be discussed below.

6.1.4. Summary

Ultimately, for the students who already cared deeply about their learning and believed that the self-assessment could help them, my system turned the homework into a powerful tool for improving their learning. This confirms to me that mathematics homework can be implemented in a way that allows my students to engage with it in more meaningful ways than they had under my previous systems. This is important because it suggests that formative assessment, specifically self-assessment, can be effectively used to promote and increase learning from daily mathematics homework.

However, my system did not help the students who did not value the self-assessment or did not care enough about their learning, as they were unwilling to engage with the system at a high enough level to benefit from it. This is important because it underscores the difference between theory and practice. While the literature argues that utilizing formative assessment as feedback will promote student learning in ways that traditional assessment as evaluation cannot (Black et al., 2004; Black & William, 1998; O'Connor, 2002; Reeves, 2011), one must realize that this can only happen if the students are ready and willing to engage at the levels required of such a system. My experiences during this study lead me to believe that it is not easy to get students to authentically engage in self-assessment. And it seems clear, especially from Jason's case, that if a

student really does not want to learn, that student will not learn, regardless of how good the assessment or homework system is.

6.2. Research Considerations

Although this small-scale study examined the experiences of six students under a particular implementation of mathematics homework as self-assessment, the conclusions reached provide suggestions for future larger scale studies. First, would those students in a larger study who want to learn and who fully engage with their homework as self-assessment replicate the very positive experiences of Joshua, Erin, and Sarah? Would their learning and achievement be improved?

Furthermore, before students can engage with homework in more meaningful ways, the question must be addressed as to whether students are even willing to engage with homework at all, especially if it is not for marks. As Akioka and Gilmore (2013) point out, “the benefits of homework are available only to those children who actually do their homework” (p. 34). A valuable topic for future research then, would be how to motivate students to complete mathematics homework in order to learn from it. Interestingly, William and Jason, the students who engaged the least with the system both mentioned that they would be more likely to complete mathematics homework if it was interesting. Future researchers would do well to explore how to make daily mathematics homework assignments more interesting for students, thus increasing their intrinsic motivation to complete it.

Future research might also look at how to implement homework so as to increase students’ autonomous motivation to complete it. In the present study, out of all the data collected, only Sarah was found to experience an increase in autonomous motivation as a result of the system, despite the autonomy support that was provided through action choices. It would be worthwhile to find additional ways to increase autonomous motivation over homework completion. One initial study has looked at this. Using the principles of Self-Determination Theory, Akioka and Gilmore (2013) conducted an experimental study where a homework system designed to better meet students’ needs for autonomy, relatedness, and competence was implemented with the aim of improving student

motivation to complete homework. The authors did not find any overall intervention effect, but observed a protective effect over the quality of student motivation. Reflecting on the limitations of their study, including duration and effectiveness of the system in meeting the three psychological needs, the authors wrote, “it is imperative that further attempts are made to create motivating, engaging homework systems” (p. 46). So, other homework systems or theoretical frameworks could be used to explore how to improve student motivation for completing homework.

Finally, one of the most surprising findings of this study was that the majority of the interviewed students primarily thought of self-assessment as applicable to work habits and not conceptual understanding. They did not identify the homework and tracking sheets as self-assessment in the manner I intended, although I explicitly explained this to them on several occasions. Instead, these students cited past experiences where they had been required to self-assess their own efforts, attitudes, punctuality, and behavior in a class. It was almost as if self-assessment had been turned into a psychological form of self-help. Despite this being such a small study, I find it curious that five of the six interviewed students all viewed self-assessment primarily in this way. Four out of the six students cited previous experiences with self-assessment of work habits, but none mentioned any past experiences with self-assessment of conceptual understanding. This causes me to wonder how students in general perceive self-assessment. Furthermore, how do teachers perceive and implement self-assessment in their classrooms? The literature primarily describes self-assessment in relation to conceptual understanding; this is the self-assessment that is considered to have the potential to powerfully improve learning. Yet, I wonder if this is not the kind of self-assessment that is primarily being implemented in classrooms. Panadero and Alonso-Tapia (2013) posit that “a high percentage of teachers do not recognize what self-assessment is useful for” (p. 570). This would provide a rich topic for future research.

6.3. How I've Grown

6.3.1. As a Researcher

I feel that I have grown immensely as a researcher, learner, and teacher throughout the course of this study. I have grown tremendously as a researcher, since this is the first piece of educational research I have conducted. Prior to this work, I had a very limited understanding of how educational research is done. In fact I was rather nervous to embark on this project because I felt like I had no idea what I was doing. Yet, through a supportive environment at Simon Fraser University and continual guidance and encouragement from my supervisor, I worked through the various components of the project and gradually gained more understanding and confidence with my work. Although there is always more to learn, I feel that I now have a much better grasp of what is involved in educational research, how to search the literature, and how to write an academic research paper.

6.3.2. As a Learner

I have grown personally as a learner during my time in the master's program at Simon Fraser University, through completing the coursework and especially through writing my thesis. I was provided with an authentic learning experience unlike any I had encountered in my previous educational endeavours. My instructors, especially my supervisor, provided a supportive yet autonomous learning environment where I was encouraged to pursue my own interests. And, especially throughout working on my thesis, I personally experienced the benefits of meaningful feedback. Numerical marks and grades had no part in this process; instead I was given specific, qualitative feedback from my supervisor through meetings, phone calls, emails, written comments, and edits of my work. Indeed, the learning process for writing my thesis was an iterative cycle of performance, feedback, and revision. I feel that I learned vastly more this way as compared to previous experiences of having one opportunity to produce quality work and receiving a numerical mark as a reward or consequence for my efforts.

I also grew in my confidence and capabilities as an autonomous learner. In my previous educational experiences, I was accustomed to the teacher or instructor telling me what to do, and I would simply do it. With this project, although I felt that I received more than adequate support and guidance, the process was still very independent and learner-driven. More than ever before, I actually felt that I was in control over my own learning; nobody was constantly telling me exactly what to do and by when to have it done. And, ironically, like some of the students in my study, I too experienced both the benefits and detriments of autonomy. I was able to work on my thesis when it was convenient me; for example, I usually worked on weekends, and would work very hard during the winter and spring breaks. I generally worked in the mornings, as that is when I think best, and usually avoided working in the evenings. However, at times the absence of any pressing deadlines got the better of me and I chose to engage in other activities rather than working on my thesis. My experience underscores that there is a tension between autonomy and authentic learning, which will be discussed below.

Finally, I constantly self-assessed my own progress during this research. I did this by reflecting on my own work; asking myself if it was good enough; proofreading my writing; looking at previous masters theses as a kind of standard to compare my work against; and adjusting my work accordingly. Indeed, I believe that in many ways I had the kind of learning experience that I was trying to provide for my students during this study. Because of this personal experience, I am confident that learning, especially from homework, has the potential to be a much richer experience than what was typically happening in my previous classrooms. So, despite the tensions and complications apparent from this study, I feel I must press on to find ways to improve learning from homework.

6.3.3. As a Teacher

I have learned much in my professional capacity as a teacher. Because of the content of this research, I was forced to experiment within my own classroom and try out some very progressive pedagogical strategies, including standards based grading, autonomous homework, and self-assessment of homework. And, although these strategies are supported by the literature, especially standards based grading, many

students and parents did not readily accept them. Several colleagues also expressed much hesitation concerning their benefits. Yet, from reading the literature about these methods, trying them out, and observing notable benefits from them, I have come to realize that just because many teachers have taught using certain methods for many years does not necessarily mean that those are the best methods. This study has greatly improved my willingness and confidence to try out new teaching methods in the interest of improved student learning, in spite of potential pushback from the school community.

I also learned about how to more effectively implement new teaching methods; students require consistent pedagogic and organizational support when asked to engage in something new. For example, a few of the participating students, including Amanda, mentioned that they would fill out the homework tracking sheets whenever they were given time in class, but that otherwise they forgot to do it at home. While I did continue to encourage the students to fill out the tracking sheets at home after completing their homework, I suspect that I might have had more students consistently using the tracking sheets if I had continued throughout the whole semester to give in-class time for completing them. When I use this system with future classes, I will be more deliberate about consistently providing in-class time for students to complete the homework tracking sheets throughout the whole semester.

Finally, I learned much about teaching from searching and reviewing educational literature. I had the opportunity to see how theories concerning homework, assessment, self-assessment, and motivation were actually applicable in my own classroom. I have realized that there is an interesting relationship, if not a tension, between theory and practice. On the one hand, I found that many aspects of the theories I read about, particularly the motivational theories, allowed me to view occurrences in my classroom through a new lens, and even brought new clarity to why students behave in certain ways. On the other hand, I found that pedagogical strategies that were highly condoned by the literature, including autonomy support and self-assessment, did not work nearly as well in practice as they were supposed to in theory.

6.4. Living with Tensions

As mentioned, two tensions were apparent from this study: autonomy versus self-assessment, and marks versus learning. These have led me to believe that there is no perfect homework system that will work for all of my students. Although my system drastically improved homework as a learning tool for certain students, these two tensions got the better of other students. Although the tensions between autonomy and self-assessment, and between marks and learning may be reduced, I do not believe they can be eradicated for all students. First, a high level of responsibility and motivation is required for students to embrace autonomy and engage in authentic self-assessment of their homework. As seen in this study, it seems unlikely that all students will achieve this. Although I can work to support and encourage students in self-assessing, I believe this tension will always be there.

And, in the educational system in which I currently find myself, there is a strong tension between marks and learning. As long as educators primarily use a traditional points assessment system, I believe this tension will likely continue for a long time. Students have been taught to care most about their numerical marks and percent grades. Yet this may distract them from genuine learning (Vansteenkiste et al., 2006). In a study on homework, Landers (2013) also found a strong tension between marks and learning, and she explains its significance concerning mathematics:

...Even when students do buy into academic work, many are simply “doing school” (Pope, 2001), instead of engaging in academic practices such as homework as opportunities to learn. This was the case for Trey and Nick’s [the interviewed students] classmates, who tended to take ownership of homework because it affected their grades, ability to pass classes, and opportunity to graduate from middle school. As long as schools are structured in ways that privilege scores and grades over learning, it is not surprising that students will copy and cheat to complete homework. These issues are especially a concern in the context of mathematics, given the need for students to learn and achieve in mathematics in order to enter into and succeed in STEM studies and careers (pp. 387-388).

Indeed, this was true for many of the students in my study. While my goal for the students was to learn deeply and well, the students’ goals differed from mine in that they all primarily wanted to obtain certain grades (with Joshua as the only exception). So, many of them

focused more on obtaining those grades than they did on learning well. Again, I can work to improve this tension by using standards based grading and formative assessment techniques, yet at the end of the day I believe that many students will still care most about the grades on their report card.

So, it seems that teaching and assigning homework involves living with these tensions. I can work to improve them as much as possible, yet I believe they will always be there. However, because of the very positive experiences of Joshua, Erin, and Sarah with my homework system as compared to their previous mathematics classes, and because of my own positive learning experience during this research, it is clear that learning from mathematics homework can be improved. Thus, it is imperative that I persist in continuing to look for ways to do that for as many students as possible.

References

- ActiveGrade. (2013). Retrieved from <http://activegrade.com/>
- Akioka, E., & Gilmore, L. (2013). An intervention to improve motivation for homework. *Australian Journal of Guidance and Counselling, 23*(1), 34–48.
- Andrade, H., & Valtcheva, A. (2009). Promoting learning and achievement through self-assessment. *Theory Into Practice, 48*(1), 12-19.
doi:10.1080/00405840802577544
- Bennett, S., & Kalish, N. (2006). *The case against homework: How homework is hurting our children and what we can do about it*. New York: Crown Publishers.
- Black, P., Harrison, C., Lee, C., Marshall, B., & William, D. (2004). Working inside the black box: Assessment for learning in the classroom. *The Phi Delta Kappan, 86*(1), 8–21.
- Black, P., Harrison, C., Lee, C., Marshall, B., & William, D. (2003). *Assessment for learning: putting it into practice*. Berkshire, England: Open University Press.
- Black, P., & William, D. (1998). Inside the black box: Raising standards through classroom assessment. *Phi Delta Kappan, 80*(2), 139–144, 146–148.
- British Columbia, Ministry of Education. (2009). Reporting student progress: Policy and practice. Retrieved March 19, 2015, from https://www.bced.gov.bc.ca/classroom_assessment/09_report_student_prog.pdf
- British Columbia, Ministry of Education. (2014). Student progress report order. Retrieved March 19, 2015, from <http://www2.gov.bc.ca/gov/DownloadAsset?assetId=4E6EB43B86874189B5518A8F8F450199>
- Brookhart, S. M., Andolina, M., Zuza, M., & Furman, R. (2004). Minute math: An action research study of student self-assessment. *Educational Studies in Mathematics, 57*(2), 213–227. doi:10.1023/B:EDUC.0000049293.55249.d4
- Carr, N. S. (2013). Increasing the effectiveness of homework for all learners in the inclusive classroom. *School Community Journal, 23*(1), 169–182.
- Cooper, H. (1989a). *Homework*. White Plains: Longman Inc.
- Cooper, H. (1989b). Synthesis of research on homework. *Educational Leadership, 47*(3), 85–91.

- Cooper, H. (2001). Homework for all - in moderation. *Educational Leadership*, 58(7), 34-38.
- Cooper, H. (2007). *The battle over homework: Common ground for administrators, teachers, and parents (3rd ed.)*. Thousand Oaks, California: Corwin Press.
- Cooper, H., Lindsay, J. J., Nye, B., & Greathouse, S. (1998). Relationships among attitudes about homework, amount of homework assigned and completed, and student achievement. *Journal of Educational Psychology*, 90(1) 70-83. doi:10.1037/0022-0663.90.1.70
- Cooper, H., Robinson, J. C., & Patall, E. A. (2006). Does homework improve academic achievement? A synthesis of research, 1987-2003. *Review of Educational Research*, 76(1) 1-62. doi:10.3102/00346543076001001
- Cross, L. H., & Frary, R. B. (1999). Hodgepodge grading: Endorsed by students and teachers alike. *Applied Measurement in Education*, 12(1), 53-72. doi:10.1207/s15324818ame1201_4
- Deci, E. L. (1971). Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology*, 18, 105-115. doi:10.1037/h0030644
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press. New York. doi:10.2307/2070638
- Deci, E. L., & Ryan, R. M. (1987). The support of autonomy and the control of behavior. *Journal of Personality and Social Psychology*, 53(6), 1024–1037. doi:10.1037/0022-3514.53.6.1024
- Deci, E. L., & Ryan, R. M. (2008a). Facilitating optimal motivation and psychological well-being across life's domains. *Canadian Psychology/Psychologie Canadienne*, 49(1), 14-23. doi:10.1037/0708-5591.49.1.14
- Deci, E. L., & Ryan, R. M. (2008b). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology/Psychologie Canadienne*, 49(3), 182-185. doi:10.1037/a0012801
- Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist*, 41(10), 1040–1048. doi:10.1037/0003-066X.41.10.1040
- Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. *Essays in social psychology*. Psychology Press.

- Fisher, D., & Frey, N. (2008). Homework and the gradual release of responsibility: Making “responsibility” possible. *The English Journal*, 98(2), 40–45. Retrieved from <http://ezproxy.msu.edu/login?url=http://search.proquest.com/docview/61971246?accountid=12598>
- Garrett, J. L. (2007). Homework. *Kappa Delta Pi Record*, 43(2), 56–57.
- Gill, B., & Schlossman, S. (2000). The lost cause of homework reform. *American Journal of Education*, 27-62. doi:10.1086/444258
- Grootenboer, P. (2009). Homework and learning mathematics. *Australian Primary Mathematics Classroom*, 14(4), 11–16. Retrieved from <http://www.aamt.edu.au/Webshop/Entire-catalogue/Australian-Primary-Mathematics-Classroom>
- Guskey, T. R. (1996). Reporting on student learning: Lessons from the past-Prescriptions for the future. *Yearbook (Association for Supervision & Curriculum Development)*, 13-24.
- Guskey, T. R. (2000). Grading policies that work against standards...and how to fix them. *NASSP Bulletin*, 84(620), 20-29. doi:10.1177/019263650008462003
- Guskey, T. R., & Bailey, J. M. (2001). *Developing grading and reporting systems for student learning*. (T. R. Guskey & R. J. Marzano, Eds.). Thousand Oaks, CA: Corwin Press.
- Hannula, M. S. (2006). Motivation in mathematics: Goals reflected in emotions. *Educational Studies in Mathematics, Affect in Mathematics Education: Exploring Theoretical Frameworks: A PME Special Issue*, 63(2), 165–178.
- Hattie, J. (1992). Measuring the effects of schooling. *Australian Journal of Education*, 36(1), 5–13.
- Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. New York: Routledge.
- Heritage, M. (2009). Using self-assessment to chart students' paths. *Middle School Journal*, 40(5), 27–30. Retrieved from <http://ovidsp.ovid.com/ovidweb.cgi?T=JS&CSC=Y&NEWS=N&PAGE=fulltext&D=eric3&AN=EJ848610>
- Kohn, A. (2006). *The Homework myth: Why our kids get too much of a bad thing*. Da Capo Press. doi:10.1097/01.chi.0000270795.20196.49
- Kralovec, E., & Buell, J. (2000). *The end of homework: How homework disrupts families, overburdens children, and limits learning*. Boston, MA: Beacon Press.

- Landers, M. G. (2013). Towards a theory of mathematics homework as a social practice. *Educational Studies in Mathematics*, 84(3), 371–391. doi:10.1007/s10649-013-9487-1
- Lange, T., & Meaney, T. (2011). I actually started to scream: Emotional and mathematical trauma from doing school mathematics homework. *Educational Studies in Mathematics*, 77, 35–51. doi:10.1007/s10649-011-9298-1
- Lee, J. F., & Pruitt, K. W. (1979). Homework assignments: Classroom games or teaching tools? *The Clearing House*, 53(1), 31–35.
- Lemos, M. S. (1999). Students' goals and self-regulation in the classroom. *International Journal of Educational Research*, 31(6), 471–485. doi:10.1016/S0883-0355(99)00016-6
- Liljedahl, P., & Allan, D. (2013). Studenting: the case of homework. In *Proceedings of the 35th Conference for Psychology of Mathematics Education - North American Chapter* (pp. 489–492). Chicago, USA.
- Linnenbrink, E. A., & Pintrich, P. R. (2000). Multiple pathways to learning and achievement: The role of goal orientation in fostering adaptive motivation, affect, and cognition. *Intrinsic and Extrinsic Motivation: The Search for Optimal Motivation and Performance*, 195–227. doi:http://dx.doi.org/10.1016/B978-012619070-0/50030-1
- Marzano, R. J. (2000). *Transforming classroom grading*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Marzano, R. J., & Pickering, D. J. (2007a). Errors and allegations about research on homework. *Phi Delta Kappan*, 88(7), 507–513. Retrieved from <http://www.kappanmagazine.org/content/88/7/507.abstract>\n<http://www.kappanmagazine.org/content/88/7/507.short>
- Marzano, R. J., & Pickering, D. J. (2007b). Special topic: The case for and against homework. *Educational Leadership*, 64(6), 74–79.
- Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement*. Association for Supervision and Curriculum Development.
- McMillan, J. H., & Hearn, J. (2008). Student self-assessment: The key to stronger student motivation and higher achievement. *Educational Horizons*, 87(1), 40–49. Retrieved from <http://www.eric.ed.gov/ERICWebPortal/contentdelivery/servlet/ERICServlet?accno=EJ815370>

- McTighe, J., & O'Connor, K. (2005). Seven practices for effective learning. *Educational Leadership*, 63(3) 10-17.
- N.A. (2001). Homework practices that support students with disabilities. *Research Connections in Special Education*, Spring(8).
- Neill, D. M. (1997). Transforming student assessment. *Phi Delta Kappan*, 79(1), 34–40, 58.
- Newby, L., & Winterbottom, M. (2011). Can research homework provide a vehicle for assessment for learning in science lessons? *Educational Review*, 63(3), 275–290. doi:10.1080/00131911.2011.560247
- O'Connor, K. (1995). Guidelines for grading that support learning and student success. *NASSP Bulletin*, 79(571), 91–101.
- O'Connor, K. (2002). *How to grade for learning: Linking grades to standards* (2nd ed.). Thousand Oaks, CA: Corwin Press.
- O'Connor, K. O., & Wormeli, R. (2011). Reporting student learning. *Educational Leadership*, 69(3), 40–44.
- Page, E. B. (1958). Teacher comments and student performance: A seventy-four classroom experiment in school motivation. *Journal of Educational Psychology*, 49(4), 173. doi:10.1037/h0041940
- Panadero, E., & Alonso-Tapia, J. (2013). Self-assessment: Theoretical and practical connotations. When it happens, how is it acquired and what to do to develop it in our students. *Electronic Journal of Research in Educational Psychology*, 11(2), 551–576.
- Paschal, R. A., Weinstein, T., & Walberg, H. J. (1984). The effects of homework on learning: A quantitative synthesis. *The Journal of Educational Research*, 78, 97–104. Retrieved from <http://www.jstor.org/stable/27540101> <http://www.jstor.org.ezp1.lib.umn.edu/stable/pdfplus/27540101.pdf?acceptTC=true>
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Pink, D. H. (2009). *Drive: The surprising truth about what motivates us*. New York, NY: Riverhead Books.

- Protheroe, N. (2009). Good homework policy = good teaching. *Principal (Reston, Va.)*, 89(1), 42–45. Retrieved from HTML: <http://vnweb.hwwilsonweb.com/hww/jumpstart.jhtml?recid=0bc05f7a67b1790ee4929bb4ae6cba83dfd77c48f493a2dcf8818620c9d48fce0d14facdfc06b121&fmt=H> PDF: <http://vnweb.hwwilsonweb.com/hww/jumpstart.jhtml?recid=0bc05f7a67b1790ee4929bb4ae6cba83dfd77c48f493a2d>
- Reeve, J., Nix, G., & Hamm, D. (2003). Testing models of the experience of self-determination in intrinsic motivation and the conundrum of choice. *Journal of Educational Psychology*, 95(2), 375–392. doi:10.1037/0022-0663.95.2.375
- Reeves, D. (2011). *Elements of grading: A guide to effective practice*. Bloomington, IN: Solution Tree Press.
- Ross, J. A., Hogaboam-Gray, A., & Rolheiser, C. (2002). Student self-evaluation in grade 5-6 mathematics effects on problem-solving achievement. *Educational Assessment*, 8(1), 43-58. doi:10.1207/S15326977EA0801_03
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *The American Psychologist*, 55(1), 68–78. doi:10.1037/0003-066X.55.1.68
- Schmitt, R. D. (2000). *Effect of homework on student commitment, growth and performance*. University of Lethbridge.
- Shannon, D. E. (2009). *Avoidance behaviour in a mathematics 10 classroom*. Simon Fraser University.
- Stallings, V., & Tascione, C. (1996). Student self-assessment and evaluation. *Mathematics Teacher*, 89, 548–555.
- Strandberg, M. (2013). Homework - is there a connection with classroom assessment? A review from Sweden. *Educational Research*, 55(4), 325–346.
- Sullivan, M. H., & Sequeira, P. V. (1996). The impact of purposeful homework on learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 69(6), 346–348. doi:10.1080/00098655.1996.10114337
- Van den Heuvel, M., Demerouti, E., Bakker, A. B., & Schaufeli, W. B. (2013). Adapting to change: The value of change information and meaning-making. *Journal of Vocational Behavior*, 83(1), 11–21. doi:10.1016/j.jvb.2013.02.004
- Vansteenkiste, M., Lens, W., & Deci, E. L. (2006). Intrinsic versus extrinsic goal contents in self-determination theory: Another look at the quality of academic motivation. *Educational Psychologist*, 41(1), 19-31. doi:10.1207/s15326985ep4101_4

Vatterott, C. (2014). Student-owned homework. *Educational Leadership*, 71(6), 39–42.

Wiggins, G. (1998). *Educative assessment: designing assessments to inform and improve student performances* (1st ed.). San Francisco, CA: Jossey-Bass Publishers.

Zhu, Y. A. N., Koon, F., & Leung, S. (2012). Homework and mathematics achievement in Hong Kong: evidence from the timss 2003. *International Journal of Science and Mathematics Education*, 10(4), 907–925.

Appendix A.

Homework Tracking Sheets for Measurement and Polynomials Units and Instructions

Name: _____ Foundations and Pre-calculus 10

Homework Tracking Sheet Instructions

Instructions:

1. On the homework-tracking table provided for each unit, write the dates of each homework assignment across the top row.
2. Under each date, record each assigned question beside the appropriate learning outcome (this will be given in class each time homework is assigned).
3. Underneath each question, code how you did with it. Please use the following code:

✓ = Completed independently and got it correct
X = Completed independently and got it wrong

H = completed with help, got it correct
O = did not complete it

*Important note:

The point of this coding is to give yourself important information about which learning outcomes you understand and which you do not. You are responsible for deciding what to do with this information. Here a few suggestions:

- Evaluate the questions with "O" – did you not do it because you already understand it (and are you **100% SURE** you understand it? How have you done with that specific learning outcome on the in-class practice quizzes?)
OR did you not do it because of laziness, lack of time, etc. (and if so, will you do it later?)
- Get some help with those questions that have "X"s (classmate, tutor, study hall, teacher)
- For those questions that have "H"s, attempt some additional questions on your own that cover the same learning outcome

Name: _____

Foundations and Pre-calculus 10

Homework Tracking Sheet

Unit 1: Measurement Systems

CODE:

√ = Completed independently and correctly H = completed with help X = Got it wrong 0 = did not complete it

Learning Outcome ↓	Date →					
<i>I can:</i>						
1-1. Convert between SI units.						
1-2. Convert between Imperial Units (easier)						
1-3. Convert between Imperial Units (harder)						
1-4. Convert between SI and Imperial units (easier)						
1-5. Convert between SI and Imperial units (harder)						
1-6. Use proportional reasoning within a measurement conversion problem						
1-7. Use SI and Imperial calipers for measurement						
1-8. Estimate referents for Imperial and SI units						
1-9. Choose appropriate units (SI & Imperial) for measurement						
1-10. Use SI and Imperial rulers for measurement						

√ = Completed independently and correctly H = completed with help X = Got it wrong O = did not complete it

Learning Outcome / Date → / can:	QUIZ	QUIZ	QUIZ	QUIZ
5-1. Represent polynomials & polynomial multiplication with algebra tiles.				QUIZ
5-2. Expand & simplify products of monomials, binomials & trinomials.				
5-3. Factor polynomials using algebra tiles and area models.				
5-4. Factor polynomials by removing the GCF.				
5-5. Factor $ax^2 + bx + c$ where $a = 1$.				
5-6. Factor $ax^2 + bx + c$ where $a \neq 1$.				
5-7. Find values of k that allow me to factor $ax^2 + kx + c$				
5-8. Factor a polynomial that is a difference of squares				
5-9. Factor a polynomial that is a perfect square $(ax + b)^2$.				
5-10. Choose appropriate method(s) to factor a given polynomial.				

Appendix B

Mathematics Study Habits Survey

Name: _____

Dubland

Mathematics Study Habits

1) How would you rate your own mathematical ability?

a) Very poor b) Poor c) Satisfactory d) Good e) Excellent

2) Do you wish that you were better at doing mathematics? Yes / No

Why or why not? _____

3) On a scale of 1 to 4 (1 = "strongly disagree", 2 = "disagree", 3 = "agree" and 4 = "strongly agree"), rate the following statements:

a) I like Mathematics	1	2	3	4
b) I like mathematics class	1	2	3	4
c) Mathematics is useful	1	2	3	4
d) Mathematics is hard	1	2	3	4
e) My family thinks that mathematics is useful	1	2	3	4
f) It is important to my parents or guardian that I do well in math class	1	2	3	4
g) My parents / guardian think math is hard	1	2	3	4
h) It is cool to be good at math	1	2	3	4
i) I'll never actually use the math I learn in school	1	2	3	4
j) Mathematics homework is useful and important	1	2	3	4
k) It is important for me to choose how and when I do my math homework	1	2	3	4
l) I wish math class was more interesting	1	2	3	4
m) I feel a sense of satisfaction and accomplishment when I solve a hard math problem.	1	2	3	4

4) Would you rather be in a class where you got an A and learned nothing or in a class where you got a B and learned something? Why?

5) If your math teacher told you that you would get a minimum of a B in math class even if you did nothing, what would you do?

1

Name: _____

Dubland

6) In your own words, explain the purpose of doing math homework.

7) Pretend that you got homework in every one of your classes, ALL due tomorrow. Would you do your math homework first, second, third, ...? Why?

8) Pretend that you have math homework tonight and that your mom/dad/brother/sister/tutor is going to help you with it. What does "help" mean?

9) Pretend that after you had tried your homework (with or without help) and there were three questions that you couldn't answer. What would you do next? Would that change if there was only one question that you couldn't answer? Five? Ten?

10) When you do your homework, how do you know that you have done it correctly? Do you care?

11) If there were 8 unit tests for this class and you could write them whenever you wanted to during the semester, as long as you finished them all before the final exam, when would you write them and why?

12) Consider the amount of work that you are willing to put into this class. If you put in exactly that amount of work, what grade do you think you would deserve? Why?

13) What is your goal for this class?

Appendix C

Mathematics Questionnaire #1

Name: _____

Period: _____

Ms. Dubland

Math Questionnaire #1

1. Are you doing the homework for mathematics class? Why or why not?

2. If you are doing the homework:

- a. How often do you do it?

- b. How much of it do you do?

- c. When do you do it? (the day it is assigned? a day later? On the weekend?)

- d. Do you mark your homework and code it according to the learning objectives on the homework-tracking sheets? Why or why not?

- e. In those instances that you do mark and code your homework, does the feedback affect what you do next? (For example: seeking extra help, asking more questions in class, studying differently, doing extra practice questions, etc.)

Name: _____

Period: _____

Ms. Dubland

3. Would you prefer a class where the teacher forces you to do homework? Why or why not?

4. In your own words, explain why your mathematics teacher is giving you freedom over your homework. Do you think this is a good reason?

5. In your own words, explain why your math teacher suggests that you mark and track your homework according to the learning objectives. Do you think this is a good reason?

Appendix D

Mathematics Questionnaire #2

Name: _____

Dubland

Math Questionnaire #2

1. Describe your experience with doing homework over the past semester in this mathematics class.

2. What were some positive aspects of the homework system in this course for you?

3. What were some negative aspects of the homework system in this course for you?

4. a) Some students in this class mentioned that they prefer a classroom where they are forced to do homework (in other words, it's for marks). Why might they say this? Do you agree? Why or why not?

- b) Other students, however, admitted that if they are forced to do homework, they would probably end up cheating or copying the homework in some way. What do you think about this? Does this describe you in at all? If so, in what way?

- c) Some students in this class mentioned that they prefer an autonomous homework system because it allows them flexibility over when they complete the homework and because it is less stressful. What do you think of this? Can you identify with this in any way? If so, how?

Name: _____

Dubland

d) Other students explained that they prefer an autonomous homework system because the homework is where they make their mistakes. Furthermore, they said that when homework counts for marks, on a certain day if they really don't understand the homework, they will lose marks for not completing it by the next day, and they will probably still not understand it or learn how to do it. What do you think of this? Can you identify with it in any way? How?

5. a) Think of those times when you haven't completed your homework (in this class or others.) What were the specific reason(s) that you did not complete it?

b) On the last survey, some students in this class said that sometimes they don't do their homework because they are lazy. What do you think of this? Does this describe you at all? If so, in what way?

c) Some students mentioned that they don't do their homework because they just don't find it interesting and that there is always something more enjoyable that they could be doing instead. What do you think of this? Does this describe you at all? If so, in what way?

d) Other students said on the previous survey that if they were able to follow the lesson in class (either the teacher's explanation, group work, or another activity), they felt that they understood the material and didn't need to do that day's homework. What do you think of this? Does it describe you in any way? How?

Name: _____

Dubland

6. a) What exactly is self-assessment? Explain in your own words.

b) Have we done any self-assessment in this class? If so, what specifically?

c) Have you done self-assessment in other classes? If so, what specifically?

7. Some students completely stopped marking and tracking their homework part-way through the semester, and some students never did it. In this way, they used the homework, if they did it, simply for practice and not to check their own understanding of specific learning outcomes (in other words, "self-assessment"). Tell me, in your own words, what is the difference (if any) between using homework for practice and using it for self-assessment? Which do you prefer?

8. Circle the statement that best describes you during this past semester:

- a. I consistently completed homework and tracked it on the homework tracking sheets from the beginning of the semester until the end.
- b. I consistently completed homework throughout the semester but did not track it on the homework tracking sheets at all.
- c. At the beginning of the semester, I did homework but not the homework tracking sheets. At some point in the semester I began doing the homework tracking sheets.
- d. I began doing both the homework and tracking sheets at the beginning of the semester, but at some point I stopped doing the homework tracking sheets.
- e. Occasionally I completed homework and the tracking sheets.
- f. I completed homework on occasion and never did the tracking sheets.
- g. I never completed either homework or the tracking sheets.
- h. If none of these statements describe you, please provide your own:

Name: _____

Dubland

9. a) Some of your classmates said that they didn't do the homework tracking sheets because it required too much effort. They admitted that they thought it would probably help them if they did it, but they were simply too lazy to do it. What do you think of this? Does it describe you at all? If so, in what way?

- b) Other students said that they didn't do the homework tracking sheets because they feel that they already know what they've mastered and what they're still struggling with. Does this describe you at all? If so, in what way?

10. Consider *how* you did (or didn't do) your homework in the first month of this course. How does that compare with *how* you did or didn't do your homework in the last month of this course? Please describe and explain any changes.

11. The homework in this course did not directly count for marks. Do you feel that it affected your mark in any way?

12. Why did I assign homework at all if it wasn't counted for marks?

13. Pretend that you could design your ideal mathematics classroom with the ideal mathematics teacher. What would the homework system in that class look like? Please explain and justify your choices.

4