

PEACE, LOVE, AND PI: IMAGINING A WORLD WHERE PARIS HILTON LOVES
MATHEMATICS

by

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Abstract

This thesis is a conceptual piece that explores how incorporating marketing theory and notions of cool into the realm of mathematics education may help to prevent qualified female students from self-selecting out of mathematics. It begins by exploring current perspectives on the problem of female attrition in educational and career trajectories involving math. Focusing on girls from Toronto, Ontario, who generally see themselves as part of the mainstream culture, this thesis speculates as to how these girls understand mathematics and their relationship to mathematics. The central purpose of this research is to understand whether these girls choose not to pursue math beyond the compulsory level because they are selecting courses to construct their identity on the basis of cool, using the same evaluation process they would when selecting products for consumption.

Drawing extensively on literature, this thesis presents a novel perspective with which to view female disinterest in mathematics. This conceptual framework is then illuminated with participants' data obtained through qualitative methodology to provide an experiential account of the conceptual. Grounding the empirical data atop the conceptual brings to life the interconnection of perspectives of scholars such as Walkerdine, Mendick, Demetriou, and Gladwell, illustrating how femininity, consumerism, and mathematics comprise our socially constructed reality. This thesis argues that treating math as a consumer good by marketing it accordingly might give rise to increased mathematical participation and enthusiasm by this particular segment of girls who rely on identity marketing for many of their consumption decisions. Finally, this argument is illuminated by a sample marketing plan that provides a practical example of how the ideas emergent from this study might applied. In conclusion, this thesis addresses the limitations and controversies that arise from the use of marketing as a means to promote education, the challenges of unfixing and subverting femininity, and the macro level possibilities that are opened up with the help of a micro level nudge in a different direction.

Table of Contents

Abstract.....	ii
Table of Contents	iii
List of Tables	iv
List of Images	v
Acknowledgements	vi
Dedication	vii
In the Beginning/Introduction	1
Chapter 1: Conceptual Grounding.....	4
1.1 Conceptually Grounded.....	4
1.2 Restricting, Extending, and Recontextualizing.....	13
Chapter 2: An Introduction to the Research Problem	16
2.1 Introducing the Research Problem	16
2.2 Research Question(s).....	18
2.3 Rationale.....	18
2.4 Sample	19
2.5 Methodological Overview	19
2.6 Delimitations	24
2.7 Data Analysis	24
2.8 Establishing Positionality	25
2.9 The Girls.....	26
Chapter 3: An Exploration of Literature and Participants' Data	29
3.1 Theme One: Identity and the Quest for Cool	29
3.2 Theme Two: Normative Femininity and Its Incongruence with Mathematics	47
3.3 Theme Three: The Mathematician Stands Alone	62
3.4 Theme Four: (Un)popular Culture	69
Chapter 4: Math Is the New Black.....	93
4.1 Less (Pedantic) Talk, More Action!	93
Chapter 5: Geek-Chic, the Way of the Future	99
Chapter 6: Limitations, Controversies, and Final Epiphanies	109
6.1 Conceptual Re-Grounding: A Temporary Conclusion	109
6.2 Limitations	110
6.3 Grassroots: Planting the Seed.....	114
Works Cited.....	120
Appendices.....	133
Appendix A: Participant Profiles	133
Appendix B (i): Photo Journal Assignment	145
Appendix B (ii): Interview Questions	147
Appendix B (iii): Interview Transcript Sample	150
Appendix C: Math Matters Advertisement.....	159
Appendix D: Geek Chic	160
Appendix E: Ethics Approval Certificate	161

List of Tables

Table A1: Participants' Profiles	133
Table A2: Emily's Profile	136
Table A3: Stef's Profile	137
Table A4: Taylor's Profile	138
Table A5: Erin's Profile	139
Table A6: Alana's Profile	140
Table A7: Sarah's Profile	141
Table A8: Emma's Profile	142
Table A9: Jessica's Profile	143
Table A10: Rachel's Profile	144

List of Images

Image 1: Excerpt From Jessica's Photo Journal	50
Image 2: Excerpt From Sarah's Photo journal	52
Image 3: Excerpt From Erin's Photo Journal	72
Image 4: Excerpt From Alana's Photo Journal	73
Image 5: Excerpt From Jessica's Photo Journal	74
Image 6: Excerpt From Erin's Photo Journal	82
Image 7: Excerpt From Alana's Photo Journal	83
Image 8: Product Placement	104
Image 9: Product Placement (2).....	104
Image 10: Celebrity Endorsement	105
Image 11: Celebrity Endorsement (2)	105
Image 12: Celebrity Endorsement (3)	106
Image 13: Celebrity Endorsement (4)	106
Image 14: Fashion	107
Image 15: Fashion (2)	107
Image 16: Brangelina and Speidi	115
Image 17: You Are What You Watch.....	116
Image 18: Peace, Love, and Pi	117
Image 19: Mmmm Pi	118
Image A1: Math Matters	159
Image A2: Fashion and Function	160

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Dedication

This project is dedicated to Ewa Kasinska, the coolest math teacher I know.

In the Beginning/Introduction

From the onset of my work as an educator in a Toronto high school, I noticed a pattern with respect to attitudes and aptitude in the math classroom. It appeared that girls¹ whose evaluations proved they were mathematically proficient consistently claimed disinterest in mathematics and, more shockingly, seemed to put effort into *appearing* mathematically incapable. At this point my observations were unsubstantiated and simply caused me to question why it was that smart girls would want to appear unintelligent, especially within the context of the math classroom. Shortly upon completing my teaching assignment, I began tutoring privately with a roster of twenty-one high school girls. Again, this same pattern emerged. Many of my female students who were mathematically proficient insisted they were mathematically incapable and, more interestingly, generally seemed to *want* to appear unintelligent! At this point, I had neither evidence that my observations were justified nor did I have any insight into what might motivate these girls to act this way. However, I had a feeling that these girls, steeped in celebrity culture and well-versed on the newest fashions, were emulating female celebrity icons such as Paris Hilton who tend toward a normative femininity that paints women as beautiful *but* brainless. These insights eventually led me to pursue my observations at the theoretical level, reaching out to various bodies of literature in order to explore this phenomenon. It was only after an in-depth exploration of work across a variety of seemingly disparate disciplines that I returned to my students for further experiential investigation with which to elucidate the conceptual conjectures that I developed.

My work picks up where innovative scholars in the field of mathematics education, such as Walkerdine (1991, 1998), Damarin (2008), and Mendick (2005a, 2005b), have left off. While these scholars combine ideas related to social construction, the positioning of mathematics and femininity, and the absence of appropriate female role models for adolescent girls, in order to analyze the mathematics participation gender gap, I extend this perspective by adding insight relating to marketing and consumerism. In light of the abundance of work that points to society and the media as the most significant influences on adolescent choice (Kelly & Stack, 2006), it seems foolish to discount the impact that such forces may have on the educational decisions of

¹ Within the scope of my thesis, female teenagers are referred to as 'girls,' as the subjects in my study use this term to refer to themselves and their peers. Moreover, students in high school are typically referred to as girls and boys by their teachers and social group.

teens. My work attempts to bridge the gap between the scattered yet intricately related bodies of work that use the aforementioned themes as a means to eventually bridge the gender-math participation gap. Furthermore, I suggest that by using marketing theory to analyze trends in mathematics participation, we can begin to not only understand our students as ‘consumers’ of education, but understand how mathematics as a *product* is marketed and sold to girls in a manner that renders it incompatible with their ‘consumption’² needs. In a society where media, corporate branding, and marketing tactics, are used in every facet of life as a means of reaching teenagers, it is perplexing that research has not been done in order to examine the effects of such institutions on the educational and career choices of this audience. As evidence consistently points to a discrepancy between the data regarding mathematical capability and that regarding mathematical participation, there is a clear need for an innovative means by which to examine and address the issue.

Drawing from my own academic backgrounds in business, marketing, and mathematics education, I take a cross-disciplinary approach in an attempt to investigate and find ways to mitigate female attrition in math. Taking a cross-disciplinary approach involves the integration of various bodies of knowledge originally unintended for use within mathematics education. In this way, this knowledge can be re-purposed in order to provide a fresh perspective on many issues within the field. Marketing theories and strategies often rely on the idea of ‘selling identity’ as a means to position and sell their products. This thesis explores the effect that marketing strategies, such as product placement and celebrity endorsement, might have on girls who choose not to pursue mathematics due to a lack of identification with its image and positioning within society.

The girls participating in this study are representative of a very specific sector of the adolescent population. They are Caucasian students from Toronto, Ontario, who identify as middle- to upper-class (Thompson & Hickey, 2005). While they achieve high scores in their math classes, most of them opt not to pursue mathematics beyond the compulsory level. These girls are popular amongst their peers, and maintaining a high social standing (being accepted

² Within the scope of this thesis, ‘consumption’ itself is two-fold. On the one hand, there is the actual physical act of consuming and acquiring a product, service, or idea. I take the act of consumption beyond the superficial and beyond the realm of the tangible by making reference to the consumption of popular culture, suggesting that it is *by* consuming that we are in fact complicit in the process of our own subject construction. Please see Chapter 1 for more details.

and liked) is a priority for them. As such, they are the girls who avidly consume all forms of pop culture, which is rife with messages disseminated by mass media that tend to promote acceptance, popularity, and the normative vision of femininity that accompanies it. This is a femininity that stipulates that girls must look pretty, be attractive to boys, not appear too intelligent, and essentially adhere to all traditional notions of femininity (Walkerdine, 1990; 1998). For more details regarding my sample, please refer to Chapter 1.4.

Focusing on this group of women, I use a conceptual bricolage, drawing from the fields of mathematics education, feminism, psychology, and marketing, in order to investigate the issue of under-representation in higher-level mathematics. I then use this conceptual framework to situate my empirical work, which investigates the ways in which young women make decisions regarding their participation in higher-level mathematics, relating it to the ways in which they make consumption decisions in other areas of their lives. By synergizing my empirical investigation with the framework provided by the literature, this study endeavours to uncover new and innovative strategies that may enable us to reposition mathematics in a manner that makes it easily consumable to this niche market. It is important to note that this study is a conceptual one that relies heavily on relevant literature from disparate disciplines in order to develop an innovative lens with which to view the issue of female attrition in mathematics. While data collection is a significant component of this study, it is intended to elucidate ideas that emerge from the conceptual, not the other way around.

In Chapter 1, I lay out the conceptual grounding for my work. I then explore my research problem in Chapter 2, stating my research questions and providing the rationale behind my work. I then introduce my sample, the methodology, and the data analysis technique that I used. In Chapter 3, I provide an in-depth literature review in which my findings are organized into four emergent themes. I then take these four themes and use participants' data to provide an experiential account of what emerged conceptually. In Chapter 4, I investigate the implications of my research, explaining how it might be used in conjunction with the mass media to market mathematics to the investigated segment of the female population. Finally, in Chapter 5, I provide a sample marketing plan as a tangible example of how I propose to turn the conceptual into the practical in an attempt to address the issue of female disinterest and attrition in higher-level mathematics. Chapter 6 concludes this thesis with an exploration of the limitations of my work, and provides suggested directions for future research.

Chapter 1: Conceptual Grounding

The following chapter is intended to conceptually ground my work in relevant literature. The theories of several authors across a variety of disciplines are explored to build my conceptual framework. In what follows, I illustrate how I restrict, extend, and recontextualize ideas drawn from the work of Walkerdine, Mendick, Demetriou, and Gladwell, in order to ground my work.

1.1 Conceptually Grounded

Valerie Walkerdine.

Valerie Walkerdine's work examines the discourse of mathematics and, specifically, that surrounding math education through a lens illuminated by work in areas relating to psychosocial studies and critical psychology, gender and class, and cultural theory. Walkerdine takes on the gendering of mathematics and explicates how it conflicts with notions of normative femininity. She proposes that it is the gendering of academics and, more specifically, mathematics education that renders it inaccessible to females trying to succeed in a society where much emphasis is placed on mastery of the 'appropriate' gender role and the gender script implicit. By centering her work around key conceptions of the subject, femininity, and binary (re)production, Walkerdine aims to find a novel approach to de-ontologizing gender and mathematics so that they are no longer (re)constructed as incongruent with one another.

It is important to note that Walkerdine's view of both the subject and of math education is premised upon social construction as a means to (re)producing both *people* as and *mathematics* as gendered subjects. While the idea of 'the subject' and of 'being subjected' contrasts with humanist perspectives that assert that people, places, and things have inherent value, for Walkerdine, this is not the case. Instead, Walkerdine sees them as interpellated³ within a symbolic system and, in a sense, assigned meaning and structure contextually. Drawing on scholars such as Butler (1997), Foucault (1980) and Davies (1994), Walkerdine tends towards

³ Interpellation, as used by Walkerdine (1998), Mendick (2005), and Butler (1993), is a term borrowed from the work of Louis Althusser (1972, as cited in Butler, 1993). A concept that describes the process by which ideology pre-supposes and encompasses the (abstract) pre-ideological individual, interpellation thus *produces* subjects, while rendering them unwittingly complicit in their own (re)production. This view of the subject is in opposition to a perspective that sees individuals and identity as inherent or in any way biologically rooted. In other words, the situation always precedes the subject.

subject construction as opposed to supposing an inherent pre-determined identity⁴ of the individual. From the perspective of social construction, individuals are constructed by their experiences, environment and, implicitly, by the way in which these experiences and environmental factors are defined by a society that has been, and continues to be, premised upon binaries stemming from a patriarchal perspective (Walkerdine, 1998).

In Walkerdine's view, social construction occurs within a spectrum of pre-defined binaries that position everything within either/or categories. Focusing specifically on gender and mathematics, Walkerdine asserts that binaries such as masculine/feminine and rational/emotional interpellate subjects, generating distinct black and white categories that leave no room for shades of grey. In this sense, to be feminine is to *not* be masculine and moreover, binaries such as rational/emotional are gendered so that to be feminine is to be emotional at the expense of rationality--a quality associated with mathematical ability. As Walkerdine (1998) asserts:

The gender and mathematics problem is a product of the distorted social construction of gender roles and differences and of mathematics itself (Ernest, 1991 as cited in Walkerdine, 1998). Thus, dominant discourses impose a 'regime of truth' (Foucault, 1980 as cited in Walkerdine, 1998) in which views such as *maths = male*, *maths ≠ feminine* and *female = inferior* are confirmed and sustained...the powers of rationality and mathematical thinking are so bound up with the cultural definition of masculinity. (p. 8)

This excerpt demonstrates Walkerdine's view on the subject and the binaries within which one becomes interpellated. Walkerdine, like Davies, extends the idea of binary articulation by arguing that femininity is always regarded as 'other' to masculinity in the sense that the qualities associated with masculinity have been historically produced as superior and continue

⁴ In the field of psychology, the term 'identity' often refers to self-image (a person's perception of him or herself), self-esteem, and individuality (Côté & Levine, 2002). Psychologists most commonly use the term to describe personal identity, or the traits that make a person unique. Meanwhile, social psychologists often use the term to describe social identity, which refers to the constellation of group relationships that interact to define the individual. However, I refrain from sticking strictly to either of these definitions in my thesis. Instead, I use the term to refer to *both* one's self image *and* to one's social identity (Côté & Levine, 2002). However, in contrast to its psychological definition, in which the term implies the capacity for self-reflection and the awareness of self (Leary & Tangney, 2003, p. 3), I take a Butlerian notion of the individual as a *subject* (Butler, 1997; Mendick, 2005; Walkerdine, 1998), socially constructed by external forces. In this sense, while identity still refers to self-image, personality, and social identity, it does so while assuming that this very identity is the result of social construction and subjectification.

to be viewed as such today (Davies, 1994). Davies (1994) uses the concept of marking in order to develop this idea by explaining that within any binary pair of subject categories (white/black, male/female, teacher/student, heterosexual/homosexual, adult/child, etc.), the former is usually understood as normal and the latter as a dependent term that takes its meaning in terms of its difference from the former. According to the gendered binaries upon which male and female are premised, traditionally to “do girl” carries with it the connotations of fragility, irrationality, complacency, and neatness, which conflict with the positioning of mathematics, a subject premised upon rationality and risk taking (Aapola, Gonick & Harris, 2004).

Drawing on Foucault’s notion of what comes to be known as a ‘truth,’ Walkerdine (1998) suggests that there is no inherent truth to anything and that, conversely, the truths we have come to believe and assume (about women and mathematics) are constructed based on the society we live in and the discourses it encompasses.

Expanding the idea of subject construction and how one comes to *be* (re)constructed, Walkerdine (2003) draws on Bauman’s (2001) notion of “consuming oneself into being,” an idea that relates the act of consumption directly to that of subject interpellation. Exploring how class might enter the production of subjectivities, Walkerdine (2003) draws on Bauman (2001) to explain the ambivalence that arises when one attempts to assert oneself as the “unitary subject” by buying into “the delusory character of self-determining, individualistic and autonomous ideas of subjectivity” (Gonick, 2004, p. 204 as cited in Walkerdine, 2003, p. 247), a necessary by-product of neo-liberalism. Ambivalence refers to “the discursive place where there is a slip or sliding, ambiguity between classifications” (Walkerdine, 2003, p. 247). A restless space to (temporarily) occupy, this ambivalence demands reconciliation, causing the subjects to rely on consumption in order to position themselves within a pre-defined spectrum of binaries in an attempt to achieve consistency and, thereby, establish a fixed, defined position as the unitary subject. Bauman (2001) explains that:

The single and simple discursive classification is what makes possible the fiction of the rational unitary and autonomous subject—I am this. Therefore the failure to classify, that he calls ambivalence, is experienced as great pain and anxiety for the subject because it is lived as a failure to become the desired singular subjectivity, the subjectivity that one can consume oneself into being. (As cited in Walkerdine, 2003, p. 247)

By consuming that which surrounds us, we are complicit in our own subjectification,

constructing ourselves within the subject offerings discursively presented to us.

Moreover, Bauman explains that our consumption is not limited to that which we are, or desire to become, but, more significantly, it defines that which we are *not*. Drawing on Bauman, Walkerdine (2003) explains that “always this desire [to arrive at one’s desired identity] must be set against its Other, that which it defends against, the other positions” (p. 247).

In a sense, Walkerdine (2003) takes on a (Butlerian) notion of a subject essentially without agency, a concept on which Mendick elaborates. According to Butler (1997), as subjects produced by the very society that we inhabit, the agency we actually possess is *not* the same as free will. She explains that “within subjection the price of existence is subordination precisely at the moment in which choice is impossible, the subject pursues subordination as the promise of existence. This pursuit is not choice, but neither is it necessity” (p. 20 as cited in Mendick, in progress). In fact, drawing on Butler and Walkerdine’s work, Mendick paraphrases the idea of agency succinctly:

To be recognised as human, to possess a liveable life, to exist at all requires becoming part of gender, being written and writing oneself as man or woman (or man trapped in a woman’s body or any of the other socially legible narratives of gender). There is nothing before this, we are always already gendered, and there is no choice but to be subjected to gender. (In progress)

Drawing on this notion of mandatory/essential subjectification, Walkerdine (2003) extends this idea to our inscription within the system of mathematical ability as essence, illustrating that just as we are inscribed within gendered binaries, we are positioned within a pre-defined system of mathematical ability that treats this ability as gendered in and of itself.

Heather Mendick.

Heather Mendick approaches her work in the field of mathematics education in much the same manner as Walkerdine. In fact, she often references Walkerdine’s ideas as a starting point for elaboration. While Walkerdine tends to focus predominantly on issues revolving around schooling, pedagogy, and the systemic nature of educational structures, Mendick brings similar concepts into the realm of the media and popular culture, extending Walkerdine’s ideas further into the mainstream. That is, while Walkerdine investigates the education system, Mendick explores how the same systemic issues come to the fore and are elaborated upon in mainstream pop culture. In pieces such as “Only connect: Troubling oppositions in gender and mathematics” (2005a), and “A beautiful myth? The gendering of being/doing ‘good at maths’”

(2005b), Mendick explores how it is that discourses surrounding mathematics and *doers* of mathematics permeate society at large. This reproduces familiar binaries that position mathematics as an antipode of femininity, rendering it near impossible to reconcile the two divergent subject positions (Damarin, 2008; Tresemer, 1976; Walkerdine, 1988, 1998). While Walkerdine (2003) focuses on binaries that surround gender and mathematics education, Mendick extends the concept of binaries further, using it as a tool with which to interpret not only math education, but the research and analysis produced by researchers within math education. Mendick (2005a) argues that the “use of the oppositional framing, separation versus connection (and others, such as cognition versus affect and objective versus subjective), operates to fix difference, and so to fix gender and mathematics within a structure of binary thinking that ultimately serves to re/produce gender inequalities” (p. 161). Much of Mendick’s (2005a) work is aimed at finding “a more productive approach to understanding the continued gendering of participation in mathematics” (p. 161).

As Mendick’s work, like Walkerdine’s, focuses on the individual being interpellated within a spectrum of binaries, her view on the subject is extremely pertinent to my work. Like Walkerdine, Mendick approaches identity as a product of social construction, asserting that she:

see(s) subject choice as being centrally about identity; it is a key site in which young people produce themselves/are produced as part of an on-going lifelong project of self. This identity work involves being positioned/positioning oneself within a range of discourses (Foucault, 1972) on mathematics, masculinity, femininity, education and much more. (2005a, p. 165)

From this perspective, Mendick sees gender as being in *motion*, rather than fixed as an inherent set of biologically rooted traits. This approach ties into Mendick’s view on agency, which is closely related, like Walkerdine’s, to Judith Butler’s: “Gender is always a doing, though not a doing by a subject who might be said to preexist the deed for there is no gender identity behind the expressions of gender; that identity is performatively constituted by the very ‘expressions’ that are said to be its results” (Butler, 1999, p. 33 as cited in Mendick, 2005a, p. 165). From this vantage point, what comes to be defined as male and/or female is “produced through reiterative performances, in such a way that they appear to precede these performances, and so are experienced as authentic by the performer/possessor” (Mendick, 2005a, p. 165). This

links to one of Mendick's main assertions that we must be aware of how we often unconsciously inscribe gender onto our conceptual categorizing of mathematics.

Mendick's work ties together notions of identity/subjectification, binaries, and subject interpellation, extending these concepts from the realm of the academic into that of popular culture. By juxtaposing both domains, Mendick demonstrates how it is that the two are inseparable and, in a sense, act to (re)construct one another.

Demetrakis Z. Demetriou.

Walkerline and Mendick's work (and in fact my own), is heavily premised upon the concept of heteronormativity and the hegemonic masculinity encompassed. Hegemonic masculinity, a term coined by Robert Connell (1987 as cited in Demetriou, 2001), describes: 1) a position in the system of gender relations; 2) the system itself; and 3) the current ideology that serves to reproduce masculine domination. The concept of hegemonic masculinity has influenced gender studies across many academic fields but has also attracted serious criticism, Demetriou (2001) being one of its main critics.

In his piece "Connell's Concept of Hegemonic Masculinity: A Critique" (2001), Demetriou argues that hegemonic masculinity is not static (as Connell assumed), but constantly in flux. Demetriou (2001) argues that hegemonic masculinity does not simply (re)construct subjects, but changes over time, as do the subjects that are born into its structure. Specifically, Demetriou argues that subordinated masculinities have the potential to influence and subvert dominant forms, ultimately enabling hegemonic masculinity to retain its dominance. By making 'allowances' for the appropriation of (formerly) non-masculine, newer forms of hegemonic masculinity provide justification for the reinforcement and perseverance of its more 'traditional' and fixed precepts.

Demetriou (2001) suggests that while discursive ideals often appear resistant to change, they do in fact undergo subtle changes over time given the introduction of minor components that are integrated and dispelled, creating a shift in what becomes acceptable and understood as masculine. Demetriou (2001) explains that to appropriate is therefore to translate and re-contextualize, to produce something *new* that is "neither the one nor the other, but is a historically novel combination, a third space that enables new strategies to emerge" (p. 351). However, as Demetriou warns, the introduction of such new components cannot be so drastic as to undermine the inherent notion of the ideal itself. In the case of hegemonic masculinity,

one might consider how traditional notions of masculinity have shifted over time, an idea I explore in depth in Chapter 3.2. Demetriou argues for redefining the concept of hegemonic masculinity by placing a stronger emphasis on the dynamic nature of hegemonic masculinity and recognizing internal contradictions that arise when its definition shifts to incorporate novel features. The result is the generation of a new version of heteronormativity that ultimately permeates society enabling hegemonic masculinity to retain its dominant stance.

Malcolm Gladwell.

One of the main focuses of my work is the idea of 'cool' and, more specifically, the way by which not only *people* acquire this often coveted status, but also how products, services, and ideas come to be declared and accepted as cool and trendy. Malcom Gladwell's work on both 1) coolness and 2) the adoption of consumer goods by the mainstream is pivotal to my project.

Being termed cool is a status that many adolescents⁵ desire and a label that many consumer goods benefit from. 'Cool' is, however, an elusive term, since what comprises cool is constantly changing and hard to pin down. In his article "The Coolhunt" (1997), Gladwell follows Baysie Wightman and DeeDee Gordon, two 'coolhunters,' on their quest to find the newest trends. Coolhunting, a term coined in the early 1990s, refers to a novel marketing approach in which marketers search far and wide, making observations and predictions with regards to new or existing cultural trends. Essentially these marketers hone in to key sites and people hoping to catch trends before they hit the mainstream. Once the trends are found, companies can intercept them by making products that are in line with the current standards of cool. Furthermore, coolhunters constantly interact with customers to determine whether companies are making cool products. Gladwell (1997) documents their search as they travel around New York trying to find items to bring into the mainstream in order to ultimately turn them into the newest trends. While there is much debate along their journey regarding what exactly constitutes cool, Gladwell (1997) asserts that while the notion of cool is always changing, it has one characteristic that remains constant: being cool/popular implies that one must be accepted by their peers. As O'Donnell and Wardlaw (2000) explain, " 'Coolness' is a set of shared meanings (e.g. language, self-presentation, artistic expression, values, attitudes)

⁵ Within the scope of this thesis, 'adolescence' (and the 'adolescents' involved) refers to a transitional stage of physical and mental human growth that occurs between childhood and adulthood. This transformation may include physiological, social, and psychological modifications.

within a peer group which signify group affiliation” (p. 13). Moreover, Gladwell explains that as opposed to definitions of cool that refer to trends and ideals located on the fringes of society, he is focused on a notion of cool that instead centres on consumption habits and social status of those who are considered to be a part of mainstream popular culture. While being accepted is a key component of being cool, it is much more nuanced than that and, most importantly, takes shape contextually, an idea that I explore further in my thesis.

In addition to exploring the essence of cool, Gladwell’s work investigates marketing techniques⁶ that promote and sell products on the basis of cool. Gladwell (2010) asserts that in many cases it is the marketer’s adherence to social visions of cool that can make or break the way a product is received by the masses:

Do you believe that it was essentially the 'cool' marketing campaign that tipped the Airwalk trend? Can you think of other more current products that have exploded onto the market with an equally impressive advertising assault? Would Apple computers and the iPod phenomenon, for example, be as popular if it didn’t have its signature marketing campaign? (paragraph 1)

Gladwell states that marketing techniques, in conjunction with the media⁷, have the potential to essentially make anything cool if utilized in the right context and, most importantly, if used to target the *right* people.

The idea of pivotal people as conductors of cool takes shape in Gladwell’s later works. It is in these works that Gladwell takes a more mathematical approach to the means by which ‘little things’ become ‘big things’ by examining the fulcrum: the point at which seemingly out of nowhere the ordinary becomes the extraordinary. As Gladwell (2002) states, "ideas and products and messages and behaviors spread like viruses do” (p. 12). He suggests that the phenomenon by which the mundane becomes popular is due to the role of specific groups of people. Gladwell (2002) uses a diffusion model in order to describe how a contagious idea, product, or innovation moves through a population.

⁶ By referring to marketing techniques, Gladwell is referring to any form of marketing, including advertising (print, media, web), celebrity endorsement, product placement, and any other form of marketing communication that organizations may use in order to promote their products. This is the definition I adopt throughout my work.

⁷ The media, like the education system, is one of society's institutions, industries, and cultural practices. The term media is commonly invoked to mean both devices of communication (radio, recorded music, Internet, television, print, film, video) as well as the products or texts of these media (journalistic accounts, television shows and film productions, videogames, web sites). The central media, which include print, radio, and television, are the ways we "imagine ourselves to be connected to the social world" (Couldry, 2003, p. 7 as cited in Kelly & Stack, p. 6).

According to Gladwell (2002), it is the Early Adopters and the Innovators who are the most pivotal in terms of adopting novel products, making them cool, and circulating them into the realm of the mainstream. Innovators and Early Adopters are Opinion Leaders, those members of a society who adapt ideas so that they are acceptable by the majority who are, as a rule, more risk-averse and intuitively conservative. They kick-start the product adoption process, enabling the product to eventually make its way into the mainstream where it can then reach the Early Majority, a skeptical mass who never try anything until the most respected of this group try it first. Gladwell (2010) asks:

How do weird, idiosyncratic things that really cool kids do end up in the mainstream? They are translated from a highly specialized world into a language the rest of us can understand. So, when we judge things as being weird and idiosyncratic are we really saying that we just don't understand it? It's not the product but our interpretation of it that is limited? Could everything, if 'sugarcoated' in a way we recognize, ultimately, become palatable and even enjoyable? (paragraph 3)

This excerpt illustrates Gladwell's view that it really is a matter of getting *key* people in social circles to adopt a product or idea *first*, before it can be accepted by the mainstream. The emphasis is really on honing in on the right people, those who comprise the Opinion Leaders, those who *already* have attained the status of cool, and promoting to them so that they can in turn promote to the larger majority who trust their opinion due to their solidified and accepted status as cool.

Gladwell elaborates, explaining that Innovators and Early Adopters are comprised of Connectors, a kind of societal glue, who consciously disseminate ideas. Connectors are the people who "link us up with the world ... people with a special gift for bringing the world together" (Gladwell, 2002, p. 38). They are "a handful of people with a truly extraordinary knack [... for] making friends and acquaintances" (Gladwell, 2002, p. 41).

Gladwell's work investigates and dismantles the essence of cool and explores the means by which this essence is ascribed to products and people. He provides a solid foundation upon which I build my own argument that it is in fact possible for the ordinary ('nerdy' math) to become the extraordinary ('cool' math), given the right circumstances, context, and group of people.

1.2 Restricting, Extending, and Recontextualizing

The four aforementioned authors play major roles in my work, as I have incorporated many of their ideas and much of their terminology into my thesis. The following is a description of the terms I have borrowed and the means by which I have extended or restricted them within the scope of my work.

Drawing on Walkerdine and Mendick's work, I adopt the definition of 'consumption' and, more specifically, of 'consuming oneself into being' as inspired by Bauman. On the one hand, there is the actual physical act of consuming and acquiring a product, service, or idea. On the other hand, however, I take the act of consumption beyond the realm of the tangible, making reference to the consumption of popular culture and its relationship to subjectification. That is, by consuming the ideals, values, and mores encompassed by popular culture, we are unwittingly generating an identity that is but a (re)production of who society dictates we *should* be.

While Walkerdine draws on Bauman's work in order to explore the role of 'class' in the production of subjectivities, Gonick (2006) applies this same idea of 'consuming oneself into being' to her own work, arguing that it is this very notion that girls rely on in order to position themselves within discourses of 'girl power'. I extend this notion further to the way by which our consumption of popular culture generates subjects that mimic the normative ideals that permeate our societal structure. I then move this idea, like Walkerdine, to the realm of mathematics education, purporting that the act of consuming academics and specifically math unwittingly constructs us as mathematically capable/incapable subjects. This is a distinction that is not always compatible with the gender scripting imposed upon us by the media that disseminates normative ideals. Specifically, with reference to the notion of 'othering,' to be mathematically capable is to *not* be feminine. As Bauman (2001) explains, consumption allows the subject to assert that "it is this, not this," or within the scope of this thesis, that it is a 'girl,' *not* a 'mathematician.'

Walkerdine and Mendick's notion of the subject is also woven throughout my work, as I approach my sample and the girls they represent as socially constructed. However, while Walkerdine and Mendick tend towards a Butlerian view of agency, I restrict this term slightly, suggesting that while we don't necessarily possess true individual/free will, we still have the ability to make choices *within* our subjectification. That is, while external forces act to

(re)construct us, we still have the capacity to make choices within the realm of possibilities afforded to us. For example, while it may be tremendously hard to escape the gender scripting that tells us to act in accordance with our gender roles, it is not *as* impossible to adopt a variety of scripts *within* those roles, and to reposition ourselves, as experience and knowledge illuminate those very possibilities.

Demetriou's (2001) vision of the subversion of hegemonic masculinity also plays a pivotal role in my work, as it is this concept with which I propose to reposition mathematics in conjunction with femininity. By extending his ideas, I suggest that there is a way by which notions of femininity and mathematical capability *can* eventually be re-positioned as congruent rather than as incompatible. Within the scope of my thesis, I repurpose Demetriou's idea of subversion by taking it out of the realm of hegemonic masculinity and applying it to both mathematics and normative femininity. It is important to note that Demetriou's work refers specifically to the fluidity of hegemonic masculinity as enabling its persisting dominance. This particular facet of his work does not apply to my argument. Instead, I simply intend to use the notion of an ideal as fluid, rather than stagnant, in order to illustrate how it is that both the categories of "feminine" and "mathematically enthusiastic" need not remain positioned as incongruent. In fact, I suggest that his ideas regarding this fluidity have already been shown to hold true for normative femininity, as can be seen by the emergence of 'new' forms of femininity such as "girl power" (Harris, 2003). A key point Demetriou makes is that for non-traditional features to be incorporated into a normative and dominant ideal, the ideal must be proven to exist first. It is only *after* the fact that minor qualities that seem incongruent with this ideal can be appropriated, giving way to the emergence of a *new* definition of the norm being altered. This is similar to the concept of mathematical capability being deemed cool *if* foregrounded onto what is *already* cool, as I propose in Chapter 3.1. In the case of normative femininity and mathematics, if normative femininity can shift to absorb intelligence into its definition, and if mathematics can be repositioned so that it absorbs cool into *its* definition, then perhaps the two can be seen as compatible, rather than divergent.

Finally, I use Gladwell's (2002) work on coolness and consumer adoption to elucidate the means by which I see the novel, subverted versions of both mathematics and femininity to be in a sense distributed among the mainstream. Gladwell's ideas regarding the trajectory of a product or idea, from being virtually unknown to 'suddenly' appearing in the mainstream as

cool and desirable, parallels the means by which mathematics might be positioned, disseminated, and consumed, once subverted. This is an idea I explore in greater depth in Chapter 4.1. However, I would like to note that as Gladwell's work delves deeper into the means by which specific subsets of the population work in synergy with their environment in order to move products and ideas from the fringes to the mainstream, so does my own. As an extension of his idea, I propose that similar strategies used to make products cool can, in fact, be applied to mathematics. The subset of the population I have chosen to explore and make the focus of this piece is pivotal as they are Opinion Leaders. In line with Gladwell's ideas, they are those individuals who hold the most authority and power in terms of making a product cool and desirable within the subset of females in which I am interested.

Walkerdine, Mendick, Demetriou and Gladwell all play essential roles in grounding my work by providing a foundation, if not a springboard, for several of the key ideas and concepts that emerge from my research and analysis. In what follows, I use this foundation to address, tackle, and propose an approach towards the issue of female attrition within mathematics for a specific subset of young women.

Chapter 2: An Introduction to the Research Problem

2.1 Introducing the Research Problem

For decades the gender gap in mathematics has been the subject of much scrutiny and analysis. To date, an abundance of humanist theories have examined biological constitution as a justification for the superior mathematics capability of males (Gallagher & Kaufman, 2005 as cited in Brandell et al, 2008). Such theories have since been debunked, and the gender gap in mathematical ability has been disproven. Studies show that women are not only achieving on par with males, but in many instances outperforming their male counterparts. Nonetheless, statistics regarding post-secondary mathematics participation show that mathematical fields of study and career trajectories remain disproportionately dominated by males (AAUW, 1998a, 1998b, 2003).

In the past year, a handful of articles have appeared in mainstream media touting headlines such as “Secret life of girls: Making a mark in math” (Gordon, 2010) and “Decimals are a girl’s best friend: Research debunks myth of gender gap in math” (Scrivener, 2010). These articles all tell the same story: the gender-gap in mathematics is being abolished as girls consistently outperform males in high school math classrooms. However, most of these articles warn that the numbers show that men still dominate math-related careers. None of these articles provokes further insight into why girls are excelling in math classrooms but continue to shy away from mathematics at the post-secondary level.

Research suggests that mathematics remains a subject that students, especially females, dislike, ultimately leading to an under-participation of women in post-secondary fields requiring mathematics (AAUW, 1998a, 1998b, 2003). Because participation in higher-level mathematics at the high school level is a precursor to math-related college pathways, and in turn a pre-requisite for math-related fields of work, this under-participation of females inevitably leads to gender disparities in the workforce. As it is predicted that (in the United States) over half of all jobs in the near future will involve mathematics (Boaler, 2007), the idea that women may not comprise a significant portion of this workforce is an important one. The subsequent effect of unbalanced gender participation rates in mathematics at the high school level is a lack of women learning mathematics at the post-secondary level, which ultimately results in an uneven distribution of males and females in certain, usually more “prestigious” (Leder, 2007), sectors of the workforce. This is problematic as it acts to reconstruct women as economically

and politically inferior to men and asserts a secured spot for males in what continues to be a patriarchal society. Given the issue of female under-representation in higher-level mathematics and the resulting societal consequences, it is imperative to explore what factors lead to and influence such attrition.

The under-participation of capable women in the field of mathematics has been ascribed to a wide range of factors including those that are socio-political, economic, affective, and psychological in nature. Theorists have proposed such factors include a lack of innate ability (Gallagher & Kaufman, 2005 as cited in Brandell et al., 2008), as well as unsatisfactory math related pedagogy in schools (Brandell et al., 2008). Of particular interest to my work is one factor that has recently been investigated as the cause behind female attrition in the field of post-compulsory mathematics: the lack of identification with the subject matter by women (Mendick, 2005a, 2005b; Walkerdine, 1990, 1998).

Many scholars have started to go this route, probing further into the mystery of gender-disproportionate mathematics participation, citing theories related to gender construction and stereotyping (Damarin, 2008; Mendick, 2005a, 2005b; Walkerdine, 1990, 1998) and the lack of female role models (Brandell et al., 2008). However, it seems as though the solutions available to parents, teachers, students and others outside of the academy are all premised upon the notion that if girls simply overcome their math anxiety and realize that they are as capable as boys, then they will suddenly begin to enjoy math and desire to pursue it of their own volition. For example, in “Secret life of girls: Making a mark in math,” Scrivener (2010) touts the abundance of ‘great’ careers available to women who choose to pursue math, such as “actuarial analyst, statistician, and program manager for a cell phone company.” However, these careers appeal to the same group of students that would likely *choose* to take math. Put bluntly, these are not exciting, novel career options to which the average teenage girl aspires. Moreover, conferences such as Waterloo’s “Think About Math” attempt to get women interested in math-related careers that are typically dominated by men. The conference targets grade nine girls with math marks that are 70% or higher. Fiona Dunbar, the director of the conference, claims that the purpose of the conference is “to show the girls that math is fun, relevant and leads to lucrative and exciting careers...grade nine is a pivotal year for girls. [We hope that] by engaging with young women we will be able to increase their confidence and preference for math in the early years of high school” (University of Waterloo, 2009). Yet,

similar to Scrivener's article, the conference leaders simply revisit familiar mathematical career trajectories. Again, note that nothing new is going on here. The same girls who are already mathematically capable are simply being marketed the same products (typical math-related careers) in the same manner (get over math anxiety, math can be useful). What about the girls who are mathematically capable, yet planning on dropping out after their compulsory credits due to a lack of interest or identification with mathematics? Such 'solutions' fail to take into account the wealth of work by scholars, such as Walkerdine (1998), who suggest that the math-gender participation gap is a result of the social construction of mathematics and gender, rather than a straightforward fear of failure due to a lack of ability or a lack of information regarding the mathematically oriented career options available.

There is a growing body of evidence that suggests that the opposing social constructions of mathematics and femininity render it difficult for girls to identify with both simultaneously (Walkerdine, 1990, 1998). This inability to negotiate an identity as both a mathematician and a female is an important one; it is an inability that current public and educational efforts to curb female attrition fail to address.

2.2 Research Question(s)

In order to address the research problem, I have formulated a main research question that encompasses two very specific components. The fundamental question is as follows:

Do girls choose to not pursue math beyond the compulsory level because they are selecting courses to construct their identity on the basis of cool, using the same evaluation process they would when selecting products for consumption?

Specifically:

1. How do adolescent girls who generally see themselves or are perceived as being part of the mainstream culture (SES, race) understand mathematics and their relationship to mathematics?
2. What are the relationships between the girls' understandings of femininity and decisions to pursue mathematics beyond compulsory requirements?

2.3 Rationale

If we can ascribe the same consumption criteria to course selection as product selection, then we can begin to question whether techniques used to sell products (such as marketing techniques) can be used in order to re-position/promote mathematics learning to this sector of the female population. If we *cannot* view math in this way, then we know that

there are other salient factors upon which these girls base their choices about mathematical participation.

It is important to note that while this thesis proposes the use of marketing techniques and theories, such strategies are in no way intended to yield monetary gain or to profit from this subset of girls. Moreover, this thesis is in no way directed at teaching girls to be critical of media or to deconstruct advertising. Rather, the proposed interweaving of marketing into the realm of education is solely intended to reduce attrition in math and keep options open for this target group.

2.4 Sample

My participants consisted of nine female students whom I previously tutored in mathematics from 2006 through 2008. Seven of the nine participants were in the process of completing their final year of high school at the time of the study. The other two were in the process of completing grade eleven, their second last year of secondary school. These students belong to mid-to-high socioeconomic status groups (Thompson & Hickey, 2005), are Caucasian, and live in Toronto, Ontario.

I decided to focus on this subset of girls for several reasons. My decision was made primarily due to issues of accessibility. I had worked with these girls for over three years and had developed a relationship with them. I believe that this relationship is integral in gaining access to in-depth and personal responses about their lives that might not be readily shared with a stranger. Additionally, these girls are all Opinion Leaders within their schools and social circles; they are significantly influential to their peers. Finally, the majority of my life has been spent with this demographic segment, either as my peers (during my adolescence) or as students of mine (as a teacher and tutor in Toronto, Ontario). Since these girls are representative of the demographic that I have taught and will continue to teach in the future, data specific to this segment of the population is of significance to me as a teacher. A brief introduction of each participant can be found in Chapter 2.9, and a complete description of each participant can be found in Appendix A.

2.5 Methodological Overview

As previously mentioned, the motivation for this study and the research questions that I address arose directly from empirical observations that took place, and *continue* to take place,

through my experience as a math teacher and tutor working with secondary school adolescents. It was these observations that initially led me to an exploration of the literature. Once I found various concepts from across disciplines with which to investigate my observations, I then returned to the empirical to formally collect data with which to substantiate my original informal observations.

As my study is one premised upon the generation and substantiation of an argument backed by empirical evidence, its goal was not to study participant experiences but rather to use such experiences in order to develop an argument cultivated from divergent bodies of literature. The primary means by which I investigated the research problem was through a comprehensive and cross-disciplinary review of literature. I then used qualitative methods to collect empirical data with which to substantiate or refute the conceptual portion of my argument. The qualitative methodology I chose to use included photo journaling, a visual method, and individual interviews, using a narrative inquiry approach to both.

The role of relevant literature.

The basis for the emergence of my research question and for the proposed approaches that ensued was an extensive literature review. Initially, I explored literature relating to mathematics education, feminism, adolescent psychology, and marketing theory. Upon formulating my research questions, I then further examined these bodies of literature in order to see if there could in fact be a meaningful relationship between them. I then used the ideas that emerged as a framework for the photo journal assignment, as well as my interview questions, in order to create a data collection plan that might illuminate or refute the ideas that had emerged from the literature. The data collection was intended to elucidate my conceptually based claims with empirical, experiential evidence so that the issue and proposed approach might move from the realm of the conceptual to that of the practical. If, however, the experiential data collected refuted my conceptual claims, then that would suggest that my proposed approach to the problem of female attrition in mathematics would remain at a hypothetical level.

Qualitative methodology.

Students were asked to participate in creating photo journals before the interviews by selecting images of things they liked (products, courses, people, places), providing written explanations of why they liked the images, and explaining how the chosen images reflected

their identities. The photo journals were designed to give insight into the relationship the participants have with the media. The photo journals also aided in providing a foundation upon which to base the interview questions. For a copy of the photo journal assignment, please refer to Appendix B.

Upon completion of the photo journals, personal in-depth interviews were conducted with each student outside of class time. Interviews ranged from 45-60 minutes in length, and included open-ended questions, which addressed not only the content of each participant's photo journal, but also touched on the following themes:

- General perceptions of mathematics
- The reasons for enjoying and/or *not* enjoying school subjects other than mathematics
- Future academic and career plans
- Reasons for their selection of consumer products
- Cool culture, popularity, and identity

The format of the personal interviews.

The one-on-one interviews took place in my apartment since it is located in the neighbourhood where all of the participants resided. Each interview followed the same format. Each began with an introduction that informed participants that they would be given a pseudonym and that they did not have to answer any questions if they did not choose to do so. This was followed by a series of questions concerning participants' relationship with mathematics, their general media use, their perception of the relationship between intelligence and femininity, and the way that they defined the notion of cool as well as the role that coolness and popularity played in their lives. Participants then viewed two short clips from the movie *Mean girls* (Shimkin, 2004), and answered a series of questions following each segment; each segment involved the depiction of a female protagonist who downplays her mathematical ability in order to appear cool and/or to attract a guy. Finally, each participant was asked to view a print advertisement for an educational institution promoting the study of mathematics and to suggest alternative ways in which math might be advertised in order to appeal to themselves and their peers (see Appendix C for the advertisement). For a sample interview transcript, in addition to a copy of my interview questions, please refer to Appendix B.

Qualitative methodology.

Visual methods as a starting point for data collection have been widely recognized as beneficial as they harness a response from participants seldom elicited by alternate qualitative methodology. Gauntlett and Holzwarth (2006) explain that by “inviting participants to create things as part of the research process, it’s a different way into a research question...and engages the brain in a different way, drawing a different kind of response” (p. 84). Moreover, as Parker points out, “[photographs] present multiple ways of knowing – through perception, signs and symbols . . . Thus, [they] do not offer some single lens authority, but afford multiple perspectives and interpretations” (Parker 2005, as cited in Packard, 2008, p. 68). Gauntlett and Holzwarth (2006) explain that in terms of research pertaining to society and popular culture, the use of visual methods can be especially useful as “the method operates on the visual plane, to a substantial degree, matching the highly visual nature of popular culture. So you have a match between mediated experiences and the kind of method you are using to explore them” (p. 85). This will be of particular importance to my research as my work relies on the means by which popular culture shapes the perspectives of my participants, and how that affects the way they approach mathematics. Gauntlett and Holzwarth (2006) go on to explain that the art of choosing the right method for answering a particular research question is premised on the notion that a method in and of itself is a tool used to gather and develop knowledge about the world and its constituents and, further, that “it’s about exploring how people think about, understand and reflect on their own identities” (p. 85). Photo-journaling encourages participants to use not only their own photography but also popular and accessible images obtained from a variety of sources, including popular media. This is pertinent as it helps to uncover how the girls understand the social construction of their identities with relation to images circulated by such sources, in particular popular culture and media.

The incorporation of personal interviewing as a method in conjunction with photo-journaling not only enables me to hone in on the benefits of instantaneous and instinctual data—a product of interviewing (Palys & Atchison, 2008)—but also allows me to obtain reflective data prompted by engagement with visual methods. By creating the photo journals in advance, the participant is given a chance to reflect on and generate meaning within the concepts integral to this study. When the participants are prompted during the interview, they will have already engaged in a thought process around these concepts and will be able to provide answers with

more depth, rather than based on an instant reaction to the interviewers questions. Further, this allows for questions and discussions to emerge based on the participant's photo journal, offering the opportunity for more flexible exploration and for the discovery of aspects that the researcher may not have anticipated (Gauntlett, 2006; Packard, 2008). Moreover, using personal interviews provides participants with the opportunity to explain their journals. Fostering a two-way dialogue with the participants limits the potential inequity and bias that can result from the researcher's preconceptions which often occur when researchers interpret the work themselves (Gauntlett & Holzwarth, 2006; Palys & Atchison, 2008). Lastly, using photo journals as a starting point helps to reduce the bias that can occur when subjects are positioned within a limited set of preconceived questions originally created to accept/reject an equally preconceived idea held by the researcher, an imbalance that interview techniques alone are often criticized for creating and perpetuating (Palys & Atchison, 2008).

It is important to note that I used a narrative inquiry approach to the interview process. Narrative inquiry suggests that narrative is a means to better understand the 'why' behind human action. In a sense, interviewing as a form of narrative inquiry allows the research participants to put the data into their own words and to reveal the latent 'why' behind their own assertions. Thus, the researcher does not attempt to predefine independent variables and dependent variables, but acknowledges the participants' context and seeks to "understand phenomena through the meanings that people assign to them" (Klein & Myers, 1999). The driving force behind Narrative Inquiry is the notion that each individual lives a storied life on a storied landscape. As such, context is instrumental to understanding the true essence of one's narrative. In this sense, the subjectivity of both the interviewer and the participant is not regarded as a flaw, but rather as instrumental to the process of interpretation. Narrative inquiry places the moment fluidly in contrast with an approach to interviewing that demands objectivity and solely takes the moment into account, failing to recognize the value of introspection. As Clandinin and Connelly (2000) explain, "Narrative Inquiry...is [a means] of trying to make sense of a life lived. To begin with, it is trying to figure out the 'taken-for-grantedness'" (p. 78). I viewed my opportunity to interview these girls and to hear their stories as a chance to understand and make meaning of their experience of being girls and mathematicians simultaneously within North American society. I wanted to uncover that very taken-for-grantedness that underpinned their statements and assertions.

2.6 Delimitations

It is important to note that qualitative methods are not without their limitations. Visual methods are not flawless. Emmison and Smith (2000, as cited in Packard, 2008) and Wang, Cash, and Powers (2000), as cited in Packard, 2008) argue that photoelicitation has its limitations if researchers continue to be the ones driving the interview by selecting the photographs from a personal collection or from among those taken by the participants. I avoided this bias in my research by allowing the participants to select all images themselves and by conducting interviews that enabled each girl to contextualize her images by explaining why she took each picture, when it was taken, and what she felt it revealed. Moreover, viewing the participants themselves as socially constructed relates to the way I view the stories they tell through their interviews, as constructed. The same holds true for the *images* they selected. Packard (2003) cautions that images are sometimes chosen because of what subjects feel they 'should' show, especially when selected to reflect a participant's identity. In combining photo journals with the interviews, allowing participants to reflect on why they have chosen the images, this tendency, which Packard cites as a critique of visual methods, can in actuality help to provide a more in-depth understanding into the social constructions at play in the construction of feminine and mathematical identities.

2.7 Data Analysis

I analyzed the data obtained through personal interviews and photo journals using thematic coding and analysis, which means that I found similarities and differences between participants' responses, coded these similarities and differences as such, and then organized them into overriding themes. Interviews were transcribed and responses were coded for common themes. I then performed comparative analysis to match up participant themes relating to the media and the desire to be cool with the themes that emerged with regards to their relationship with mathematics. Finally, I organized all quotations and journal excerpts into the four major themes that had previously emerged from the literature review, providing the framework for the final piece:

- Theme 1: Identity and the Quest for Cool
- Theme 2: Normative Femininity and Its Incongruence with Mathematics
- Theme 3: The Mathematician Stands Alone
- Theme 4: (Un)popular Culture

2.8 Establishing Positionality

While I attempted to mitigate the power imbalance inherent in the participant-researcher relationship (Palys & Atchison, 2008) by utilizing visual methods and semi-structured personal interviews, which have been applauded for their tendency to empower research subjects (Gauntlett & Holzwarth, 2006), it is important to note that certain imbalances still remain. Insider/outsider debates (Gonick, 2003; Naples, 1996) have shed light on the role of the researcher as an 'outsider' to the world of their research subjects and the issues that occur as a result. As an adult female of minority status researching Caucasian female youth, I run the risk of not only appearing as 'other' to my subjects, influencing the data I am able to collect, but the risk of analyzing their responses from my perspective, which might not be analogous to theirs. Gonick (2003) explains that "one constructs knowledge from a particular social location or standpoint shaped by race, class, and gender, [and that] this analysis contests both the epistemological possibility of understanding the experience of others, as well as the political legitimacy of representing it" (p. 30). While as a researcher one must be aware of the influence that such social locations impose on the research, as well as on the subjects themselves, Naples (1996) points out that absolute "objectivity is an illusion--an illusion smuggled in the comforting blanket of positivism--that the world is ultimately knowable and secure" (p. 87). Moreover, she explains that:

The insider/outsider distinction masks the power differentials and experiential differences between the researcher and the researched. The bipolar construction of insider/outsider also sets up a false separation that neglects the interactive processes through which 'insiderness' and 'outsiderness' are constructed. 'Outsiderness' and 'insiderness' are not fixed or static positions, rather they are ever-shifting & permeable social locations. (Naples, 1996, p. 84)

In a sense, the researcher/participant interaction is an inherent *part* of the research process that can be seen as inhibiting certain aspects of knowledge while simultaneously enabling a flow of information that otherwise might never come to the fore. Lastly, Naples (1996) and Loutzenheiser (2005) both allude to the fact that we are a product of multiple categories that render us simultaneously as 'other' to certain groups in some ways and 'the same' as these groups in different ways. In my case, for example, while I am 'other' to the girls in that I am not Caucasian, I am concurrently 'similar' in terms of gender and class. Again, each of these categories (Caucasian and female) carries with it a range of implications, and an infinite

kaleidoscope of images created by further intersections with class, ability, SES, and so on. Keeping all of this in mind and remaining attentive and reflective to the biases that have the potential to ensue--and understanding that true objectivity does not and cannot exist--enabled me to take as impartial an approach as possible to my research.

It is important to note that I have a unique relationship with the participants that allowed me to obtain results that others may have not been able to access. None of these girls was unfamiliar to me; I have tutored all of them in the past. As a tutor, I distanced myself from adult authority figures (e.g., parents, teachers) by dressing in casual clothing and using the lexicon of adolescents. By showing my genuine interest in their daily lives, I developed a high level of rapport with these adolescents, which was reflected in the girls' willingness to reveal information about themselves (see Sherif & Sherif, 1964 as cited in Kinney, 1993). Moreover, I attempted to carve out a neutral identity for myself by making connections with students belonging to a wide variety of peer groups and by being open to their different viewpoints (Lesko, 1988). Over the duration of my relationship with these girls, even when I have not been actively tutoring them, I have maintained, and continue to maintain, a relationship with all of them using social applications, such as Facebook, text messages, and/or the telephone. Due to our closeness in age (I am 29, and the youngest participant interviewed was 16), and my familiarity with the fashion, interests, and lexicon of these girls, all participants were comfortable enough with me that every so often we went out for coffee, and they updated me with regard to their lives. They considered me a peer or mentor, rather than a teacher or authority figure.

2.9 The Girls

Before delving into an exploration of relevant literature and participant data, I introduce the participants involved in this study in order to contextualize the excerpts from their interviews and photo journals. While the girls are similar in that they are intelligent, mathematically capable, and considered relatively cool by their peers, there are significant differences between them that make for a more nuanced reading into why particular girls self-select out of mathematics.

Several of the girls interviewed are considered Opinion Leaders within their peer groups, as evidenced by their assertions as well as my observations within the classroom, meaning that they are considered role models by their friends and classmates and play a key role in deciding

which fashions, attitudes, and ideas ultimately ‘pass’ as cool.

Taylor is one such participant. Having been popular for all her life, Taylor is proud of her brains, claiming that her intelligence, combined with her social life and fashion sense, makes her the ‘full package.’ While Taylor is insecure regarding her mathematical abilities, she works hard, and consistently achieves high grades. At the time of the study, Taylor had just accepted admittance to the commerce program at The University of British Columbia.

Jessica is another Opinion Leader. While concerned with appearing cool and fashionable, she has managed to find a balance between her social life and her academic pursuits. Jessica enjoyed math until grade ten when she began to struggle. She switched to the applied stream in grade eleven, but after working with me as a tutor, she switched back into academic math and is currently completing all three grade twelve math courses abroad in Switzerland. While Jessica claims to secretly love math, she hides her newfound love for the subject from peers as she claims that her mathematical enthusiasm might threaten her popularity.

A self-proclaimed fashionista, Rachel is yet another Opinion Leader. While she has always understood mathematics fairly well without working too hard at it, she finds it boring. Rachel has always been cool but seems aloof about this status claiming that she cannot be bothered to care about what people think or say about her. Currently, Rachel is attending Concordia University’s Fine Arts program.

The last of the distinct Opinion Leaders, Sarah has steadily enjoyed math and has excelled academically since childhood. Refusing to let academics get in the way of her social life, Sarah claims to love partying and boys, yet she works hard to find a balance between academics and the social. At the time of the study, Sarah had just accepted admittance into a university psychology program that did not require mathematics.

Emma, while not necessarily an Opinion Leader, is definitely termed cool within her social circle. Raised by a significantly wealthy family, Emma detests mathematics and does not understand it, mostly due to a lack of motivation and effort. At the time of this study, Emma had just completed grade eleven applied mathematics, the final math course required in order to graduate from high school, with no plans to continue with higher-level mathematics.

Alana is another popular girl, who prides herself on being able to hang out with girls yet be “one of the guys” (Alana), which she claims makes her more of a cool girl than most. Alana enjoys mathematics when she understands it, but is not motivated to try hard. Alana is

currently at the University of Guelph in a general arts program.

Like Emma and Alana, Erin can also be considered popular. Erin admits to being a little too preoccupied with her image and with what others think of her. She dislikes mathematics, and although she tries relatively hard to succeed, she does not enjoy it. Currently Erin is completing an additional year of high school in order to augment her grades.

The two final participants, Stef and Emily, differ from the others in that they are very high achievers with a passion for the academic. Emily has steadily enjoyed math and has consistently excelled academically going so far as to be crowned captain of the math team at her school. However, Emily would not be considered nerdy by any means, and while she prioritizes academics over the social, she still has friends, attends parties, and dresses fashionably. Currently, Emily is attending a math-, science-, and arts-based program at the University of Waterloo. Stef is similar to Emily in that she has always excelled academically. She is not ashamed to profess her love for math or that she thinks math is cool! Stef is currently completing her final year of high school with plans to attend a post-secondary photography program next year at an unspecified university.

As illustrated, while the participants share similarities, they also possess many differences. In the chapter that follows, the participants' photo journals and interviews help to contextualize the themes that emerge from relevant literature and empirical data.

Chapter 3: An Exploration of Literature and Participants' Data

In the following chapter, I conduct an in-depth literature review, exploring disparate bodies of literature in order to position my observations regarding female desire to appear unintelligent at the expense of mathematical enthusiasm and excellence. Then, I explore participant photo journals and interview data in order to provide an experiential account of what emerged conceptually. I segment my findings into the following four categories: Notions of cool and identity; normative femininity; Intelligence and the antisocial; and the media.

3.1 Theme One: Identity and the Quest for Cool

Adolescence is a pivotal time in terms of personal development. Leaving elementary school and beginning high school marks an important transition in life; children suddenly find themselves in an unfamiliar setting, without the structure and familiarity of one singular class of peers. The lack of a consistent and familiar peer group, coupled with the onset of adolescence, may cause teenagers to reconsider and (re)construct their identities. One of the main motivators of such identity de/re-construction is the desire to fit in and achieve popularity (Kinney, 1993). More than simply acting as sites of education, schools also serve as principal sites of socialization. Moreover, the priorities of students shift from excelling academically to achieving popularity (Kinney, 1993).

All participants interviewed confirmed that self-development was a key component to entering high school. They confirmed that the transition from elementary school is not only an academic one but is also an intrinsic identity shift. Alana explains that “you're trying to fit in but stand out at the same time... in grade nine it's all about first appearance and how people perceive you.” Emily likewise asserts that “[grade nine] is, like, the pivotal year when girls feel the need to conform to this idea of ‘cool’.” Through investigating their high school experiences, all of the girls interviewed admitted to having felt anxious leaving the familiarity of their elementary school peer groups and entering a new environment where peer group formation became their safety net--a necessary social support. For this reason, many of them admitted that although excelling academically may previously have been a priority to them, their interests eventually shifted to the social, often at the expense of the academic. In response to

determining to what extent girls prioritize popularity over academics, Jessica, a grade eleven student, used the following example from her high school experience:

Well the surprising thing was that some of (the girls) were really smart, like in grade eight some of them would get 90's and stuff, but it depended on who they hung out with, like, this girl named Kim, she would get 90's, and then she would hang out with other girls who studied really hard. Then when she joined our group in grade nine [the cool group], she totally went downhill and started doing really badly, like she kind of learned from what we were doing that we didn't care that much. Like, in grade nine I did not get honour roll and almost failed two classes, then in grade ten I, like, shafted that group, I really *really* didn't like them, then I got honour roll and did really well, but I was really upset, I didn't like who I was hanging out with, and I didn't like school at all. Then in grade eleven, I, like, loved school, had a great group of friends, we partied, which I loved, but kept up with academics; it was the perfect mix.

This excerpt demonstrates the struggle to balance the desire for popularity with the aspiration for academic excellence. Rachel, a grade twelve student, concurs, explaining “when I was younger, class wasn't about learning, it was about socializing. I remember there was a huge jump from grade six to seven, and, like, these kids are going through a lot, they're going through puberty, they don't want to DO math, you know?” Here Rachel further illustrates the either/or manner with which popularity and academics are constructed.

Identity.

The negotiation of identity is intricate and nuanced. Identity, from the perspective of social construction, does not connote entirely agentic individual choice but instead is indicative of the idea that identity is (re)constructed by external forces embodied by the subject, rather than internal forces that might be regarded as a product of the subject. That is, as Gonick (2003, 2004) suggests, contrary to the idea that students are autonomous individuals with the capacity to pick and choose components to incorporate into their selves, the terms ‘subject’ and ‘subjectivity’ replace terms like ‘identity,’ with its connotations of autonomy and unity, as the term ‘subject’ more fully captures the sense of subjectification. Gonick (2006) explains that, from this perspective, the self is seen as being fashioned by its “insertion into an already articulated symbolic economy” (p. 19) as cultivated by societal forces such as the media. Thus, “the subject is never fully complete; it is always in process. As a result, this subject-in-process is always simultaneously a product and producer of the symbolic economy” (Gonick, 2006, p. 19). In this sense, there is a constant feedback loop between the (re)constructed subject and the society that instigates such (re)production.

Society exerts normative influences on adolescents, stipulating the means by which they are to fit in and/or achieve popularity. The two most influential aspects of society on the lives of teenagers are 1) the educational system and 2) the media. I expand on the influence of the media later in this thesis, but for now I focus on the means by which schools as institutions act as significant sites of the development of self. Specifically, I focus on how schools (re)construct identities that are socially accepted and have the potential to qualify as popular.

Sociological and anthropological studies of schools have documented adolescents' pervasive use of social-type labels that place their peers within a social tracking system comprised of different groups (Kinney, 1993). These studies of adolescents have found that daily peer relations within and between groups in schools are highly salient to teenagers because they underlie the teenagers' definitions of social reality and personal identity. In general, these studies indicate that membership in specific crowds or categories structure adolescents' selection of friends and everyday social interactions (Kinney, 1993). Kinney (1993) explains that:

Students typically rank diverse peer groups in terms of social status, and positioning in the school social structure denotes their members' relative peer status or popularity. Categories or groups, such as preppies, jocks, nerds, and burnouts, commonly exist, although the social-type labels attached to these crowds differ across communities and from school to school. (p. 23)

Douvan and Adelson (1966, p. 179 as cited in Kinney, 1993, p. 22) argue that teenagers are “about to crystallize an identity, and for this [they need] others of [their] generation to act as models, mirrors, helpers, testers, foils,” illustrating not only that the onset of high school is a pivotal time for the development of self, but that peers play a pivotal role in the (re)construction of the self. Sherif and Sherif (1964) and Sullivan (1953) concur that a supportive adolescent peer group is the primary social factor by which adolescents develop a healthy sense of identity as they experiment with various social roles (as cited in Kinney, 1993, p. 22). As students negotiate their identity by adopting qualities that their peers approve of and by assuming qualities exhibited by the popular set of peers in their immediate environment, they simultaneously engage in the act of reconstructing the norm in order to be accepted by their classmates. Implicitly, this leads to the notion that one of the key factors in the construction of identity is that of achieving acceptance, or popularity, among colleagues. Using one's peers group as a gauge of such approval is not only instrumental, but it also leads to the

gendered structure of identity, suggesting that what is required by both boys and girls in order to achieve acceptance and ultimately popularity may differ. Kurtz-Costes et al. (2008) explain that:

As children enter adolescence and their social group membership becomes increasingly important to them, their beliefs about their own skills and interests become more aligned with their perceptions of normative behavior and values for their social group. The energy they devote to various activities and the choices they make in terms of course selection, extracurricular activities, and future career objectives soon lead to disparate paths for boys and girls. (p. 406)

Kurtz-Costes et al. (2008) allude to the notion that the motivation behind the desire to (re)construct one's identity is largely based upon an ultimate goal of achieving acceptance and, for many adolescents, of surpassing acceptance to the point of being deemed cool or popular. However, key to the notion of cool is the mastery of qualities associated with adolescents' respective gender roles. For young girls, identity development is largely premised upon the notion of "becoming a woman" (Napoli, 2004), and thus, the emulation of the characteristics purported by hegemonic femininity (Gonick, 2003) is essential. The idea of hegemonic/normative femininity and its relation to popularity and academics is further explored in Chapter 3.2. For now, I focus on the desire to become cool, the interaction between notions of cool and popularity, and how adolescent girls negotiate the path to this status.

Playing the part.

It is no secret that the desire to be popular/accepted by peers is the driving force behind the decisions of many teenagers, especially when it comes to consumption⁸ (Aloise-Young & Graham, 1996; Aloise-Young & Hennigan, 1996; Danesi 1993, 1994; Gladwell, 1997; Zollo, 1995 as cited in O'Donnell and Wardlow, 2000). As early as elementary school, kids stratify themselves into cliques based on their perceptions of popularity. Adler, Adler and Kless (1992) explain that:

The determinants of popularity vary greatly between boys and girls, with gender-appropriate models relevant to each. Embedded within these idealized models of masculinity and femininity are the gender images that children actively synthesize from the larger culture and apply to themselves and to each other. As they learn and direct themselves to fit within these perceived parameters of popularity, they socialize themselves to gender roles. (p. 170)

⁸ Please see Chapter 1 for an understanding of how this term is defined within the scope of this thesis.

Noting that conformity to appropriate gender roles is a key component to popularity, Adler, Adler and Kless (1992) explain that achieving such popularity is a key motivator in the identity development of children. While much of the literature cites the common belief that achieving popularity is of great significance to adolescents, the question of what makes one popular and what makes one cool remains.

Teenagers who were unpopular in middle school described their popular counterparts as having "the ability to gain recognition from everybody else, and [...] more or less get [...] choice of what to do or who to go out with" (Kinney, 1993, p. 26). Students noted that, in addition to having a choice of activities and dating partners, popular people "have the most fun" and are always invited to private parties on weekends (Kinney, 1993, p. 26). The teenagers in this study emphasized compliance with traditional gender roles (achievement, competition, and toughness for boys; attractiveness, appearance, and interpersonal relations for girls) and maintaining high peer status' which required limiting the size of their group by excluding peers who did not meet their standards (Eder, 1985; Eder & Parker, 1987; Parker 1991 as cited in Kinney, 1993) as the secret behind popularity. Moreover, research has shown that both boys and girls who are perceived as popular are more likely to be nominated by peers as cool (Lease, Kennedy, et al., 2002), tying together the two-way interaction between the terms cool and popular. That is, to be popular, one must be cool (Closson, 2009, p. 422). Closson (2009) notes that in the lexicon of early adolescents the term cool appeared to be highly related to being popular. Closson (2009) explains that while cool remains to be defined by early adolescents themselves, it has been reported in ethnographic studies (Adler & Adler, 1998 as cited in Closson, 2009) as well as quantitative studies (Farmer et al., 2003; Lease, Musgrove, et al., 2002; Rodkin et al., 2000, 2006 as cited in Closson, 2009) that individuals who are perceived as popular are typically also deemed to be cool.

As Abel et al. (2002) suggest, being cool correlates positively with conforming to normative gender roles and correlates negatively with academic achievement: "The widespread existence of labels like 'cool' and 'nerd' suggests [a] similarity that is perhaps predictable from the global media networks that impinge on adolescence" (p. 177). O'Donnell and Wardlow (2000) argue that cool originates in "the fluctuating discrepancy between actual and ideal selves in early adolescence" and the "use of external props to shore up the faltering sense of self" that they ascribe to young people (p. 14). Moreover, while the notion of cool is always

changing, it has one characteristic that remains constant: being cool/popular implies that one must be accepted. As O'Donnell and Wardlaw (2000) explain, "coolness is a set of shared meanings (e.g., language, self-presentation, artistic expression, values, attitudes) within a peer group which signify group affiliation" (p. 13). For the subset of adolescent girls in North America that comprises my research group, this equates with not only adhering to and consuming normative feminine behaviour but also excelling at doing so.

Research has illustrated that cool takes on different characteristics for girls and boys, reinforcing the notion that what is cool correlates positively with mastering characteristics traditionally associated with each respective gender role. From an agentic perspective regarding identity (re)construction, boys and girls are both active and passive within their own realms. They employ agency *within* the structural framework provided by their gender roles, socially constructing their behaviour so that it accords with what is required to achieve popularity among their peers (Adler, Adler, & Kless, 1992, p. 185). The normative requirements stipulated by traditional feminine ideals and their impact on female notions of identity and popularity will be explored in Chapter 3.2. For now, suffice to say that in accordance with normative gender roles, for a boy to be deemed cool, his mastery of athletics is most important, followed by the extent to which he acts tough/clowns around, followed finally by his mastery of inter-gender relationships (Adler, Adler, & Kless, 1992, p. 173). Conversely, for a girl to be cool, SES, physical appearance (Coleman, 1961; Eder & Parker, 1987; Eder & Sanford, 1986; Schofield, 1981 as cited in Adler, Adler, & Kless, 1992), appearing to be 'boy crazy' and attractiveness to boys appear to be the most salient features (Adler, Adler, & Kless, 1992). Interestingly, several of the girls interviewed insisted that being cool involved not only embodying those qualities implicitly associated with femininity but doing so while simultaneously mastering certain characteristics associated with masculinity. Alana explains that "I think 'cool' is defined as someone down-to-earth that you can get along with, not snobby, um, *can be a boy but hang out with the girls* (emphasis added)." Not only does this illustrate the dichotomy within which youth continue to view males and females, but Alana's repeated references during the remainder of the interview to acting like a boy as a means to *impress* boys demonstrates that, ultimately, cool girls must be attractive to males, once again reinforcing that being popular for a girl is largely premised upon adherence and mastery of heteronormative femininity.

Several participants insisted that being cool was unrelated to the possession of specific characteristics but instead related to confidence. That is, as long as one acts confident regarding their actions, then they appear cool. This is very interesting especially with regards to the early adoption of consumer goods before they are deemed socially acceptable or popular, an idea that will be explored in greater detail in Chapter 4.

Within the scope of this thesis, I focus explicitly on what it takes to achieve popularity--a notion in which being cool is embedded--as a female. For girls, as aforementioned, being cool has much to do with excelling at being feminine. The idea of excelling at being feminine implies a variety of salient factors that have been well documented. Abel et al. (2002) asked a group of female students to describe the popular girls at their school:

IntL: Can you describe the popular group a bit more for us?

Caroline: Take hours to do their hair and, [laugh] um, they just...

Karen: Sort of tanning their legs. Yeah.

Caroline: And has to be...

Karen: Every lunchtime.

Caroline: Got all the guy friends and they think they're cool. (p. 176)

In the above interview excerpt, Caroline and Karen refer to stereotypically feminine activities in order to describe the popular girls at their school. Along the same lines, in a study regarding Mary-Kate and Ashley Olsen as role models for young women, Napoli (2004) asked a similar question of female students involved in the study:

Mary: So, are we saying that to be a girl you have to be popular and dress nice like Mary-Kate and Ashley (Olsen)?

Britney: Well, sort of. I think that you have to be yourself, but sometimes if I have something really cool on, I feel really good about myself.

Shane: I know what you mean. I think that wearing the latest fashions sort of makes you popular, but it's also other stuff too, like having the right friends and liking the right things. I don't know. (p. 11)

The girls in Napoli's study also refer to stereotypically feminine ideals, such as dressing fashionably, when defining qualities associated with being a 'proper' girl. Both of these interview excerpts suggest that many girls equate coolness and popularity with adhering to traditional notions of femininity. Scholars such as Beal (1994) and Brown and Gilligan (1992) have noted that socialization into femininity begins at an early age and that the transition from childhood to adolescence has been referred to as a "flight to femininity" where preadolescent girls become more focused on their appearance (Beal, 1994; Brown & Gilligan, 1992).

Moreover, Napoli (2004) notes that girls begin to internalize cultural prescriptions for acceptable feminine behavior, and that "feminine beauty" is one tenet held up as an ideal for which girls are to strive (p. 12). Appearing physically attractive and socially active is related implicitly to traditional feminine ideals of passivity, nurture, and fragility. Moreover, being "boy crazy" and appearing "attractive to boys" are explicitly steeped with hegemonic femininity (Gonick, 2003) and heteronormative ideals, which are intertwined. That is, in order to be cool and popular, girls are required to conform to normative feminine ideals that continue to pervade our society despite the progress many feminists have made in terms of re-scripting and androgynizing feminine gender roles.

The following interview excerpts from my research study illustrate the general consensus between participants regarding what consists of the ideal cool boy and ideal cool girl. This further demonstrates that a mastery of one's normative gender role is a key component of being deemed cool.

Alana's response to being asked to describe the popular girls at her school:

A: They were pretty girls, they had nice clothes--that's when everyone was into spending a hundred dollars on a stupid t-shirt, they were good in school, they were good girls, all the boys liked them...

V: They were smart?

A: Well, ya, at first they would come across as ditzy...maybe just 'cause they were so pretty...but I had class with them and they were as smart as I was...I think, again, you're so influenced by those movies you think that, like, the quarterback of the football team isn't good in math, but, like...guys would never at least act dumb like girls would, 'cause a girl would never find that attractive in a guy; and, honestly, I don't even know why guys find that attractive in girls, but anyways, ya, they were all pretty smart.

Erin's response to being asked to describe the popular girls at her school:

E: Honestly, like, in my mind, it's just, like, gorgeous clothes, and their reputation; like, I just want to hang out with her cause she's so cool--her social status is huge

V: So does your whole being tanned and blond thing fall into your idea of what would be cool?

E: That's true actually, probably. 'Cause, like, I think I'll be more accepted, or looked upon as more attractive if I'm blonde and tanned and fit, you know?

V: Can you describe to me a cool girl and then a cool guy?

E: Okay, cool girl is easy to be around, attractive--but not necessarily, funny, accepting; umm...and for a guy probably funny is big, smart is a good thing, attractive, easy to be around, similar stuff.

Emily's response to being asked to describe the popular girls at her school:

There was a specific type of girl, and she was kind of well dressed, but we had uniforms so you couldn't tell, but had nice hair, make up, jewellery, really confident--confident with guys...you definitely got the ditzy kind of factor that you'd see, and again, that was mostly, like, around guys 'cause that's what girls thought guys liked. I wasn't there for very long, but...in the cool of the cool group, there were, like, I think the guys were actually pretty intelligent, or they showed their intelligence more than other people...like even, they weren't...nerds in the middle school sense, but they were intelligent and showed it more than the girls did, but they were still attracted to that kind of girl.

Stef's response to being asked to describe the popular girls at her school:

Um loud, trendy or whatever; they go to parties all the time and don't give a shit about school or don't seem to.

These interview segments not only illustrate that conventional gender characteristics are the predominant source of descriptive labels when describing popular boys and girls, but that there is a distinct difference between what constitutes a popular boy versus a popular girl. Of most pertinence to my work, I investigate the glaring reference to popular girls either feigning stupidity, or concealing their intelligence, as a means to achieve and maintain popularity.

While the majority of participants agreed that most girls who enjoyed mathematics were 'nerds,' several clarified that the term was not always negative. As Emily points out, there is "the kind of nerd you look down on...but also, like, Ewa's [a well-liked math teacher at Emily's school] a nerd, you're a nerd, and that's different." This notion of nerd/popular as nuanced and not necessarily always in opposition is detailed in this chapter. When unspecified, the term nerd is used in a derogatory way by the participants in order to describe a person who is the antithesis of cool and popular.

Defining math nerds.

The classification of girls who enjoy mathematics as nerds points to one of the overriding themes from the interview data that to be mathematically capable and enthusiastic is in direct conflict with being cool. The participants, while intelligent and mathematically capable, are in a position where they feel that either: 1) mathematical excellence is not desirable, so they cease to pursue it, and/or 2) while excelling at math is important, it does not supersede the desire to be popular, and, therefore, they must hide their mathematical aptitude.

While several participants insisted that girls *could* be cool while simultaneously excelling at mathematics, most of them warned "they could like math, they just wouldn't tell

people...they just wouldn't want people to know that" (Stef). The following clip between Jessica and me explores this idea:

V: Describe to me a girl who really likes math.

J: Hmmm...She's really into her studies, like studies really hard...she could be really quiet because she doesn't want people to know she knows math... 'cause no one wants to know math at my school.

V: How come?

J: I don't know; people just aren't into math. Actually, so there could be people who know math, they just don't want to show it....like, if I wanted to join the 'mathletes,' my friends back in grade nine would let me do it, they would just hold it over my head like 'Jessica's in the mathletes, Jessica do this for us'; they would make a joke of it, but they would never tell me not to do it, but they would hint at it like 'Jessica, this is really weird,' but like if a guy was ever like 'Jessica's a loser, she's in mathletes,' they would probably put the guy ahead of me, which you would find surprising, but it's not, but they would just like, slowly distance themselves, like not on purpose but it would just happen, like I would just find myself not that close to them.

This excerpt illustrates the way girls are often ostracized by their peers for enjoying mathematics, as they are deemed nerds, a term that is a social red flag to the popular kids. With such a social threat looming over them, it is no wonder that many girls opt to sacrifice their mathematical know-how in favour of appearing less intelligent.

While conformity to feminine ideals correlates positively with being labeled cool, achieving academic excellence has the opposite effect. As I explain in Chapter 3.2, academic apathy is in fact congruent with normative femininity, while academic excellence is not. In this sense, drawing on what I have explained regarding femininity as a pre-requisite for popularity, it follows that academic excellence *should* correlate negatively with popularity, as it is *incongruent* with femininity.

School as a site for the uncool.

As my participants were describing not only their aversion to overt mathematical enthusiasm but also their accounts of the mathematical aversion of other girls, I wondered what it was exactly about being mathematically capable that makes one a nerd. By investigating the concept of academic excellence, and specifically of mathematical disinterest, the girls struggled to come up with an explanation for the correlation between mathematical know-how and lack of popularity.

Initially the participants expressed frustration with being asked to describe what was, to them, such an obvious association. Emma, for example, insisted that you could tell if someone

likes math simply by looking at them because they simply carry themselves in a “nerdy way.” However, she was unable to describe any specific behaviour, insisting that it was obvious and that “you could just tell” (Emma). While many of the girls interviewed expressed similar viewpoints regarding the correlation between mathematics and nerdiness, there were two prominent themes that emerged. First, the adjectives used to describe ‘math people’ conflicted directly with the gender-specific labels used initially to describe the popular crowd, positioning math at odds with the feminine component of popularity. Second, the participants alluded to the notion that students who genuinely enjoy mathematics are nerdy due to media-induced stereotypes regarding people who enjoy mathematics, an idea that is explored in Chapter 3.4. These stereotypes characterize math people as one-dimensional, enjoying only activities that centre on academics. The girls unanimously agreed that enjoying mathematics was linked to a stereotypical portrait of ‘the nerd’ fed to them by the media, a portrayal that dictates that once an individual possesses one quality associated with nerdiness (ie., liking math), that they are automatically assigned the slew of qualities stereotypically associated with geeks/losers, qualities that lie diametrically opposed to the cool.

In describing the relationship between mathematics and unpopularity, the girls made it clear that not only is it social suicide to be known as a nerd, but that enjoying and excelling at math of one’s own volition essentially guarantees nerd status. One portion of the interview that illustrates this point is that which explored the movie *Mean girls* (Shimkin, 2004). *Mean girls* is a film in which the protagonist, a math-savvy Lindsay Lohan, gets chastised for her desire to join her high school’s math team, ‘The Mathletes’:

V: Why is it considered social suicide to join ‘The Mathletes’?

T: Well Mathletes are known...like if you're a Mathlete, you're, like, gifted in math...and nobody wants to be viewed as a nerd.

V: So if you're gifted in math, you're a nerd?

T: Well, this sounds really bad...but in high school if you're a Mathlete, or, like in the chess club, or, like, in space camp at UCC [a boys’ private school in Toronto]...we view them as nerds because, I guess, it comes back to academics; like, you’re gifted in academics, but we generalize those people as only being academic and not having the full package, not being good at other stuff, but that's just a quick assumption.

Here Taylor illustrates that possessing mathematical enthusiasm automatically places one in the nerd category, which polarizes them to the extreme of the nerd/cool binary. Stef confirms when asked the same question:

V: So but why are they saying that joining The Mathletes is social suicide?

S: I think not for me, but the stereotype [is] nerdy. Like, math and sciences are nerdy to really care about...and then people think of you as a nerd, and then, like, all the things associated with being nerdy.

Interestingly, several girls interviewed pointed out the double standard between boys who excel mathematically versus girls:

V: Do you think that generally being smart isn't cool?

S: I don't want to say this, but yes.

V: And do you think it's different for boys and girls?

S: Again, don't want to admit it, but yes.

V: If you can describe to me what you think of when you think of a girl who likes math.

S: Stereotype? Okay: nerdy, glasses, not that popular, doesn't have a huge social life, bookish, not that...attractive I guess.

V: And what about a guy?

S: Maybe the same thing, but I think that a guy that likes math doesn't have to be a nerd--totally going by stereotypes, but they can also be a cool guy that likes math; but I think with girls there is sort of a double standard: they're not supposed to be cool kind of thing, if they want to be cool, they can't like math.

(Sarah)

Again, the gendering of mathematics and, simultaneously, the gendering of cool and popularity come to the fore, illustrating the especially conflicted position girls often find themselves in regarding succeeding mathematically while simultaneously trying to be cool.

Within the literature and according to my observations, there is a strong correlation between being smart and being a nerd and an even stronger inverse correlation between being a nerd and being popular. Being smart seems to *make* you unpopular. While I elaborate further on the portrayal of mathematicians by the media in Chapter 3.4, for now it is important to note that popular films and television shows about adolescents and schools usually include a certain type of teenager who is frequently ridiculed and rejected by his or her peers. These adolescents are often portrayed as awkward, intelligent, shy, unattractive social outcasts with unfashionable hair and dress styles who sometimes attempt to get revenge on their peers who shun them. They are called 'nerds,' 'dweebs,' 'dorks,' 'geeks,' 'brainiacs,' and 'computer jocks' (Kinney, 1993, p. 21). Kinney's research found that while those labeled 'nerds' were singled out for their superior academic performance, others were viewed primarily as having low levels of social skills and dressing in an unfashionable manner (Kinney, 1993, p. 27). In fact, as I explore in Chapter 3.3, achieving academic excellence is often linked with a lack of social skills, which is

not only a key component of the feminine ideal, but also a key factor in achieving popularity. For this reason, academic excellence is often disassociated with coolness.

Exceptions to the cool rule.

While mathematics was consistently described by participants as conflicting with popularity, there were several situations in which this was not the case. The first was that of context; Emma explained that depending on the school that one attended sometimes being mathematically keen did not render one a nerd. In reference to what is classified as geeky, she explained that it “depends on what school you're at. Like, at my old school it was cool to be on like student council, but at my school now, if you were on it you'd be a huge brownnose loser.” This echoes Renold's (2001) sentiments regarding the contextualization of academic success. Second, the later secondary school years allowed for one to be smart and popular. Almost all the girls expressed that while being overtly mathematically capable is often detrimental to popularity at the onset of high school, it does not have the same effect in grades eleven and twelve. In fact, as the years progress, and especially in grade twelve when university applications are a priority, mathematical excellence not only loses its nerdy status but is *coveted* by many students. Moreover, in many cases it actually has the ability to *enhance* one's coolness. Emily illustrates this idea in the following excerpt:

Originally I was really embarrassed by being good at math; like, when you're younger, that's when kids aren't really okay with you being better at something or, like, nerdy, but then like, especially when you get to high school, and the older grades, people become okay with it...especially in grade twelve when other people are trying to get good marks, they admire you for it. It's an age thing because people are trying to fit in and that's when you get the stereotypes and everything, so you get the stereotype of the nerd, and people are like ‘oh I don't want to be the nerd’ so trying to do well in school isn't a cool thing, and I think that happens a lot. I wasn't really a nerd in grade seven and eight, but I did look down on, like, the nerds; I think most people did in middle school. But now it's fine. And, I mean, now I'd say ‘hey I'm a nerd’ but I don't consider myself only that; I don't just do math; I don't just do well in school; I have a social life and stuff.

Alana elaborates, adding that not only is mathematical ability admirable in the later high school years, but that it is actually, in and of itself, cool:

I think if you want to be cool or whatever, the last thing you do is join something--like The Mathletes [in grade nine]. At this age [later in high school], people would be, like, "that's sick!" you're good at math; it would be cool, like now people are really into doing well, but in grade nine it's all about first appearance and how people perceive you, so stuff about school would definitely affect that.

While it may seem somewhat consoling that academics eventually makes its way into the priority list of most girls, the initial deviation from academics can have extremely negative effects. As Emily points out, “so grade nine is, like, the pivotal year when girls feel the need to conform to this idea of cool that conflicts with intelligence. So once they’ve done that, later on, when math becomes okay, it’s too late.” While in subsequent high school years mathematics may eventually be less incongruent with popularity, the concern is that by then it is ‘too late’ as many girls are lacking the pre-requisite mathematical knowledge they need to succeed in higher-level mathematics.

Complexities of coolness.

Both of the aforementioned cases, in which mathematics is not seen as diametrically opposed to popularity, have something in common: the adherence to a social norm. In the first case, due to the academic nature of an environment such as a school, mathematical achievement is desired because it is the norm. Therefore, to defy it would render one an outcast or unpopular. In the latter case, the same theory holds as the norm becomes the desire to excel academically in order to achieve university-worthy grades. In this case, the norm is academic excellence, and achieving mathematically *adheres to* the norm. Again, the notion of complying with a norm rather than defying it shines through as a key component to being cool. The fact that at the onset of high school, and in most social settings, the desire to excel mathematically is not prioritized and thus not a normative desire explains partially why mathematics is, in many cases, not seen as cool.

Studies have in fact found that the art of achieving cool *can* include achieving academic excellence; however, these two exist in a complex and nuanced web. Kinney’s (1993) work found that some students were able to negotiate popularity in conjunction with academic achievement, but the task involved creating a balance between the two so that academic preoccupation did not appear as prioritized over being cool. In doing so, academic enthusiasm did not stand out as salient to one’s peers. One such male student, who appeared to have mastered the task, explained as follows:

I like to think of myself as somewhat intelligent, but not necessarily the nerdy type. I like to think my personality strikes a balance between intelligence and being a normal human being.... I should sorta say I mainly am able to do that through my interest in sports. I suppose if I didn't have as strong an interest in sports as I did, I might seem much more of the nerdy type. I might strike someone that way. I hope I don't. I think that by being able to talk about things that regular people and people that I know talk about helps me fit in

with the mainstream of high school ... and not stand out . . . or even be outcast because of my intelligence, which really would be terrible. (Kinney, 1993, p. 32)

As illustrated, at the same time that this student embraces the dominant activity of the popular boys (athletics), he distances himself from the label of nerd by refraining from being *exclusively* an intellectual (Kinney, 1993). This quotation illustrates the importance of conforming to one's gender norms as a type of backdrop to academic excellence. Only once gender mastery is achieved can one incorporate academic excellence into their identity while managing to retain popularity. Fordham and Ogbu (1986, p. 220 as cited in Kinney, 1993, p. 24) concur with the idea that one's academic competence must be disguised in order to retain popularity. They document that black high school students cope with the burden of 'acting white' (working hard to get good grades and getting good grades) by using strategies such as acting out and underachieving in order to avoid the negative labels of brain or nerd (Kinney, 1993, p. 24). Fordham and Ogbu suggest that "high-achieving students (...) would do much better if they did not have to divert time and effort into strategies designed to camouflage their academic pursuit" (Fordham & Ogbu, 1986 as cited in Kinney, 1993, p. 37).

From nerd to normal.

In line with Demetriou's work (2001), which I explore further in Chapter 3.2, the idea that mathematical interest is not always necessarily incongruent with popularity opens up possibilities for the subversion and incorporation of mathematical enthusiasm as a component, rather than deterrent, to popularity. In fact, one of the most interesting points that arose out of the interview data relates directly to this idea. While girls consistently described the mathematically capable as unpopular, the majority of girls at some point during the interview made reference to 'special cases' where girls were 'allowed' to be mathematically capable while retaining popularity status.

The fine line between enjoying mathematics in a nerdy way and enjoying mathematics in a way that is acceptable or popular appears conditional upon two factors. The first, that a girl may excel mathematically, but she must do so while maintaining a balance between the academic and the social. That is, for nerds math "is like their entire life as opposed to a part of it" (Stef). The second condition is that her mathematical aptitude is always contextualized as previously mentioned and, as such, it must come to the fore only *after* she is already deemed cool. The following excerpt from my interview with Erin illustrates this point:

V: So you don't think there's a certain person who would want to do math for fun?

E: Well, obviously the stereotype is nerdy. Like someone who, like, lives, breathes, and does whatever with math. Also, there's a difference between someone who's popular and smart, and someone who's just smart and not as popular. Because someone who isn't popular and really likes math and smart in that department, they're probably seen as a loser or a nerd.

Jessica expands on this idea:

V: Okay what about a girl joining The Mathletes; do you think it would be the same?

J: Ummmm, I think if a girl joined, it would depend on what social rank she was before that; like, if she was one of the really popular girls before she joined it, we would probably think it was okay.

In relation to a different topic, Jessica illustrates the notion of the contextual nature of popularity in relation to fashion:

J: Like, there are some girls that can just pull off the whackest fashion...

V: What makes them pull it off?

J: Um, I think it's kind of their personalities and also the fact that they're genuinely nice and pretty and known...and have other fashion things that people like so they've already built being fashionable.

The idea of girls 'pulling off' clothing has to do with a pre-established image of them as being fashionable, so 'whack' clothing becomes acceptable. The same idea holds for mathematical ability: once a girl is known to be popular, everything she does is judged in light of that.

Therefore, what she does is more likely to be regarded as cool so that it remains consistent with her pre-established image.

In fact, in select cases, the girls explained that mathematical aptitude did not interfere with a girl's popularity but *added* to her status, rendering her even cooler than if she did not possess mathematical drive and skill. In her interview, Taylor acknowledged this idea by explaining how mathematical ability adds to her status as cool, motivating her to excel further in mathematics:

V: So did you ever feel that way about being gifted in math? Were you worried that people would view you that way?

T: No. Because I guess I'm confident, I had a group of friends, I'm involved in so many other things, I still socialize, I'm not worried about losing friends cause I'm in gifted math. I mean, I was happy that people thought I was smart, I showed off that I was in gifted math almost. Like, people were surprised and impressed. I guess, maybe because my group of friends weren't known as an academic bunch, and, like, we go out, and socialize, and we're like *that* kind of girl, and maybe I was categorized as one of them, and they

didn't know we were also intelligent. There was this other side of me you couldn't see just by looking at me.

While I have explored the idea of certain schools as contextual, or specific grades and desires of peers as contextual, in fact, our entire society is contextual. That is, all of these ideas are backdropped against the social construction of both femininity and mathematics. While these two entities appear fixed in opposition to one another, in most cases, this is not necessarily true. Due to the fluid nature of popular culture and the swiftly ebbing and flowing nature of society as a whole, it is not necessary that mathematics and popularity remain in opposition forever. According to Bird and Tapp (2008), cool remains constantly in flux. One need simply to think of the latest fashion trends compared to that of two years ago in order to illustrate this idea. Stef elaborates on this concept, applying it to mathematics, in the following excerpt:

V: You mentioned that people view those who like math as nerds...would you say that's true for everyone?

S: Ya, but I think it's changing a bit.

V: Like how?

S: I don't think people really think of you as being that much of a nerd for liking math and science anymore; it's more other things now. I don't know where I'm going with this, but with the internet and stuff all the nerds are rich and famous. So I think with math and science people have accepted it, and they're like, oh well they'll be, like, set for life, whereas it's more socially awkward liking math and science and computers not leaving your house.

The implications of these findings are pivotal as they suggest that mathematical ability and its relationship with popularity are intricately nuanced, and that mathematical ability is not considered so extremely incongruent with notions of popularity for females that the two are entirely unable to co-exist. Moreover, Stef's insight raises questions about the possibilities of transformation regarding the reputation of mathematics in a changing society increasingly reliant on technology and the mathematics that underlie it. I have illustrated that popularity is reliant on 1) adhering to and excelling at normative femininity and 2) mastery of the social. In the Chapter sections 3.2 and 3.3, I examine these two facets of popularity relative to mathematics. In Chapter section 3.4, I illustrate how perhaps by slightly altering the positioning of mathematical ability so that it does not conflict so aggressively with femininity and the social, mathematical ability might be subverted and assimilated, allowing mathematical

aptitude and interest to become a core component of popularity, rather than an exception to the rule.

Performing cool.

The idea that coolness is a result of an intricate balancing act raises questions regarding the means by which adolescents go about not only (re)creating, but also displaying their identity for others to see. It is, after all, meticulous calculation and procurement of all things cool and then the overt presentation of the resulting identity, that ultimately results in popularity.

Abel et al. (2002) draw on the ideas of 'performativity' and 'social space' in order to illustrate how all children face the 'problem' of establishing credentials for a self that must be interpellated in an adolescent status/power structure, becoming ensnared into either 'performing coolness' or accrediting self against this performance (p. 177). In their article addressing the use of smoking as a means of asserting identity, they explain that not only has it been recognized that adolescents fashion identities during schooling years (Kinney, 1993; Martino, 1999 as cited in Abel et al., 2002), but that such fashioning and negotiation are not optional. Butler (1988), using her notion of performativity, explains that "identity consists in this 'doing.' Identity is not something we 'acquire,' but something we 'do'; 'not an ...expression of what one is, but...something that one does: 'the stylized repetition of acts through time'" (Butler, 1988, p. 392). Moreover, using notions of 'social space,' Abel et al. (2002) elaborate on Butler's theory, invoking the symbolic realm in order to explain how subjects are interpellated:

Presentation of self is inescapable for everyone, and the accoutrements used, the products consumed, and the competence in behaviors displayed, are the basis of claims and ascriptions of identity. Individuals are not free to 'fashion' identity as they choose, but have to do so under conditions of others' readings of their competence. Each has to make a claim to some identity, but lacks the power to ensure the claim. Pejorative readings are always possible. (p. 169)

Abel et al. (2002) illustrate that the idea of acquiring and sustaining identity is derived from the social construction of gendered subjects inherent in the (re)construction of boys and girls within a socially constructed society. Such a view on identity leaves little room for agency. However, it does allude to agency *within* prescribed gender roles, which can be used by subjects in order to work out the detailed nuances of a gendered identity. In relation to mathematics learning and identity, one can view the act of consumption here as the act of

choosing to pursue mathematics. Then, as Butler's ideas suggest, the product consumed (mathematics) and the competence in behaviors displayed (mathematical capability), become the basis of ascriptions to identity. If these features are especially salient and exist at the exclusion of normative gender characteristics that make one popular, one's identity may well be read pejoratively. However, if one can negotiate the act of excelling academically while managing to play the role required by one's gender, their identity is likely to be read as cool or popular, enabling the individual to excel mathematically, a capability that alone or in the wrong context may render one a nerd. Abel et al.'s (2002) use of the concept of smoking as a means of asserting popular status illustrates the idea of cool as nuanced in an example *opposite* that of mathematical enthusiasm. They explain that 'coolness' was not guaranteed by smoking; [...] some smokers were contemptible rather than cool. Unless [they] could demonstrate the whole range of competence [...]”(Abel et al., 2002, p. 170). The notion of demonstrating the whole range of competence illustrates the idea that smoking, or academic excellence, is evaluated against a backdrop of one's other qualities. Only if foregrounded by qualities that already render one cool, can smoking, or mathematical excellence, ever be seen as fitting cohesively with one's identity, adding to, rather than detracting from, their status as cool.

As illustrated, popularity and the act of being cool that it encompasses are incredibly nuanced and require intricate identity work on the part of the subject. As suggested, the art of attaining cool status correlates positively with excelling at one's normative gender script and correlates negatively with mathematical excellence and enthusiasm. These two notions are explored in detail in the following chapters as these curious correlations are examined and explicated. Finally, I investigate the relationship between consumption, identity, and the means by which normative identities are (re)constructed as congruent with gender norms and incongruent with mathematics. In doing so, I explore the fine line between being cool *and* mathematically capable, while simultaneously avoiding the perilous pitfall of being labeled a nerd.

3.2 Theme Two: Normative Femininity and Its Incongruence with Mathematics

Normative femininity exerts tremendous force on the way in which mathematics is perceived and consumed by adolescent females. Not only does it permeate society and the everyday environment of teenagers, but it also permeates the discourse of the education system and, more specifically, that of the math classroom. Normative femininity acts to

incessantly (re)construct girls in a manner conducive to widely accepted heteronormative ideals, reinforcing familiar binaries that find femininity to be incongruent with intelligence, academic excellence and, more specifically, mathematics. While seemingly ever-changing and fluid, at the core the ceaseless (re)construction of normative femininity reifies the stagnant nature of the gender roles that continue to be reconstructed today.

Normative femininity defined.

The pressure to adhere to the norm exerts tremendous influence on the means by which adolescents construct their identities (Kehily & Nayak, 2008; Kinney, 1993). Subjects are (re)constructed in the image of prescribed gender roles which, while appearing to shift temporally and contextually, remain stagnant at the core. Gonick argues that although “Femininity is [...] being rearticulated to ideally integrate and embody both conventionally feminine and masculine aspirations (McLeod, 2002) [...] while gender is transforming, it may also be recoded and reworked along familiar binaries” (Gonick, 2004, p. 191). What constitutes the feminine and masculine is strictly defined by a set of terms that exist in binaries with one another. That is, to be feminine is to *not* be masculine and vice versa. However, it should be noted that feminine is always regarded as ‘other’ to masculine in the sense that the qualities associated with masculinity have been historically produced as superior and continue to be viewed as such today (Davies, 1994). Davies (1994) uses the concept of marking in order to develop this idea by explaining that within any binary pair of subject categories (for example, white/black, male/female, teacher/student, heterosexual/homosexual, adult/child), the former is usually understood as normal and the latter as a dependent term that takes its meaning in terms of its difference from the former. Davies (1994) explains that:

The first term is the privileged term and is often equated in an unstated way with humanness, normality, the way anyone would be and could be if they were not ‘different,’ that difference being understood as a deviance from the ascendant term. It is a deviance they are not necessarily able to correct however, since their category membership may specifically preclude the behaviour defined as normal for those positioned in the ascendant category. (p. 289)

According to the gendered binaries upon which male and female are premised, traditionally to “do girl” (Aapola, Gonick, & Harris, 2004) carries with it the connotations of fragility, irrationality, complacency, and neatness.

Progressive femininity.

While post-feminisms (Harris, 2003), such as 'girl power,' appear to have altered the ideas behind femininity on a surface level, the actual essence of what it means to be a girl remains the same. Charlton et al. (2007) explain that:

While contemporary young women are more often represented as desiring and (hetero)sexual subjects, objectified desirability continues to be a central marker of dominant femininities (Aapola et al., 2005; Best, 2004). Young women must present a desirable heterosexual femininity or risk marginalization, yet bear responsibility for negative attention afforded to their embodied femininity. (p. 125)

Given the proliferation of media that tell us that gender inequality is all but nonexistent, that stereotypical images of men and women have nearly been obliterated, and that as a society we have progressed beyond archaic traditional notions of gender, it seems surprising that the current generation of adolescents still has such a stark, binary-constructed view of gender and how it operates upon its subjects. The girls interviewed, while purporting to be in favour of abolishing 'traditional' notions of gender roles, demonstrate that, nonetheless, these notions have, in ways that *appear* socially acceptable today⁹, helped shape their identities. All participants, at some point, articulated distinct binaries in relation to masculinity and femininity. Jessica illustrates one of these binaries through a clip from her photo journal (see Image 1) in which she depicts the conflicted nature of being "stereotyped as blonde" (Jessica). Jessica explains that blonde girls have the reputation for being pretty, *but* dumb. This is why she struggles with being termed blonde, despite the fact that it describes her natural hair colour. Interestingly, it is because we live in a society where binaries are articulated that the binary of being pretty *but* dumb simultaneously end up becoming a lived reality and, in many cases, a self-fulfilling prophecy.

⁹ By appearing socially acceptable, I mean that outdated forms of sexism, such as overt harassment, or explicit discrimination against women, are clearly not forms of gender discrimination that would be tolerated in today's modern society. However, women are still objectified for the most part, expected to act in a specific, ladylike manner, and considered unsuitable for 'traditionally masculine' career trajectories. In this way, traditional gender roles continue to permeate society, yet escape under the radar of the type overt gender stratification that would not generally be accepted.

Image 1: Excerpt from Jessica's Photo Journal

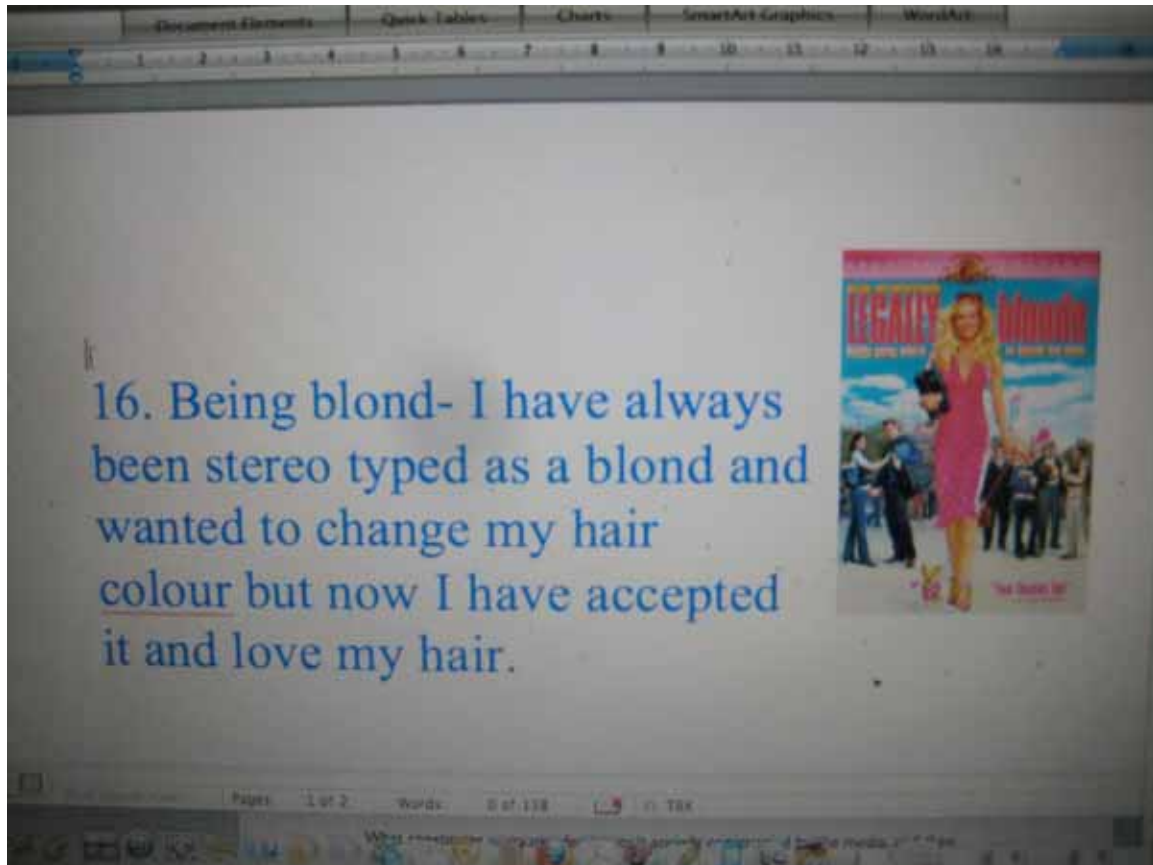


Image 1: While many participants explicitly stated that they “hate to admit it” (Sarah), they nonetheless concurred that they felt there were distinct differences between boys and girls. Although they did not necessarily endorse these differences, they were still aware of them. In the quotation that follows, Alana explains how it is that she feels she embodies both masculine and feminine properties. In doing so, she demonstrates that she views personality as gendered and delineates the divide between the domain of the masculine and that of the feminine:

Okay, well, like, the feminine side is you want to hang with your girls. Like, you want to go shopping, I mean I'm not saying, well, like, I mean, obviously you should care about your image, like, I don't; like, I'm not saying you should be like 'who cares about make up,' I mean you're a girl, obviously it's fun to do those things, but you shouldn't let it control your life, and, like, obviously the media influences you and stuff...getting ready for two hours, so that's like the feminine side...and the boy side is, like, just, like, not prioritizing those kinds of things. Cause when you're with a guy they don't care about their hair or what they're wearing...the tomboy side is just more down-to-earth sometimes, like, just more relaxed; when you think about guys nothing gets to them, like, no cares, and it's nice to be like that...like when I think about stressing about school, girls are always freaking out and guys are so relaxed about it, and still do so well...like girls have other qualities; like, they're more organized and to the point, which I can be really picky and...I don't know the word...but guys are laidback and do just as well and get the same job as

us or go to the same university but they don't stress as much...I think girls just overanalyze a lot of stuff sometimes, especially in a group of girls, just breaking everything down to the smallest things.

One of the central features of the norm and how it operates to control, organize, and legitimize its subjects is by interpellating individuals within a spectrum of discrete binaries. Alana illustrates the discrete binaries within which aspects of girls' personalities are perceived to exist. An excerpt from Sarah's photo journal illustrates the means by which gendered subjects are still (re)constructed within distinct binaries and, moreover, how adolescents generally strive to create an identity marketed to them (Image 2).

Image 2: Excerpt from Sarah's Photo Journal

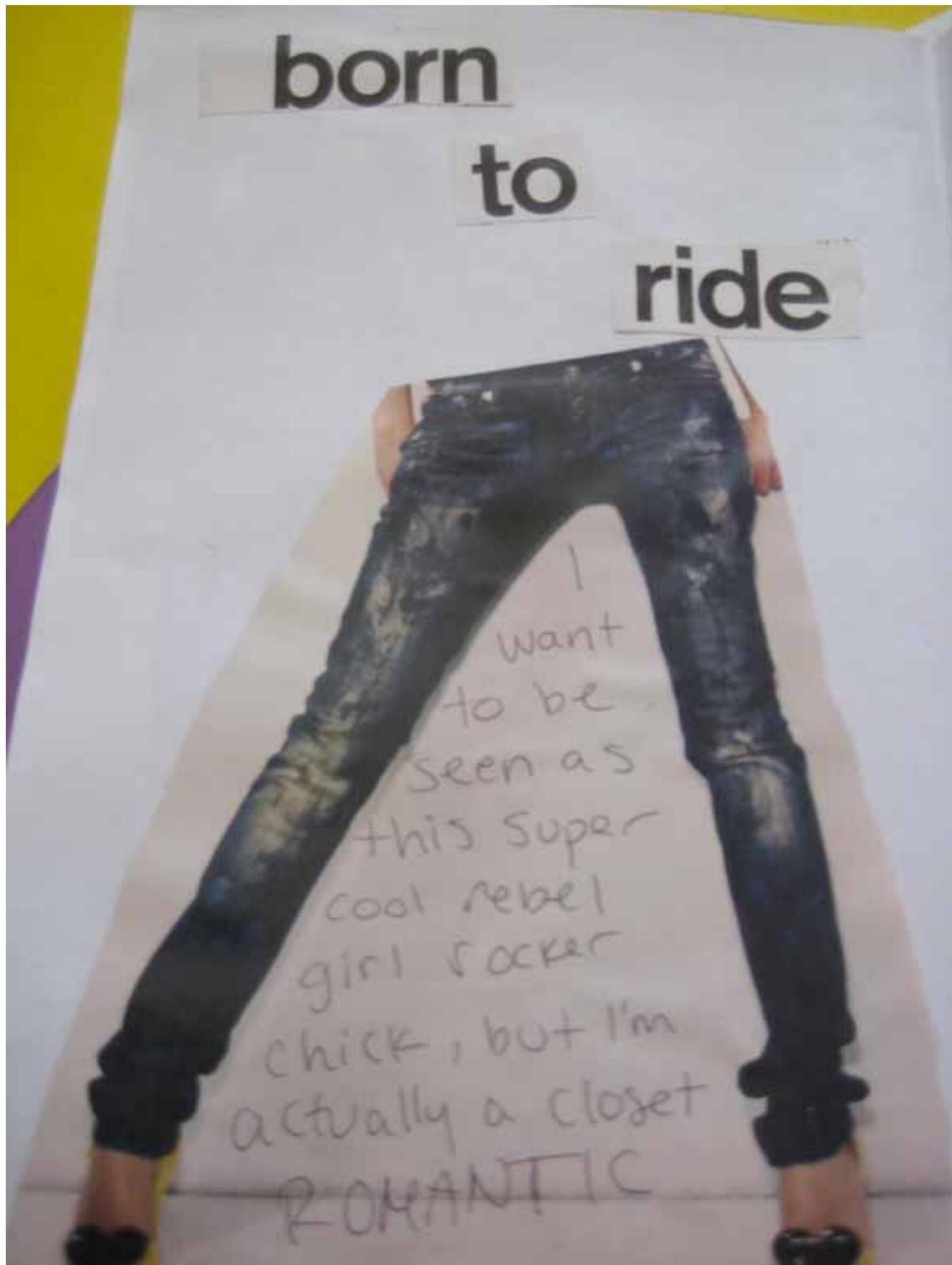


Image 2: Note the choice Sarah must make between either being a 'rebel' or a 'romantic.' Moreover, note her desire to adopt a particular identity (re)constructed by the media.

The modernized divide between genders is further exemplified by Alana, who claims that:

Boys, like, only like to hang out with the guys... guys can find girls so annoying if they're all 'omg my clothes and my hair,' you know? Like, ya, we can talk about sports, we can go out to a movie, that kind of stuff, so not a tomboyish and feminine side but combining [the] best of both worlds...I think that guys find girls who can do that attractive; like, girls that they can relate to they want to hang out with more.

While Alana claims that she defies stereotypical notions of femininity, she does so while citing that she is aware that her subversion of the feminine is what appears *attractive* to males. In a sense she is still occupying the feminine role of being the object of the male gaze, but she is doing so in a way that has been socially constructed and positioned as empowerment.

Intersectionalities.

It is important to note that while the omnipresence of normative ideals place specific gendered demands on its subjects, the individual constellations created when gender merges with class, socio-economic status, and ethnicity tend to modify the expectations of what shape the feminine norm may take (Youdell, 2005). While perhaps intelligence and academic success are seen as incongruent with traditional notions of femininity in certain spheres, in many local contexts this may not always be the case (Kehily & Nayak, 2008). As Hey (1997) claims in her analysis of research conducted in the UK, in a westernized context, “to be middle class and academically super-competent, or a 'boffin,' [...] is, by definition, to lack femininity” (Hey, 1997 as cited in Renold, 2001, p. 581). On the other end of the spectrum, Renold (2001) illustrates the converse in describing student perspectives of girls who grow up in academically oriented environments, explaining that “their middle-classness, coupled with their high achievement, does offer some explanation in an academically successful, oversubscribed school where such identities were promoted” (p. 581). These two conflicting perspectives illustrate how academic success can be seen as either an asset or a drawback depending on one’s social context.

Normative femininity in the classroom

The power that socially accepted and proliferated ideas of femininity have on girls is exaggerated and promoted by the education system, a key site for identity development and, specifically, for the (re)construction of perspectives and ideals relating to academics and career trajectories (Kinney, 1993). Delamont (1990) suggests that “schools not only reinforce dominant societal sex roles but [...] enforce[...] a set of sex and gender roles which are more rigid than those current in the wider society” (p. 5 as cited in Youdell, 2005, p. 250). As Rich

(1980) argues, “the school is a key site for the proliferation, modification, and incessant inscription of these discourses and, therefore, the production and reproduction of ‘compulsory heterosexuality’” (as cited in Youdell, 2005, p. 253). The idea that the education system holds such weight in shaping subjectivities is of great importance when one considers that the majority of girls will undoubtedly spend most of their developing years under its influence. One cannot help but wonder how greatly the ideals promoted by the institution with regards to not only ‘doing gender,’ but also ‘doing academia,’ and then, more explicitly, ‘doing academia *while* doing gender,’ must affect (re)construction of the female *student* and, as such, the (re)construction of the female subject in its entirety.

Math as masculine.

One of the central features of the norm and how it operates to control, organize, and legitimize its subjects, is the categorization of individuals within a spectrum of discrete binaries. While there are many qualities assigned to men and women, of most interest to this project is the frequency with which qualities relating to intelligence and mathematical ability were referred to in a gendered manner during the interview process.

Intelligence, academic success, and mathematics have historically been correlated with rationality, which in turn has been constructed as masculine. In fact, all but two of the participants alluded to the idea that intelligence itself is a gendered construct and that math is an academic subject that pertains to the domain of intelligence and, therefore, the masculine. As such, mathematical ability and success continue to be (re)constructed as incongruent with femininity, which places feminine subjects in diametric opposition to mathematical success, making it almost impossible to occupy or reconcile the two divergent subject positions (Damarin, 2008; Tresemer, 1976; Walkerdine, 1988, 1998). Lees (1993, p. 16) explains how “being academically successful involves taking on (...) attributes that are considered to be masculine,” and Walkerdine (1990) explains that to ‘be clever’ and to ‘be feminine’ involves a paradox of contradictory gendered subject positions. Reay explains that “embodying excellence and achieving ‘femininity’ continues to involve a precarious balancing act for many primary school girls. Girls’ abilities and achievements continue to be undermined as a result of ‘hard-work’ rather than ‘natural flair or brilliance’” (as cited in Renold & Allan, 2006, p. 459). Girls continue to be represented passively by their teachers as ‘conformist plodders,’ such that girls who display ambition and assertiveness are framed as ‘pushy’ (Skelton, 2001, as cited in Renold

& Allan, 2006, p. 459) or as 'little madams' (Reay, 2001 as cited in Renold & Allan, 2006, p. 459). Renold and Allan (2006) concur, explaining that "girls continue to hide, downplay, or deny rather than celebrate and improve upon their successes and feel the pressure to conform to normative cultural representations of (hetero)femininity" (p. 459). Moreover, not only does the pervasive dominance of normative femininity prevent girls from identifying as mathematicians, but it also stifles their desire to achieve excellence academically for fear of threatening their femininity socially. Renold, through her work with primary school girls in the UK, found that being able to talk confidently and positively about their academic successes was a difficulty experienced by many girls, especially by those who were the most academically successful. She illustrates this notion through multiple interviews in which girls explain that while they want to do well in school, they do not want to do *too* well. Specifically, while they "want to get the highest, [they] don't want to get too high because [they] don't want to be called a 'square'" (Renold, 2001, p. 580). The pressure to conform to traditional gender roles is evident in this quotation, demonstrating the detrimental effect that the pressure to conform to ideals of femininity can have on the academic success and goals of girls.

The idea of intelligence as gendered is nuanced as many of the girls not only correlate intellect with the masculine, but go further by suggesting that it is due to this that intelligence is a component of what makes a guy cool, whereas the same does not hold true for girls. Moreover, drawing on what it means to be cool as explored in Chapter 3.1, one of the key components required to achieve popularity for a girl is to be attractive to guys. It follows from the interview data that in order to be attractive to a guy one must be feminine and, therefore, implicitly (albeit sometimes the girls were quite explicit about this!), a girl must not be intelligent as that conflicts with her femininity. Thus, being either downright unintelligent, or at least being *less* intelligent than one's male counterpart, is an essential component of mastering femininity (Reay, 2007; Renold & Allan, 2006).

Intelligence as Unattractive.

The idea that mathematical ability correlates negatively with female attractiveness and implicitly with femininity emerged through the exploration of one of the central themes in the movie *Mean girls* (Shimkin, 2004), which finds the protagonist played by Lindsay Lohan intentionally 'dumbing herself down' in order to appear mathematically vulnerable to a boy she likes romantically. In the scenes that follow, she recruits his help academically even though she

is more mathematically capable than him, and over the course of the film he returns her amorous feelings. During the interviews, the participants watched several clips from the film and were then asked to describe what exactly Lindsay Lohan was attempting, whether they thought that this was a realistic depiction of the way girls act, and why or why not. The majority of participants agreed that while the film may have put an exaggerated spin on the nature of the situation, the idea that girls dumb themselves down in order to appear attractive is quite realistic. Moreover, they concurred that, for the most part, they believe boys actually are attracted to girls that are less intelligent than they are.

In the following excerpt, Stef addresses the notion of girls dumbing themselves down in order to impress guys:

S: Ya, I've seen girls do that before. My friends have done it occasionally, but generally other girls at school [do it].

V: What kind of girls are these?

S: Everyone, [it] depends on the situation.

V: Are these girls smart?

S: Some of them, not all of them. Some are legitimately idiots, but some are smart.

Jessica, upon concurring that she has quite frequently witnessed girls behaving in this manner, goes on to shed light as to why it is that girls tend to put an effort into appearing unintelligent in front of their male counterparts:

V: So, how come a girl would want to do that?

J: I think girls are just smarter, more manipulative; like, they know that a guy would want to help a girl and, like, feel smarter and crap.

V: Don't you think it's weird that a girl would be okay with looking stupid?

J: Well it's stupid that she actually starts failing, but, like, innocent flirting without it affecting your grades is smart. When I say that out loud it sounds stupid.

V: So, do you think guys would find this attractive?

J: I think some guys would find it attractive, like a girl being a little stupider, but I know that some guys find it attractive to be smart, and guys do like smart girls, but some guys like girls that aren't as smart as them.

Stef, although making it quite clear that she disapproves of such female behaviour and the guys who find it attractive, agrees with Jessica:

V: Do guys like girls better when they're dumb?

S: Assholes do.

V: Why?

S: Cause they like to be, like, smarter and powerful and all that, but I think generally no, they don't want an idiot as a girlfriend; it depends.

While several girls argued that they have no desire to appear unintelligent or mathematically challenged in front of their male counterparts, they nonetheless agreed that they did not want to appear *too* intelligent. In Chapter 3.3, I illustrate further how it is that the participants allude to dumbing themselves down, if not specifically for a guy, then for the sake of appearing cool.

Taylor was the only girl interviewed who insisted that she hates when people, males included, perceive her as stupid. Moreover, she had no explanation for why girls dumb themselves down. Taylor notes in her own words:

I *hate* when people think I'm ditzy or stupid; it really bothers me... I'm also very threatened by intelligent people, because I don't actually think I'm that intelligent or gifted, and, like, for example, this guy in my class, he's quick to analyze everyone and prejudices people and I'm always really nervous and I want to say big words but they, like, don't even make sense when I say them and I'm just basically trying to impress him but, like, to not make him think, like, I'm an idiot...I don't know why anyone would want to come across as stupid.

Taylor is one of the participants who suggest that mathematical ability and intelligence can be cool when it is a 'bonus' feature that no one expects. That is, since Taylor and her friends are already perceived as having mastered the feminine and are thus already part of the cool group at school, the fact that they are *also* intelligent is acceptable because they incorporate it into their personalities without forgoing any of the traditional gender qualities that make them feminine. Intelligence is a 'bonus,' rather than something that conflicts with their femininity.

In a similar vein, Alana argues that she does not see mathematical ability as being gendered. Interestingly, even when Alana talks about mathematical ability as a non-gendered characteristic, she does so by gendering mathematical ability. That is, she claims that both boys and girls are equally mathematically capable, but then she goes on to justify her statement by citing the aesthetic value of girls' work, as well as the 'organized' nature of their study habits. Both qualities reinforce the feminine stereotype, rather than highlighting intelligence or authentic mathematical aptitude. This is an idea that Walkerdine (1998) cites often as one of the means by which women are positioned as mathematically inferior despite their proven equality in terms of mathematical capability; by excelling only at 'easy' math, which requires only neatness and diligence, as opposed to 'authentic' math, which requires intelligence and skill. In a sense, Alana is simply reinforcing the need for girls to be attractive to males by way of the feminine, by painting beauty and delicacy onto their academic work:

I don't think there's a difference between girls or guys--you have to have a lot of motivation either way. The thing with girls is they have these study habits, which I notice cause I've studied with girls and I've studied with guys before; girls have really good study habits, cause girls love to be organized, like having their binders neat and stuff, and that's half the battle of studying, like when everything's neat you'll do better, and that comes across in girls, cause guys aren't into that, [...]But there's no difference in who's better.

The notion of intelligence as a desirable quality for males to possess is illustrated in the following excerpts, which explore not only the idea of girls dumbing themselves down but also why it is that boys would never engage in the same sort of behaviour in order to attract a girl. Alana explains that “guys would never at least act dumb like girls would, cause a girl would never find that attractive in a guy, and, honestly, I don't even know why guys find that attractive in girls, but anyways...” Jessica agrees that “a guy wouldn't want to put himself down in front of a girl; like, he wouldn't want to be, like, ‘oh you're smarter than me, help me’; like, a guy just wouldn't want to do that.”

While the majority of these excerpts illustrate the means by which girls feign a lack of intelligence in order to attract males, the underlying assumption here is that it is because intelligence and mathematical aptitude are masculine characteristics that they are *not* attractive to males, and must therefore be hidden. This idea is indicative of the gendered nature by which students perceive and delineate personality features. To illustrate this point, take something as simple as the traditional visible colour divide of pink/blue for girls/boys. This may seem like an oversimplification of the gender divide, but the fact that colours are still ascribed to the sexes is indicative of the social construction within which subjects become inherently interpellated, and which they find impossible to escape.

Upon showing participants a mathematical advertisement (see Appendix C) and inquiring as to whether or not the ad appealed to them, several of the respondents cited the colour and shapes used in the advert as reasons for which they disliked the ad. These were factors that I personally had neither anticipated nor even noticed when selecting the ad. Stef stated that she did not find the ad relevant to her and that she believed it targeted males as “it's all blue, and I don't want to be stereotypical, but, like, blue is for boys, but just the way it's set up also--like the graphics in there, the octagons-- generally would appeal more to boys.” Alana agreed, stating that “It seems very boyish--I think it's cause of the blue, it makes me think ‘boy’...and it does come across [as] masculine cause of the colour or shapes.” Emily also

explicitly relates mathematics to the masculine and simultaneously reaffirms that traditional gender scripting is still pervasive today, claiming:

When you think of someone who likes math, you never really think of a girl when you think of a stereotypical person that likes math...I have no idea...if this is true...but it seems like guys are more mathematically inclined...ya, so I think maybe they're more inherently more inclined, like the right brain left brain...and also when you get to gender roles and stuff, girls are usually groomed for that...and you say that doesn't go on now and stuff, but it still kind of does.

Sarah also demonstrates her indoctrination into the sphere of normative femininity, despite her awareness that her perspective is socially constructed and not necessarily indicative of an inherent truth. When asked whether she thinks that femininity is at all related to her previously stated belief that it is harder for girls to overtly enjoy and excel at math than boys do, she agrees, explaining that:

It's because the traditional feminine ideal is [that] you're supposed to be delicate and dainty and know, like, things that don't have any useful application, like, um, you know home life versus career life. I know that was abolished a while ago, even though it's still there, but like the thing is there [are] still a lot of standards about girls, you still hear woman jokes a lot; and, like, um, you don't ever hear anything about guys in that same sense, so I think it's harder for girls who are good at math who want to show they're good at math, because they're supposed to be--in a social sense--not smart.

The shifting nature of hegemonic masculinity and normative femininity.

While the literature and data regarding normative femininity positions the mathematical interests and motivation of girls as unlikely, if not downright impossible (Walkerdine, 1998), Demetriou's (2001) work suggests that there is a way by which notions of femininity and mathematical capability can eventually be repositioned as congruent, rather than incompatible with one another. Demetriou (2001) uses the concept of hegemonic masculinity in order to explain that while discursive ideals often appear resistant to change, they *do* in fact undergo subtle changes over time given the introduction of minor components that are integrated and dispelled. However, as Demetriou (2001) warns, the introduction of such new components cannot be so drastic as to undermine the inherent notion of the ideal itself. Moreover, the altered components must be minor enough that they do not rattle the entire ideal itself, working *within* the existing system, rather than attempting to overhaul the system itself. In the case of hegemonic masculinity, one might consider how traditional notions of masculinity have shifted over time. One need only think of icons of masculinity such as David Beckham,

who can be seen sporting pink dress shirts and diamond earrings--symbols traditionally associated with femininity--in order to imagine the subtle yet evident ways by which masculinity itself has shifted. However, in the case of David Beckham, it is because he promotes and embodies specific properties associated with traditional notions of hegemonic masculinity (sports, heterosexuality, white, upper-class) that he is able to appropriate relatively insignificant qualities traditionally associated with femininity into his identity, while maintaining his identity as masculine. Note that the pink shirt or earrings are not in direct conflict with masculinity. That is, his display of overtly significant masculine qualities dominates subtleties such as the pink shirt. However, if he were gay, for example, such subtleties may instantly threaten his masculine status, as being gay is in *direct* opposition within the binary heterosexual/gay, a binary upon which hegemonic masculinity is premised. As prominent figures recognized and popularized for their display of a gendered norm overtly incorporate foreign subtleties into their images, these images then pervade society, creating a shift in what becomes acceptable and understood as masculine. Given the right circumstances, new versions of hegemonic masculinity can then emerge, as long as any quality directly in contradiction with its core essence is avoided.

I am suggesting that the same holds true for normative femininity. A key point Demetriou (2001) makes is that for novel qualities to be incorporated into a normative and dominant ideal, the ideal must be proven to exist first. In the case of Beckham, he is initially positioned as possessing all of the qualities that would enable him to be accepted as a poster boy for hegemonic masculinity. It is only *after* the fact that he may appropriate minor characteristics that seem incongruent with this ideal, giving way to the emergence of a 'new' norm. This is similar to the concept of mathematical capability being deemed cool *if* foregrounded onto what is *already* cool, as explained in Chapter 3.1. In the case of normative femininity and mathematics, if normative femininity can shift to absorb intelligence into its definition, then perhaps the two can be seen as compatible, rather than divergent. The problem, however, lies in the fact that mathematics has been so finitely positioned as masculine. Herein lies the interplay between the normative positioning of both femininity and mathematics and, more generally, femininity and intelligence/academic success. As Demetriou (2001) points out, what is incorporated into the dominant ideal *cannot* be in direct opposition with the essence of the ideal itself. As such, mathematics must first be repositioned so that it is not entirely

incongruent with the core tenets of normative femininity before femininity can shift to absorb intelligence into its definition. This modification requires a simultaneous alteration of *both* femininity *and* mathematics in order for the two to become seamless, rather than contradictory. I am suggesting that while altering normative femininity seems like quite a daunting task to undertake, perhaps we can start off by changing the gendered positioning of mathematics. This might be a less overwhelming place to start in terms of equating femininity with not only mathematics, but also intelligence itself. If David Beckham, the prototype of masculinity, can masculinize pink shirts, then perhaps similarly influential role models or embodiments of femininity can do the same for mathematics, *if* mathematics is first shifted slightly from its positioning as discretely masculine. Through her work with research that looks at 'girling,' Hey (2006) suggests that intelligence need not remain eternally in the domain of the masculine and that "the de-ontologising of gender as fixed in biology allows for the interrogation of the ways in which being an intellectual might become unfixed from particular forms of hegemonic masculinity" (as cited in Clegg, 2008, p. 211).

To illustrate this point, consider the newest trend in fashion: "geek-chic"¹⁰. Until recently, intelligence has been entirely incongruent with femininity; fashion, a key signifier of one's gender identity, has reflected this notion. Clothing girls in pretty, dainty, and irrational (emphasizing fashion over function) garments, while men sport smart-looking clothes that infrequently require them to sacrifice practical comfort for their appearance, is commonplace. However, the past year has seen a new style emerge: thick glasses, smart jackets, and 'nerdy clothing' have become trendy. Fashion magazines dedicate pages to images of girls sporting these items, making geek-chic a mainstream trend that is fast becoming accepted. It is not that classically feminine women are now sporting what is traditionally masculine; rather, these items (for example, thick-framed glasses) have been slightly altered to meet the criteria imposed by femininity. Trendy models wear form-fitting clothes and dainty heels *while* sporting thick librarian glasses that have been modified in order to suit the female face. This is a case where apparel traditionally associated with intelligence, and thus, implicitly, masculinity, has been modified slightly so that it is not incongruent with femininity. Simultaneously, the media portrays traditionally feminine girls as appropriating these items. The two simultaneous forces

¹⁰ Please refer to Appendix D for examples of "geek chic" today.

together enable geek-chic to become a socially accepted position for females to occupy, allowing them to retain their femininity *while* promoting an overt picture of intelligence, no longer solely the domain of the masculine.

As I have illustrated, the pressure to comply with normative gender roles makes it very difficult for female students to identify as mathematicians while retaining their femininity. At the onset of adolescence, being perceived as feminine is especially important for girls as it is the adherence to this norm that acts as a precursor to being labeled cool, an aspiration that many girls have. Schools and the media are key sites for the proliferation of what it means to embody femininity and, as such, exert tremendous pressure on girls to conform to the feminine, simultaneously requiring them to abandon extreme intellect. While mathematics and femininity are currently positioned as incongruent with one another, I argue that along the lines of Demetriou's work, the two can be subverted so that they are no longer incompatible. While it is evident that traditional gender roles and gendered ideas of mathematical ability are pervasive today, I am suggesting that there may be a way by which these notions can be overcome and subverted so that they ultimately augment, rather than counteract, one another. Chapter section 3.3 explores further the means by which mathematics is undesirable to females due to its positioning as not only unfeminine, but also antisocial. Finally, in Chapter section 3.4 I explore how math is positioned as incongruent with both femininity and the social by the media and suggest how we may instead use this influential apparatus in order to reconstruct, rather than simply reproduce, the relationship between mathematics and femininity.

3.3 Theme Three: The Mathematician Stands Alone

As demonstrated, the notion of being cool is deeply rooted in conformity to socially-bound norms, which for adolescent girls equates with appearing within the acceptable margins of normative femininity. However, there is another component to being cool, and that is the idea that popularity is tied explicitly to the idea of being social, which means attaining and maintaining friendships that ultimately result in a favorable status amongst peers. This is where the notion of mathematics as an academic subject, as well as the identification of being a mathematician, falls short. As previously illustrated, not only is mathematics incongruent with normative femininity, but its inherent nature and positioning within social and educational spheres is antisocial--the second key precept of popularity.

In the previous section, I explored how mathematics conflicts with normative femininity and explained that being nurturing and social are traditionally female qualities (Gonick, 2003). In this section, I explore how it is that mathematics, as positioned by the media, conflicts directly with the social both within the education system and within society at large. I will then explicate how it is that the antisocial is incongruent with being feminine, ultimately positioning mathematics as incongruent with popularity itself.

Math in education: Triple threat.

The antisocial nature of mathematics can be seen within the educational sphere in three ways. First, the abstract nature of the field renders it one of the most challenging of academic subjects, requiring students to devote extended time and energy to achieve mathematical mastery. The perception is that, in order to be willing to devote such a vast amount of time to the mastery of one subject, one must lack the social skills required to do anything else, choosing instead to retreat to a life revolving around mathematics. Second, since mathematics requires a great time commitment to excel at, mathematical enthusiasm is perceived as antisocial as it detracts from time that might otherwise be spent socializing with peers. Finally, the individualistic manner by which math is taught in our schools positions math as an activity that is performed independently, rather than through group work, a pedagogical style which renders mathematics as academic *as opposed to* social, rather than as academic *in addition to* social.

Educational factor #1: A lack of social skills associated with mathematical competence.

All but two of the participants interviewed made reference to those who enjoy and excel at mathematics as being the type of people who “live, breathe, and do [...] math” (Taylor). The perception is that these people enjoy math at the expense of everything else, including having a social life, because they lack the social skills it takes to be popular.

The idea that people who choose to become mathematicians do so partly because they lack the social skills to do a variety of other things was touched on by a number of participants. Emily explained that those who enjoy math in school “are just nerds [...], the kids who don't have social skills, so all they have is school, and that's kind of the same thing; like, people just...and until you discover who you are, you usually just think of yourself as one thing, or other people think of you as just, like, one thing.”

Taylor elaborates on this point, explaining how it is that math-centred careers are the

only viable option for those lacking social skills. She explains:

I think you need more for commerce; like, you don't *just* need to be good at math. For engineering, how much do you really need to have the full package...I don't know, when you think about math people, you don't think of a person who's a social bomb¹¹. My dad was telling me the other day that some doctors that he's had go into the medical field because they don't have the social skills a business person might have, but they're math prone and hardworking so that would be good for them¹².

Here being 'math prone' correlates with being socially inept, thus rendering such a person fit only for a purely mathematically oriented career, which requires no social skills. According to Taylor, those who are 'math prone' are often so at the expense of other desirable character qualities, including those social skills required to be popular.

Educational factor #2: The time consuming nature of mathematical mastery.

In addition to the idea that those who are innately mathematically prone are implicitly socially inept, Rachel and Emma illustrate that to master mathematics takes so much time that it becomes impossible to have a social life. When asked if the typical popular girl could be good at math, Rachel responds with "maybe, but it's hard to maintain your social life the amount *they* [the popular kids] do and your school." When asked the difference between her group of friends (who she claims are the cool kids) and those kids who enjoy math, Emma responds with "we don't sit around on a Saturday night studying for fun." Emma and Rachel illustrate that excelling at mathematics requires one to sacrifice time that might be spent socializing in order to acquire mathematical aptitude. As Jessica points out, this time is crucial as the cool kids spend much of their time creating and maintaining their social networks:

I remember in grade nine and ten it was really important to be at lunch cause I didn't have any classes with [my friends]; so what I learned at lunch, like, for drama or gossip or what we were doing that weekend all happened at lunch, so if I wasn't there, I missed a bunch of stuff, so if [The] Mathletes was something I had to do at lunch, it would really affect me, cause I wouldn't know what was going on.

That committing oneself to mathematical success involves sacrificing social relations that take place in the classroom, immediately places math at odds with socializing and, thus, with attaining and maintaining popularity.

¹¹ A "social bomb" refers to someone who is very successful socially.

¹² Taylor is referring to the fact that the medical profession is one that carries with it a great amount of social prestige and financial compensation, thus it is an attractive career option.

Educational factor #3: Antisocial pedagogy in the classroom.

Finally, several participants suggested that it is the manner in which mathematics is treated pedagogically that renders it an antisocial activity. The nature of academic excellence itself is inherently antisocial for several reasons. Not only does succeeding academically entail paying attention in the classroom, detracting from talking to one's peers, but it also requires spending time outside of the classroom doing homework, which detracts from the time that could be spent engaging in social activities. As the classroom is a key site for building friendship groups and maintaining peer relations (Kinney, 1993), committing oneself to academic success involves sacrificing, to an extent, social relations that take place in the classroom, immediately placing academics at odds with popularity.

Within the scope of the academic, mathematics classrooms have the distinct reputation of being the most antisocial of all classroom environments. Despite the development of the new mathematical standards on which mathematical curricula and pedagogy are based (NCTM, 1989, 1991 and NRC, 1989 as cited in Borasi, 1996), and the abundance of constructivist-based approaches to mathematical learning that have made substantial headway in many math classrooms (Borasi, 1996; Schoenfeld, 2004), the traditional math classroom remains most often teacher centred. This is the case physically, as desks are lined up in rows facing the front of the classroom where the teacher lectures, and figuratively, as a pedagogical practice in which teachers most often lecture and require the class to complete quiet, independent work at their desks, leaving little opportunity for collective discussion (Schoenfeld, 2004). As such, mathematics itself is specifically antisocial relative to other courses in the curriculum, making it particularly hard to identify with if one's interests are to be cool, popular and, implicitly then, social.

One of Rachel's main critiques of math relative to the social is that "it's really about the individual...it's not really socially something ...it's not social." She claims that although math can be interesting, there are such major drawbacks as the lack of creativity in the classroom and the lack of space for social interaction. She suggests that "if it was...like, if you could sit and have fun and talk about it with other people...it just needs to be active. It's just so straightforward, you can't be creative, it needs to be more active and, like, fun, basically, and less sitting in a classroom at a desk, same textbook, same teacher..." In her interview, Rachel compares math to one of her favorite classes, media, asserting that it is the ability to socialize while learning

that makes media class fun and engaging. In contrast, mathematics seems to lack dimension as it is solely about intellect with a distinct absence of the social. Here, Rachel raises an interesting point regarding the positioning of mathematics within the curriculum: perhaps if math were taught in a manner that rendered it compatible with the interactive and social, students would not feel as though they were sanctioned to the realm of the academic at the *expense* of the social. Again, we are faced with the idea that it is the social construction of mathematics, this time in a scholastic setting, rather than the inherent nature of the subject itself, that is the cause for its rejection by many adolescent girls. Such a perspective on mathematics once again raises signposts of agency, and embedded within that agency, there is a possibility for change.

Older and wiser.

Interestingly, while achieving academic success tends to be looked upon as uncool in the early high school years, in the final year of high school there is a marked difference in the opinions of students. For example, as some work (Brown et al., 1986 as cited in Boyatzis, 1998) has shown, the desire to excel academically increases across the high school years, perhaps because students get closer to graduation and begin to contemplate attending college (Boyatzis, 1998). Due to the fact that high marks become necessary for university/college admittance, coupled with the reality that attending university/college is the norm for the majority of students, achieving academic excellence at the expense of socializing becomes accepted as the norm. As such, it loses the connotation of deviance that renders it incongruent with coolness and popularity (Boyatzis, 1998; Brandel et al, 2008) in the early portion of secondary school.

Math in the media as anti-social.

While math within education is presented as an independent activity, this is not exclusive to the educational system. The media, one of the largest influences on adolescent identity (Arnett, 1995), plays a large role in reinforcing the antisocial aspects of mathematics and mathematicians, emphasizing that the category of mathematician is aberrant because this group is often regarded as lacking in social skills, popularity, and sometimes even sanity (Damarin, 2000; Mendick, 2005b). Moreover, mathematics is consistently positioned in popular culture as a body of knowledge to which only a specific group of people have access. For example, when asked to describe someone who enjoys mathematics as depicted by the media, Jessica illustrated as follows:

V: Can you think of any other images of people liking math in media or pop culture?

J: Not very fashionable. Unlike you, you're fashionable and math. Ya, I don't know, they're not fashionable, not very social, they're just, ya...

Jessica's repeated reference to 'fashionable' as a quality that one who enjoys math does not possess illustrates the distinct divide between enjoying math and attaining popularity, as earlier in her interview Jessica cites 'being fashionable' as one of the qualities required to be cool.

As mathematics has become pervasive throughout pop culture in the past decade, taking centre stage in blockbuster films, such as *Good will hunting* (1997), and television shows, such as *Numbers* (2005), its portrayal has reached a wider range of audiences, notably teenagers, who rely on pop culture for much of their socialization (Arnett, 1995). Most of the characters in films and television shows are white, heterosexual males, portrayed as having to choose between belonging to the world of mathematics and leading a 'normal' life (Mendick, 2005b). They are polarized to extremes within binaries consisting of antipodes such as connectedness/separateness and rational/emotional. These protagonists are only deemed mathematically capable once they sacrifice personal relationships and, in many cases, sanity (*A beautiful mind*, 2001; *Enigma*, 2001; *Good will hunting*, 1997 as cited in Mendick, 2005b). In the few cases where women are portrayed as being mathematically competent, they are depicted as lacking social skills, friends, and any social desirability (Shimkin, 2004). Moreover, while mathematically inclined men are depicted as geniuses, women who enjoy mathematics are depicted as nerds, especially in media targeted at adolescent girls (*Clueless*, 1995; Shimkin, 2004). In fact, while seven out of nine participants cited qualities commonly associated with nerds as pertaining to those who enjoy math (two participants insisted that there were no discernable characteristics associated with mathematicians), a handful of girls interviewed actually stated explicitly that when picturing a mathematician, they rarely considered women as part of their evoked set. Sarah, describing a girl who likes math, explains:

V: If you can, describe to me what you think of when you think of a girl who likes math.

S: Stereotype? Okay: nerdy, glasses, not that popular, doesn't have a huge social life, bookish...not that...attractive, I guess.

V: And what about a guy?

S: Maybe the same thing, but I think that a guy that likes math doesn't have to be a nerd, I'm totally going by stereotypes, but they can also be a cool guy that likes math but I think with girls, there is sort of a double standard. They're not supposed to be cool kind of thing; if they want to be cool, they can't like math.

Again, Sarah refers explicitly to the notion that a girl who enjoys mathematics has no social life and is simultaneously unpopular. Moreover, she refers to the gendering of mathematics. The excerpt from her interview illustrates the nuanced manner in which mathematical enthusiasm and popularity *can* co-exist, albeit exclusively for males. As this quotation illustrates, it is possible for males to retain popularity while enjoying mathematics, but not likely for females. A scene from the hit movie *Mean girls* (Shimkin, 2004) further illustrates this point. The following dialogue takes place between a new student, portrayed by the ever-influential/trendy Lindsay Lohan, and the popular girls in school who have decidedly taken her under their wing:

Cady (*Lindsay Lohan*): I think I'm joining The Mathletes.

Regina, Gretchen, Karen (*Popular girls*): No! No! No!

Regina (*Popular girl*): You cannot do that. That is social suicide. Damn! You are so lucky you have us to guide you.

(*Mean girls*, 2004)

It is no surprise, given popular media images of what those who enjoy mathematics must/should 'be' and how they are viewed by their peers, that students' impressions of mathematicians reflect these ideas and images. Girls are taught to believe that the identification of oneself as a mathematician is directly in conflict with nurture, compassion, and peer relations, making it not only incongruent with the social, and implicitly with being cool and/or popular, but also with the core notions of normative femininity.

Antisocial = anticool.

The perceived antisocial position that girls who enjoy mathematics occupy is of great pertinence when shadowed against the backdrop of the cool label young girls want so badly to attain. As Emily explains, being cool has to do with "how social you are and how, like, you relate and go talk to people and make friends and put yourself out there." Moreover, Jessica delineates the divide between the cool group and those who excel academically by explaining:

In grade nine and ten our school was very cliquey...so it's, like, the people who party and have fun and somewhat do well in school, and then there are people who, like, if they go out, they go out to a movie, and, like, they're done and they study or whatever, I don't know. I don't want to be put in a group. I do hang out with some of the kids that just go to movies, but, like, I do that during school; like, if I need to study, I sit with them and study. But then there's, like, my group on the other side where I just party all the time, like summer: I'm partying non-stop, so I hang out with them.

Jessica illustrates exactly how it is that the cool girls carry out social activities in a manner that is distinctly different from the nerdy girls who excel at math. As Jessica and Emily suggest, in order to be cool one must be social, and as illustrated throughout this chapter, those who are social are assigned qualities that are seen as conflicting directly with enjoying mathematics.

Unfixing mathematics from its socially constructed position.

The positioning of mathematics within the education system and by the media creates a discrete dissonance between coolness/popularity, femininity, and identifying oneself as a mathematician. Just as femininity is not inherently rooted in nurture and compliance (Gonick, 2003; Damarin, 2008; Walkerdine, 1998), mathematics is not inherently rooted in independence and the antisocial. That is, the two are both socially constructed as such (Damarin, 2008) and thus perceived and consumed as diametric opposites. Just as Demetriou (2001) suggests that the structure of hegemonic masculinity can be altered, I am suggesting that normative femininity can be modified, as can ideas related to what it means to be cool, popular, and mathematically enthusiastic and capable. By simultaneously modifying the two socially constructed discourses, perhaps mathematical success and the desire to work hard and achieve academic excellence can begin to be seen as a positive goal for even the cool kids, reducing the tendency for this desire to be seen as nerdy, antisocial, and unfeminine. At an age where social acceptance is of utmost importance to teens, disconnecting math from the antisocial is pivotal to engaging girls in mathematics. While academic excellence will always require hard work and time diverted from the social, I am suggesting that if mathematics shifts from its category of deviant for females, and becomes more normative (as Brandell (2008) illustrates that it does during the final year of secondary school), perhaps convening with peers in order to collaborate on math problems, or simply studying with friends, might become a new and acceptable form of socialization, ultimately allowing the social and the mathematical to supplement with one another, rather than remain diametrically opposed. In the final section of this chapter, I demonstrate how while the media has the potential to be a pivotal vehicle in this transformation, currently it is actually an accomplice in the negative portrayal of mathematicians.

3.4 Theme Four: (Un)popular Culture

We have now seen how identity construction and the desire to be popular interact with both normative femininity and academic excellence/enthusiasm, creating an archetype of what

cool consists of for an adolescent girl belonging to the particular demographic being studied. While I have illustrated that notions of cool are manifested and disseminated via the education system and one's peer group, how is it that widely accepted and generalized notions of cool and popular come to be? As aforementioned, Abel et al. (2002) propose that "the widespread existence of labels like 'cool' and 'nerd' suggests similarity that is perhaps predictable from the global media networks that impinge on adolescence" (p. 177). That is, underlying micro level notions of cool is a mechanism that creates and disseminates cool on a macro level: the media. The media is not only accountable for the nerdy connotations associated with mathematicians, but as I demonstrate, it is the media that underlies local definitions of what it means to be feminine and, moreover, what constitutes cool.

The influence of the media on teenagers.

Normative femininity is in part socially constructed by the media, and then disseminated via media channels such as advertising, magazines, and television. The way media consistently (re)constructs these normative images creates a feedback loop; participants continually strive to create an image for themselves that matches those normative images generated by media images (Maynard & Taylor, 1999). As such, the media selectively reinforces normative cultural ideals. In terms of societal standards of what consists of the feminine:

The idealized images portrayed in advertising help shape a person's self-image, contributing to the way one's identity is defined in and by society. Discourses of normative femininity encompass the gendered subject who is continually (re)produced by various acts of media consumption. (Walkerdine, 2003, p. 247)

As the girls interviewed demonstrate, they are largely a product of the society in which they are subjects and as such, they (re)construct social norms perpetuated by the media. As Dimitriadis and McCarthy (1999) argue, the media and pop culture are prime arenas where "ideas circulate and identities are produced" (p. 3). In a sense, by emulating pop culture, subjects are (re)constructed and young identities formed. As this section deals specifically with the media, participants' photo journals are especially useful. The photo journals were primarily media based, and while they laid a foundation for many of the interview questions, they also played a pivotal role in depicting participants' relationships with the different forms the media can take. Interestingly, while participants were asked to create journals that acted as self-portraits and instructed to use any materials desired, the majority of girls mostly drew from

media channels such as magazines, advertisements, and TV shows in order to build collages of images that epitomized their identities.

Despite interviews and photo journals demonstrating that the participants possess impressive astuteness with regard to the hidden agenda of media, throughout the interview process girls admitted to being influenced by media messages regardless of the manipulative tactics often employed. Moreover, the participants emphasized the impact of role models and celebrity personalities on their consumption decisions and, conversely, the ineffectiveness of marketing techniques that promote products based upon functional elements, rather than on image/identity acquisition. Finally, the interviewees illustrated that the means by which mathematics is currently promoted falls into the former category of functional promotion, which remains ineffective, often having the opposite effect than those intended by marketers.

As previously mentioned, the media's influence over participants was made incredibly salient vis-à-vis the plethora of media images found in their photo journals. When asked to create photo journals that reflected how they saw themselves and/or saw their *desired* identities, a large percentage of the representative images were media related (see Image 3, Image 4 and Image 5 below). Note that the participants selected photos that were related to the media in a variety of ways, whether by including specific brands they valued, television shows they drew inspiration from, or celebrities they wished to emulate.

Image 3: Excerpt from Erin's Photo Journal



Image 3: A collage of images that reflect who she is. Sixty-four percent of images relate to branding and consumerism, with the exception of ice cream, chocolate milk, basketball, the diamond ring, salad, and sandwich.

Image 4: Excerpt from Alana's Photo Journal

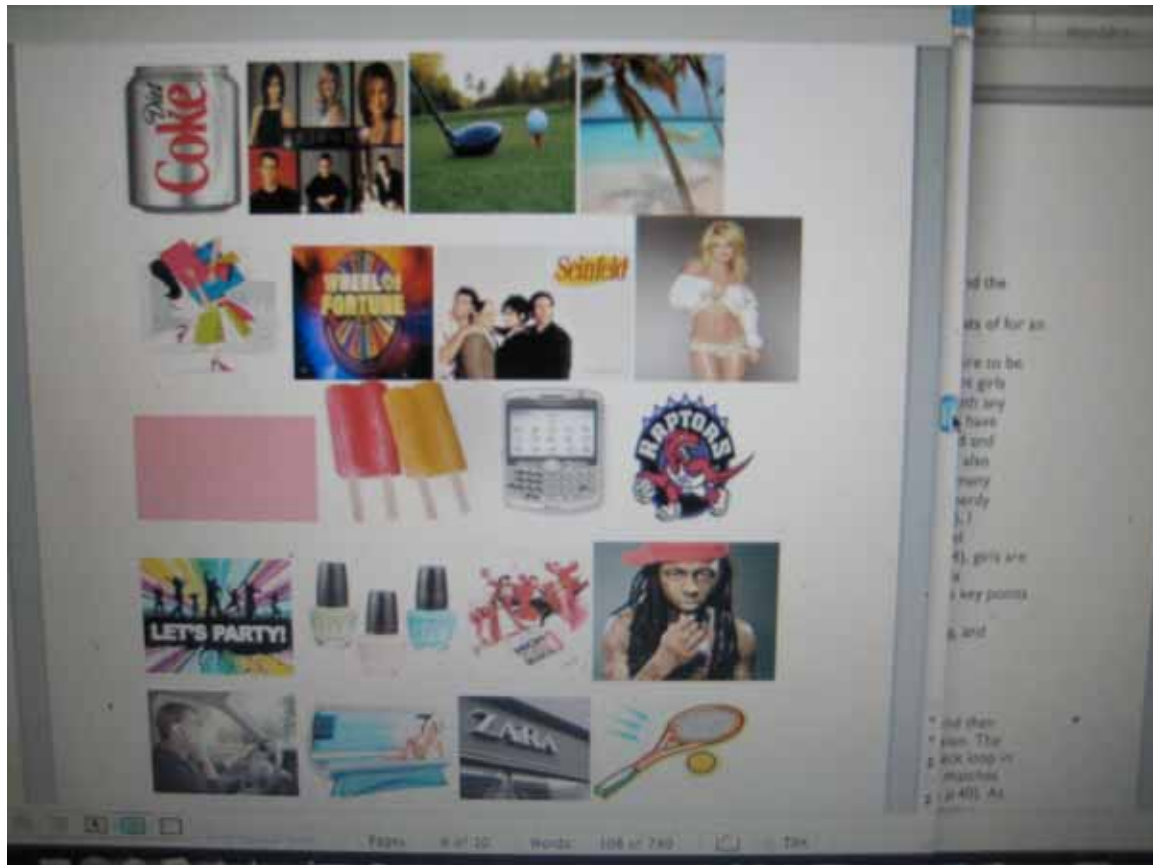


Image 4: A collage of images that reflect who she is. Sixty percent of images relate to branding and consumerism, with the exception of popsicles, 'let's party' image, girl tanning, tennis, pink, palm trees, golf, and image of girl shopping.

A collage of various images including clothing, celebrities, logos, and social media references. The collage includes: a black dress on a hanger; the 'urban outfitters' logo and three models; a woman in a red dress; a woman in a purple shirt; a woman in a black top and white skirt; a pair of sunglasses; the 'NEUCHÂTEL JUNIOR COLLEGE' logo; a woman in a white top and blue skirt; a man's face; a group of women; a 'PEACE' sign with colorful peace symbols; a 'facebook' logo; a world map; a pi symbol; and a group of people.

The majority of girls interviewed exhibited remarkable awareness with regard to the intentions of the media; however, despite this awareness, they admitted to often being affected by its messages. As Bordo (2003) warns:

While Bordo (2003) is referring to body image amongst teenage girls, the message is still the same: regardless of what authority figures might purport and what rationality might tell you, the media still manages to circumvent such messages, exerting tremendous weight over the

beliefs of teens. In reference to advertisements that ultimately influence her purchase decisions, Alana explains:

We did tons of analysis of ads in media class and the only example I can think of is an ad of this model in a business setting and she was holding a piece of gum. It was Trident Splash, and she made it look really good cause she was hot and wearing nice clothes, and it was busy and colourful and it caught my attention. I mean I never bought the gum, but it's in your subconscious, I think. Like, we're surrounded by ads...and you definitely don't realize why you purchase something, you don't think about why you're buying this pack of gum...and it's probably because it's in our subconscious, like, the media is such a freaky thing.

Alana illustrates that despite her awareness, media messages still retain their influence. Although she professes astuteness regarding the intentions of the media, Alana nonetheless admits to sometimes being affected by its ideas. However, it appears that the effectiveness of messages regarding femininity and the idea of cool is most apparent when it comes to campaigns in which this type of message is implicit, rather than overt. For example, the gum advert mentioned above is not for *femininity*, it is for *gum*; the signposts of femininity that appear in the context of the ad seem peripheral, almost taken for granted. It is this type of message that influences the perspectives of young women, as such images are not questioned but rather assumed to be the norm. In contrast, what this quote also illustrates is the media savvy of this particular generation and, more specifically, of girls belonging to it. This is pertinent as it illustrates the means by which girls consume and digest what the media feeds them. Specifically, it is important to this particular project because it gives insight as to how it is that girls consume and digest educational marketing efforts that *explicitly* market their products, an idea that is explored next.

Marketing identity: Purchasing popularity .

The prioritization of popularity versus the functional elements of schooling explored in Chapter section 3.1 parallels the prioritization of image over functional elements of products (Curtis, 2001) by adolescents as consumers. In response to this shift in consumption patterns, marketers have altered their strategies in order to draw such consumers in on the basis of image, rather than the functionality of the products they are selling. Companies have gone from marketing their products based on need, to marketing products and services based on image and desire, particularly the desire to be popular and accepted (Curtis, 2001).

The idea of marketing based on image refers to the way in which companies attempt to

sell an *identity* via their products, rather than the product itself. The product is just a medium for delivery: it is a means to an end, rather than an end in itself.

'Identity marketing' refers to a relatively new marketing paradigm that emerged in the late 90's (Curtis, 2001; Dretzin, 2001). Identity marketing is a strategy in which organizations place greater emphasis on the associations consumers have with their brand(s), rather than on promoting their products based on their functional attributes. Identity marketing relies on a feedback loop in which qualitative research is done in order to determine what identities consumers desire, resulting in the association of a brand with this image. As Alsem and Kosteljik (2008) postulate, "the new marketing paradigm means that better, more systematic brand theories need to be developed in close cooperation with other disciplines such as psychology and reputation management" (p. 21). As such, brands must stay dynamic, constantly meeting the changing needs of their consumers who mimic their culture's fluid representations of the normative ideals they wish to emulate.

Of specific interest to my work is the means by which organizations position their brands so that they match the identity that girls have/want to have of themselves, convincing consumers that by purchasing their products they are simultaneously acquiring their desired identity. Alana illustrates:

V: Let's talk about ads. Have you ever seen an ad that has made you want something?

A: When I see billboards and stuff for clothes, it's stuff I could never afford, so no; but when I see ads on TV, like infomercials, sometimes I really want to get the stuff because I like the idea of making life simpler, but I do think that food...or a pretty picture of a girl wearing something...it's not like you want to capture that person, but you want that lifestyle. Like if you see a picture of a girl with diamonds and gowns drinking vodka, you don't really want the vodka, but you want that lifestyle, and that's how the media has its tricks on people for sure, and that's when your media knowledge comes in handy. It doesn't influence me that much, but I know it influences other people.

Rachel concurs, explaining that:

V: Talking about being accessible through the media, can you think of an ad that you've really hated or liked that made you want to buy something?

R: Ya. American Apparel. Their ads are really weird and raunchy and pornographic...I know that sounds weird, but they're *different*. It's not like you want to be that person or need that weird underwear on that girl, but you just feel like it's different, original--or was original, refreshing--something not common I guess. But, I mean, you don't really think about it.

V: So does it give that image to their product or clothes?

R: Ya, and then you feel like if you own them you have that image.

The idea that through product consumption teenagers can acquire the status of cool (purchasing popularity) is the inspiration behind these marketing tactics (Gladwell, 1997; O'Donnell & Wardlow, 2000; Bird & Tapp, 2008; Dretzin, 2001). Thompson and Haylko (1997) explain that:

At the heart of the attainment of coolness is the notion that various people and groups exist which have established norms for coolness, the adoption of which validate the teen group member, [...] understanding the norms for various peer groups should help marketers predict behavior, in the form of peer-sanctioned consumption. (As cited in O'Donnell and Wardlow, 2000, p. 13)

Gladwell (1997) describes coolhunting, one of the recent trends in marketing, which operates on the premise of marketing coolness. Coolhunters make a living by conducting ethnographic studies in order to monitor trends, determining what is cool amongst adolescents and then selling this information to companies. Marketers then incorporate these ideas into their product communications, making it possible to “buy cool off the shelf” (Bird & Tapp, 2008, p. 20). This type of aggressive and pro-active marketing is the key to product and brand success in this era.

While coolhunting might be the key to brand success, one question often remains elusive: What *is* cool? In Chapter section 3.1, I proposed that cool exists in a nuanced web with particular specifications dependent upon a range of factors including but not limited to gender, age, SES and geographic location. Within the scope of this thesis, as I am focusing on what cool means to adolescent girls of a specific demographic: cool correlates positively with excelling at being feminine as socially defined, and correlates negatively with academic success and enthusiasm.

A key reason for exploring the components of cool portrayed by the media is that, as Kelly and Stack (2006) explain, “the media are a central, if not primary, pedagogue” for children and adolescents (p. 6)¹³. Moreover, as Maynard and Taylor (1999) posit, at a societal level, media can play a significant role in the development of one's self-image or self-identification. Napoli (2004) concurs, explaining that:

Girls become socialized into gendered identities long before they enter school and/or join after-school book clubs. In a media-saturated society, it becomes

¹³ For more information, and quantitative data on the media and its involvement in the lives of children and adolescents, please refer to Kelly and Stack, 2006.

critical to encourage students, such as the girls in [her] after-school book club, to become more cognizant of the implicit messages embedded in cultural texts and to offer them opportunities to resist them. (p. 16)

The media's (re)construction of normative femininity shapes the way one perceives what is acceptable, normative, or even 'perfect.' According to Cathcart and Gumpert (1983), "the more advertisers project images the reader has been taught to value, the more the reader will see himself/herself in them, creating a feedback loop in which readers strive to produce a self-concept (identity) that confirms the image" (as cited in Maynard & Taylor, 1999, p. 40). Advertising works within a cultural context by selectively reinforcing the styles, roles, and values of the culture. In terms of societal standards of style and beauty, the idealized images portrayed in advertising help shape a person's self-image, contributing to the way one's identity is defined in society. In this manner, discourses of normative femininity encompass the gendered subject who is then (re)produced, as Walkerdine (2003) asserts, by "consuming oneself into being" (p. 247).

The effectiveness of implicit marketing techniques.

Marketing based on image, rather than marketing based on functional and tangible product properties, is an effective way to reach the particular demographic in which I am interested. This genre of marketing is one example of an implicit, rather than explicit, marketing tactic. Rather than blatantly trying to sell a product to consumers based on its functional properties, the acquisition of a particular *image* is implied via proposed product consumption. This is a technique that is more understated, enabling consumers to believe that they are empowered in their resistance to being bombarded with advertisements and constantly being 'sold to.' One specific example of this strategy is product endorsement by celebrity icons and role models. This strategy allows marketers to remain silent, allowing consumers to make their own decisions regarding what it means if a particular celebrity consumes a certain product, a strategy that enables consumers to feel as though they have agency with regards to their consumption decisions.

The use of celebrities for promoting products, services, and causes is not new; however, in view of the increasing marketing savvy of the adolescent population, it has become increasingly instrumental in the success of disseminating ideas that teenagers might otherwise be averse to consuming. The interview and photo journal content of the participants in this

study suggest that celebrities that the girls look up to play a crucial role with regards to the girls' consumption and endorsement of particular products, opinions, and beliefs.

As part of the interview process, I asked the girls what factors influenced their consumption decisions. None of the girls mentioned advertising and, when explicitly asked, all of them claimed that overt product promotion was a turn-off and bore no weight on their consumption decisions. For the majority of girls, when consumption did not directly relate to function, their consumption decisions were influenced by cool role models that the girls desired to emulate, including peers and celebrity personalities, as the following excerpts illustrate:

V: When you decide to buy products and stuff, what do you think influences those decisions?

E: A lot of the time, it's when everyone else has them; like, Alana got a blackberry, so I was like I need one. Like, as more and more people got them, I would look at my phone and be like this is *nothing* compared to a blackberry.

Jessica responds along the same vein; however, her response is striking in its explicit reference to seeking the approval of peers and exemplars with regards to consumption decisions:

V: You wrote you love American Apparel etc. What makes you decide what to buy?

J: I buy stuff that makes [me] feel hot. Like, I like other girls' opinions on what I'm wearing. A couple of other girls are, like, 'oh I love what you're wearing no one else could pull it off,' I love that, because I'm an individual, no one else could pull it off, stuff like that. But then I do conform a lot in my shopping; like, if a girl is, like - like these pocket skirts, I have like three of them, and I always see girls wearing them in different colours and then I'm like 'omg that colour is so much better than mine I *need* it!' But I do limit myself, like if I think something's cool, then I'm like 'what would my friend think of that or what would a guy think of that?'

V: Do you get ideas from people or celebrities or stores or...?

J: It's mostly when I go online shopping, which I do every day. I pick out my own things that I really like, but I'm really influenced by my friends...I copy what they're wearing, like, they're really fashionable. So I'll buy stuff that they wear but I'll space it out so I'm not wearing them too close to when they wore it.

This excerpt from Jessica's interview illustrates how influential the perceived opinions of others can be with regards to one's consumption decisions. As Alana and Rachel reveal in the following quotations, this influence is not limited simply to tangible product consumption, but to the adoption of opinions, ideas, attitudes, and perspectives:

V: So you think if Britney Spears back then or now was to do something or promote something, that you'd be more likely to listen?

A: Back then, for sure. I think she's very influential, she was the top pop singer, so obviously you look up to her when you're younger, not that I want to be a singer or

dancer but she had this thing where you're like 'it's *Britney*,' you just love her. I think when I was younger, anything she did we would do or support.

Rachel continues along the same vein:

V: How do you decide to buy clothes? What factors do you take into account?

R: Well, first it's if I like what I see in a magazine, when you walk down the street--like, if you see someone wearing something you like –

V: Does it depend where you see it or who's wearing it?

R: Ya, as much as I want to say no, ya. I feel like it's *where* you buy your clothes...it's not necessarily who wore what...it's *where*.....it is really subconscious...what's accessible through the media and advertising and celebrities...that's what matters.

V: Do you think you'd ever not like something because someone you didn't like was wearing it?

R: Ya, for sure.

V: What about messages? I mean, I just thought about this right now, but in your journal you wrote a lot about Bob Dylan. So let's say, he's running around touting certain points of view, and you already like a bunch of stuff about him, would you think that the fact that you already like him would be influential in terms of you liking what comes out of his mouth?

R: Ya, definitely. But it's not like whatever he says is God, but because I like him so much, his points actually make me think, but it's not like I automatically believe everything he says.

Rachel's quote is significant as it broadens the notion of consumption beyond of the idea of simply consuming the tangible. Here, Rachel demonstrates that influential personalities have an effect on the perspectives that consumers choose to adopt, an idea that is significant with regard to the idea of promoting mathematics. Rachel emphasizes that while she would not blindly buy into everything her idol, Bob Dylan, promotes, that she would definitely be more open to considering anything that he supports as she values his opinion and looks up to him. Moreover, note that Rachel claims she might be turned off of a particular product if she saw someone she did not like consuming it. This gives credence to the idea that the popularized stereotype that nerds love math might play a part in making math undesirable to many girls, as girls desiring popularity may not want to emulate girls categorized as nerds.

Finally, Sarah takes the notion of role models as influential and ties it together with the idea of promoting mathematics. When asked how she feels that mathematics might be successfully sold to adolescent females who either do not enjoy math, or who are otherwise ambivalent, she responds as follows:

V: Do you think your advertising ideas would in any way help that (with femininity being seen as incongruent with math)?

S: Ya. The media's so influential, especially with teenagers now, I think that if you got someone who was cool and who was a girl who was successful and sort of just portraying that positive image of what math could be, I think that would be helpful cause a lot of times all you need is a role model and if all girls have are stupid, naked girls in, like, music videos, obviously, they don't take calculus, so you think you're not going to do that either...Celebs are advertising all sorts of causes like animal rights. All it takes is a trendsetter to get it going. Students don't look up to their math teachers or parents, and think 'I want to be like that.' But they feel that way about celebrities. Celebrities have such a big impact. Like, as soon as you put a celebrity on a cause, people listen.

Sarah not only reinforces the idea that celebrities have a tremendously powerful effect on the identity development of adolescents, but that this effect also applies to promoting causes and perspectives as well as products. Her use of current examples of celebrities successfully promoting charitable causes parallels my idea that the same type of endorsement might be used in order to promote mathematics. Ultimately, this might bridge the gap between femininity, coolness, and mathematics, influencing and inspiring adolescent girls to actively seek mathematical enthusiasm and excellence. This emerging framework is the crux of my project and will be explored in detail in Chapter 4 of this thesis.

The effectiveness of role models.

In addition to the notion that role models specifically influence the way adolescents think and consume, many girls cited the media, including TV shows, music, messages, personalities, and adverts, as a considerable determinant of how their consumption choices are made. In the following excerpt, Alana teases out the manner by which the media infiltrates the lives of teens:

V: Do you ever see your friends trying to imitate it (in reference to *The Hills*, a reality TV show about the lives of rich girls in Beverly Hills)?

A: Hairstyles for sure, it's *huge*. And it's funny because sometimes it just doesn't work, or like, the braid; my sister does it every day, I can't pull it off, um...styles of clothes I think rubs off, just in the media in general, like if you see someone with these kinds of sunglasses, slowly everyone has them, it's like this chain, a domino effect...imitate exactly, no, but definitely taking ideas from shows and the media.

Jessica concurs, admitting that:

The media's also a big part of [helping me decide what to buy], for me at least,...like, if I see something that, like, Lauren Conrad [of *The hills*] is wearing, like, I will want to wear

that, like, it's just 'cause I like the way it looks on her, I want to dress like her, I guess, so, like, I'll go out and buy something that's similar to her.

Several participants' photo journals also demonstrated how influential the media are in inspiring the identity construction process. Both Alana (Image 6) and Erin (Image 7) included messages derived from television shows as central determinants in their consumption decisions.

Image 6: Excerpt from Erin's Photo Journal

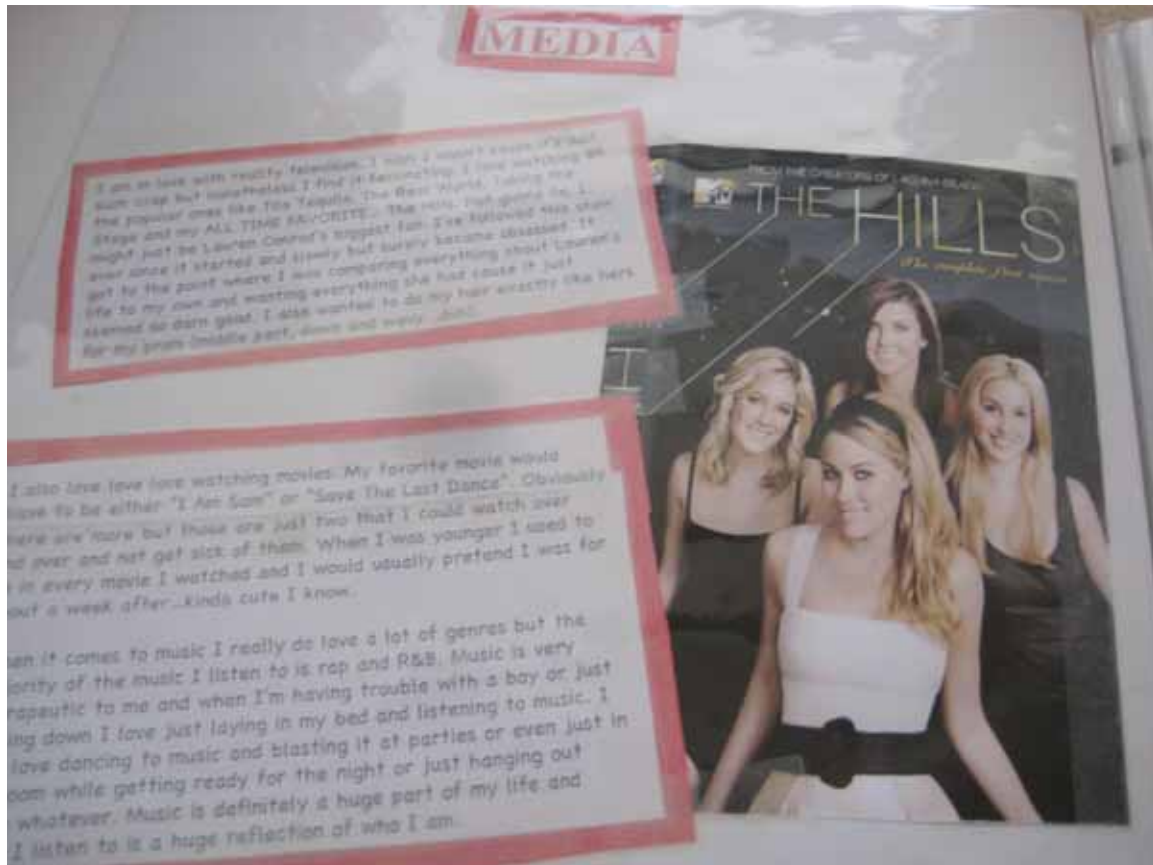


Image 6: A section entitled 'media' explains the influence that Erin's favorite TV shows have on her life. Here, the show depicted is *The hills*, a trendy reality show about the lives of rich party girls who live in Hollywood.

Image 7: Excerpt from Alana's Photo Journal

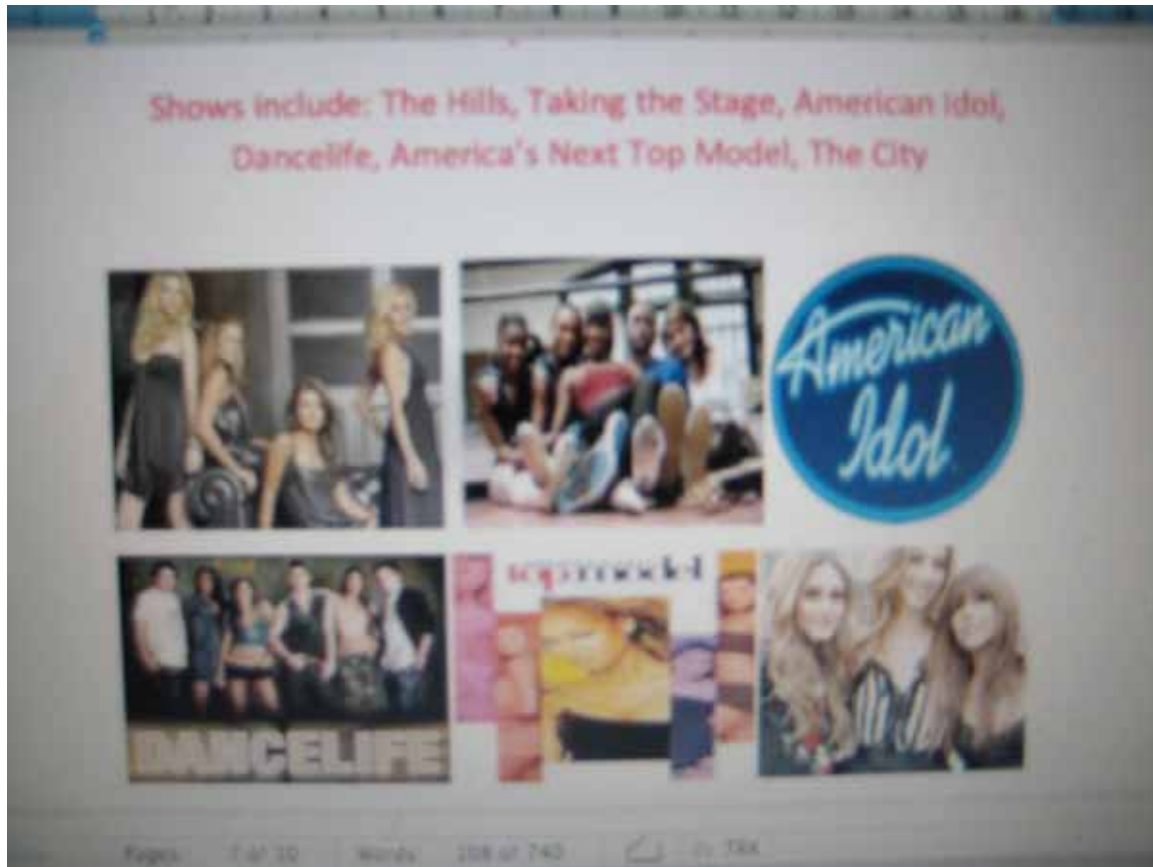


Image 7: A section devoted to the shows that influence her life. Here, the shows depicted are all reality shows. *The hills* and *The city* are both shows depicting rich girls' lives in Hollywood. *America's Next Top Model* is a reality show that follows the lives of girls in competition to be the next top model. *American idol*, *Taking the stage*, and *Dancelife* all revolve around talent competitions.

One of the prevalent concerns that emerged from the interviews was that while most of the girls emphasized the importance of role models and the media in influencing their consumption decisions, not one could think of a positive depiction of math in the media, nor recount a positive mathematically inspiring role model. As well as explicitly suggesting the use of celebrity role models for the promotion of mathematics, the participants also blamed the media for many of their negative attitudes with regard to mathematics, specifically with regards to the perception that those who enjoy mathematics cannot be cool. When asked why she did not consider intelligence congruent with the art of being cool for girls, Alana explains that "I think it's just cause I watched all those movies where the jock's dumb and the pretty girl is dumb, like the media does that, they just stereotype those people in the high school

stereotype...and, ya, those girls actually did act stupid with boys.” Here Alana refers to the notion that girls who enjoy or excel at mathematics are consistently portrayed as being nerds within the scope of the media. Therefore, even if girls do not specifically associate math with the masculine, or view math as gendered, they would most likely still be inclined to avoid mathematics since people who do math are generally portrayed as being uncool.

Locus of causality and susceptibility to stereotype endorsement.

While I am not purporting that all teenage girls who choose not to pursue mathematics make their decisions based upon stereotypes, or even the mass media, there is much evidence that points to the idea that some girls are more susceptible to such influences than others. Drawing on social identity theory (Tajfel, 1982; Tajfel & Turner, 1979, 1986; Turner, 1982 as cited in Crocker and Luhtanen, 1992), Seta et al. (2006) postulate that where an individual’s locus of causality¹⁴ lies largely determines the degree to which they ascribe individual behaviour to that of the group versus the individual. If a student’s locus of causality leans more towards the social, they are likely to place more of an emphasis on the *group* as responsible for the *individual’s* behaviour. For example, such girls might determine that since the stereotype of someone who does/enjoys math is negative, masculine, and un-cool (the group to which math learners/does belong), by relation *anyone* who chooses to do math automatically takes on these characteristics. By fear of association, such girls may choose not to pursue mathematics.

The work of Nosek et al. (2002) continues in the same vein, asserting that girls likely to be strongly influenced by stereotypes about a group to which they belong are those who associate strongly with the stereotyped group. Within the scope of this thesis, one might think of these students as those girls who identify strongly with their prescribed gender roles. It is important to them to retain membership of this group (the group of ‘female’ to which normative feminine qualities are associated), and thus they are more susceptible to stereotypes that de-feminize mathematics than their counterparts who do not place such an importance on belonging to this group.

Given the ideas brought forth by social identity theory coupled with Nosek et al.’s (2002) ideas regarding gender identity, one can assume that girls who are subjected to both of

¹⁴ Seta et al. describe the ‘locus of causality’ as a determinant of whether people attribute someone else’s behaviour to individual choice or to group attitudes and values. They suggest that “the salience of the locus of causality, either person or group, determines how individuals explain behavior” (Seta et al., 2006, p.355).

these factors, a locus of causality located in the social combined with a strong gender identity, are most susceptible to media messages that rely on group stereotyping and notions of cool.

While identifying this particular subset of at-risk girls is useful, distinguishing/targeting such girls is complicated as even those girls that do make their decisions based on such factors may explicitly state that they do not necessarily believe in the stereotypes they are endorsing. Nosek et al. (2002) suggest that while some students may justify their decisions on the basis of individual choice, for many, such decisions “reflect group membership, the strength of identity with the group, and beliefs about the capability of the group” (p. 44). For example, in Nosek et al.’s (2002) study of women in university mathematics programs, the majority of students rejected the stereotype that the notions of ‘female’ and ‘mathematics’ were incompatible. However, despite their capacity for higher math learning and their enjoyment of the subject, many of them opted not to pursue mathematics at the graduate level. Nosek et al. (2002) posit that for many of these women, it was their ‘implicit’ identity that was responsible for making these decisions. They explain that one’s implicit identity has to do with the desire (conscious or subconscious) to belong to an ‘in-group.’ Such a group is the unit with which one identifies, yearns to be a part of/retain membership in, and upon which the individual places great importance. As previously mentioned, within the scope of this thesis, one might think of the notion of ‘in-group’ as representing the group of females within which a particular group of girls associate/want to be associated. Nosek et al. (2002) explain that:

While consciously expressed preferences for math may be viewed by the individual (and others) to be a function of his or her own choosing (e.g., “I just don’t like math”) ... in fact, those preferences may be traced to implicit social group identity and implicit knowledge of the attributes associated with the group. (p. 50)

They continue to explain that “the stronger the association is between self and group (gender identity), the greater the extent to which individual preferences (attitudes) mirror the expectations of the group (stereotypes), even when those preferences appear to be freely chosen” (Nosek et al., 2002, p. 54).

Female students who identify strongly with femininity are more likely to be affected by the stereotype that mathematical appreciation equates with less acceptance as a female than their counterparts who do not see femininity as a priority, thus being more inclined to reject math. In fact, Nosek et al.’s study (2002) illustrates that for women, stronger female gender identity was associated with negative attitudes towards mathematics. Their study concludes by

asserting that for a woman to develop positive attitudes toward math:

She must disrupt the balance in the pattern of relationships between math, gender, and self. In particular, a quality that is attached to another 'not-me' group needs to become associated to self. This cannot happen unless the mental connections between math and male (stereotype) and/or self and female (identity) are diminished. As seen in the data from these studies, that stereotype is strong and can persist outside conscious awareness or control. (Nosek et al., 2002, p. 57)

Using marketing techniques to promote mathematics.

How can the negative mental connections between 'math' and 'female' be disrupted?

As illustrated, there is a specific subset of mathematically capable girls who are particularly likely not to choose to pursue mathematics. Such girls are influenced by popular images of groups and are threatened by the idea of not being accepted into their in-group. As a result, they are more likely to be influenced by marketing strategies that target consumers based on identity/coolness. As previously mentioned, these marketing techniques are used to sell products/brands by selling *identities* and, implicitly then, a sense of belonging. These are the strategies that consumers who prioritize their in-groups are amenable to. Moreover, femininities aside, girls are fed negative images of math, and especially of *females* doing/enjoying math. Therefore, even if girls do not specifically associate math with masculinity, or associate themselves with traditional femininity, they may still be inclined to avoid mathematics as girls who do math are always portrayed as being uncool. As mentioned in Chapter section 3.1, the idea that math is uncool is consistently reinforced by the media, leading girls to formulate negative impressions of what being a mathematical enthusiast means.

The very notion that it is not possible to simultaneously do math and be feminine, and to go one step further, that it is not possible to enjoy math while being *cool and popular*, weaves itself within the hidden curriculum by the way in which women who do mathematics are shunned (Damarin, 2000) and the way in which students identify/do not identify with mathematics, and select their educational trajectories accordingly. Of most interest to my project is the incorporation of math into the mass media.

As Picker and Berry's (2000) study demonstrates, representations of mathematicians in the media greatly affect the image of mathematicians held by teens. Moreover, popular culture is also responsible for the spread of notions of femininity and what it means to be a popular

female versus what it means to be a female who enjoys math. Using these two associations, I wonder if we can use the elements of mass media that fuel pop culture in order to re-position mathematics and femininity so that they intersect, rather than repel one another.

If marketers can use techniques such as coolhunting and branding based upon image in order to position and sell their consumables, can similar techniques be used within education? Course selection in schools might be reframed so that it is regarded as another act of consumption. There are distinct gendered patterns in many post-secondary programs and career trajectories that parallel the way specific jobs and fields of education are portrayed by the media. This correlation demonstrates that adolescents base their decisions to pursue educational pathways, such as mathematics, in part on the way in which such pathways are portrayed through popular culture and analogously then, through marketing. If the subset of girls who are the focus of this study can be persuaded to consume Sprite because its drinkers are positioned as cool¹⁵, can the same set of girls then be encouraged to consume mathematics if its consumers are portrayed, through similar vehicles, as cool?

Social marketing: Function versus fashion.

The promotion of math is not new. In fact, social marketing has been used throughout educational spheres by campaigns such as the 'Math Matters'¹⁶ campaign produced by an organization in the UK (Institute of Mathematics and its Applications, 2006). The problem is that such social marketing campaigns attempt to promote the end product itself (education) on the basis of utility, a method that is archaic (Dretzin , 2001) and ineffective (Bird & Tapp, 2008). Touting the crafty and thoroughly geeky slogan "It all *adds* up to a great career (emphasis added)," the 'Math Matters' campaign is not only the antithesis of cool, but appeals to only those students who actually consume courses on the basis of their future utility, a functional element. Such communication tactics reek of establishment, are transparent in their attempts to persuade consumers to buy and, most importantly, are anything *but* cool.

During part of the interview process, girls were shown the aforementioned 'Math

¹⁵ Media Giant's *Century of Self* explores the means by which Sprite moved from an attribute-based marketing campaign to an identity-based campaign, dramatically increasing its sales simply by portraying its users as cool due to product consumption (2001).

¹⁶ See Appendix C For "Math Matters" Advertisement

Matters' advertisement. The participants were asked for their emotive response and, then subsequently, asked what they felt the intention of the advertisement was, whether or not the ad appealed to them, and how they thought that the ad could be improved. The results of this component of the interview are investigated later in this chapter; however, at this point I would like to mention that several of the participants explicitly expressed disdain with this advertisement, categorizing it as "nothing more than TDSB [Toronto District Schoolboard] propaganda" (Stef). In the following excerpt, Emma illustrates how the tendency to become saturated by media messages leads to adolescent weariness and disillusionment with such messages, resulting in educational media that, while possibly well intentioned, remains largely ineffective:

(Show ad)

E: Whatever, this kind of thing is all over our school.

V: So what's an ad like 'this'?

E: Like, it has pics of all the things you can do or all the branches you can go off onto.

V: So what does it make you think?

E: I don't know. I've seen so many of those, they don't affect me anymore.

V: So what's the message of this one?

E: That math matters.

V: And does this in any way make you like math?

E: No. It doesn't affect me at all.

Emma and Sarah both demonstrate the prevalence and strength of media savvy among this particular demographic of teenage girls. Such *savoir-faire* ultimately affects the means available to marketers who wish to successfully disseminate their messages to these girls, versus those methods that will ultimately not work.

In addition to the skepticism with which consumers digest social marketing attempts, one of the main themes that emerged through the interviews was the notion that social marketers focus explicitly on the functional elements of what they are trying to promote and neglect entirely the idea of appealing to the needs and desires of their target market. Stef illustrates as follows:

V: Have you ever seen any educational ads?

S: Not any good ones. They're all outdated and ugly and don't make you want to do anything that has to do with the subject at all. Like, there's a bunch of ones in a few rooms at school and it's all these different careers, like ones you *obviously* need math for, like engineering or a scientist or a mechanic and it's like 'don't give up on math you need this' and it's like, from the 70's and it's really unattractive to the eye, and no one would want to take math because of those ads.

Stef illustrates that what she notices about the advert is not its 'product' specific content but, instead, the fact that it portrays the 'outdated and ugly.' This point is directly related to her statement that "no one would want to take math because of those ads." Later in the interview, Stef suggests that if educational institutions were to depict stylish girls that she and her peers could relate to in their adverts, that perhaps they might be more effective. Jessica responds to the same advertisement in a similar fashion:

V: Can you think of any educational ads?

J: We have them at our school but I ignore them...they're pretty stupid and straightforward and like 'do this, your career is like your life' and I'm like, whatever, it's just a poster, like whatever, it's just something Bayview Glen (her school) has put up on the wall.

(show math ad)

J: Like even though it's filled with colours and stuff it's kind of boring, okay so it applies to those things, I guess I didn't know some of those jobs had that I guess.

V: Does it make you want to take math?

J: It makes me want to take it. I guess so I can get into some of those things, but it doesn't make me love math, like really care about it, like any more than I do...It makes me want to like, just in case, take it!

V: Who do you think this appeals to?

J: The people who made it, like the teachers and older people, like 'oooh this is how we'll get kids involved.' It's like, the kids don't care. They'll see this in the halls and 90% won't look at it, and like, of the ten percent left, 5% will look at it and the other 5% will be like 'great, ok, done, I don't care.'

Again, this quotation illustrates the manner in which educational propaganda is tuned out by adolescents due to the monotony and redundancy of familiar function-oriented techniques.

While these responses refer to a specific example of educational advertising related to mathematics, the participants' responses apply to the techniques used by the majority of social marketing campaigns that attempt to persuade consumers to adopt an *idea*, rather than a tangible product. Examples of such campaigns include but are not limited to those relating to education, smoking, and health.

A look at current social marketing campaigns relating to education shows a narrow range of communications strategies aimed at promoting education on the basis of its relevance for future career attainment, its role in attaining high earning power in the future, and/or the assertion that knowledge equates to joy for all. All of these strategies attempt to get students to go along with the establishment and the dominant ideals of how 'intelligence' and 'success'

are traditionally defined--and negate the role of social pressure/influence at the expense of a future that is safe and secure. Much like smoking campaigns that use fear tactics in order to convince teenagers not to smoke by scaring them into thinking that if they do the future will be all but horrendous, math education marketing campaigns attempt to elicit the same emotional response. Such fear tactics have been proven to be largely ineffective (Bird & Tapp, 2008), as:

At this age [adolescence], social pressures significantly outweigh any long-term health concerns, as young adults have little sense of their own mortality (Pechmann, 2001 as cited in Bird & Tapp, 2008); consequently, long-term messages often have little impact. Furthermore, risk can be perceived as attractive and threatening messages seen merely as challenges rather than realistic outcomes (Brody, 1998 as cited in Bird & Tapp, 2008). (p. 24)

While Bird and Tapp are referring to social marketing campaigns targeted at smokers, a similar argument can be made here in terms of the promotion of mathematics and academics. Just as social marketing campaigns using fear tactics to promote non-smoking fail to influence their target market, educational campaigns that use fear tactics to convince youth to succeed academically fail to affect their target demographic.

From my experience with educational advertising, my research regarding social marketing, and the response to such promotional efforts by the girls interviewed, it seems as though educational marketers do not even see the work they are doing as marketing. As Masterman (2001) points out, "Pop culture exists today as 'a kind of bizarre alternative curriculum' (p. 55 as cited in Kelly & Stack, 2006, p. 16), and educators who refuse to consider it as a resource in their official or established curriculum miss opportunities to connect with young people's lives and enhance critical literacy" (Kelly & Stack, 2006, p. 16). Nonetheless, it is as though educational promoters do not make any effort to tap into the bodies of work relating to advertising and promotion in order to sell their products.

As the girls themselves point out, the adverts are archaic and outdated, and make no use of advancements in marketing research and theory. Instead, educational efforts focus exclusively on the functional benefits of what they are promoting. In this case, for instance, the 'Math Matters' campaign depicts how mathematics might be useful in obtaining specific jobs. The advocates have focused exclusively on expressing the functional elements, neglecting to consider that perhaps factors other than function might affect the decisions of adolescents. In the following quotation, Rachel explains that even though it seems that one *should* make many

decisions based on rationality, this is often not the case, especially when it comes to those decisions relating to product consumption:

V: Do you ever buy anything for function instead of fashion?

R: Ya, for sure.

V: Like clothes? I mean when you're shopping, there are certain functional elements, for example, a shoe has to fit...if you had ten points to divide between function and fashion, how would your purchase factors divide out?

R: I think even. Which is funny, cause you think that when you buy clothes, it should be more functional, but well...

V: And can you think of any other products besides clothes that get purchased according to the same factors?

R: Yes, for sure.

Given the girls' self-proclaimed prioritization of image over function when it comes to the majority of their product selection, it seems unproductive for social marketers to continue to promote the functional qualities of what they're selling at the expense of image identity associations.

As Bird and Tapp (2008) assert, "social marketers have a problem. The messages, means, and managers of social marketing are often the antithesis of cool, and it may seem an insurmountable barrier to change these perceptions" (p. 24). *The Merchants of Cool* documents the switch that companies that once marketed on the basis of utility have made to identity marketing (Dretzin, 2001). Sprite, for instance, conducted focus groups and found that adolescents were beginning to get angry with marketers for the onslaught of campaigns that they saw as exploiting their generation. As such, Sprite changed its tactics. Instead of blatant in-your-face marketing, they began using subtler marketing techniques such as concert sponsorship and celebrity endorsement. Sprite is constantly changing its image through advertising. At first, Sprite advertised like any other company. Sprite then briefly adopted a novel 'anti-marketing' campaign in order to gain credibility as being on the side of its consumers rather than on the side of 'the establishment.' Sprite is now immersed in hip-hop culture, paying cool looking people, as well as popular rappers and artists, to attend its concerts, which are then shown on MTV. This strategy demonstrates Sprite's efforts at subtly positioning their product as a part of their consumer's lifestyle/identity, rather than as a mere beverage used to quench thirst. As their tactics changed from utility-based marketing to identity-based marketing, they saw a dramatic increase in sales as consumers shifted from feeling as though a product was being pushed upon them, to feeling as though the

consumption of Sprite was simply an extension of themselves, their identity, and the person they aspired to be (Dretzin , 2001).

Marketing meets math.

As I have illustrated in this chapter, girls' relationships with the media are incredibly nuanced and involved. The media exerts tremendous influence, dictating what qualifies as feminine, what qualifies as cool, and how these notions are disseminated for consumption. Moreover, I have illustrated that not only do girls obtain information from the media, but that it is a trusted source that most girls look to for guidance. In the following chapter, I tie together all four of the themes that emerged from my research and suggest an alternative approach to getting mathematically capable girls interested and involved in math beyond the compulsory years.

Chapter 4: Math Is the New Black

4.1 Less (Pedantic) Talk, More Action!

Given the pervasiveness and influence of media in our daily lives, the informal public pedagogies of popular media may in fact be more influential than the formal public pedagogies of schooling in terms of where and how we form citizens (Kelly & Stack, 2006). Bordo (2003) argues that most of us do not want to admit how much the media influences the way we come to know ourselves and others. While we have the ability to think critically about what we see and hear, and while institutions other than the media do exert some influence on how we come to know the world, “the media are a pivotal vehicle through which the social is continually reconstructed, maintained, and sometimes challenged. Simultaneously, we can be both vulnerable and savvy to the empire of images” (Bordo, 2003, p. B7). As educators and marketers, this information is pivotal in terms of the promotion and consumption of mathematics.

If marketing based on function has been proven ineffective; if marketing companies and PR firms have tapped into a whole new way of marketing their products via identity reinforcement/enhancement; and if educational and governmental organizations are clearly willing to use funding in order to promote mathematics as has been demonstrated by current social marketing efforts, then why are we using outdated methods that no organization marketing to teens would consider using?

The idea of using mass media outlets such as celebrity endorsement, product placement, and sponsorship for the promotion and positioning of mathematics as cool, is at the crux of my research. As Lim and Ernest (1999 as cited in Picker & Berry, 2000) point out, “it is only through ascertaining how popular or unpopular mathematics is, that measures can be created to change and improve its public image” (p. 66). By exploring the possibilities for re-positioning math in such a manner that it parallels products that girls choose to consume on the basis of identity reinforcement, I believe that girls who have the capacity to succeed at math, yet choose not to pursue it, may begin to see math as an activity that not only refrains from paralyzing their femininity/popularity, but instead enhances it.

4.2 Fusing Disparate Bodies: A New Conceptual Framework Emerges

As I have demonstrated, marketers have progressed in the manner by which they promote their products, moving from function-based promotion to the utilization of techniques such as coolhunting and identity branding in order to position and sell their consumables. Moreover, I have suggested and illustrated that course selection is in and of itself just another act of consumption, and that girls use identity associations in order to determine whether or not they want to be seen as a math person or not. If the subset of girls to which I am referring to can be persuaded to consume Sprite because its drinkers are positioned as cool, then I propose that the same set of girls can be encouraged to consume mathematics by positioning and portraying *it* as cool.

The final portion of the interview process explored participant-generated mathematical campaigns. I asked the girls to design and describe a mathematical advertisement that might convince them and their friends to take an interest in math. Seven out of the nine girls interviewed described advertisements that focused on themes of male attention and/or celebrity endorsement. The two remaining girls described ads that promoted aspects of mathematics that could be used in everyday life, such as for shopping or calculating calories. The aforementioned ratio suggests that this demographic is tempted more by identity-oriented product properties than by functional properties.

The first parallel between the majority of the girls' ad ideas was that most of their themes centred around attaining popularity or male attention. An excerpt from Taylor's interview illustrates this point:

V: Describe your ad.

T: (Laughs) I'm just thinking if, like, really hot guys were doing math...that would appeal to me. That would appeal to, like, a teenage girl, seeing really hot smart guys doing math.

V: What would the guys be doing, what would you walk away thinking?

T: Math problems.

V: So would you think if you did math they would think you were hot?

T: No! It's cool! Like, I'm going to meet a hot guy if I do math (laughs).

The second theme that arose was relevance. Some girls suggested that math should be advertised in a manner that makes it relevant to the girls' lives, as opposed to current math advertising that the participants critiqued as outdated. These advertisements depict protagonists as not only undesirable role models, but as impossible to relate to. Jessica insists that "there should be people like me. I would want a person that looks almost like me, stuff like

that, or a lookalike to, like, my friend or something.” She also claims that if such ads were set to a soundtrack of “our generation’s music, we *would* be more interested!” She then proposes that not only should the personalities in the advertisement reflect hers, or reflect someone she wants to associate with, but that the message should pertain to her generation and relate to something cool that her peers would do:

If they wanted to even direct it to people of like the drinking age, it would be cool if they could apply it to the party scene like ‘how much are you going to drink tonight?’ I would find that totally a joke and it would be just a funny advertisement, and people would talk about it cause it would be funny and hilarious that people were trying to apply math to our environment and it's so funny and out of the blue and you wouldn't expect a math company to think of that.

Alana also illustrates how important it is to use celebrities who are opinion leaders whom girls can relate to:

V: Can you think of anyone in the media or otherwise that likes math who you think is cool?

T: Well obviously you...no I'm not just saying that...you changed math for a lot of people, like my friends who study with you, like, they enjoy math cause you made so many great notes--changing the equation to something we're currently interested in, like *The Hills*, makes math like a hundred times better, it's more motivating, it's more interesting cause you can relate to it! I think for math um....

V: What would the message be for you?

T: Like, a young tutor attracts people. I like someone closer in age that I can relate to. I know people who have math tutors that are a lot older and they have a hard time cause of the age difference...when people are more current in things, like what's going on in life and the media, like you are, it makes you connect to students better at their level...and it makes it a lot better. So the ad, relating it to the interests of your target market with pictures, words, whatever.

Finally, the idea that the promotion of math should be relevant to teenage girls, paralleling the qualities associated with their desired identities, and moreover that it should be promoted by role models whom these girls desire to emulate, was brought up by several participants, including Sarah:

You know what, they've never done that with math, and I think that would be really cool cause as soon as you hear--I heard a story the other day about someone who had a professor in university who was like, ‘I failed calculus the first two times I took it, and then I took it again and passed, and took it again and got a ninety and then I figured out that's what I wanted to do with my life,’ and that's a really cool story. So if you could get a celebrity, like a really cool celebrity, saying something like that, I think people would be more into math.

Sarah treats math as any other consumable and illustrates that identity branding techniques could easily be applied to the promotion of math. She goes on to describe the type of role model that would benefit mathematics promotion, explaining that it could be:

Anyone who's popular right now...it can't be someone like...okay take Lindsay Lohan...she has a bad rep right now. So you wouldn't want her representing math, but a lot of people do still look up to her, so it would have to be that kind of person, someone that teenagers--and depending on what age you're trying to appeal to, like, the Jonas Brothers [a boy band which is currently popular with adolescent girls] for younger people, if they all of a sudden were like 'we love math,' then younger kids would start doing math--or like, even if you made like, a Jonas Brothers calculator. People would like, buy that and use it, like it would be cool.

Note that two of the girls I tutor have Jonas Brothers' pencil cases that they display proudly on their desks for everyone to see.

4.3 Follow the (Opinion) Leader

This thesis is primarily conceptual in focus and has centred exclusively on the bridging of divergent perspectives supported and augmented by empirical evidence and data collection in order to justify the use of modern marketing techniques for the promotion of mathematics. As an addendum, I would like to present a tangible example of how the concepts emergent from this study might be put into practice. To this end, I have developed a sample marketing plan based on the findings of this study and the conceptual framework upon which it is grounded. Before presenting the plan, I address how it is that products go from being virtually unknown or unpopular to becoming not only coveted, but trendy. I can foresee much skepticism regarding my ideas surrounding the marketing of mathematics as well as the anticipated adoption of mathematics, as a consumer product, and feel it is necessary to demonstrate that this exact trajectory of a product from unpopular to suddenly cool is not unheard of, and in fact happens quite frequently in the realm of consumer culture.

From ordinary to extraordinary.

There has been much research regarding the adoption of consumer goods (Bird & Tapp, 2008), and of specific interest to my project, the means by which certain consumables are adopted in a manner that eventually results in their status as cool or trendy (Bird & Tapp, 2008; Gladwell, 2002). Most of the research centers around the notion of product adoption by trendsetters, or what are termed in the literature as Opinion Leaders or Early Adopters (Gladwell, 2002). Gladwell (2002) explores the means by which 'little things' become 'big

things.’ The fulcrum is the point at which seemingly out of nowhere the ordinary becomes the extraordinary. As Gladwell (2002) states, “ideas and products and messages and behaviors spread like viruses do” (p. 12). He suggests that the phenomenon by which the mundane becomes popular is due to the role of specific groups of people. Gladwell (2002) uses a diffusion model to describe how a contagious idea, product, or innovation moves through a population. According to Gladwell (2002), it is the Early Adopters and the Innovators who are the most pivotal in terms of adopting novel products, making them cool, and circulating them into the realm of the mainstream. Innovators and Early Adopters are those members of a society who adapt ideas so that they are acceptable by the majority who are, as a rule, more risk-averse and intuitively conservative. They kick-start the product adoption process, eventually enabling the product to make its way into the mainstream where it ultimately reaches the Early Majority (Gladwell, 2002), who are generally comprised of a skeptical mass who never try anything until the most respected of this group try it first. Moreover, the Innovators and Early Adopters are comprised of Connectors, a kind of societal glue, who consciously disseminate ideas. “Connectors are the people who link us up with the world...people with a special gift for bringing the world together” (Gladwell, 2002, 38). They are “a handful of people with a truly extraordinary knack [...] for making friends and acquaintances” (Gladwell, 2002, p. 41).

Gladwell’s ideas regarding the trajectory of a product or idea from being virtually unknown to ‘suddenly’ appearing in the mainstream as cool and desirable, parallels the means by which I suggest mathematics might be positioned, disseminated, and consumed. The Early Adopters or Innovators may consist of those adolescent girls who are considered cool/popular, making them Opinion Leaders. Once these girls are targeted by niche-specific mathematical marketing, they theoretically would adopt a math-friendly perspective. Once this cool group ascertains that it is not only acceptable, but also *cool* to enjoy mathematics, the Early Majority, which comprises a large portion of the adolescent female population, would subsequently covet what would now be familiar as cool, and seek to obtain what the cool kids have: mathematical aptitude and zeal. In fact, Erin illustrates this point in relation to fashion when describing the means by which she and her peers choose clothing to purchase. She explains that “there are some girls that can just pull off the whackest fashion...I think it's kind of their personalities and also the fact that they're genuinely nice and pretty and known...and have

other fashion things that people like so they've already built being fashionable.” Erin is essentially describing an Early Adopter or Innovator, whose opinions hold weight due to their pre-established status as cool. Essentially, whatever this type of girl promotes is seen by others as cool in light of her pre-existing status. It is her adoption of certain items of clothing, for example, that transforms those garments from adverse to socially acceptable, from mundane to popular.

While the subtle ways in which I propose mathematics be marketed and sold (for a detailed description, please see Chapter 5) may take time to be detected under the radar of even Early Adopters and Innovators, Gladwell (2002) asserts that they embody the very type of cumulative, low-key approach that can, over time, build to a tipping point of massive popularity and influence. Gladwell’s work delves deeper into the means by which specific subsets of the population work in synergy with their environment in order to move products and ideas from the fringes to the mainstream. The subset of the population I have chosen to explore, and make the focus of this piece, is pivotal as they are Opinion Leaders. In line with Gladwell’s ideas, they are those individuals who hold the most authority and power within their peer group, in terms of making a product cool.

Chapter 5: Geek-Chic, the Way of the Future

In the chapter that follows, I provide a practical application of my research and analysis. The marketing plan that ensues is intended to provide a brief overview of the means by which several modern marketing techniques might be used in order to “sell” mathematics to my target market consisting of the demographic of girls that I have chosen to study. As previously illustrated, marketing techniques that explicitly advertise products and services have in large part been cast aside in favour of marketing strategies that implicitly attempt to sell products via identity branding, as opposed to archaic techniques that focus on functional product properties. In order to provide a practical application of such implicit identity-oriented branding to my work, I explore the following three implicit marketing techniques: 1) product placement, 2) celebrity endorsement, and 3) promotion through fashion. I begin by giving a brief description of each of the aforementioned marketing techniques. I then provide tangible examples of what it might be like to apply each technique to my project.

Product placement.

Product placement is a form of advertisement where branded goods or services are placed in a context usually devoid of ads, such as movies and television shows. Characters are seen using commercial products, although the product placement is often not disclosed at the time that the good or service is featured. In April 2006, Broadcasting and Cable reported that two thirds of advertisers employ 'branded entertainment' (product placement) with the vast majority (80%) in commercial TV programming. Reasons for using this marketing technique varied from “'stronger emotional connection' to better dovetailing with relevant content, to targeting a specific group” (Eggerton, 2006). Using product placement not only allows marketers to conveniently access their target consumers by tapping into their favourite TV shows and movies, but enables advertisers to avoid the pitfalls of commercial fast forwarding as the product is embedded right into the primary medium, rather than being shafted in between show segments which most viewers are liable to skip, especially with novel television watching technology such as Tivo (www.Tivo.com).

Product placement, as a marketing strategy, is of great relevance because the girls I describe in this study are of the media-savvy generation. While television watching, teenagers are aggressively marketed to by not only commercials airing *during* their favourite television shows, but via products embedded *within* these shows. Moreover, as previously mentioned,

many of the girls interviewed look up to characters in shows such as *The hills* and *Gossip girl*, desiring to emulate not only their fashion sense, but also their lifestyles. Therefore, I propose that if these characters were depicted either as girls who enjoy and excel at mathematics, and/or sporting trendy products that *relate* to mathematics, these same viewers may inadvertently covet these very aspects of their favourite characters' lifestyles, in addition to the other qualities that they may already desire. In the marketing plan that follows, I illustrate product placement in terms of marketing mathematics by placing items like calculator watches and bejeweled calculators in the context of the major television hit series, *Gossip girl*.

Celebrity endorsement.

Celebrity endorsement is a marketing technique in which celebrities are paid to overtly sanction a product, service, or idea. Endorsement can range from blatantly explicit or craftily subtle. A television commercial overtly depicting Kate Moss as a spokesperson for Rimmel (2007) makeup is an example of explicit endorsement. On the other hand, Paris Hilton being 'candidly' photographed consuming Yogen Früz frozen yogurt (Taylor, 2007) is an example of subtle, yet effective, endorsement. In this case, while it appears that Paris Hilton is choosing to consume Yogen Früz of her own volition, she was most likely paid a hefty sum of money to be photographed doing so. Frequently, it appears that celebrities choose to publicly consume products of their own volition although they are often paid by corporations to do so. By engaging celebrities to endorse products, corporations 'trick' consumers into believing their role models prefer certain brands over others thus influencing many consumers who desire to emulate their celebrity icons. Advertisers have attempted to quantify and qualify the use of celebrities in their marketing campaigns by evaluating their awareness, appeal, and relevance to a brand's image, as well as the celebrity's influence on consumer buying behavior. In this way, advertisers are able to match the identity purported by their product with a particular celebrity who embodies a congruent identity image.

As I have illustrated, the girls described in this study are part of a media-saturated generation and, consequently, often cite celebrities as role models for the way they dress, think, and act. Using celebrity endorsement to promote mathematics consumption may prove very effective if the right stars were chosen for the cause. The demographic studied may need to identify and look up to these celebrities in order to be receptive to unfamiliar messages, such as those promoting mathematical enthusiasm, that is a cause which to date has rarely been

advocated by Hollywood stars. In the marketing plan that follows, I choose celebrities that several of the participants cited as their role models. By placing mathematically oriented products in their possession and/or on their person, I demonstrate what it might look like to have Hollywood stars endorse math.

Fashion.

It is no secret that following trends and sporting the latest fashions is central to being deemed cool. For this reason, I suggest the use of fashion to promote mathematical messages. Slogan-touting clothing is not new. One needs only to look around to see the extent to which ideas, products, services, and political messages are strewn across the chests of many as a declaration of support for a variety of causes. Covering clothing with messages and slogans is a simple way for advertisers to generate walking advertisements out of their consumers. Consumers often buy garments that contain messages they believe in, and then wear these items in public inadvertently promoting the garment's message wherever they go.

In many cases, adolescents first develop enthusiasm and support for a given cause by watching their role models who are celebrities. These celebrities are often seen sporting anything from anti-war shirts to peace sign tattoos, thereby giving weight to the messages contained because of their influence and the publicity they receive. These messages then make their way into the mainstream as clothing companies plaster them onto their garments. These items, bought by the masses, are then worn in school hallways, shopping malls, and on the street, advertising the messages contained to anyone who passes by. In this way, consumers unwittingly become walking billboards.

Moreover, as I explained in Chapter section 3.2, the current trend in fashion is Geek-Chic¹⁷. As aforementioned, the past year has produced a plethora of fashion magazines showing pages of girls wearing form-fitting clothes and dainty heels while sporting thick librarian glasses, proudly declaring their support for all things nerdy. Clothing that already classifies as cool, by adhering to socially prevalent fashion norms, has been bedazzled with nerd related images and slogans. These garments have made it into the mainstream. At the same time, the media has portrayed traditionally feminine girls appropriating these items. These two simultaneous forces enable Geek-Chic to become socially accepted as a position for females to

¹⁷ Please refer to Appendix D for examples of Geek Chic today.

occupy, allowing them to retain their femininity *while* promoting an overt picture of intelligence. I propose that the same be done specifically in terms of *mathematical* images and messages.

In the marketing plan that follows, I contrast current garments containing mathematical messages with an example of hypothetical mathematically oriented clothing. I demonstrate that, at this time, there is no accessible way for teens to show their support for math via their clothing choices as the existing math gear clashes with current trends in fashion. As I previously demonstrated, being fashionable is a key component of being cool that takes priority over intelligence at the onset of high school. I suggest that if fashionable garments with mathematical messages were available and promoted in a trendy and consumer-friendly way, teens might be more likely to support and broadcast such messages via their fashion choices.

Product placement, celebrity endorsement, and promotion via fashion, are three implicit marketing techniques frequently used today. In the marketing plan that follows, I illustrate the practical use of these three strategies by applying them to the promotion of mathematical enthusiasm and excellence.

Geek-Chic: Sample marketing plan in action.

The following is a practical application of what I have illustrated throughout the body of this thesis. In the pages that follow, I apply my conceptual work to create tangible examples of how I propose to market mathematics to the specific demographic of females discussed in this paper. By using marketing techniques, I demonstrate that mathematics no longer need only be associated with nerdiness. If treated like many other consumer goods targeted at teens, geekiness has the potential to become consistent with all things cool.

Images 8 & 9: Product Placement

Images 8 & 9 have been removed due to copyright restrictions. They were illustrations of two scenes from the TV series *Gossip girl*. Image 8 depicted the characters Blair and Chuck embracing, and highlighted a gold calculator watch on Blair's arm. Image 9 showed the character Serena sitting behind a desk upon which a bejeweled pink calculator rested. Original source: Inspired by *Gossip girl*: Levy, B., Moregenstein, L., Savage, S. & Schwartz, J. (Producers). (2007). *Gossip girl* [Television series]. USA: 17th Street Productions.

Product placement is commonly used among marketers to generate product recognition from their target audience. The idea is that this subtle marketing technique leaves viewers coveting products that their favourite television and movie characters are seen using, instead of feeling as though companies are pushing commodities onto them by means of blatant advertising.

In this particular example, I have illustrated what it might be like to use a similar technique in terms of placing mathematically inspired products in popular television shows in order to familiarize viewers with seeing math as being a part of the realm of the cool, rather than distinct from it. Both scenarios above are mockups of scenes from *Gossip girl*, an American teen drama series that airs on The CW Television Network. *Gossip girl* is famous for its cutting edge fashion and inclusion of the latest trends, accessories, and 'all things cool.' In Image 8, one of the protagonists, Blair, is seen sporting a gold calculator watch while making out with her beau, Chuck. In Image 9, another main character, Serena, is at her desk casually chatting with an acquaintance, a pink bejeweled calculator resting atop her books. Both scenes subtly incorporate mathematical interest into the personalities of the protagonists by process of viewer deduction. By glancing at the 'props,' viewers get the impression that their teenage icons enjoy mathematics while still managing to be the coolest girls at their school.

Images 10 & 11: Celebrity Endorsement

Images 10 & 11 have been removed due to copyright restrictions. Image 10 depicted an illustration of Paris Hilton wearing a shirt which read 'that's hot.' Image 11 depicted Paris Hilton wearing a similar shirt touting the slogan 'math is hot.' Original source: There is no original source for these images as they were hypothetical illustrations of a celebrity personality.

Celebrity endorsement is a strategy used by marketers to associate their products with particular celebrities. Celebrity endorsement usually entails gifting items to stars in hopes that they will wear/use them, or outright paying celebrities to overtly tout specific products. The idea is that consumers will believe that these celebrities choose to wear/use such products of their own volition leading consumers to emulate their icons by consuming similar products.

In this particular example, I have illustrated what it might be like to use a similar technique in terms of encouraging celebrities to endorse mathematically inspired products in order to get their fans to associate math with their favorite stars who are often their role models. Image 10 illustrates Paris Hilton touting her famous slogan 'that's hot' on a t-shirt. Image 11 depicts Paris wearing a similar t-shirt, but this time she is shown associating math with femininity and being 'hot.' As many of the interviewees stated, sometimes all it takes is a celebrity promoting a particular cause for their fans to get interested and excited about it.

Images 12 & 13: Celebrity Endorsement Continued

Images 12 & 13 have been removed due to copyright restrictions. Image 12 depicted an illustration of Mary-Kate Olsen wearing a pin with a peace sign on it. Image 13 depicted Mary-Kate Olsen wearing a similar pin touting the slogan 'peace, love, pi.' Original source: There is no original source for these images as they were hypothetical illustrations of a celebrity personality.

Mary Kate Olsen is a famous fashion icon these days, known for supporting causes she believes in through her choice of trend wear. Image 12 is a shot of Mary Kate featured in a celebrity magazine, touting a 'peace' button. Image 13 depicts Mary Kate incorporating a similar button into her outfit, this time touting the slogan 'peace, love, pi.' The idea here is that those girls, who look up to Mary Kate for her expertise with regards to being at the forefront of all that is cool and stylish, will be just as inclined to purchase a mathematically inspired accessory as they would be to buy that same plaid dress.

Images 14 & 15: Fashion



Image 14: Fashion - The above is an illustration of typical math-wear currently offered to the general public.



Image 15: Fashion (2) - The above is an illustration of a math t-shirt that I designed.

In order for girls to covet mathematically inspired products, the products must first exist. A basic internet search makes it clear that fashionable garments with mathematical connotations are almost impossible to find. In fact, most clothing items that tout math messages are within the realm of what is considered stereotypically nerdy, lacking all current stylistic attributes. As a result, these items ostracize girls wanting to be cool from mathematics.

In this particular example, I have illustrated what it might be like to create products that are in line with current trends while, at the same time, tout mathematical messages. Image 14 shows two examples of math shirts typically offered. Note these basic and shapeless t-shirts contain messages that are in no way aesthetically or linguistically cool. On the other hand, Image 15 depicts a girl sporting a fashionable t-shirt that ‘happens’ to have a Rubik’s Cube on it. The subtlety of the mathematical connotation here is key as it relays a mathematical message while retaining its aesthetic appeal. This appeal takes shape in relation to what is deemed aesthetically cool at any given point in time.

Chapter 6: Limitations, Controversies, and Final Epiphanies

6.1 Conceptual Re-Grounding: A Temporary Conclusion

I have now examined the idea that mathematics has the potential to be treated as a consumer good with respect to both promotion, from a marketing standpoint, and consumer adoption on the receiving end. By extending Bauman's notion of consumption, specifically consuming oneself into being, I have emphasized just how significant the process of social construction can be on both the individual and on *mathematics* as a subject in the scholastic sense. Moreover, I have also demonstrated how adolescent girls from particular demographic have the tendency to make their consumption decisions on the basis of acquiring cool, and how mathematics might be approached in the same manner. This is in line with both Walkerdine's and Mendick's perspectives on the subject, consumption, and social construction of both coolness and mathematical ability. By applying and extending Demetriou's (2001) notion of subverting hegemonic masculinity to the repositioning of both femininity and mathematics, I have illustrated that mathematical aptitude and enthusiasm do have the potential to become consistent with societal versions of normative femininity. Ultimately, this integration may enable math to be seen as cool if promoted by way of identity branding and appropriated, in line with Gladwell's (2002) work, by the *right* people. Lastly, I have provided a sample marketing plan to illustrate the final product of my initial vision, ultimately presenting a concrete example of how I see my ideas being applied practically. By combining the conceptual and the empirical, I have outlined a new approach with which to approach the problem of unnecessary female attrition in mathematics by a certain group of girls, in a manner that takes the issue out of the realm of strictly the academic. My concrete marketing plan illustrates a way by which we might approach this problem while evading systemic issues relating to academics and the education system. This plan presents a potential approach that is unique, relevant, and accessible.

By extending the conceptual grounding upon which I have based my research, my ideas regarding changing the perceptions of mathematics among high school girls can be seen as emergent progress towards the goal of breaking down pre-conceived notions of mathematical identity. By using techniques currently intended for the marketing of consumer products to this specific segment of the female population, it is my objective to reposition mathematics so that

it is perceived as a desirable facet of education, thus becoming a palatable consumable by capable girls who lack mathematical enthusiasm.

6.2 Limitations

The marketing of mathematics as a consumer good is not without drawbacks, pitfalls, and/or cautionary tales. While I have provided a unique and innovative approach to the problem of female attrition in mathematics, for some, I am well aware that my approach must be accompanied by words of caution that underscore the delicate nature of both my proposition and the subjects involved. In this chapter, I explore the limitations of my study and suggest avenues for future research.

Limitations of the sample.

As previously mentioned, this study focuses on girls of particular demographic. While many findings emerged from the work I did with these participants, these findings are limited to this particular subset of the population. Consequently, they are not necessarily applicable to other students, including females belonging to divergent demographic. However, as I mentioned at the onset of this thesis, this segment of the population is one which I encounter on a daily basis through my practice as a teacher, and one which has, to date remained relatively unexplored with regards to mathematical ability, enthusiasm, and participation. As such, I feel that working with this subset of the population is not only personally relevant and meaningful, but necessary.

Limitations of a bricolage approach.

Cross-disciplinary work and a bricolage approach are not without limitations. Bricolage involves making creative use of concepts from disparate fields. Conceptual models that stem from one paradigm in their original context are acquired and given a new, often subversive meaning when used in conjunction with another concept. In this way, many of these conjectures are repurposed and recontextualized. In a theoretical sense, Derrida (1966/2005) explains how this notion applies to any discourse, arguing "if one calls bricolage the necessity of borrowing one's concept from the text of a heritage ... it must be said that every discourse is bricoleur". Conversely, from a more practical perspective, Joe L. Kincheloe (2005) uses the term bricolage in educational research to denote the use of multi-perspective research methods. In Kincheloe's (2005) view of the research bricolage, diverse theoretical traditions are adopted and used in a broader critical conceptual context. Using these multiple frameworks

and methodology empowers researchers to produce more rigorous insights into socio-political and educational phenomena. While this approach allows the emergence of novel conceptual perspectives, it also carries with it the nuances of recontextualization. Concepts often conflict due to contrasts in ontology and, when brought together, these concepts are reframed. As a result, unique epistemologies and frameworks emerge. However, it must be emphasized that what emerges as new is not necessarily what the originators of these ideas intended for their work. Further, they may not necessarily agree with such repurposing. While bricolage carries with it the weight of epistemologically rooted incongruence, it does so in order to lay the foundation for a transformative mode of cross-disciplinary inquiry that is a critical form of rigor that avoids the reductionism of many monological and mimetic research orientations (Kincheloe, 2005).

As my work is premised on the notion of bringing multiple and unrelated perspectives together in order to address a familiar issue, the use of bricolage was essential in order to generate a truly unique lens with which to view the issue of female attrition in mathematics amongst this specific segment of the female population. While bricolage can prove quite trying and at times even controversial due to the necessary repurposing that takes place, the novel perspectives that emerge can often be attained by no other means. If treated with caution and delicacy, it is this emergence of such perspectives that allows the benefits of bricolage to flourish.

Limitations of femininity: An easy way out of a hard place.

My work proposes positioning mathematics so that it fits *within* the limits of normative femininity. This strategy partially addresses the issue at hand by encouraging the girls who are currently ostracized by mathematical discourse to *do* math. However, it simultaneously supports the (re)construction of issues relating to what it means to be feminine.

Essentially, my work is premised on a “truth” (Foucault, 1980 as cited in Atencio and Wright, 2008) about girls, specifically that they require tailored pedagogical style and marketing content. My work illustrates, rather than questions, the construction of this truth. In a sense, this strategy (re)constructs a problem that seems much easier to ‘solve’ by simply catering to the generally accepted normative version of femininity instead of addressing the *actual* issues relating to prescribed gender roles and their congruence/incongruence with intelligence and mathematical ability.

Campbell and Wahl (2008) point out that any solution that is “premised on fixed notions about what women as a group are like or what women as a group are capable of, tends to reinforce limiting stereotypes that create barriers to women’s advancement” (p. 33). Loutzenheiser (2005) terms what results as the “educational imaginary” (p. 33). She explains its cyclical nature in that “an educational imaginary ... propagates an embodied educational experience that relies upon identity categories for its (common) sense-making” (p. 33). She goes on to explain that “curricular inclusion” (in this case, the inclusion of ‘girl-friendly’ pedagogy), while important, may also provide a justification for the failure to make changes at the systemic level. As such, while my approach to subverting mathematics may provide a surface level solution, one might argue that it ultimately fails to address the underlying problem, “leav[ing] identity categories uncontested and normalized” (Loutzenheiser, 2005, p. 34).

While I realize the importance of ultimately contesting the truths upon which our society is premised, I want to point out that I am in no way claiming to fulfill any sort of feminist project through my work. I presently want to suggest that whether this ‘truth about girls’ is innate or constructed does not necessarily matter in the context of providing girls with educational opportunities that meet their particular needs and allow them to achieve the highest level of success possible. Further, I am arguing that regardless of how these truths came to be, the mere fact that they exist is reason enough to justify altering the positioning of educational trajectories to meet the needs of these girls. From this standpoint, marketing mathematics based on cohesion with the attainment of a feminine-friendly identity may prove to be a beneficial approach.

My work takes a ‘when in Rome...’ approach and is solely focused on generating an innovative way by which to engage females who are essentially ‘left out’ of the math discourse due to a variety of reasons, including the current positioning of discourses relating to academics and those relating to gender roles. However, I am still interested in finding a way to subvert both mathematics *and* femininity simultaneously in the hope that ultimately the definition of femininity may expand so that it is partially defined by, rather than contested by, constructed notions of intelligence and mathematical ability.

Limitations of consumerism: Marketing is not a four letter word.

The use of marketing theory and pop culture in order to sell to young people in the demographic carries with it risks and potential pitfalls if not approached with caution. My use of marketing in relation to education is strictly limited to finding an innovative and accessible way to make mathematics appealing to a population of females who might otherwise remain disinterested due to its current positioning and image in society.

The first issue concerns the celebrities selected for the endorsement of math. Understandably, my use of Paris Hilton, Mary-Kate Olsen, and the cast of *Gossip girl* raises justifiable concern. While I suggest that these icons are aligned with the identity the girls in my sample covet, I realize that they do not necessarily embody values and ideals that girls 'should' strive for. However, this raises questions relating to what exactly girls *should* strive to be like, and I do not think such questions have any one answer. That being said, I propose that the celebrities ultimately selected for my proposed math campaign *must* be people whom the girls in my study look up to. While they should embody characteristics that these girls currently covet, they must simultaneously be positive role models to a certain extent. While I think it is unrealistic to expect any celebrity to be the prototype for adolescent femininity (if such a prototype even exists!), it *is* important that the role models selected, at the very least, do not tout overt fondness for unhealthy habits and/or ideals, such as drug use or cosmetic surgery. While my goal is to use the weight placed on celebrity opinion in order to augment mathematical interest, this is not to be achieved at the expense of other values.

While the use of celebrities for product endorsement is not new, in this particular instance, one might wonder what the motivation would be for certain stars to engage in math endorsement. Often celebrities are paid to sponsor products and, in many cases, celebrities sponsor causes of their own volition either out of goodwill or often as a strategic public relations move. As the promotion of mathematics is a not-for-profit cause, celebrity endorsement would most likely be unpaid. However, the promotion of learning and education is a cause that I expect many celebrities might be interested in supporting for either of the aforementioned reasons.

Finally, in light of efforts to help students become more critically aware of media and its influence, there is a chance that students might see through the implicit marketing techniques being used to sell them mathematics, and rebel by distancing themselves further. However, as I

have illustrated, current attempts at marketing mathematics *are* in place by educational and governmental institutions. These attempts are outdated, explicit, and my research has shown that they generated nothing but students' disdain amongst these participants. Conversely, participants demonstrated that implicit, identity-based marketing approaches, such as those proposed in the marketing plan, do not tend to generate unfavourable responses among adolescent girls. In fact, as I have illustrated, identity-based marketing approaches have proven to be quite effective in many cases.

6.3 Grassroots: Planting the Seed

While valuable findings and implications have emerged from this study, further exploration is needed to move these findings from the realm of the conceptual to that of the practical. In Chapter 5, I included a sample marketing plan based on my findings. As this plan is a proposal, I have not taken resource constraints into consideration. While it would be interesting to see what might happen if the funding were available to put such a plan into place at a large scale level, a smaller scale plan would also be an option. Given a limited budget, mathematics products could be produced; however, the media tie-in requires funding that is currently unavailable to me. Conversely, executing a similar plan on a micro level has the potential to generate the same results as the proposed macro level marketing plan. I have included the following section to illustrate the means by which I have already begun to execute this plan at the grassroots level, and the resulting mathematical interest I have begun to generate amongst this segment of girls.

Grassroots.

The term 'grassroots' applies to any movement with its origins *within* a community, rather than imposed *upon* a community by an external source such as marketers and politicians). In many cases, such movements are more likely to be welcomed by community members who feel involved as active participants in the movement, invited by trusted sources within their communities (Lara & Molina, 1997). While such movements begin on a micro level, if successful, they have the ability to generate macro level interest, ultimately resulting in societal change.

In my everyday interactions with my students, I try to exude and embody the principles that initially inspired and, eventually, emerged from this study. I have already noticed many of my students and their peers inquiring as to where I purchased my pink calculator, or telling me

that they are fans of my diamond-encrusted gold calculator watch. Students who previously demonstrated no interest in math now routinely brag to me about their latest test scores and invite their friends along to the ‘math parties’¹⁸ I throw. By showing students that they can integrate mathematics within the lifestyles they already have or aspire to have, I demonstrate that mathematical enthusiasm can be entirely congruent with their identities and, in fact, may even help them explore their interests. The following examples illustrate the means by which I have begun practically applying the concepts that emerged from this study at the grassroots level.

Image 16: Brangelina and Speidi

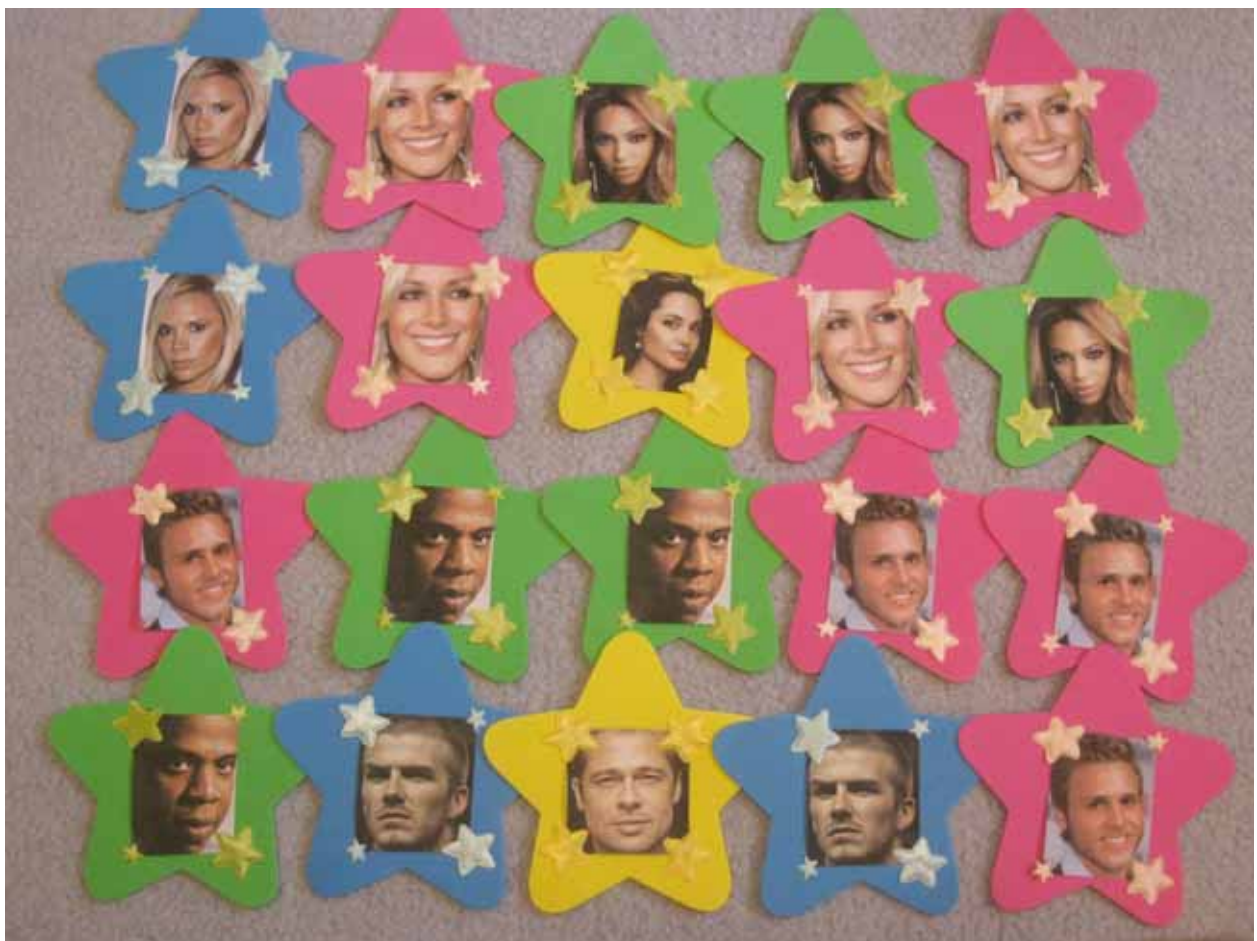


Image 16: This is an image taken of one of my student’s data management projects, a game where the goal is to match celebrity couples, mimicking the well-known game ‘memory.’ Memory is a card game in which all of the cards are laid face down on a surface and two cards are flipped face up over each turn. The object of the game is to turn over pairs of matching cards. Using probability techniques, she calculated the likelihood of winning the game given an

¹⁸ ‘Math parties’ are get-togethers I host where students and their friends study together and share ideas, solutions, and snacks, while I facilitate.

unequal number of cards pertaining to each couple. For example, there were five pairs of cards corresponding to Angelina Jolie and Brad Pitt, but only three pairs corresponding to David and Victoria Beckham. This is an example of how math can be merged with the social, in addition to the current interests of students.

Image 17: You Are What You Watch

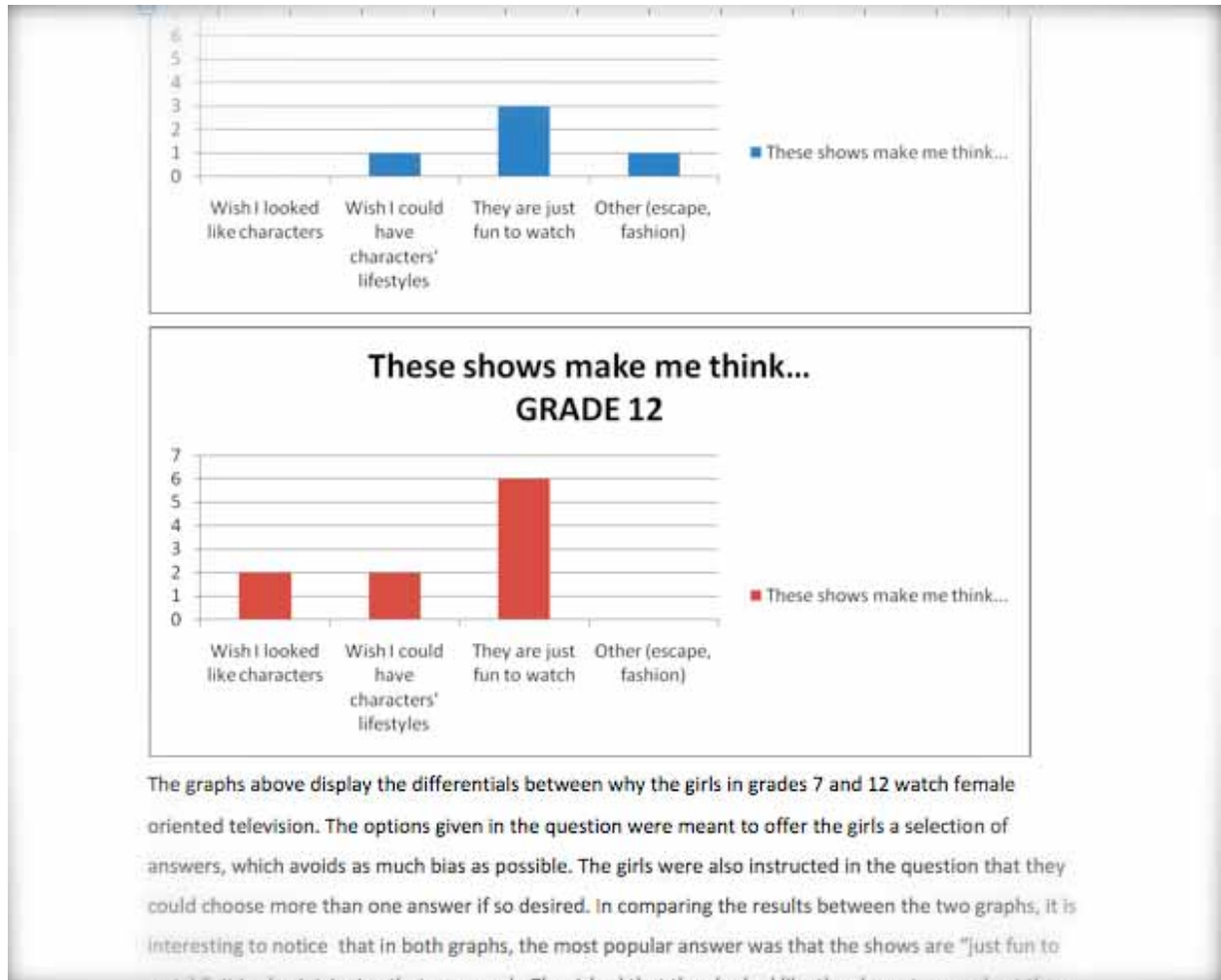


Image 17: An example of one of my student's data management projects, Emma uses statistical techniques in order to determine whether there is a correlation between her peers' consumption of reality television programs and their body image. This is an example of how math can be used to investigate the effect of the media on the lives of girls and, moreover, how math can be integrated with these girls' current interests in popular culture. Within the scope of her project, Emma included only shows that were targeted towards teenage girls and young women.

Image 18: Peace, Love, and Pi



Image 18: In this image, Taylor shows off her mathematically inspired jewelry, demonstrating that girls are happy to tout their mathematical enthusiasm as long as it's fashionable!

Image 19: Mmmm Pi

mmmm... Pi!

GIRL POWER NEEDS TO GROW EXPONENTIALLY

BY VANESSA VAKHARIA

IT'S ALL TOO COMMON TO HEAR OTHERWISE INTELLIGENT ADULTS—FREQUENTLY WOMEN—BRAG ABOUT THEIR INABILITY TO BALANCE A CHEQUEBOOK OR CALCULATE A TIP. WE WOULD NEVER BRAG ABOUT BEING ILLITERATE!

WHY LOVE MATH?
Many people think of math as a subject to be feared, or at least avoided. But it's not as intimidating as it seems. It's just a way to solve problems. It's the only way to figure out the origins of the universe.

It's not just about the numbers. It's about the power of calculation on the bill at the end of a yummy dinner. It's about seeing you are on that fabulous new pair of shoes. It's about the calories you calculate having burned off during a workout. Math is everywhere, but many of us have been trained to believe it's boring and useless. Not true!

"I'M NOT A MATHS PERSON"
There's nothing such as a "maths person". Training yourself to be good at math is just like training yourself to be good at a sport.

GET A TUTOR!
So you barely passed math in Grades 9 and 10 and now you're stuck in Grade 11 with only the vaguest recollection of what BEDMAS is even supposed to stand for. Get yourself a fabulous tutor. You'll be amazed at what a difference an hour or two per week can make.

USE MATH!
Use the math you're learning in ways that are meaningful to you. Use geometry for the perfect pool shot; use percentages to compare sale prices; change recipes using ratios.

1 + 1 = YOUR FUTURE!
Being a math genius means having a better chance of making serious cash! Many of the highest-paying careers—medicine, business, computers, piloting—require math.

"What sucks," says high school math teacher Cassie Radtchuk, "is that men dominate many of the mathematics and science-based careers, perpetuating the stereotype that men are more successful in mathematics than women. It doesn't have to be this way!"

Even if you're not thinking of pursuing a career expressly related to math, it pays to keep crunching those numbers—at least during high school. Ewa Karinska, mathematics department head at the School of Liberal Arts in Toronto, says many university programs—psychology, marketing, social work, even many visual and graphic arts programs—now require you to have at least one Grade 12 math credit before considering your application. *

vg Vanessa Vakharia is a high school math teacher and tutor who's passionate about sharing her love for math. Check out her Math Doctor Room at vervegirl.com!

5 HOT careers REQUIRING MATH POWER

- Urban Planner: Design cities
- Cryptographer: Crack codes
- Audio Engineer: Produce albums
- Environmental Engineer: Protect the environment
- Multimedia Videogame Producer: Create entire worlds

Ontario's Most Competitive Students enrolled in a secondary school in OGIS are eligible to get one of five awards worth \$1000 each plus must participate in a four-month program focused on applying and integrating knowledge of physics, chemistry and mathematics to solve engineering-related problems. **STUDENT AWARDS** Deadline is April 1, 2016.

Image 19: This is an image taken of an article I wrote for a magazine aimed at teenage girls that is distributed free of charge in high schools across Ontario. The article explores career paths consistent with participants' current interests demonstrating that math is found in many careers unconventionally associated with mathematics. Moreover, the article explains that math can be applied to activities that girls care about *right now*—such as the use of

trigonometry to calculate the perfect eyebrow arch before tweezing!

While these grassroots approaches may seem like small strides in the way of changing the way math is perceived by society at large, these examples illustrate that my ideas have the potential to hold weight at the experiential level. If I can't get the big bucks needed in order to pay Paris Hilton to wear a bright pink 'math is hot' t-shirt, then I will just have to change the world we live in myself, one math-phobic girl at a time!

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Appendices

Appendix A: Participant Profiles

Name	Age and Grade	High School Average	Current Math Courses (at time of interview)	High School	Parents' Marital Status	SES ¹⁹	Relationship With Math	Future Goals
Emily	17 Grade 12	90%+	Grade 12 Functions Grade 12 Calculus	School of Liberal Arts (Private Independent ²⁰)	Married	High	Emily has steadily enjoyed math and has consistently excelled mathematically, from childhood to present. She is also the captain of her school's math team.	Attending UWO for an interdisciplinary program that merges math and the arts, in which math is required.
Stef	16 Grade 11	90%+	Grade 12 Functions Grade 12 Calculus	Northern Secondary School (Public)	Married	High	Stef enjoyed math until grade 10 when she started struggling. After working with a tutor, she proceeded and continues to excel mathematically, overtly bragging that she is a self-claimed "math geek."	Attending a post-secondary program focused on photography, in which mathematics may or may not be required.
Taylor	17 Grade 12	85%-90%	Grade 12 Functions Grade 12 Calculus	Northern Secondary School (Public)	Married	High	Taylor is insecure regarding her mathematical abilities even though she constantly achieves high grades. She has always had math anxiety but works hard since she believes that she needs math in order to excel in university and become a successful business woman.	Attending a university program related to business, in which math is required.

Table A1: Participants' Profiles – This table summarizes participants' data.

¹⁹ Based on the following annual dual parent income scale: Low: 0k-39.5k Low/Mid: 40k-79.5k Mid: 80k-129.5k Mid/High: 130k-179.5k High: 180k +

²⁰ Often called alternative schools, these schools provide a value, specialized service for children who need a high degree of individual attention.

Name	Age and Grade	High School Average	Current Math Courses (at time of interview)	High School	Parents' Marital Status	SES ²¹	Relationship With Math	Future Goals
Erin	17 Grade 12	70%-75%	None	Northern Secondary School (Public)	Divorced	Mid	Erin dislikes mathematics. Although she tries relatively hard to succeed, she does not enjoy it.	Attending a fifth year of high school in order to augment her grades, followed by college or university.
Alana	17 Grade 12	70%-75%	Grade 12 Data Management	Northern Secondary School (Public)	Divorced	Mid/High	Alana enjoys mathematics when she understands it, but is not motivated to try hard.	Attending a university program related to psychology, in which math is not required.
Sarah	17 Grade 12	80%-85%	Grade 12 Functions Grade 12 Calculus	North Toronto (Public)	Divorced	High	Sarah has steadily enjoyed math and has excelled mathematically since childhood.	Attending a university program related to psychology, in which math is not required.
Emma	16 Grade 11	80%-85%	Grade 11 Applied	Metropolitan Preparatory Academy (Private Independent)	Married	High	Emma detests math and does not understand it, mostly due to a lack of motivation and effort.	Attending a university program related to social work, in which math is not required.
Jessica	16 Grade 11	80%-85%	Grade 12 Functions	Bayview Glen (Private)	Divorced	High	Jessica enjoyed math until grade 10 when she struggled. After working with a tutor, she began achieving high grades. Although she claims to love math, she hides her newfound love for the subject from peers.	Attending an undetermined university program after completing her final high school year at a private high school in Switzerland.

Table A1 (continued): Participants' Profiles – This table summarizes participants' data.

²¹ Based on the following annual dual parent income scale: Low: 0k-39.5k Low/Mid: 40k-79.5k Mid: 80k-129.5k Mid/High: 130k-179.5k High: 180k +

Name	Age and Grade	High School Average	Current Math Courses (at time of interview)	High School	Parents' Marital Status	SES ²²	Relationship With Math	Future Goals
Rachel	17 Grade 12	75%-80%	Grade 12 Data Management	Northern Secondary School (Public)	Married	Mid/High	Rachel has always understood mathematics without working too hard at it. However, she finds it boring and is unmotivated to carry on past compulsory courses needed to graduate.	Attending a university program related to fine arts, in which math is not required.

Table A1 (continued): Participants' Profiles – This table summarizes participants' data.

²² Based on the following annual dual parent income scale: Low: 0k-39.5k Low/Mid: 40k-79.5k Mid: 80k-129.5k Mid/High: 130k-179.5k High: 180k +

Name	Emily
Age and Grade	17 Grade 12
High School Average	90%+
Current Math Courses	Grade 12 Functions Grade 12 Calculus
High School	School of Liberal Arts (Private Independent)
SES	High
Relationship With Math	Emily has steadily enjoyed math and has consistently excelled mathematically, from childhood to present. She is also the captain of her school's math team.
Future Goals	Attending UWO for an interdisciplinary program that merges math and the arts, in which math is required.
Additional Notes	Emily is a very bright girl who has never struggled with academics. She has always been top of her class. She is not only a mathematical enthusiast but also engages in mathematical activity outside of the classroom in her role as captain of the math team at her school. Emily values her parents' opinion more than her peers' or the media. She believes that academics take priority over boys, friends and the social. While Emily excels academically, she is also very involved in Irish dance. She is a perfectionist that strives to do the best in everything she does. She believes that her inclination to be a balanced individual negates the potential malaise caused by any external judgment that she is a nerd. She is secure enough in her abilities and identity that she does not care what others think. However, she is well aware of the means by which people are stigmatized due to their gender and/or academic ability. Emily is neither extremely popular nor extraordinarily nerdy. She is simply determined and academically oriented, yet not at the expense of fashion and the social.

Table A2: Emily's Profile

Name	Stef
Age and Grade	16 Grade 11
High School Average	90%+
Current Math Courses	Grade 12 Functions Grade 12 Calculus
High School	Northern Secondary School (Public)
SES	Mid-High
Relationship With Math	Stef enjoyed math until grade 10 when she started struggling. After working with a tutor, she proceeded and continues to excel mathematically, overtly bragging that she is a self-claimed “math geek.”
Future Goals	Attending a post-secondary program focused on photography, in which mathematics may or may not be required.
Additional Notes	Stef is a very bright girl who never struggled with academics until grade 10, when she began failing math. After working with me as a tutor, she regained her aptitude and love for mathematics. Since then, she has been top of her class and is not only a mathematical enthusiast inside the classroom, but boasts her aptitude for all things “nerdy” outside of the classroom. Stef values the opinions of her parents and peers, however is very independent and secure regarding her personality and her ability to make her own decisions. While Stef excels academically, her true passion lies in photography. She is secure enough in her abilities and identity that she does not care what others think, yet is well aware of the means by which people are stigmatized due to their gender and/or academic ability. Stef is very academically oriented, yet is not considered a nerd, nor at the top of the popularity hierarchy. She fits comfortably in the middle achieving a balance of both the academic and social realms.

Table A3: Stef’s Profile

Name	Taylor
Age and Grade	17 Grade 12
High School Average	85%-90%
Current Math Courses	Grade 12 Functions Grade 12 Calculus
High School	Northern Secondary School (Public)
SES	High
Relationship With Math	Taylor is insecure regarding her mathematical abilities even though she constantly achieves high grades. She has always had math anxiety. However, she works hard since she believes that she needs math in order to excel in university and become a successful business woman
Future Goals	Attending a university program related to business, in which math is required.
Additional Notes	<p>Taylor is a very bright girl who has always prioritized her education and as a result, has never struggled with academics. Although Taylor achieves academically, she puts a lot of pressure on herself and tends to panic a lot about her grades and admission to university. Taylor values her parents' opinion more than her peers' or the media. She believes that academics take priority over boys, friends and the social.</p> <p>Taylor scoffs at the idea that intelligence is treated in a gendered manner, and cannot fathom why it is that girls would want to downplay their intelligence. While she claims that she wants people to see her as smart, she still buys into what it takes for one to be popular and feminine, at least on a superficial level. However, she is secure enough in her abilities and identity that she refuses to compromise her determination to excel academically and career wise. In fact, she sees her intelligence as a quality that makes her cooler than she might be otherwise, as it is an unexpected bonus; others do not expect pretty, popular girls to be smart. Taylor is one of the girls in the popular group at her school, which adds to her confidence that any educational motivation or aptitude she has will only add to, not detract from, her ascertained popular status.</p>

Table A4: Taylor's Profile

Name	Erin
Age and Grade	17 Grade 12
High School Average	70%-75%
Current Math Courses	Grade 12 Data Management
High School	Northern Secondary School (Public)
SES	Mid
Relationship With Math	Erin dislikes mathematics, and although she tries relatively hard to succeed, does not enjoy it.
Future Goals	Attending a fifth year of high school in order to augment her grades, followed by college or university.
Additional Notes	Erin has never loved math and while she tries relatively hard to do well academically, she is convinced that she is not inherently intelligent and although she wishes she were, she is happy with trying relatively hard and achieving moderate, rather than high, grades. Erin is highly influenced by the opinions of her peers and the media, and admits that these influences effect much of what she does. She admits that she is less susceptible to such influences now than she was at the onset of high school, but that they still are to blame for her desire to look a certain way and be attractive to guys in the way society deems she should be. Erin is one of the girls in the popular group at her school and often feels the need to conform to the norm in order to maintain this status that she greatly desires and works hard to maintain.

Table A5: Erin's Profile

Name	Alana
Age and Grade	17 Grade 12
High School Average	70%-75%
Current Math Courses	Grade 12 Data Management
High School	Northern Secondary School (Public)
SES	Mid
Relationship With Math	Alana enjoys mathematics when she understands it, but is not motivated to try hard.
Future Goals	Attending a university program related to psychology in which math is not required.
Additional Notes	<p>Alana does not feel strongly about math. She enjoys it when she understands it but is unmotivated to try when she finds it difficult. Achieving academically is important to her, and while she does not feel the need to get high marks, she wants to do well enough to go to university. Alana prides herself on being a 'guys girl,' stating that while she likes to be girly sometimes, she is more down to earth than most of the girls at her school.</p> <p>Alana is very aware of the influence the media exerts on her peers, and tries not to let it get to her. However, she admits that she is sometimes susceptible to the manipulative tactics of the media regarding femininity even though she wishes she wasn't. Alana is one of the girls in the popular group at her school, and loves to drink and chill with the boys, referring to herself as a 'party girl.'</p>

Table A6: Alana's Profile

Name	Sarah
Age and Grade	17 Grade 12
High School Average	85%-90%
Current Math Courses	Grade 12 Functions Grade 12 Calculus
High School	North Toronto Collegiate Institute (Public)
SES	High
Relationship With Math	Sarah has steadily enjoyed math has excelled mathematically since childhood.
Future Goals	Attending a university program related to psychology in which math is not required.
Additional Notes	<p>Coming from a family where educational and career oriented successes were always reinforced, Sarah has always prioritized academics and succeeded. However, one could never tell by her external appearance or party-oriented lifestyle. A self-proclaimed “serial monogamous,” Sarah has always had a boy on her arm and the latest in fashion on the rest of her! Sarah is completing all math courses available in order to keep her options open for university. She is very focused on image, claiming that even though she tries to appear cool and “hardcore,” that inside she’s really actually shy and romantic. Sarah is very aware of the influence the media exerts on her peers, and tries not to let it get to her. However, she admits that she is sometimes susceptible to the manipulative tactics of the media regarding femininity even though she wishes she weren’t. Sarah loves celebrities and the celebrity lifestyle, and claims that even though she went through a huge party phase last year that she has since calmed down and regained the balance between academics and her social life. Moreover, she is well aware of the means by which people are stigmatized due to their gender and/or academic ability. Sarah is one of the girls in the popular group at her school, yet insists that she is more down to earth than most of the girls at her school.</p>

Table A7: Sarah’s Profile

Name	Emma
Age and Grade	16 Grade 11
High School Average	80%-85%
Current Math Courses	Grade 11 Applied
High School	Metro Prep (Private Independent)
SES	High
Relationship With Math	Emma detests mathematics and does not understand it, mostly due to a lack of motivation and effort.
Future Goals	Attending a university program related to social work that does not require mathematics.
Additional Notes	<p>Coming from a family where educational effort was always reinforced, Emma has always prioritized academics and achieved relatively high grades. However, Emma's approach to education is quite different from many others. She has tutors for almost every subject and has no interest in learning the subject content. She simply wants to produce work that gets the results desired. Her two siblings are the same, and the family boasts a range of tutors, including a life coach, and a tutor who organizes and prioritizes the kids' agendas. Emma's family is exceptionally wealthy, and while obtaining post-secondary education is emphasized by her parents, Emma never has to worry about getting a job which will provide her with a certain income as she has family money to rely on. Emma grew up in a Jewish household and Jewish values are emphasized, but not in an orthodox way. However, Emma values the opinions of her parents and peers and makes many of her consumption (educational and otherwise) decisions accordingly. While many of the girls at Emma's school go to extremes in order to be popular and tend to the male gaze, Emma does not. Emma believes that dressing "like a slut" and doing drugs just because everyone else is, is disgusting and refuses to participate in such behaviour, often choosing to hang out with close friends on the weekend rather than go out and partying. While she is relatively unaware of the way in which the media creates ideals and the norm, when presented with such ideas she understands them clearly and tends to agree. Emma is one of the girls in the popular group at her school, and loves to drink and chill with her friends who are mostly all girls.</p>

Table A8: Emma's Profile

Name	Jessica
Age and Grade	16 Grade 11
High School Average	85%-90%
Current Math Courses	Grade 12 Functions
High School	Bayview Glen (Private)
SES	High
Relationship With Math	Jessica enjoyed math until grade 10 when she struggled. After working with a tutor, she began achieving high grades, and while claims to secretly love math, hides her newfound love for the subject from peers.
Future Goals	Attending an undetermined university program after completing her final high school year at a private high school in Switzerland.
Additional Notes	Coming from a family where educational and career oriented successes were always reinforced, Jessica has always prioritized academics and succeeded. However, one could never tell by her external appearance or party-oriented lifestyle. Jessica is a self- professed 'shopaholic' and changes her boyfriends as often as her accessories. While she hated math in grade 10, after working with me as a tutor she began to love math, switching out of grade 10 Applied and into the academic stream, continuing on to complete all math courses available in order to keep her options open for university. She is very focused on image, claiming that even though she is intelligent, she intentionally hides it and plays the part of a "dumb blonde" in order to be cool. She admits that she is sometimes susceptible to the manipulative tactics of the media regarding femininity. Jessica loves celebrities and the celebrity lifestyle, and claims that even though she went through a huge party phase last year that she has since calmed down and regained her balance between academics and her social life. Jessica is one of the girls in the popular group at her school. She loves to drink, and refers to herself as a 'party girl.' However, she is confident enough in her popularity to continue to succeed academically, rather than being social at the expense of academic success--even if she does so in secret.

Table A9: Jessica's Profile

Name	Rachel
Age and Grade	17 Grade 12
High School Average	75%-80%
Current Math Courses	Grade 12 Data Management
High School	Northern Secondary School (Public)
SES	Mid-High
Relationship With Math	Rachel has always understood mathematics fairly well without working too hard at it. However, she finds it boring and is unmotivated to carry on past compulsory courses needed to graduate.
Future Goals	Attending a university program related to fine arts that does not require math.
Additional Notes	<p>Rachel is an intelligent girl who has always succeeded academically, but has also always known that her true calling was visual art. An incredibly talented artist, Rachel embodies the artistic stereotype by projecting an independent and unique image. She is always clothed in the latest trends and fashions, and touts obscure musical tastes such as Bob Dylan. While Rachel is clearly focused on image, it is not the norm that she is trying to emulate. Rachel might be considered an Early Adopter by Gladwell's standards (Gladwell, 2002), often seen sporting products that have not yet made it to the mainstream. However, it is this idea of cool which she tries to project and it is important to note that she is very aware of the image and identity she is trying to cultivate. Moreover, Rachel hates the idea that she has to conform to normative values, and claims that people often get the wrong impression about her simply because she sometimes likes to be alone, or doesn't like talking to strangers at parties. Rachel is very aware of the influence the media exerts on her peers and tries not to let it get to her. However, she admits that she is sometimes susceptible to the manipulative tactics of the media regarding femininity even though she wishes she weren't. Rachel is one of the girls in the popular group at her school and while she loves to drink and chill with the boys, she is more down to earth than most of the girls at her school, claiming that there are many types of cool and that what makes one truly cool are confidence, uniqueness, and the ability to get along with everyone.</p>

Table A10: Rachel's Profile

Appendix B (i): Photo Journal Assignment

Your “Photo”-Journal Project

Okay so here it is: your first project. Keep in mind – this project is TOTALLY open – there is no “right” or “wrong!”

I want you to show me all the things that are important to you, and that make up who you are. Using photos, magazines, and/or whatever other media you want, create a journal which details the things that you think make up your *identity*, which demonstrate who you are now, or want to be later, or a mix of both. (I am hoping for about 5-10 pages, more is also fine).

This might include products, clothing, places, food, beverages...anything! Try to include a mix of things – it’s totally open ended and all I ask is that you tell me WHY you have picked these things and HOW they make you YOU. That means that you need to include some writing talking me about what you were thinking when you chose which things to include.

If you’re having trouble getting started or want some ideas, the following is a list of things you might think about. Remember you don’t HAVE to use ANY of these categories, they are just some ideas to get you started:

1. **People:** (Family, friends, celebrities, public figures, etc)
2. **Places:** (Geographic (ie. Cities, countries), virtual (ie. Facebook, Myspace), private spaces, public spaces, buildings, etc)
3. **Ideas, Values and Beliefs:** (Spiritual, philosophies, religious, quotes, etc)
4. **Things:** (Clothing, gadgets, food, drinks...!)
5. **Media:** (Television shows, movies, music, etc)
6. **Events:** (Going out, socializing, parties, etc)
7. **Anything else you can think of!**

BE AS SPECIFIC AS POSSIBLE!

The project can take any form – I’m thinking a booklet but if you want to make a giant collage, that’s fine also. As I said - it is totally open-ended, and I want it to be a reflection of YOU, so I want you to do it the way you feel is best, and the way YOU want to. Remember, you are showing the photo journals to me, and you may very well be showing them to others at conferences or through publications!

Please get a copy of the project to me by _____2009. I will personally come to your house to pick it up, OR if you do it on the computer, you can simply email it to me instead of printing it out. Either way is fine.

If you have any questions at ALL feel free to ask! Call me at 778.887.MATH, email me at Vanessa.vakharia@gmail.com!

Thank you so much for being a part of this – and don't forget – this is supposed to be FUN and help YOU reflect on who you are, who you want to be, and why – so be honest –no one is judging😊.

Please remember that data from your photo journal may be used in any publications, presentations, or conferences that come from my research – so make sure you choose your photos and information accordingly! Just a note – I will not use images of any people, other than you, that are depicted in your photos.

VaneSSa

Appendix B (ii): Interview Questions

Interview Duration

45-60 minutes in length

Getting Started (approximately 5 minutes)

Remind participant about the project, detail confidentiality terms, and explain the video recording process and purpose.

Part 1: Identity (approximately 10 minutes)

1. Describe “popular?”/”cool”
2. Describe the cool kids in school
3. Is there a difference between cool girls and cool boys?
4. How much do you care?
5. Would you consider yourself to be one of these people? (cool)
6. Name 5 traits that describe you
7. Name 5 traits that describe how others see you
8. Name 5 traits that describe your ideal self
9. How do you try to get from how you see yourself now, to your ideal self?
10. Do you try to get people to see you a certain way? Why/why not? How do you do it? (How does education/math fit in with the image you want others to see)?

Part 2: Discourses Of People Doing Math (approximately 10 minutes)

Show clip from “Mean Girls” depicting Lindsay Lohan being asked to join the math team, and the “popular girls” making fun of her.

Discuss clip by using the following prompts:

Prompt Questions

1. How would you describe the characters in Mean Girls?
2. What kind of people do you think they are?
3. Do you know anyone who they remind you of?
4. What do you think you have in common with them/what’s different?
5. Do you like them? Why? Why not?
6. Would you like to be like them? Why? Why not?
7. Would you invite them to hang out with you and your friends if they were real? Why? Why not?
8. Can you relate to Lindsay Lohan’s character? Why or why not?

9. What other examples do you remember of people doing math in pop culture?

Areas for probing

1. Popularity/nerdiness
2. Normalcy/craziness
3. Issues of difference: sexuality, masculinity, race?
4. Mathematical capability attributed to innate intelligence versus hard work
5. Perceptions of mathematicians (personality, body image, clothing, what do they like/do, family, friends)
6. Is there anyone you look up to who likes math/is good at math? Are they typical or an exception to how you normally view people who like math?
7. If math was a person, what would he/she be like?
8. Would math be your friend? Your idol?

Part 3: Discourses Of Consumerism (approximately 10 minutes)

1. Tell me about some of the things you wrote about in your photo-essay. Why did you pick them?
2. What do you use to decide what products to consume? For example, that shirt you're wearing?
3. What about utility? Function over fashion?
4. Can you think of a time that an advertisement/marketing technique has made you want a product? What was the product and describe the ad.
6. What do you think of the following advertisement (show ads produced by the National Council of Teachers of Mathematics)
7. How does this (math) ad compare with ads that you actually like? What are the similarities differences?
8. How much does the product have to do with it?

Part 4: Relationship With Mathematics (approximately 10 minutes)

1. What math courses are you taking this year? (This is the final year of high school for most of the girls, so if they are taking math, it is beyond the compulsory level)
2. Why did you choose to pursue? (Or why did you choose not to pursue math?) What factors affected your decision?
3. What factors affect course selection? Rate: Utility, friends, enjoyment...
4. Did a lot of your friends make the same choice?
5. Did their choice (of your friends) affect your choice?
6. How would you describe how math is taught in school?
7. How does this mode of teaching fit or not fit with how you learn math?
8. What kinds of people choose to pursue math? What kinds of people do math recreationally? Would you describe yourself as one of those people?
9. How do you think your peers think about math and the ways math is taught in schools

Part 5: Social Identity (approximately 5 minutes)

1. Do you find that you and your friends make similar decisions? Give me some examples.
2. How important are your friends opinions of you?
3. We touched on this before, but in the same vein, what about decisions regarding courses/university? Do your friends and you make decisions in the same way then? (ie using the same processes, comparisons, etc)

Part 6: Math Marketing (approximately 5 minutes)

Show examples of a math marketing campaign. Please refer to Appendix C for the “Math Matters” advertisement used.

Discuss advertisement by using the following prompts:

Prompt Questions

1. What did you think of this ad?
2. Does an ad like this make you feel a certain way about math? Does it change the current opinion you have about math at all?
3. Do you think this ad would make someone want to take math? Why or why not?
4. If you had to create an ad to sell math to you or your friends, describe what it might be like.

Appendix B (iii): Interview Transcript Sample

Stef: Transcribed

Tape Length: 28.24

Date of Interview: June 24

Transcribe: September 28 2009

School: Northern

Grade: Eleven

V: We're going to start by your photo journal, so the first thing that struck me was that you said you loved doing sudoku and you're a huge nerd and do 5 a day, and the other thing was that you said you were a 5 year old boy at heart, okay so why are you a huge nerd for liking sudoku and super heroes?

S: Because most people don't I guess, I don't know.

V: Most people like, your age...?

S: ya and girls.

V: So who likes those things?

S: My mom likes sudoku, like we fight over the morning paper. And I don't know, like boys like super heroes?

V: Okay so do boys like sudoku?

S: No

V: So when you're talking about nerds and stuff like that, would you say your friends think you're a nerd for this stuff?

S: No not really, my friends don't really care, but like generally, people associate sudoku with nerds.

V: Do you have any idea why?

S: Because it's all about numbers and like, thinking, and not going out and getting drunk?

V: Okay let's talk about that. So who thinks numbers and thinking is nerdy?

S: Uhhhh..society. My friends are all nerdy too, so it's okay.

V: So when you're talking about being nerdy you're talking about liking numbers and things?

S: I guess.

V: Do you consider yourself a nerd?

S: Uhhh...sort of. Like I don't really put any effort into anything I do, I just enjoy it I guess.

V: So you just enjoy numbers?

S: Sometimes.

V: When do you not enjoy them?

S: When I have to do it, and if it's like, boring

V: So let's think about your school. give me a history of your relationship with math.

S: When I was little I really liked math and was really good at it, and had a really good math teacher in grade 5, and he would give us like, we were separated in skill level groups and in grade four we got a booklet of problems that we were supposed to work through the year, and the people who did it faster got more, and they wouldn't tell us how to do it so we'd be doing like, it kind of screwed me in grade 9 cause I could do it in grade four, but then in grade 9 they gave you all these formulas which I didn't need cause I could figure them out the other way, so that sort of screwed me over, and then math teachers at Northern suck so that didn't work out too well, so I went to City.

V: So were you getting bad grades at Northern?

S: Ya

V: And then you went to City and got good grades because of what?

S: The teacher, and it's a smaller class, because like, sitting in class at Northern, it was an afternoon, and hot, and I would get bored after the first half of class and get lost, and the teachers weren't into explaining it or helping you

V: and why do you take math?

S: Cause I have to and my parents want me to, but I don't hate it so much, I just hate parts of it.

V: And you're in grade eleven...do you think you're going to take something math related in university?

S: I doubt it.

V: How come?

S: Just because the programs I want to go into don't need math, so I'm not going to take it as an elective.

V: Even though you like it?

S: I don't like it enough to take it in university.

V: And what programs did you want to go into?

S: Photography, history, arts type thing

V: Thinking about people you know at northern, think of a girl that likes math, can you think of some one?

S: Ummm my cousin

V: Would you say she's your idea of the typical person who would like math?

S: She really likes science and math, but she's not a nerd, you wouldn't think about that at first when you met her, but deep down she is. Like she loves like star wars and her older brother is also a huge nerd, he's in computer programming and game development and goes on all these conventions across the country to do like, video game stuff and she's like him, a nerd, but not on the surface when you first meet her

V: What's she like on the surface

S: An average teenage girl

V: So are you saying if you were to normally describe some one who liked math that they should be nerdy?

S: No. well like, if she didn't like all these other things I wouldn't call her nerdy, like if she only liked math and science, but it's all those other things.

V: And do you think people feel the same way? would they classify people the same way?

S: Ya, but I also think people throw around the word nerd without thinking about it, like if someone's studying for their chem test at lunch people will be like "oh you're such a nerd, you're studying at lunch" but people don't really mean it. But the kids that are actually sitting alone studying at lunch, people would actually call a nerd.

V: What's the difference?

S: Because it's like their entire life as opposed to a part of it.

V: Can you think of cool kids at your school and what are they like? Let's do a boy and a girl. Give me some traits associated with each.

S: Obnoxious.

V: Is this for both?

S: Ya. Um loud, trendy or whatever, they go to parties all the time and don't give a shit about school or don't seem to.

V: And is it the same thing for girls and boys?

S: Basically

V: So neither of them care about school

S: Well they don't show it, I'm sure a lot of them do

V: So can you think of a cool kind of girl that would really like math as opposed to a cool kind of boy that would really like math, does that make sense to you?

S: They could both like math they just wouldn't tell people

V: Why?

S: It wouldn't come up in their conversations, or they just wouldn't want people to know that

(Show Mean Girls Clip #2)

V: So describe what kind of people these girls are

S: Generally I think mean girls is a good movie, but I think it over-exaggerates high school, it's more actually like junior high...mathletes don't really exist.

V: Yes they do! Have you not seen my mathletes shirt? You have a mathletes team at Northern!

S: Well no one knows about it!

V: Do you think anything about it is accurate?

S: I think that people in general would say that joining the mathletes is social suicide, but I also think that I understand Lindsay Lohan's point of view cause like she likes math, but she's never gone to public school so she doesn't want that to take over her life, cause she's had like, so much academic time up till now I guess cause she's been homeschooled, so I think if it wasn't such a big deal at that school and it was hidden, it wouldn't really matter.

V: So but why are they saying that joining the mathletes is social suicide?

S: Because people think of you as a nerd, and then like all the things associated with being nerdy

V: Do you think if this was a guy things would be reversed? Like is a guy on the mathletes as nerdy?

S: Well guys deal with things differently and I don't think this situation would really happen, cause like if a guy likes math he doesn't care about fitting in, and he wouldn't go with the popular guys and TRY to fit in , they would just sort of make fun of him but wouldn't force him to do anything though, I don't think

V: So do you think it's easier for a guy to be popular and like math?

S: No it's the same

(Show Mean Girls Clip #1)

V: So what's going on?

S: She wants his attention so she acts dumb to get it

V: So have you ever seen that?

S: Well, I don't think there's anything wrong with it, like she knows and she's not going to change what she's doing, but here like, I don't think that's an issue to pretend you're stupid to talk to a guy, like you can still do fine on the test, it's just an excuse to talk to him

V: Have you done that?

S: No. I've asked a guy like, do you know what's going on when I do just to talk to him, but I would never actually act dumb and lose grades and stuff.

V: Do you think girls do this, like not to the extent of failing, but...

S: Ya I think girls do that

V: Do you think guys do that?

S: Probably. Guys are probably a lot less obvious about it.

V: Why do you think girls do that?

S: Well it depends why, if they do it to get his attention, then that's why, but if they actually dumb themselves down all the time just so they think he'll like them better?

V: Do guys like girls better when they're dumb?

S: assholes do

V: Why?

S: Cause they like to be like, smarter and powerful and all that, but I think generally no, they don't want an idiot as a girlfriend, it depends

V: Have you seen girls do this before

S: Ya I've seen girls do that before. My friends have done it occasionally, but generally other girls at school

V: What kind of girls are these

S: Everyone, depends on the situation

V: Are these girls smart?

S: Some of them, not all of them. Some are legitimately idiots, but some are smart.

V: So let's talk about shopping and stuff, what influences you to buy certain things.

S: Like, what they look like...wait are we talking about clothes or...?

V: Whatever, like, pick something

S: Well like clothes...how much it costs, how it looks on, and if I need it

V: How do you get the idea?

S: I just window shop

V: Do you ever see an ad that makes you want something?

S: Not really. maybe for like, ten seconds, but not really

V: And are you ever influenced by what other people are wearing?

S: Like I like looking at what other people are wearing, but I'm not like, going out to copy them

V: Do you think you buy clothes more for their usefulness or what it looks like

S: Both

V: Have you ever seen any educational ads?

S: Not any good ones. They're all outdated and ugly and don't make you want to do anything that has to do with the subject at all. Like, there's a bunch of ones in a few rooms at school and

it's all these different careers, like ones you OBVIOUSLY need math for, like engineering or a scientist or a mechanic and it's like "don't give up on math you need this" and it's like, from the 70s and it's really unattractive to the eye, and no one would want to take math because of those ads

(show math ad)

S: Like this is at least a bit better because it's visually appealing and has different stuff, like graphic design, food technology, media, newer careers I guess, whereas the other one is like "scientist, engineering," like we all know that

V: Who do you think this ad would appeal to?

S: Mostly guys. It's all blue, and I don't want to be stereotypical, but like blue is for boys, but just the way it's set up also, like the graphics in there, the octagons, generally would appeal more to boys.

V: Why kind of guy would this appeal to?

S: I think all guys would look at it, but it wouldn't appeal to all of them

V: So who would it appeal to?

S: Like most guys, the average guy, but ones who just don't care about school at all won't care about it.

V: Do you want to show me your ad idea?

S: Ya it is sort of based on that idea, but one that appeals to girls. So it would be like a really nice interior designed room or models and clothes and writing about how you need math for these careers, but ones that girls are more interested in, but like in the ad, if there was a window, maybe put a plus sign in it or cool math signs

V: So the message would be...

S: Like the same idea, that you need math for all these careers

V: Okay but just careers that are more interesting to girls?

S: Ya. Like architecture, any type of design

V: Do you think this would influence people who don't like math, or who already like math?

S: Um I think for sure the ones who already like math, but also ones that are on the fence

V: Remember when you mentioned being a 5 year old boy at heart...? Like, how do you think of being a boy or a girl?

S: Well like, 5 year old boys generally like super heroes and 5 year old girls like Barbies.

V: So when you think of yourself now do you think more boyish or girlish?

S: No not really.

V: Is there anyone you look up to who likes math or who's good at math?

S: You?

V: Besides me!

S: My parents are good at math...but I don't look up to them because of it. But not really.

V: You mentioned that people view those who like math as nerds...would you say that's true for everyone?

S: Ya, but I think it's changing a bit.

V: Like how?

S: I don't think people really think of you as being that much of a nerd for liking math and science anymore, it's more other things now. I don't know where I'm going with this, but with the internet and stuff all the nerds are rich and famous, so I think with math and science people have accepted it, and they're like, oh well they'll be like set for life, where as it's more socially awkward liking math and science and computers not leaving you house.

V: And again do you think people have the same perception regardless if you're a boy or a girl?

S: Um ya I think they do.

V: One more thing, you mention that you're advertising math based on what it can do for you...do you think that's the same for other subjects? Like if you were advertising photography would you do it the same way?

S: No. because most people think photography can't take you anywhere in life.

V: So how would you advertise that to someone?

S: Um more based on artistic creativity and fun

V: But do people not ever take math just for fun?

S: Um sort of...I mean I'm taking math because my parents want me to, but I still enjoy it most of the time. But you'll find in grade twelve people are taking calc cause they need it to get into their program, or they're taking all of the sciences and all of the maths partially cause they enjoy it and partially because they want to go into science or engineering, so in that case I guess it's cause you like it and cause you want it to take you somewhere. But I don't think people just take it for fun.

V: Why?

S: Because for most people it's a hard course, and in grade twelve you don't need it anymore, and you can take a lot more interesting things and get better marks to go to university and they've just had bad experiences with it.

Appendix C: Math Matters Advertisement

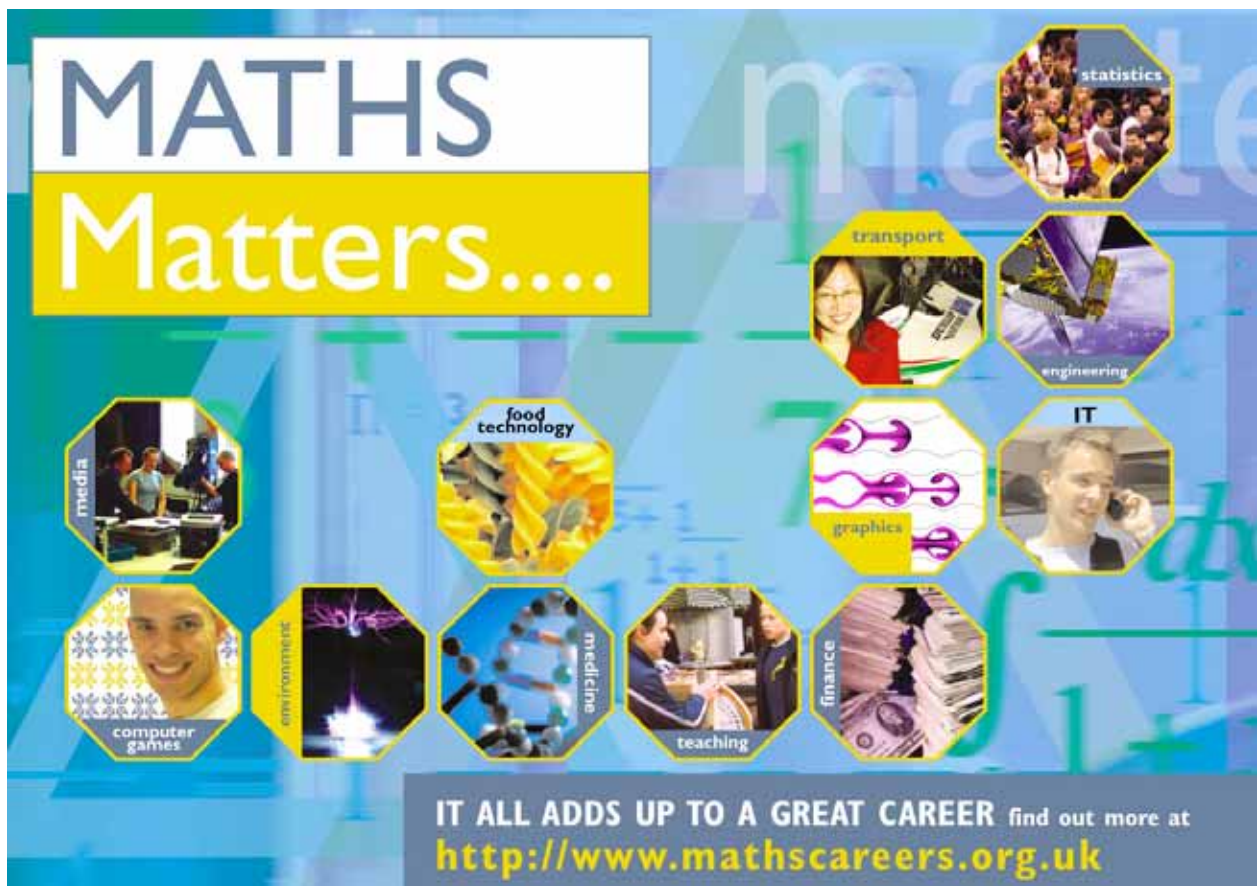


Image A1: Math Matters--This is an image of an educational advertisement that was shown to participants during the interview process.

Appendix D: Geek Chic

Geek-Chic Looking Smart is SO HOT right now!

This image has been removed due to copyright restrictions. The image was an illustration of a photograph which appeared in a local newspaper. The photo depicted a model sporting a fashionable schoolgirl style dress and thick, librarian-style glasses., during Toronto Fashion Week. Original source: Inspired by: Calabrese, D. (Photographer). (2010, March 30). Preloved Fashion Show (Image). Metronews, pp. 1.



The accessory table at Forever21¹, featuring 'Reading Glasses' sans prescriptive lenses
Forever 21 Inc., 2010

Toronto Fashion Week Image

This image is an illustration of the photograph which appeared in Metronews



A hypothetical illustration of Lindsay Lohan accessorizing with a pair of prescription-free 'reading glasses,' which she has recently been seen touting



Paul Frank² calculator watches
Paul Frank Industries, 2010

A fashion blogger's style guide for summer 2010
OnSugar Inc, 2010



¹ Forever 21 is an American retail chain that targets adolescents and young adults, providing the latest trends and fashion accessories.

² Paul Frank is a well known international designer who produces a wide range of consumer products and fashion accessories.

Image A2: Fashion And Function--This collage illustrates the many forms the newest trend in fashion is currently taking. The illustrations demonstrate that 'looking smart' is in style right now.

Appendix E: Ethics Approval Certificate

<https://rise.ubc.ca/rise/Doc/0/CR0VGT0PDS5KRB44KFGFDEAP6A/fromString.html>

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The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road, Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL - FULL BOARD

PRINCIPAL INVESTIGATOR: Susan Gerofsky	INSTITUTION / DEPARTMENT: UBC/Education/Curriculum and Pedagogy	UBC BREB NUMBER: H09-00510
INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:		
Institution		Site
N/A		N/A
Other locations where the research will be conducted: The research will be conducted in either the subject's home, my home, a local coffee shop, or a spare classroom if necessary. The research will be conducted wherever the participant feels the most comfortable.		
CO-INVESTIGATOR(S): N/A		
SPONSORING AGENCIES: N/A		
PROJECT TITLE: Math As "Cool": A New Perspective on Mathematics, Gender, and Identity		
REB MEETING DATE: May 14, 2009	CERTIFICATE EXPIRY DATE: May 14, 2010	
DOCUMENTS INCLUDED IN THIS APPROVAL:		DATE APPROVED: May 28, 2009
Document Name	Version	Date
Protocol: Research Proposal	2	April 25, 2009
Consent Forms: Parent/guardian consent form	3	May 19, 2009
Assent Forms: Student Assent Form	2	April 25, 2009
Questionnaire, Questionnaire Cover Letter, Tests: Personal interview questions/ script	1	February 14, 2009
Photo Journal Assignment	3	May 19, 2009
Letter of Initial Contact: Letter of Initial Contact	1	February 14, 2009
The application for ethical review and the document(s) listed above have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.		
<p style="text-align: center;">Approval is issued on behalf of the Behavioural Research Ethics Board and signed electronically by one of the following:</p> <hr style="width: 50%; margin: auto;"/> <p style="text-align: center;">Dr. M. Judith Lynam, Chair Dr. Ken Craig, Chair Dr. Jim Rupert, Associate Chair Dr. Laurie Ford, Associate Chair Dr. Anita Ho, Associate Chair</p>		