SUPPORT OF MARGINALIZED STUDENTS IN SCIENCE: AN EXAMINATION OF SUCCESSFUL LESBIAN INDIVIDUALS IN SCIENCE CAREER PATHS

DISSERTATION

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ABSTRACT

The initiative to increase highly qualified college STEM graduates coupled with the phrase “science for all” pushed by standards-based reform has opened an avenue for science education research. How can we increase students’ interests in science careers? Specifically, do marginalized groups require differing instructional approaches to increase science interests? By closely examining individuals from marginalized groups that have been successful in following a science career path, we may understand how to further help these groups. Gloria Ladson-Billings’ work on culturally relevant teaching was utilized as a guide to help understand potential responses about science experiences in the classroom. This study specifically examined six lesbian individuals’ experiences with science while in high school and college. The information was collected via semi-structured, open-ended interviews and was analyzed for reoccurring themes. Most of the participants did not have access to lesbian science mentors/role models even though prior research has shown the importance of such. The participants also recommended identifying mentors/role models for potential future lesbians interested in science.
Dedicated to Melissa
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CHAPTER 1

INTRODUCTION

The initiative to increase highly qualified college STEM graduates coupled with the phrase “science for all” pushed by standards-based reform has opened an avenue for science education research. How can we increase students’ interests in science careers? Specifically, do marginalized groups require differing approaches to increase science interests? By closely examining individuals from marginalized groups who have been successful in following a science career path, we may understand how to further help these groups. This study will specifically examine lesbian individuals’ experiences with science while in high school and college. The researcher will attempt to determine if any particular experiences either encouraged or discouraged them from pursuing a career in science. The research will inquire directly what lesbian individuals feel could have been done or could be done to make science open to all. Gloria Ladson-Billings’ work on culturally relevant teaching will be utilized as a guide to help understand potential responses about science experiences in the classroom.

DEFINITION OF TERMS

Culture- A community of individuals who have shared experiences and beliefs
Gender- Refers to a continuum of femininity and masculinity
Gender identity- The perception of a person’s own gender, which can be male, female, transgender, or other descriptors

LGBT- Lesbian, gay, bisexual, and transgender

Science- Based on the five major areas of funding from the National Science Foundation: biological, computer and information science, engineering, geoscience, and mathematical and physical science

Sex- Biological identity of male or female

Sexual identity- How a person describes his/her own sexuality, which can include sexual orientation and sexual behavior

RATIONALE

The recent federal government initiative to increase the quality of STEM education is linked to the hope of producing more highly qualified college STEM graduates (National Science Board, 2007). Part of the plan to increase STEM graduates is to attempt to increase the number of under-represented students in STEM programs. Students from marginalized groups, groups in which the dominant discourse excludes them as participants, are seen as an untapped resource needed to push the United States forward into the demands of the 21st century. The current period of standards-based reform has pushed the idea of “science for all” to the forefront. One of the main questions behind this is how an “equitable distribution of opportunities to learn” science may be ensured (Romber & Collins, 2000).

Several attempts have been made to document the number of LGBT individuals in the population, and the most recent numbers (Gates, 2006) based on the 2000 U.S.
Census data have estimated the number to be roughly 8.8 million LGBT individuals in the U.S. No research exists at this time to indicate the number of lesbian individuals involved in science careers, but gender differences have been documented (i.e., more males entering science careers than females). According to the National Science Board (2008), in 2005 women represented only 26% of the college-educated work-force in scientific and engineering occupations even though women represent close to half of the total number of college-educated individuals in the work force. In 2003 women represented 29% of the physical scientists and 11% of the engineers. Overall the number of women in science and engineering occupations has risen since 1993 except for computer science and mathematics which has actually dropped 2% (National Science Board, 2008).

Ben Barres (2006), a female-to-male transgendered scientist, revealed the differences in treatment he received in the science field after becoming male. As a woman, Barres encountered multiple forms of gender bias; for example, after solving a complex mathematics problem, Barres’ professor stated that his boyfriend must have solved it for him. Barres also later, after his transition, heard a faculty member state, “Ben Barres gave a great seminar today, but then his work is much better than his sister’s.”

A connection can be made between the gender differential in the sciences and homophobia. Homophobia is rooted in genderism (words like “sissy” or “fairy” directed at individuals used to show an absence of masculinity and a presence of femininity) and the link between genderism and homophobia provides evidence for a subject area that is
not open to all. Students who may fear being labeled as gay or lesbian may opt out of taking courses that defy gender norms (Unks, 1995). The impact of biological sex norms has been influencing course selection of students for many years and, some courses offered in schools were reserved for one sex. Boys were pushed towards mechanical arts courses like woodworking or automobile repair. Female students were often required to take home economics (Reece, 2009). Individuals of one sex wishing to take courses typically reserved for individuals of the opposite sex would have to defy sex/societal norms.

Girls wishing not to be labeled as “lesbian” may choose to not take science courses that they perceive to be more “male” (i.e., physics or chemistry), and boys not wanting to be thought of anything less than fully masculine may take these courses (Unks, 1995). However, any gay or lesbian student thinking of following a science career path will encounter a lack of LGBT representation in both science topics and “out” scientists (Unks, 1995). Even if LGBT students try to pursue science, based on most current classroom and school practices, the students are considered marginal members of classroom discourse (Crocco, 2002; Kumashiro, 2001; Owens, 1998) and are left to make sense of science as they experience it on their own.

Much of the research that examines gender differences in the sciences has falsely assumed that the representatives of the categories “male” and “female” are homogenous groups (Letts, 2001). Research about males and females in science has examined sex differences (male, female) rather than gender differences (masculine, feminine). This is a subtle difference that is overlooked but crucial to understanding human actions. People in
general are too complex to be easily placed into a dichotomy (male/female) and by examining gender researchers can potentially obtain more meaningful answers to questions being investigated. By stepping away from the sex dichotomy, researchers would be required to go beyond visual characteristics of an individual, which are not always reliable, and would need to obtain personality traits in order to potentially place subjects on a “gender continuum.”

Science in schools is presented as a masculine endeavor in that it is “unemotional, detached, and politically unbiased” done in isolation and represents absolute “truths” (Letts, 2001, p. 263). Consequently, some students (often women) view science as being disconnected from their lives. This can explain, in part, the lack of females in science, and therefore a subject which is not open to all.

THEORETICAL FRAMEWORK

LGBT students and children of LGBT parents are cultural groups ignored in classrooms (Lipkin, 1995; Unks, 1995). The gay culture is a sexuality and gender identity based culture which contains members who have shared experiences and beliefs. Teachers, the curriculum, and the schools often disregard these individuals like much of the outside world, but LGBT students deserve to feel a part of their education. The voice of LGBT individuals needs to be heard in schools, but this is not common practice. In most educational settings, the teacher is the individual responsible for showing students the ways of the world or the world as they see it regardless of the curriculum. If the teacher has a skewed concept of the world which fails to recognize LGBT individuals, the skewed concept will continually be presented to the students and the students will
never be able to see the world as it exists for them. The presentation of a singular world
vision by a teacher will never allow for oppressed or marginal individuals to overcome
that domination (Freire, 1972).

Students from racial and ethnic minorities have suffered from an educational
system that fails to recognize their presence just like LGBT students. The idea of
culturally relevant pedagogy (Ladson-Billings, 1994) was introduced in order to provide
assistance to teachers of racial and ethnic minority students. These same ideas of
culturally relevant teaching can be applied to other marginalized groups.

Gloria Ladson-Billings has helped to lay a foundation for culturally relevant
pedagogy. The main ideas behind culturally relevant pedagogy stretch beyond
race/ethnicity and can be applied to LGBT students. Billings (1994) states that culturally
relevant teaching is not just for students who may speak different languages, but includes
providing students the opportunity to surpass any negative influences (such as a lack of
representation in the textbooks or curriculum) presented by the dominant culture. Much
focus is given in research on how to alter the curriculum to meet cultural needs, but the
way the content is taught has a deeper effect on students (Ladson-Billings, 1994).
Ladson-Billings (1995) identified three criteria necessary for culturally relevant teaching
to acquire a collective empowerment for students: student academic success, student
development/maintenance of cultural competence, and student development of a critical
consciousness in order to challenge the status quo. Student academic success can be
achieved by teachers demanding scholarly excellence from all of their students and not
just trying to make the students feel good. Culturally relevant pedagogy also requires
teachers to connect students’ culture to the content being presented in class. The culture can be experienced by drawing in parents of the community to illustrate for students familiar resources of various cultures. The final criterion, critical consciousness, must be achieved to move culturally relevant pedagogy beyond the individual level. Students must learn to examine cultural norms and values, so that they can critically assess the status quo (Ladson-Billings, 1995).

The Education Alliance Program at Brown University (2006) provides seven principles for culturally responsive teaching. The work of Ladson-Billings (1994, 1995) was utilized to help in the creation of these principles. The seven principles are: positive perspective on families, high expectations of students, learning within the context of culture, student-centered pedagogy, culturally mediated pedagogy, curriculum reform, and a teacher as a facilitator. Teachers must reach out to parents to discover their hopes and concerns for their children. This communication also can introduce teachers to cultural skills they may need to know and allow the teacher to express their own high academic expectations for their students. Students whose homes do not mirror the culture found in schools may become disengaged in school; the teacher must bridge the gap with the appropriate teaching strategies to get the students interested again. Teachers also should promote a community of learners in their classroom to make students the focus of instruction. Culturally mediated pedagogy should integrate “diverse ways of knowing, understanding, and representing information” (Education Alliance at Brown University, 2006). The curriculum should allow for cultural integration and teachers should be able to allow students some freedom to discover their areas of interest. Of these principles the
final one, teacher as a facilitator, is extremely important because the teacher helps students to connect their cultural knowledge to the classroom content.

By learning about lesbian individuals who have successfully followed a science career path, is it possible to identify aspects of Ladson-Billings culturally relevant teaching in their education experiences? Must all three theoretical criteria presented by Ladson-Billings be fulfilled in order to achieve “science for all” for lesbian students? How can teachers create science classroom environments that support all children regardless of their sexual or gender identity?

STATEMENT OF PROBLEM

LGBT students are an oppressed and marginalized group who suffer from having their presence ignored in classrooms, attend schools in which homophobia and heterosexism by the staff and other students is the norm, and experience minimal attempts to make the curriculum relevant to their lives (Lipkin, 1995; Unks, 1995). LGBT students of color must deal with oppression and marginalization in schools on multiple fronts (Harper, Jernewall, & Zea, 2004). Teachers must realize that they will have some sexual diversity among the students and the parents of the students. When LGBT people are not ignored in school, often the attention given is negative. Schools notoriously are institutions of homophobia-places of hostility, prejudice, and fear (Owens, 1998; Unks, 1995).

In an attempt to support future lesbian scientists, research must turn to lesbian individuals who have chosen a science career path. Lesbian scientists can provide road markers for those wishing to follow their path as well as highlight barriers these scientists
were able to overcome. Science for this study is defined as the five major areas of funding from the National Science Foundation. These areas are biological, computer and information science, engineering, geoscience, and mathematical and physical science. The purpose of this study is to examine successful lesbian individuals in science careers or college science majors to determine not only what made them successful, but also how that information could be utilized to foster lesbian students interested in science and enter science career paths.

Given the literature presented, a model can be created that may illustrate potential findings. Lesbian scientists could have experienced only negative representations of gay and lesbian individuals in and outside of the classroom while in high school. These individuals may have had a gay or lesbian science teacher that served as a role model for them, which was an illustration that science based careers may be open to lesbians. While in college, the lesbian scientists could have been more drawn to science careers due either to the diversity of the field (medicine) or the ability to work alone or in tight-knit groups. These lesbian scientists could feel that if more LGBT topics were brought up in high school more lesbian students may be interested in science careers.

Specifically, this study will attempt to determine:
1. Among lesbian individuals following a science career path, what factors influenced their interest in science?
2. Particularly, did high school or college science courses have any impact on the lesbian participants’ interest in science? If so, how?
3. How did the participants’ sexual orientation influence their career decisions?
4. What do lesbian individuals feel could be done to increase science interests of other lesbian students?
CHAPTER 2

LITERATURE REVIEW

The literature review includes six parts: gender bias and sexism in science, the connection between gender bias/sexism and homophobia, school obstacles for LGBT students, teaching LGBT students, teaching science, and choosing a science career path. The first portion of the review examines existing gender bias and sexism throughout science. The second section connects gender bias and sexism with homophobia. The third section covers LGBT school experiences and why LGBT students are therefore considered a marginalized group. The fourth portion contains research on current strategies/suggestions for helping to teach LGBT students and about LGBT topics. The fifth portion deals specifically with inclusion of LGBT issues in science, and the sixth section covers research on selecting science as a career.

Biological Sex Bias and Sexism in Science

Biological sex bias has been documented in science for many years; however this bias can still be found in science laboratories and science classrooms across the country. The experiences of Ben Barres are an excellent example of the current sex bias (see page 3). In 2005 the president of Harvard University, Lawrence Summers, made several inflammatory comments during a speech at a research conference. Summers stated that women lack an innate or natural ability in some fields when compared to men.
(Bombardieri, 2005). These comments sparked women and men from across the country to speak out against the sexist ideology (Bombardieri, 2005; Mielczarek, Smith, & Roberts, 2006).

As Berube and Glanz (2008) point out, the performance of girls and boys mimic each other in mathematics and science in elementary school, but by the end of high school boys surpass girls. The authors attribute this decline in performance to hidden stereotypes, a lack of confidence for girls in these subjects, and the societal environment. Spears (2008) points to an unconscious gender schema as the source for the sex bias. Gender schema are the beliefs of sexual differences held by individuals. These unconscious thoughts portrayed in the classroom may lead to a teacher talking a male student through a problem while simply taking over for a female student with the same problem. Gender schema can also illustrate why some believe that females’ successes in STEM fields are usually linked to hard work, while males’ successes are often linked to a gift for STEM (Spears, 2008).

Recent decades have seen more females performing well in mathematics and science in secondary schools and entering science careers. The number of women receiving doctoral degrees in the sciences has increased steadily since the 1960’s; however, the number of women who hold full professorships in academia has not increased in the same manner (Fox, 2001).

A national survey (Fox, 2001) of 5,000 students and faculty members in five science fields revealed that women from departments which awarded higher numbers of degrees to women felt more support from advisers when learning how to design research,
write grant proposals, coauthor papers, and organize people when compared to women in departments that had lower numbers of degrees awarded to women. Regardless of the number of degrees awarded to women by the department, overall, women reported less support for completing these types of tasks when compared to the support felt by men. Women also reported the relationship with their faculty adviser felt more like “student-faculty” instead of “mentor-mentee” or “colleagues,” which was more often reported by men.

When applying for a tenure track faculty position at research universities, women and men are not starting on the same level. In a study (Schmader, Whitehead, & Wysocki, 2007) which examined 886 letters of recommendation, the researchers found that letters written for male applicants contained more standout words (e.g., “excellent” or “outstanding”). These same letters with more standout words also contained more ability words (e.g., “talented” or “intellectual”) and less grindstone words (e.g., “hardworking” or “diligent”). These findings with the letters of recommendation also link to the idea of women successes in science being labeled as “hard work” and men successes labeled as “a gift for science” (Spears, 2008). The letters of recommendation are subtle reminders of the existing sexism bias; faculty search committees need to be aware of this issue in order to conduct fair searches (Schmader, Whitehead, & Wysocki, 2007).

The National Academies (2007) released a report which documented eight findings involving women in STEM careers. These findings include: women have the ability to succeed in STEM careers; some women interested in STEM careers are lost
during educational transitions; women are extremely likely to encounter discrimination in all STEM fields; most people hold hidden sexism biases; subjective evaluation criteria hinder promotion of women; women lack spousal support more often found with men (i.e., less than half of male faculty have a spouse who works outside of the home, whereas 90% of female faculty have a spouse who works outside of the home); and inaction by the government or other institutions will lead to a decline in the nation’s competitiveness in STEM fields. The committee who released the report stressed that many of these findings are unintentional acts and can be related to obsolete practices of academia.

A House bill also introduced in 2007 ("Gender Bias Elimination Act of 2007 ") is aimed at reducing gender bias in research labs. The bill is seen as an extension of the current Title IX sex discrimination amendment often used in enforcing equality in athletics. Two aspects of the 2007 bill would require funding to help enforce sexual-equality laws and to provide education on sexual discrimination. The bill is currently in committee and awaits further action.

The Connection between Gender Bias/Sexism and Homophobia

Sexism and homophobia are cultural constructs utilized to create and maintain emblematic boundaries (Capezza, 2007; Madureira, 2007). Sexism defines a dichotomy (male/female) and systematically removes power from one group while erroneously assigning the power to another group, which can then utilize prejudice to illustrate/maintain the power differential (Madureira, 2007). Sexism is used to keep two different genders with their “appropriate” gender roles. Homophobia is needed to keep
sexism alive (Madureira, 2007); homophobia serves as a maintenance tool to the gender dichotomy. The tool is most often used by men in traditional gender roles who are the oppressors of both women and LGBT individuals (Capezza, 2007), because these men lose power. Some men with traditional masculine gender roles perceive LGBT individuals as a threat to the privilege and status of being men (Capezza, 2007).

As stated earlier a connection can be made between the gender differential in the sciences and homophobia in science. Students who may fear being labeled as gay or lesbian may opt out of taking courses that go against gender norms (Unks, 1995). Girls wishing not to be labeled as “lesbian” or who are attempting to hide their intelligence may not take science courses that they perceive to be masculine or difficult (i.e., physics or chemistry), and boys may take these courses to demonstrate their masculinity.

School Obstacles for LGBT Students

Most gay and lesbian students initially realize their predominant attraction to members of the same sex when they are between the ages of twelve and fourteen (Anderson, 1995). This is not an indication that these individuals identify as gay, lesbian, or bisexual, and their own change in sexual identity and coming out to their peers and family members is a unique situation for each person (Owens, 1998). When students do begin to acknowledge their same-sex attractions, they also begin to recognize derogatory terms (i.e., fag or dyke) used to refer to individuals who also have same-sex attractions (Anderson, 1995). In the Gay, Lesbian, and Straight Education Network (GLSEN) National School Climate Survey of 2005, 75.4% of responding students reported hearing derogatory comments, such as “faggot” or “dyke” frequently or often in school. Also,
89.2% of students also reported hearing phrases such as “that’s so gay” or “you’re so gay” (commonly implying stupid) frequently or often. Physical harassment based on sexual orientation was reported by 37.8% of students. Students who experienced more harassment reported more often that they did not plan to go on to college and their overall GPA for school was a half grade lower than students who did not experience/report physical harassment. Not surprisingly, students who felt supported by the staff at the school reported increased school attendance, a greater feeling of safety, and a higher frequency of plans to attend college (Gay Lesbian and Straight Education Network, 2005).

In a study that randomly surveyed 124 school districts across the U.S. (Rienzo, Button, Jiunn-jye, & Ying, 2006), the researchers found that only 39% of school districts offered some kind of education about sexual orientation; this includes inclusion of LGBT topics in existing curricula and separate curricula for LGBT topics. The districts that had classroom inclusion of LGBT curriculum reported less than five hours of instruction devoted to the topic. Fewer than 3 out of 10 districts offered sexual orientation training to their teachers, and only 22% reported having LGBT support groups for students such as gay-straight alliances. If a district was located in a state with antigay discrimination policies, a high correlation existed for the district to also have antigay discrimination policies. Politics were obviously highly influential in school practices and recommendations from health professionals on fostering inclusive student environments are often ignored (Rienzo, Button, Jiunn-jye, & Ying). The lack of discussions about LGBT individuals or topics is a potent message to students: no LGBT individual has
done anything of value (Unks, 1995). The missing LGBT curriculum hurts both heterosexual and LGBT students by not opening a dialogue about sexuality which can lead to discrimination and anxiety (Lipkin, 1995).

Why are LGBT students ignored through the curricula and teacher practices in classrooms? Researchers must turn to teacher education programs to look further at this question, because the teacher is the ultimate individual responsible for connecting to marginalized groups present in their classroom. According to Straut and Sapon-Shevin (2002), four barriers exist that keep inclusion of LGBT issues out of teacher education and therefore out of education of K-12 students: assumptions that all students are heterosexual, ignorance of the hegemonic norm clearly established, intolerance of counterhegemonic practices, and gaps within the curriculum which make LGBT inclusion difficult (i.e., lack of specific places in the curriculum to add LGBT topics). A teacher cannot make a connection to a group of students who they do not recognize as being a part of their classroom. Too often teachers assume that everyone in their class is heterosexual and therefore push the hegemonic norm of thinking onto their students (all students are raised by heterosexual families or all students want to date a person of the opposite sex). If a teacher or a student is brave enough to challenge this hegemonic norm, they are often seen as “pushing their agenda.” The teacher who actually tries to incorporate LGBT issues into their classroom will also struggle with finding appropriate areas within the curricula to include such material (Fifield & Swain, 2002). LGBT issues should be taught inclusively and not as add-ons to already loaded courses (Straut & Sapon-Shevin, 2002). If the curriculum is absent of LGBT topics, the school is then
responsible for adding to the marginalization of these students (Crocco, 2002). The assumption is also made though that any teacher willing to include LGBT topics must themselves be LGBT (Unks, 1995).

Many teachers must take at least one course in their training that involves multicultural education. Multicultural education can be a path towards changing schools into places of “social change, equity, and justice” (Bedford, 2002, p. 134). Even having taken multicultural courses, many teachers still do not acknowledge the existence of homosexuality in their classrooms. The lack of inclusion of LGBT students could be linked to the teacher’s negative feelings about homosexuality (Hall, 2006). People in general may not want to deal with an issue that they feel apprehensive about. Teaching anti-oppressive content not only can make the teacher feel uncomfortable about the marginalized group but also may internally trouble the teacher about themselves and their thinking (Kumashiro, 2001). Teaching about issues related to homosexuality in schools will benefit both homosexual and heterosexual youth by opening up a dialogue to help decrease homophobia (Lipkin, 1995). Heterosexual students will have an opportunity to learn more about and better understand LGBT students, which could potentially decrease prejudice and keep heterosexual students free from bigotry (Lipkin). Revealing the heterosexual privilege pervasive in schools is also crucial to helping open up this dialogue (Bedford, 2002). The heterosexual privilege refers to the power given to heterosexual students as being seen as the norm or the ideal (Chesir-Teran, 2003). The privilege can be seen in homosexual students being harassed or beaten due to their sexual identity or students not being able to express same-sex affections.
Many teachers still rely heavily on textbooks for the information they present to their students. Are science textbook writers ignorant of LGBT students and therefore they ignore their presence in the learning process? In a study of biology textbooks (Snyder & Broadway, 2004), researchers found that of the eight books examined none contained any reference to sexuality outside of the heterosexual norm except in three texts in the section covering HIV/AIDS, which is connecting homosexuality to a life-threatening disease. Based on previous articles, Snyder and Broadway were able to identify five areas (genetics, behavior, sexuality, AIDS, and inquiry and nature of science) within biology that would be appropriate realms to discuss sexual orientation. The researchers also identified a sixth area, equity, which fits with the “science for all” initiative. They found “deafening silence” in all areas of the texts and argue that non-normative sexuality is absent from them due to hegemonic and heteronormative practices.

Science textbooks also have been found to misrepresent scientific phenomena related to sexuality (Nehm & Young, 2008). Steroid hormones like estrogen and testosterone are often labeled “sex hormones,” which are then usually presented as a duality (i.e., testosterone is only found in males and estrogen is only found in females) even though these hormones can be found in both sexes. This false presentation could potentially be argued as an attempt to simplify scientific phenomena for students, but these same textbooks present other hormones as existing in both sexes. A more socio-cultural explanation of the misrepresentation of “sex hormones” can be made as well. Hormones are the biochemical determinant used to explain sex differences between males and females and are utilized in sex role justifications. If testosterone no longer
equates to “maleness” and estrogen no longer equates to “femaleness,” scientific evidence does not support current cultural sexual duality. These textbooks further add to the misconception of specific “sex hormones” only belonging to males or females. Many people in society still falsely hold the belief that gay men have more estrogen in their bodies than heterosexual men and lesbians have more testosterone than heterosexual women even though no research has ever been able to link sexual orientation with the so-called sex hormones. A scientific inaccuracy such as this presented in a science classroom could cause confusion for all students.

Teaching LGBT Students

Integration of sexual diversity into their lessons can be taught to preservice teachers just like inclusive schooling for students with disabilities (Kluth & Colleary, 2002). Kluth and Colleary recognize the five tenets of the inclusive school movement, which they argue can be applied to teaching LGBT students. These tenets include: (a) recognizing differences among students, (b) being cognizant of possible stereotypic labels, (c) preserving student dignity, (d) creating appropriate and sensitive curricula, and (e) encouraging advocacy and agency of the students as a way to teach new teachers about sexual diversity. Regardless of the method of delivery, teachers must somehow integrate their knowledge of students’ culture with the science content in order to make “science for all” (Lee, 2003).

Introductions to and discussions related to homosexuality should not be left just to the middle school or high school classroom. Elementary school students also should be introduced to the idea of sexual identity to help avoid the acquisition of heterosexist and
homophobic ideas (Sears, 1999). Letts (1999) examined the preexisting heteronormative nature of elementary school science by presenting two pedagogical instances taken from a videotaped classroom observation. The first observation reveals a male student who is chastised during a lab for not being able to hold onto a cockroach even though, as it is pointed out to him, one of the girls in his group is holding it. The boy’s feelings were not a part of normal “boy” behavior and the teacher informs him of this. The second instance is of a teacher and how her pedagogical decision was heteronormative in nature. The teacher called for same sex groups to be formed, because she felt it safer to have children of the same sex feel each other for bones in their bodies. The teacher assumed that gender and sexuality were one in the same and ignored the possibility that one of her students might be gay or lesbian (Letts, 1999).

King and Brindley (2002) completed a series of activities in an attempt to introduce elementary education students to gay and lesbian content. The activities ranged from having a parent-teacher conference with the child of a lesbian couple to classroom and group discussions of Matthew Shepard. The activities were very direct approaches to covering gay and lesbian issues, but the education students grew tired of the topic by mid-semester and an alternative, indirect approach had to be undertaken. Throughout the course several themes emerged from the student-teacher responses. Two themes in particular, teacher professional obligations and fear, illustrate the problems encountered when attempting to cover LGBT issues. The teacher professional obligations theme showed an inability to disconnect student-teacher’s personal beliefs and their professional goals of teaching the “whole child.” Pre-service teacher responses centered on avoiding
any LGBT topics that came up in class or even telling children from LGBT homes that homosexuality is wrong in God’s eyes. The overall suggestion to help alleviate these issues is to help pre-service teachers explore multiple perspectives and understand that their professional obligation as teachers comes before their personal beliefs. The second theme, fear, dealt with the pre-service teacher’s concern about potential backlash from presenting any material related to sexual orientation. The researchers point to teacher education programs as the potential problem solver for this fear. Individuals who teach pre-service teachers need to provide them with the tools to properly integrate LGBT issues into their classroom and not just tell student teachers what they should do (King & Brindley).

Teaching Science

Science is often seen as objective and not socially constructed; therefore, the information presented in a science classroom context is accepted as unbiased. Scientific knowledge may be unbiased, but the practice of presenting that knowledge is morphed by community standards and cultural practices. Fifield and Swain (2002) suggested that this feeling of objectivity makes inclusion of LGBT topics in science classrooms (and science education classrooms) very difficult. They proposed that topics about sexuality in a science classroom are not normal due to “heteronormative common sense.” Many teachers and students possess the same understanding of normal, and non-normative sexuality topics go outside of their view of “normal.” Many teachers will then opt out of including LGBT topics into their classrooms in order to keep their credibility because
adding “non-normal” topics could cause a decrease in perceived credibility (Fifield & Swain, 2002).

The science classroom is a place to review and possibly test science knowledge that has “been used to privilege or marginalize different groups” (Kumashiro, 2001, p. 7). Students should not be taught to be just blind consumers of science, but should be taught to understand how to be critical of science so that the students learn to not just accept something as a scientific “fact”. Being critical of science is a key portion of culturally relevant pedagogy, which pushes for students to develop a critical consciousness in order to challenge the status quo. Science teachers should realize the partiality of science and enlighten students to see beyond the proposed “normal.” Being able to critically evaluate scientific knowledge and practices is a large part of being scientifically literate (Norman, 1998).

Hall (2006) suggested that the connections teachers make with students are greatly influenced by their perceptions of the students. To help teachers not only overcome their own biases but to also help their students learn, Hall provided some strategies that could be used in both science and science education classrooms. Problem solving scenarios involving youth in crisis can be utilized to encourage critical thinking and positive outcome development. Diversity issues can be tackled through guided discussions to help overcome potential cultural biases. Guest speakers or multimedia formats can be used to present the narratives of LGBT individuals, which could help teachers and students see the “people behind the labels.”
For those teachers willing to include LGBT topics in their science classrooms, what information is available to them? Current research on the origins of sexual orientation indicate that both a genetic and environmental cause are responsible (Abrams, 2007), so sexual orientation is both nature and nurture. This type of information could easily be presented during classroom discussions of behavioral genetics, which would need to include examples of research involving twin studies, same sex behavior in animals, and other current research (Smith & Drake, 2001). Sexual orientation also could be used to discuss the nature of science because, like evolution, sexual orientation draws religion and science together into a debate (Smith & Drake, 2001). As with any marginalized group, the mention of well-known LGBT scientists in connection with their work as it pertains to the in-place curriculum also could help to not only introduce students to the idea of LGBT scientists but also provide role models for LGBT students (Smith & Drake, 2001). Scientists like Margaret Mead, a cultural anthropologist most known for her work in Samoa, geophysicist Allan Cox, who worked with other scientists to create an outline of the polarity changes of Earth, and Alan Turing, the father of modern computer science and creator of the Enigma machine used to decipher German codes in WWII, are just some of the examples of well-known LGBT individuals who could be mentioned in connection with the in-place curriculum.

Choosing a Science Career Path

Multiple factors go into selecting a career path, and the process is not entirely understood. Social cognitive career theory (SCCT) has been developed based on Bandura’s (1986) work covering general social cognitive theory. SCCT is a framework
that attempts to understand the processes through which people develop educational/career interests, make career choices, and achieve varying levels of quality in educational and career performances (Lent, Brown, & Hackett, 1994). The theory focuses on cognitive-personal variables, like self-efficacy, which enable individuals to direct their own actions in career decisions (known as personal agency) (Lent et al., 2002). The theory also recognizes the relationship between cognitive-personal variables and other personal characteristics (like behavior) and the context in which a person lives, for example gender, ethnicity, or support systems can augment or constrain personal agency (Lent et al., 2002).

In a study (Lent et al., 2002) which examined 19 university level students and 12 technical college students, the researchers found six reoccurring categories mentioned which influenced the participants’ expected career choices: (a) interests, (b) direct exposure to relevant work activities, (c) vicarious exposure to relevant work experiences, (d) work conditions or reinforcers, (e) confidence of ability, and (f) leisure experiences. While discussing rejected career choices, the researchers found disinterest and negative expectations involving work conditions or rewards were the most often categories cited by participants. Negative family/social influences and gender barriers were also mentioned but in low frequency.

Of the barriers that existed for the participants in their current career choice, university level students cited financial issues, personal difficulties (time management, adjustment to college), and ability concerns; the technical college students also cited the same three barriers as the university level students, but these students mentioned negative
life experiences (death of a parent, being forced to move out of the home early) which have hindered their chosen career path. Almost all participants cited social support and encouragement as crucial factors to success. Role models and mentors were mentioned with moderate frequency as being important factors of support for participants’ career choices.

Students who have a high ability self-concept in science tend to select careers in that domain (Jacobs, 2005). In a study by Lewis and Connell (2005) involving African-American students and their decisions to enroll in advanced science courses in high school, the authors suggest that even though research exists that indicates that the number of science courses taken at the high school level has a direct influence on selecting science related careers, the findings of this prior research are superficial and underlying reasons exist. Their study revealed that taking more science courses in high school was due to a preexisting interest in science related careers and the number of science courses taken was correlated with a prior interest in science. Forcing students to take additional science courses will not lead to an increased interest in science (Lewis & Connell, 2005). An earlier study completed by Lewis and Collins (2001) also found that students’ interest in science related careers was positively correlated to their understanding of the nature of science. Students with a basic understanding of the nature of science could possess a higher self-concept of ability within science, which could then foster a pre-existing interest in science careers.

Schools need to ensure that they are raising students’ self-concept of ability and interest in science as well as showing parents the importance of particular subjects to
career paths (Jacobs, 2005). Schools need to be aware of the variables that may sway a student’s career decision, such as self-concept of ability, parental influence, lack of role models known in the field, and the need to create a supportive environment (Jacobs, 2005).

A survey study (Lehtonen, 2008) of 212 Finnish lesbian and bisexual women found that less than six percent of those women avoided a career field due to perceived negative attitudes towards LGBT individuals in that field; conversely, less than six percent of the respondents selected a career field due to perceived positive attitudes towards LGBT individuals. Most of the respondents in the study stated that their sexual orientation did not influence their career choice and the possible connection between sexual identity and career seemed objectionable to them. Several participants who indicated that their sexual orientation had not influenced their career choices still made career decisions influenced by their sexual identity (i.e., specifically searching for companies to work for who have a reputation for a tolerant atmosphere). The author proposes the lack of recognition of influence of sexual orientation on career choices to be due to the fact that her lesbian respondents do not want to be defined by their sexuality and want to be thought of as individuals with a sense of independence. Admitting the influence of sexuality on career choices makes these women feel as if they lack an ability to choose their direction. Many women in the study also chose a career in which they were the only member of their gender (or one of a few), but the participants did not think this was due to their sexual orientation. 51% of the participants work in female-dominant
fields, and 16% indicate they work in male-dominant fields. The remaining respondents
work in either gender-neutral fields or are independent.

Summary

Biological sex bias can still be found in science classrooms and laboratories
across the country. The existing bias is a link to homophobia in science. LGBT students
must overcome both physical and mental obstacles in order to feel a part of their own
education. Even if these students feel safe in their classroom, most current curricular
practices especially within science ignore LGBT individuals. The potential exists to
include LGBT topics within science classroom discussions. When students start thinking
about future career decisions in science, many variables can influence their choice.
Schools need to be aware of potential factors in order to help more students enter science
careers.
CHAPTER 3

METHODS

Introduction

The following section presents several aspects of the study: research design; participants and context of study; ethical issues; data collection and recording; data analysis; validity, reliability, and trustworthiness; and researcher as instrument. Each section fully describes the research process completed and other related topics.

Research Design

A qualitative research design was implemented and results are reported utilizing case studies. Specifically, an explanatory case study strategy was conducted because these types of studies “deal with operational links needing to be traced over time, rather than mere frequencies or incidence” (Yin, 1994, p. 6). Case studies attempt to look at the whole person in order to determine emotions, thoughts, and actions in both the past and present. Case studies go beyond documenting behavior and attempt to determine why people behave as they do (Ary, Jacobs, & Razavieh, 2002). Case studies are also advantageous because they allow the researcher to give whole descriptions that contextualize the information presented (Yin, 1994). Information was collected via a demographic questionnaire and interviews, which allow for more detailed data to be gathered as opposed to conducting only survey research.
Participants and Context of Study

A purposeful sample of participants for the study was drawn, which included six individuals: 2 lesbian university level students in science career majors, 2 lesbian individuals who have recently completed science majors, and 2 lesbian individuals with established careers in science. The intent of the purposeful sampling was to identify two participants in each of the three categories. The first category, lesbian university level students in science career majors, represents individuals who are experiencing early successes with science. They have been able to transform high school interests into potential careers by further study of science. The second category, lesbian individuals who have recently completed science majors, contains participants who are new members of the workforce or graduate researchers. These individuals are more knowledgeable about science careers than those in the first category, but they are not entirely familiar with what is needed to maintain a science career. The third category, lesbian individuals with established careers in science, represent those who have had enough life and career experiences to understand what it takes to be a lesbian scientist. The three categories also represent different generations of lesbian individuals. The life experiences of participants in each category have the potential to be vastly different based on the ever-changing societal thoughts about lesbian individuals.

By interviewing two participants in each category, data can be compared within each group and then compared among groups. A snowball sampling approach was utilized; the initial individuals were identified through LGBT contacts within a large Midwestern university and large Southern university. The initial participants were then
asked to provide additional contacts in order to identify other possible subjects. Due to the difficulty in identifying an individual’s sexual orientation, snowball sampling helps to recognize potential participants who otherwise might be difficult to find.

Ethical Issues

Due to the nature of the research involving human subjects, Internal Review Board (IRB) approval was requested and received before any contact with potential participants is made. The Initial Review of Human Subjects form version 1.3 was completed along with Appendix B requesting an expedited review. A consent form for participants was provided (see Appendix C).

Because of the personal nature of the case study, the researcher must be extra diligent to strictly maintain anonymity and confidentiality. Pseudonyms for all participants, schools, and towns have been used in order to maintain anonymity for all of the individuals involved.

The case study allows for the demonstration of the interaction between the researcher and participants. The researcher should present the participant’s perspective through interview words derived by the participant (Stark & Torrance, 2005). A deviation from this would be considered unethical, and therefore bias on the researcher’s behalf could be detected (Lincoln, Guba, & Egon, 1985).

Possible relationships (supervisors interviewing subordinates, teachers interviewing students, and interviewing acquaintances/friends) between the interviewer and participant can also be detected, and these situations will be avoided to control bias.
or further difficulties outside of the research process (Seidman, 2006). The researcher has
easured that no relationship with the participants exists outside of the scope of the study.

Data Collection and Recording

A brief demographic questionnaire was completed by the participants at the
beginning of the study (see Appendix A). The remaining data for the study was gathered
via semi-structured, open-ended interviews (see Appendix B). The questions for the
questionnaire and interviews were created by the researcher, a self-identified lesbian and
former science teacher. Three university STEM education faculty members, a university
English education faculty member, and a STEM graduate student reviewed the questions
for content validity. Background information, such as personal education experiences and
sexual orientation background, and current views of being lesbian in science has been
addressed. Additional questions were added by the interviewer as each session progressed
in order to obtain complete, in-depth answers.

Demographic Questionnaire

The questionnaire serves as a tool to collect background information which is
needed in order to place the participants’ experiences in context and to distinguish the
participants from each other. By having participants complete this information outside of
the interview process, the participants and interviewer had a greater opportunity to focus
on other thought-provoking questions. The background information allows for a detailed
description of the case study participants.
Interviews

Three separate interviews per participant were conducted by the graduate student researcher, who is not affiliated with the various university science programs represented by the participants. The purpose of interviewing is to make meaning out of experiences by verbalizing them through open-ended questions (Seidman, 2006). The three interview series approach was implemented in order to allow the interviewer and the interviewee to examine prior experiences and place them in a context relevant to present and future situations. The initial interview set the context for the participants’ prior experiences; participants then provided details of their experiences during the second interview; finally, the third interview allowed the participants to reflect on the meaning of their experiences (Seidman, 2006). Each interview provides a basis for the next interview, and the researcher must be diligent to stay within the scope or purpose for each interview session. In other words, even if the participant begins to tell a wonderful story about a more present experience and the focus of the interview is supposed to be on historical background, the researcher must re-direct to the intended questions (Seidman, 2006).

All interviews were conducted in a private setting either in-person or over the telephone. If in-person, the participants were allowed to select a secure location in which they and the researcher felt most comfortable. All in-person interviews were recorded using a standard microphone and voice recorder, and the telephone interviews were recorded as well by using a tele-recorder device. The recordings were transcribed verbatim by the researcher. The interviews lasted from one half-hour to one hour and occurred over a period of approximately one month or so that no more than two weeks
passed between each of the three interviews. The time between each interview allowed for transcriptions to be completed and a copy of the transcription was provided to the participants before each subsequent interview as a member check in order to reflect on previous questions asked. The time also served as a way for the participants to think about the previous interview but not so much time that the interviewee may forget the connection between them (Seidman, 2006).

Interview Rationale

Demographic information was collected via a questionnaire before the first interview in order to keep interview one short. Any questions that arose from the demographic information were asked prior to beginning the first interview questions. The questions for the interviews are divided into three categories. The first interview deals with all personal background information and interests in the field of science. The second interview focuses upon the participants’ experiences being lesbian in educational settings. The third interview concentrates on participants’ experiences being lesbian within a science career or major and how that relates back to education. Table 3.1 (see pg 118) illustrates the connection between the research questions and the interview questions.

The questions for interview one are ordered specifically to help the researcher establish a rapport with the participants before asking about their sexual orientation, which can feel threatening. Interview two consists of more questions than the first interview, but questions 2 through 9, which cover high school experiences, are basically the same as questions 10 through 17, which cover college experiences. The number of
questions for interview three is purposefully kept short due to the probing nature of the questions being asked. These personal questions were also left until the end of the interview series in hopes of obtaining an open relationship with the participants beforehand in order to potentially increase the completeness of the responses.

Data Analysis

The interview transcripts were coded and analyzed for reoccurring themes and discrepant data within and among participants’ responses. All school experiences were compared back to Ladson-Billings concept of culturally relevant teaching (Ladson-Billings, 1994), which could impact future pedagogy in terms of LGBT students and science content. Codes based on the seven principles created by the Education Alliance at Brown University (2006) were utilized, but the resulting analysis was not beneficial. Relying on theoretical propositions is the preferred strategy for case study data analysis (Yin, 1994). A cross-case analysis of the three different groups of participants examined differences in life experiences in which they were lived. By understanding how the participants became successful with science, we could potentially alter teaching practices to make “science for all.”

Validity, Reliability, and Trustworthiness

Yin (1994) describes three criteria which must be met in order to increase construct validity in a case study: multiple evidence sources, a chain of evidence, and a review of the case study report by key informants. Evidence sources include such things as documents (demographic questionnaire) and interviews. A chain of evidence refers to the researcher’s ability to maintain all original data sources so that subsequent researchers
of the data could reach the same conclusions, or not. All questionnaire and interview data gathered was maintained in files separate from all analytical data. When the final case study report was completed, each participant was provided a copy of their case and then had the opportunity to ensure that their views were appropriately represented. Their review served as a member check.

A key challenge of case studies is internal validity (Yin, 1994). One way to achieve internal validity in a case study is through pattern-matching during analysis of the data. Participants could present similar experiences that follow patterns and lead to parallel outcomes. Coinciding patterns illustrate and strengthen internal validity (Yin, 1994).

External validity in qualitative research is based on transferability (Ary, Jacobs, & Razavieh, 2002). Case studies are often said to lack external validity because the focus is so narrow; however case studies are not based on statistical generalizations like survey research (Yin, 1994). Case studies focus on analytical generalizations as the investigator attempts to “generalize a particular set of results to some broader theory” (Yin, 1994, p. 36). By examining multiple groups and multiple individuals within each group, there exists an increased likelihood for external validity.

In order to achieve reliability of the study, the coding scheme along with a portion of the interview data and documents was provided to an outside graduate researcher. The researcher was able to apply the coding scheme and replicate most of the findings. All research procedures were documented in a coding book in order to allow for the
repeatability of the same results. The coding book provides a written record for the coding process and decision making.

Potential discrepant data was searched for across all cases. Discrepant data illustrates that the researcher did not go into the field and look only for confirming evidence (Erickson, 1986). Discrepant data found was compared back to the original assertions. Comparisons like these can help researchers from prematurely disregarding initial assertions and in altering existing assertions to coincide with data (Erickson, 1986).

Researcher as Instrument

As the researcher I understand the importance of my role in the collection and analysis of data. In order to avoid bias in interviews, I needed to ensure that I avoided making assumptions during my questioning. The questions I asked during the semi-structured protocol were framed so that no built in bias exists. Furthermore, in order to assist the reader, I have an obligation to describe my background to provide context for my situation as a lesbian science educator and context for potential conclusions in my research.

I was the younger of two children in my middle class, Michigan family. My mother became ill when I was only three years old and eventually passed away from stomach cancer just before I turned five. Her death was immensely significant and has affected every aspect of my life. As a child in school I became very interested in science. No one could tell me why my mother died, but I knew science had the answers. My goal became to learn everything I could about science to understand why she died at only 32 years of age.
At the University of Michigan I had the opportunity to take a course titled “Biology of Cancer.” In this course I learned the biomechanisms of cancer and could finally grasp what had happened so many years ago. I could not wait to pass this knowledge along to my future students.

After graduating from Michigan I spent two years at an inner-city high school teaching biology and anatomy to classrooms full of at-risk students. I tried to spend time teaching some cancer biology to the students even though the curriculum did not specifically include the topic. The discussions I had with my classes represent some of the most powerful talks I had ever experienced.

As for being a lesbian science educator, coming out to myself and others has taken years. I am out now to my friends and some family, but I chose to remain closeted while I was teaching high school. As a brand new teacher in an inner city school at the time I felt I had enough to deal with and did not want my sexuality to become a factor.

My experiences with science have shown me that LGBT individuals are ignored as both “practitioners” and “learners.” The United States needs to increase the number of individuals entering science based careers regardless of their background. I feel one of the best ways to do this is to look at groups of marginalized individuals (like lesbians) to discover why they have been successful. Understanding their successes can help to further increase the number of people entering science career fields.

I attempted to ensure that my follow-up questions to participants’ responses were not leading them to my feelings of LGBT individuals being ignored by science. The participants may feel that science is very open to all LGBT individuals and I needed to
make certain their thoughts were properly represented. I also needed to ensure that I analyzed all of the data and not just those pieces that fit with my personal biases.
CHAPTER 4

CASE STUDIES

Individual case studies will be presented in order of increasing experience with science. First introduced will be participants in undergraduate science, then participants new to science careers, and finally participants with established science careers. The participants within each of the three categories are presented in order of when the set of three interviews was completed. Within each individual case study the information is introduced within six categories: education and work history, sexual identity, entering the field of science, high school LGBT experiences, college LGBT experiences, and connecting sexuality and science. The background information (education and work history and sexual identity) is provided first to the reader to help establish a context for the participant’s experiences. Connecting sexuality and science is the last category presented because this section brings together all of the participant’s experiences. Important aspects of the participants’ stories include the factors that influenced their interest in science, the impact of high school and/or college science courses, the influence of sexual orientation on career aspirations, and their thoughts on how to increase other lesbians’ interest in science.
Participants in Undergraduate Science

The following section profiles two participants, Mary and Ann. Mary is currently an undergraduate student in engineering and Ann is an undergraduate student in nursing. Ann has earned an undergraduate degree in a non-science field and is now pursuing a science based career; therefore, Ann is still considered an undergraduate in science even though she already holds a degree. Both of these individuals hope to transform high school interests into potential careers by further study of science.

Mary

Education and Work History

Mary is a 21 year old engineering student at a large Midwestern, public university, who grew up in a large Southwestern City that felt to her more like a suburb than a large metropolis. Mary identified her socio-economic status during her childhood to be above average. The high school she attended had a student population of roughly 3,500 students enrolled, and while in high school Mary took several science courses, such as chemistry, biology, physics, and AP physics.

Mary is currently studying industrial and operations engineering (IOE) and will be graduating soon with a Bachelor of Science degree. She has taken general chemistry, two physics courses, and numerous engineering courses during her undergraduate career. Mary has participated in several research projects whose purposes range from automobile robotics to voice recognition systems for NASA.
**Sexual Identity**

Mary identifies her sexuality as lesbian and has identified this way since her senior year in high school. Before identifying as lesbian Mary points out she identified as bisexual. Due to the fact she does not express a stereotypical lesbian persona (short hair, masculine style of dress), Mary was not perceived as a lesbian by anyone prior to her coming out. She came out to her friends at the end of her high school tenure and to her parents at the end of her freshman year in college. She has slowly been coming out to the rest of her family most recently to her grandparents. Until her most recent summer internship, Mary has chosen to remain closeted about her sexuality to her co-workers. She does not have any current involvement with the LGBT communities, but she will be taking a year off in order to participate in an LGBT volunteer program. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” Mary feels she falls more towards the femme side of the continuum and she feels other people see her the same way.

**Entering the Field of Science**

A university program Mary attended during high school had the largest influence on her career choices, even though both of her parents are in science careers (physics and food chemistry). The week long program was geared towards introducing women interested in mathematics and science to engineering. Mary was compelled to enter engineering not just because of her interest in the subject but also for her “need to prove that girls can do this kind of thing.” Her passion for engineering keeps Mary interested in the field.
To this point Mary has not had to face any major obstacles except for financial issues due to the fact she is an out-of-state student at her university. Current scholarship programs for women in engineering have made it possible for her to continue her studies. Mary attributes her parents’ scientific background as the main factor for her success in the field thus far and also credits the week-long university program.

*High School LGBT Experiences*

Mary last attended high school over 3½ years ago. The few gay and lesbian students who were out in her high school mainly associate with a small group of friends and did not interact with any of the larger LGBT communities. Mary recalls students’ reactions to individuals who did come out to be handled in a very gossipy manner but not necessarily positive or negative. Her high school had a gay-straight alliance (GSA) but the group was not well known by the students at the high school.

Mary does not recall any LGBT topics being covered in the content in any of her high school courses nor in any interactions with her teachers outside of the classroom. She does recall an incident involving her computer science teacher and Mary’s topic choice for a paper:

We were required to write a journal or…just kind of a newspaper article. So we had to format it correctly on the computer and whatnot and you could fill it in with anything she suggested… so for this class I decided to write a piece…about gay marriage and a piece about Bush, kind of bashing him and his views on gays…. This woman, my teacher was very Bible oriented and I got my paper back and it said 95 out of 100 but “please come talk to me.” I said fine so I walked up
to her and I said “You wanted me to talk to you” and she said “Your ideas in this paper are problematic”…her and I and this other girl who was like bi got into a screaming fight in front of the entire classroom about how gays should be able to adopt and gay marriage should be legal. And she started yelling at me about how she is a single mother and she always tries to get men as influences for her kids and this girl and I were like…we can do that…but that was the only time in all of high school that anything gay was ever mentioned. I know it’s because I brought it up in my paper not because she felt a need to talk about it. In fact she felt the need to argue with me and my ideas. (Mary, Interview 2)

The overall lack of recognition of LGBT topics in her high school tenure did not impact Mary’s career choices. She also does not think her science teachers could have done anything to help her or other LGBT students to become more interested in science.

*College LGBT Experiences*

Mary describes her current university environment and the city in which it is located to be very “open and accepting” of LGBT individuals. She understands there are people who disagree with homosexuality, but overall the open gay population on campus does not turn many heads. LGBT content has been absent from her college science and engineering courses as well as any mention during out-of-classroom discussions. Mary has taken a course, Introduction to LGBT Studies, which followed the path of LGBT individuals from the 1800’s through present struggles for gay marriage. She is currently enrolled in a women’s studies course, Politics of Activism, which focuses on gender and often covers LGBT communities. Both of these courses have changed her career
aspirations to the point that she will be taking a year off before attending graduate school in order to volunteer in an LGBT community.

When asked what she felt could be done by her college science and engineering professors to help her or other LGBT students to become more interested in science careers, Mary states she would have loved for someone to help her make a connection between engineering and the LGBT community:

I would’ve liked to take a course on how to combine…work within the LGBT community with engineering somehow because I would be very interested in combining the two however without any knowledge on that…I don’t have any way to start it. And I’m in love with engineering and I’m not going to give it up, but at the same time I would love to be able to volunteer in that community.

(Mary, Interview 2)

She feels she would have benefited from some type of LGBT mentor who could possibly help her make these connections.

Connecting Sexuality and Science

Mary points out her sexual identity has not influenced her interests in science and engineering except for her wanting to step away from engineering in order to work within the LGBT community. Mary has not experienced any discrimination within engineering due to her sexuality, but she admits the topic does not come up very often and is absent from discussions:
I’m not saying that’s a good thing or a bad thing. I mean clearly I’d love for it to not be ignored; however, it’s better than having a negative impression inside the field. But I don’t see it ever mentioned. (Mary, Interview 3)

When asked how she thinks individuals become lesbian or gay, Mary states she is still working on the idea in her mind, but she is sure being gay or lesbian is not a choice. She feels a person’s environment can greatly influence whether or not they follow through on their same-sex attractions but the feelings are there nonetheless. Mary wishes more research would be done on the topic, but she understands the potential risk if parents were to find out before birth that their child was gay or lesbian.

She believes students in high school should be given an introduction to LGBT science issues but the topics should not be the focus. Mary feels a college science course that covered research attempting to understand LGBT scientific origins would be the best way to teach students. When asked to suggest how to help more lesbian individuals become successful in science in hopes of them choosing a science career path, Mary suggests:

I think just getting it known that there are lesbian engineers would be great. Get a support group, get a student group going. Have the GSA’s have some sort of science built into them. Were…one of the weeks the discussion topic could be science. (Mary, Interview 3)

The lesbian engineers could serve as role models/mentors for the lesbian students.
Summary

Mary is a 21 year old lesbian who came out during her senior year of high school, and is currently an undergraduate student in IOE. She identifies as femme and feels others view her the same way as well. Mary’s parents and an extra-curricular high school engineering program were key factors for Mary’s interests in science. Her only experience being introduced to LGBT topics while in high school was a self-selected paper topic covering gay marriage for a computer science course. The teacher of the course challenged Mary about the content of her paper in front of a classroom of students. While enrolled in college, Mary experienced LGBT topics being covered during courses taken within her university’s women’s studies department. She has never experienced explicit coverage of LGBT topics or individuals while enrolled in either a high school or college science course. Due to her inability to connect her chosen career path (engineering) with her sexual identity (lesbian), Mary is taking a year off from her career in order to volunteer for the LGBT community. Finally, Mary feels mentors would help to increase the interests in science for other lesbian students.

Ann

Education and Work History

Ann is a 27 year old student currently attending classes at a Midwestern Community college with hopes of transferring to a local nursing school in order to obtain a Bachelor of Science in Nursing. Ann grew up in a suburban Midwestern town with a population of over 50,000. She identified her socio-economic status during her childhood
to be above average. While in high school, she took several science courses: two biology courses, two chemistry courses, two physics courses, genetics, physiology, and zoology.

Ann attended a small, private, Midwestern liberal arts college for her initial undergraduate degree. She began taking science courses to possibly pursue a science degree, but then realized after taking English courses she wanted to switch her focus. Ann was not impressed by the science faculty at her university and found herself bored at the repetitive feel with the curriculum when comparing her high school science courses to her college science courses. She found herself truly enjoying her English courses because English was new and interesting to her. Ann eventually earned a Bachelor of Arts Degree in English Literature and Studio Art. She states her switch back to a science career is due to her having a “better grasp” of what she wants to do for her career and feeling freedom with her choices. Ann works in corporate insurance now and has recently taken several science courses at the community college such as, general chemistry, organic chemistry, and microbiology.

**Sexual Identity**

Ann identifies her sexuality as gay and has identified this way since 2002 (her junior year during her first degree). Some lesbians interchange the term “gay” for “lesbian” with no intention of implying any particular gender leanings. Ann admits before this time she did not have a label for her sexuality, and she recalls coming out to a small group of friends during a spring break vacation and upon returning to her college she came out to the rest of her campus friends. She revealed her sexual identity to her sister at the same time, but did not come out to her parents until a year later. Ann
remembers during high school she broke up with a boy she had been dating, and this boy told everyone she was gay to get back at her. Even though at the time she did not identify as gay, she still lost friends, and her mother began to pray for her sexuality. Ann points out she felt tension with her parents ever since this incident, and her coming out to them in college was a sign for them to stop thinking about her sexuality. She is out to her co-workers on a case-by-case basis but admits her style of dress and hair are stereotypically lesbian and no one has been shocked by her revelation.

Ann was involved with the gay-straight alliance at her first undergraduate institution, but now she is not actively involved in any LGBT organization. She attends LGBT events like drag shows and Gay Pride Festivals. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” she feels she falls somewhere in the middle:

I would definitely say my personality would be categorized [in the middle] but I do tend to wear pants. I don’t wear dresses. I have short hair. Going back to the question of do people know you’re gay before you were I would say I get “Sir’d” a lot but my friends don’t see why that happens. So I think it depends on how well you know me.” (Ann, Interview 3)

Ann represents a butch style, but she feels her personality contains a more femme side when compared to her outward presentation.

*Entering the Field of Science*

Ann attributes her initial interest in science to the push in STEM fields for more female involvement. She felt she was listened to in her science classes and she was also
presented with many opportunities to attend science camps due to her close proximity to a large university. Her female physics teacher and male genetics teacher made an impact on Ann by trying to connect the content to everyday experiences of a teenager. Ann maintains interest in science because she sees it everywhere; she feels science is tangible. At this point in her career, she feels the biggest obstacle she has had to overcome is personal direction in understanding what she wanted to do for a career. Active and passionate teachers are the main factor for helping Ann to become successful in science:

I think I was lucky to go to a high school were the teachers were also really interested in what they were doing and fostered following through beyond the classroom. (Ann, Interview 1)

She feels that teachers need to encourage students to want to learn more than what is required by the classroom curriculum.

*High School LGBT Experiences*

Ann last attended high school almost ten years ago. She feels gay males were accepted in her school due to contemporary televisions shows like Will & Grace. She only recalls one openly gay female and felt at the time lesbians would not be as accepted as gay men. She feels her community at school did not have a place for lesbians.

Ann does not recall any LGBT topics being covered within the content of lessons taught by any of her high school teachers, but this did not impact her career decisions in anyway because she did not identify as gay until college. She also spent time with her teachers outside of the classroom participating in various extracurricular activities like volunteering and quiz bowl. The teacher who ran both of these programs, Ann’s
psychology teacher, would often make references to “...things... ‘as queer as a three dollar bill.’” The psychology teacher also told stories of a male teacher he had who would give him candy and make passes at him and how uncomfortable the situation made him feel. At the time Ann admits she did not think much of those statements but as she looks back now she perceives he had a problem dealing with and understanding issues of sexuality. She does not recall any of her other teachers making any mention of LGBT topics outside of the classroom, but once again this situation did not influence her career aspirations.

When asked what she felt could be done by her high school science teachers to help her or other LGBT students to become interested in science, Ann feels teachers should show excitement and encourage out-of-school science interests in their students. She states this is not exclusive to gay and lesbian students only, but applies to students in general.

College LGBT Experiences

When looking back at her first undergraduate institution, Ann feels the environment was very open and welcoming and there were many openly gay couples and faculty. She did not have any interactions with her professors outside of the classroom, so any potential LGBT discussion she might have experienced had to be in a classroom situation. She does not recall LGBT topics being discussed in any of her science classes, but she does recall the topic coming up in her English literature courses at the liberal arts college. She was able to read and study works by gay and lesbian authors and content that involved gay and lesbian characters, which was presented to her by openly gay and
lesbian professors. Ann points out this exposure to LGBT content and individuals helped her:

I think it just let me know once if I did identify as gay that it was fine and that gay and lesbian, whether its writers or scientists or whatever, could create the same output as straight or other individuals. I think it just made me feel okay that there were gay and lesbian teachers and they were fine and they were the same basically as everyone else. (Ann, Interview 2)

She feels her college science professors could not have done anything to help her maintain early interests in pursuing a science career path, and any LGBT content inclusion would not have made a difference.

Ann feels the students at her college now do not really care one way or the other about LGBT individuals. She attributes this to the core group of students being older. She has not experienced any mention of LGBT topics or individuals in her courses or outside of the classroom at her current institution.

**Connecting Sexuality and Science**

At this point in her career, Ann feels her sexuality has not influenced her interests in science, but she recognizes the fact her sexuality could expose her to different experiences than if she was heterosexual. She also states she has not experienced any discrimination in the field of science due to her sexuality.

When asked how she thinks individuals become lesbian or gay, Ann suggests:

I think they’re born lesbian or gay and either realize it and choose to embrace it or choose to ignore it and live without following that path. I don’t think I chose it
nor would I have chosen it for the fact that it’s difficult but I wouldn’t suppress it because that’s not only unhealthy but I’ve had a great life as a lesbian. I have wonderful lesbian friends so…luckily I, for whatever reason, chose to embrace it and be who I am. But I think definitely people are either gay or straight or whatever the label might be they are what they are and they choose to live that way or not. (Ann, Interview 3)

She feels the portrayal of scientific evidence and research regarding the origins of sexuality is often presented as though “an accident” occurs either in utero or genetically as though these processes are not presented as normal occurrences. Being LGBT is a mistake.

She believes gay and lesbian topics should be covered in high school and college science courses because people are beginning to recognize at younger and younger ages that they are not heterosexual. She feels this inclusion would give students potentially struggling with their sexuality something to connect to. While Ann feels these topics could be easily covered within a college science course by having open-ended discussions on current research, she understands the difficulty of trying to create the same openness in a high school classroom. Ann concludes:

I think if you start children or high school students thinking about these topics scientifically more than religiously or…more opinionated side of it, if you start it in the school system, people might be more open to it and say “hey we talked about it in a science class we didn’t talk about this at church we talked about it in
science class.” And it might be more open to seeing it as something that just happens rather than something someone chooses. (Ann, Interview 3)

Ann feels advice should be given to lesbians thinking about pursuing a science career path. She thinks people need to understand you cannot stop the pursuit of a career path just because you may think others will make life difficult on you due to your sexuality. She feels people need to get over their “internal struggle” with what career path to choose and follow their interests.

Summary

Ann is a 27 year old lesbian nursing student, who came out when she was 20 years old while enrolled in her first undergraduate program during her junior year. She identifies as being in the middle of the butch/femme continuum and feels others view her the same. She credits her parents and an extracurricular high school science program for fostering her interests in science. Ann feels her high school science teachers connected their lesson plans to her real life and therefore she feels those courses impacted her interests in science. Ann did not experience any coverage of LGBT topics during her high school curriculum, but she was exposed to LGBT topics during college while enrolled in literature courses. Ann feels her sexual orientation may influence her chosen specialty within her nursing career, but to this point her sexual identity has not influenced her career decisions. Finally, Ann states lesbian students should be given advice about following their interests and not allowing their sexual identity to influence their career choices; she feels this advice could help increase science interests in other lesbian students.
Participants New to Science Careers

The following section discusses the background and experiences of Kate and Jen both of whom are currently medical students. As medical students they are being introduced to science (medicine) as a career. The third and fourth year of medical school requires students to begin engaging with patients and other medical professionals, and even though they have minimal responsibility Kate and Jen are now being treated as doctors. As stated earlier, these individuals are more knowledgeable about science careers than those in the first category, but they are not entirely familiar with what is needed to maintain a science career.

Kate

Education and Work History

Kate is a 26 year old 3rd year medical student at a large Midwestern University. She lived in a small suburb in the Southeastern U.S. until age 11. She then moved to another Southern suburban town for a year, and finally her family settled in a suburban Midwestern town close to where she currently attends medical school. Kate identified her socio-economic status during her childhood to be above average. The high school she attended had roughly 1,000 students enrolled. While in high school she took several science courses: college preparatory earth science, biology, chemistry, astronomy, physics, AP biology, and AP physics.

Kate attended a large, private university located in the Southeastern U.S. for her undergraduate education. She studied biomedical engineering and chemistry and took numerous science courses in the process: biology, general chemistry, physics, organic
chemistry, biomaterials, models of cell systems, genetics, cell biology, biochemistry, 
electrobiology, tissue engineering, cell mechanics, and transport phenomena in biological systems. Kate also worked on a research project as an undergraduate engineering fellow and completed a senior thesis.

Not long after graduation, Kate began attending medical school. She has taken a year off from medical school in order to complete research as a fellow with the National Science Foundation (NSF). She plans on completing her residency in Internal Medicine with hopes of continuing her medical research career.

Sexual Identity

Kate identifies her sexuality as lesbian. She first began identifying this way when she was in 9th grade in high school and has never identified her sexuality in any other way. She began coming out to her friends when she was a junior in high school, and did not come out to her family until the week before she left home to attend college. Kate states she has been open about her sexuality to her co-workers during her NSF fellowship and at medical school. She admits she was perceived as lesbian prior to her coming out by teammates on her high school softball team during her sophomore year. Nothing was said directly about her sexuality, but Kate’s teammates would tease her about being “in love with [the] assistant softball coach,” which she now admits to be true.

She is now involved with the LGBT group at her medical school, but she reveals she was very closeted at her undergraduate university due to the conservative nature of the school. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” Kate feels she falls somewhere in the middle and possibly closer to
the “butch” side of the continuum, and she thinks other people perceive her the same way.

**Entering the Field of Science**

Kate states her initial interest in science is due to the influence of her father who is an industrial engineer. He encouraged her to select a major in college in which she could get a job, and he did not support “abstract things like art or music” unless they were a part of an extracurricular activity. During Kate’s high school career, her AP physics teacher was responsible for continuing her science interests. Her teacher ran both Science Olympiads and a group called Team Physics, who would go to local elementary schools and perform physics experiments for the students. Kate points out:

> He was just very much a guy who always took the extra effort to make science apply to something. He would like give us real world examples and there again he was a guy who said science was definitely a pathway where you are in demand and you can get a job and its interesting. And to me that was something that was nice about it you know it felt like there’s a lot of opportunity and a lot of stability. (Kate, Interview 3)

Science maintains Kate’s interests due to her curiosity because she feels you can never master it; there is always something new to learn. She adds, “I worked at the NSF last year and there were 70 year old guys, retired professors that were asking questions and trying to learn about different science phenomena. So I thought that was neat.” (Kate, Interview 1)
Kate reveals her biggest challenge in getting to this point in her career to be the difficulty of her undergraduate major, which she attributes to her feeling as if she was in a “man’s world.” She points out her engineering classes were roughly 25% female and she only had one female engineering professor during her entire undergraduate tenure. She states:

There was something about the culture that made it seem it was sort of like a hard-ass field…they didn’t go out of their way to offer extra help. They didn’t go out of their way to sort of…ask if you had questions…It just wasn’t like any sort of nurturing environment. It just kind of felt like it was very cold. And it’s probably unfair to…attribute that to there being so many men in the field but it just felt different. I actually did have a very good female electrical engineering professor and she…her class had a totally different feel. It was actually one of the classes that made me stay in engineering. And I think had I had…a little more exposure to women in the field it would have been a little bit [of] a different major. (Kate, Interview 2)

The factors Kate attributes to her success in the field of science are very good professors and great teaching assistants in college and her own strong work ethic.

*High School LGBT Experiences*

Kate graduated from high school almost eight years ago. She believes the image of LGBT individuals held by the student population in her high school at that time to be negative. She attributes this to several lesbian teachers and staff members, who were very masculine and very strict with the students, which she feels tainted the image of LGBT
individuals. She goes on to state that these teachers were not open about their sexuality but rumors led the students to believe these teachers were lesbian. Kate has a younger sister currently enrolled in the high school and Kate now knows these teachers personally and knows that they are lesbian. She points out the teachers are not allowed to be open about their sexuality, but she is unsure if this is due to an unwritten rule or an actual mandate put forth by the administration. Kate’s sister is also gay and Kate has been able to see a change in the attitude of the student population towards LGBT individuals through her sister’s experiences.

Throughout her high school courses, Kate only remembers LGBT topics coming up during sexually transmitted disease (STD) lessons taught by her health teacher and possibly in one of her English courses when they read Walt Whitman and Emily Dickinson. She feels her high school was fairly conservative and LGBT individuals and topics were a “taboo subject.” Kate maintains the lack of inclusion of LGBT topics did not influence her career aspirations due to the fact that at the time she kept her sexual identity completely separate from her professional ambitions.

She spent a great deal of time with her teachers outside of the classroom being involved in Science Olympiads, Team Physics, mock trials, and softball. During all of these interactions she reveals LGBT individuals or topics were never mentioned by any of the teachers. She states, “I’m pretty sure you know in high school it would have been such a big thing if someone would have brought it up but I think I would have remembered it.” When asked if this influenced her career aspirations in anyway, Kate refers back to her sister:
Probably because now I see my little sister who is interested in government and
interested in…the law and interested in…policy making and she’s gay. And I
think she has a little bit more of the activist streak in her and I think it might be
because she was sort of exposed to the gay culture at a younger age. But for me
even the lesbian and gay teachers at my high school, they were closeted while at
school so it never really occurred to me that you could connect, you could link up
sort of your career with your sexual orientation or that somehow…the two things
are related. And I guess now I feel like kids in high school who are gay that’s part
of their identity and it does sort of factor into the career choice but for me that
wasn’t the case. (Kate, Interview 2)

Kate suggests in order to encourage more LGBT students interested in science
high school teachers should stay away from textbooks and make science hands-on, which
made her really enjoy the science courses she took.

*College LGBT Experiences*

When asked to describe the image of LGBT individuals held by the student
population in her undergraduate college, Kate claims that the students were divided on
the topic:

There’s a huge subset of very conservative sort of fraternity and sorority college
students at [my undergraduate university] and their impression of LGBT members
is very negative. I was actually called you know ‘dyke’ walking around on
campus at some point. And then I think there’s a small undercurrent of liberal
students [who] were extremely accepting of LGBT students, just more progressive in general. (Kate, Interview 2)

She feels her undergraduate university was more conservative than her high school, which she assumes is often the opposite of most LGBT people’s experiences.

Kate only recalls LGBT individuals or topics being discussed during a 19th Century American Literature course when the students read Walt Whitman and attempted to use his lens to see the experiences of a gay man. Once again, she feels the lack of inclusion did not alter her career aspirations because she has only recently been able to understand a possible connection between her sexual orientation and her professional goals.

Kate had the opportunity to spend time with her female electrical engineering professor outside of normal office hours due to that fact that they were both on the same softball team. She discovered her professor had a lot of gay friends who were also on the team and Kate feels this was a very positive experience for her and her career aspirations even though her professor identified as heterosexual:

I think it was nice to see that, a woman who was not sort of a stiff who could make it in electric engineering. She was tenured faculty and she was at a pretty conservative university and that didn’t really jutapose with her views. She was successful anyway. (Kate, Interview 2)

When asked what she felt could be done by her college science professors to help her or other LGBT students to become more interested in science careers, Kate suggests:
To recognize that maybe I felt a little bit out of place and I could’ve used some extra counsel, could’ve used some extra attention I think in some of my science classes. I think just encouraging me to be a little more open [about my sexuality] in college probably would have changed my experience a lot and I’m sure that would have carried over into my classes and my interests in science as well…I just wanted to suppress my sexuality in college. (Kate, Interview 2)

Kate continues:

I think when you’re not completely out with who you are especially in college when you’re trying to find your way it makes you a little more tentative in everything in your life including your classes, including extracurriculars. It’s just hard to get to know people. It’s hard for your professors in their classes to get to know you and you feel you can’t be entirely open. (Kate, Interview 2)

Kate was able to compare her undergraduate experience being closeted to her medical school experiences where she has been open about her sexuality from the beginning. The medical school she attends has several open gay faculty members, who serve as role models to the students and Kate feels the environment is nurturing to her growth as a lesbian doctor.

Connecting Sexuality and Science

Kate admits she has difficulty understanding how her sexual identity has influenced her interests in science. She proposes the masculine feel of science and the perceived difficult nature of science made the topic appealing to her. She felt “it was sort of this guy’s world I can go into and conquer.” Kate goes on to state when a person
realizes their sexual identity is different from the majority of other people it is not a huge step to also have differing career goals as well.

Kate points out she never felt any discrimination from her undergraduate science professors, but she did feel some hostility from the students in her classes. She adds her engineering courses contained mostly men and many of those men were involved in the socially conservative fraternity groups on campus. She felt she did not fit in at all with the students and the environment felt hostile due to her sexual identity.

When asked how she thinks individuals become lesbian or gay, Kate explains:

I think it’s a combination of nature and nurture. I think there’s probably a genetic predisposition and I think there’s probably something that goes on environmentally and whether that happens…in the womb during development or whether it happens early on in child development. I think there’s a combination of things. (Kate, Interview 3)

Kate admits she does not spend a lot of time thinking about the scientific basis for gay and lesbian individuals. She understands she is lesbian and knows she could be nothing else.

Kate thinks the scientific ideas about gay and lesbian individuals should be included in both high school and college science courses. She feels this would fit well during nature vs. nurture content, and due to its controversial nature the subject would help to pique student’s interests.
When asked to suggest how to help more lesbian individuals become successful in science in hopes of them choosing a science career path, Kate turns her attention to role models and creating nurturing environments:

I think one good way is for obviously for there to be role models…for there to be successful gay or lesbians whether its high school teachers or whether its college professors who are in the field and obviously…you can see them and model yourself after them. I think another way is just for there to be a lot of nurturing in high school for kids confidence. I think the sciences are a little bit intimidating especially in high school for kids who aren’t as confident and aren’t as willing to challenge themselves and maybe a little gun shy. I don’t know that they’re going to jump right in to difficult science classes and…take on that challenge. They’re more worried about their social image; they’re more worried about…taking the easy way out because other things are hard. (Kate, Interview 3)

The presence of role models could help create the more nurturing environment which Kate feels is necessary.

Summary

Kate is a 26 year old lesbian, third year medical student, who came out when she was 15 years old, and she feels she falls in the middle of the butch/femme continuum. She credits her father, teachers, and personal traits for her interests in science. The only coverage of LGBT topics Kate experienced while in high school was during an STD lesson in a health class, and during college she covered LGBT topics and individuals while enrolled in a literature courses. Her sexual orientation did not influence her career
decisions, but she now understands due to her sister’s experiences how the two can intertwine. Kate feels introducing role models to lesbian students would be a great way to increase their interests in science.

Jen

Education and Work History

Jen is a 28 year old fourth year medical student at a large Southern University. She grew up in a Midwestern college town with a population of roughly 250,000. She identifies her socio-economic status during her childhood to be above average. The high school she attended had over 2,500 students enrolled, and while in high school, Jen studied science for three years: biology, chemistry, and physics.

Jen attended her hometown university for her undergraduate degree, which was a Bachelor of Arts in Psychology. During this time she took one chemistry course and focused mainly on social sciences. Jen also worked as a research assistant for projects in both the psychology department and the neuropsychology department. After graduation Jen decided to follow a career in medicine and moved to the Western U.S. to take her remaining prerequisite courses for pre-med. Her pre-med courses consisted of one year of chemistry, one year of organic chemistry, one year of biology, and one year of biochemistry.

Upon completion of her prerequisites, Jen was admitted to her current medical school from which she will soon be graduating from. She will soon begin the physical medicine and rehabilitation (PMR) residency program at this same school.
Sexual Identity

Jen identifies her sexuality as lesbian and has identified this way since she was 19 years old. Before this time, she identified as straight. She came out to her family and friends at roughly the same time. She has only been out to her co-workers during medical school which began for her in 2005. Jen points out a family friend perceived her as lesbian when she was only 17 years old, but she states at the time she did not believe her. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” Jen feels she is considered to be femme and other people perceive her the same way.

Jen used to be involved with LGBT organizations while at her first undergraduate institution. She participated in a lesbian discussion group and attended rallies and other LGBT events. She attended one gay-straight alliance meeting while in medical school but found the organization catered more towards LGBT individuals who were just coming out.

Entering the Field of Science

Jen feels her initial interest in science was due to the science courses she took while in high school. She finds science to be challenging and enjoys the changing nature of the topic. Jen’s mother, who is also a physician, has served as a role model for her and has encouraged Jen’s science interests but did not push the medical field upon her. After initially wanting to pursue a career in psychology, Jen became involved in a research project during her senior year of college, which covered cognitive mobility and utilized functional MRI images. She found herself more interested in the medical aspects of the
project versus the psychological aspects and eventually decided to pursue medicine. After entering medical school, Jen found a lesbian physician who now serves as a role model and person of support for her. She also credits good educational support and her own hard work and determination.

The two biggest challenges Jen has had to overcome in getting to this point in her career were a language-based learning disability and a pre-med advisor at her undergraduate institution during her freshman year who told her she could not attend medical school due to the fact she was a woman. She describes her disability as follows:

When I was in college I was diagnosed with a language-based learning disability. Mostly this means I read slow and have poor comprehension. In school I overcame this after accommodation during test taking, but the NBME [National Board of Medical Examiners] would not accommodate me on the MCAT [Medical College Admissions Test]. This was a challenge both emotionally and academically. I didn’t finish the MCAT in the time allowed, but apparently still did well enough to get into medical school. (Jen, Interview 1)

Jen points out the pre-med advisor she encountered was a much older man who she felt was obviously out-of-date. The advisor told her that she could not have both a family and attend medical school; she would need to choose to either raise a family or be a doctor.

High School LGBT Experiences

Jen last attended high school 10 years ago. She states lesbian and gay individuals were accepted at her high school but they were not openly discussed. Jen recalls attending prom with several friends and a female couple being a part of the group.
Jen remembers LGBT topics and individuals being brought up only once throughout her entire high school tenure. Her psychology teacher mentioned LGBT individuals during a discussion on different types of family units. Jen does not recall specific details but felt the overall tone of the discussion to be neutral. The lack of inclusion of LGBT individuals and topics did not have any influence on her career aspirations nor does she feel her teachers could have done anything to help her or other LGBT students to become more interested in science.

**College LGBT Experiences**

Jen’s first undergraduate institution was very accepting of LGBT individuals:

There was a lot of publicity on campus about LGBT events and there were a lot of rallies, a lot of activism going on. And people were involved in these and the students that weren’t involved for the most part were accepting of them. And I mean there were always the few that were rallying against the rally that was for LGBT activism but for the most part I think people were pretty accepting and open to it. (Jen, Interview 2)

Jen experienced LGBT individuals and topics covered throughout the curriculum of the various courses she took during her undergraduate career. She self-selected a LGBT topic, theories of biological versus environmental influences on human sexuality, for a paper in a bio-psychology course. LGBT topics were also covered in her women’s studies courses and various psychology courses. Jen feels this coverage of LGBT topics did not directly influence her career aspirations, but she feels the attention given to the
topics made her more comfortable about herself and gave her the confidence she needed in order to pursue a science career path.

Jen did not spend much time with her professors outside of the classroom except for her psychology advisor. She recalls having personal discussions with this professor about experiences living a “non-traditional lifestyle,” but these discussions did not have any influence on her career choices. She feels her college science professors could have been more supportive of students attempting to enter the medical field and all students could have benefited from more general guidance from the science professors.

*Connecting Sexuality and Science*

Jen feels her sexual identity has not influenced her interests in science in any way. She also has not felt any discrimination in the field of science due to her sexuality, but she does admit to trying to keep her personal life and career separate in order to avoid any potential discrimination. She points out this purposeful separation would be for any career and not just a career in science.

When asked how she thinks individuals become lesbian or gay, Jen states:

I don’t think that it’s a choice that you get to choose whether or not you’re going to be gay or straight but that you’re born one way or the other. And then you grow up in an environment that either allows and accepts that or forces you to adopt a heterosexual identity even if that’s not your true identity. (Jen, Interview 3)

She feels if an actual scientific marker could be identified the potential for LGBT individuals to understand themselves more exists, but she also understands the potential for discrimination by others in which people would try to “fix” or “change” their
sexuality. Jen thinks this type of inclusion of LGBT topics in high school should be left for health classes, in which the topics could be covered in either a very neutral or positive way.

When asked to suggest how to help more lesbian individuals become successful in science in hopes of them choosing a science career path, Jen states:

I would say to not give up on what their passion is if they feel like there’s not a lot of other people like them in the field because they will find other lesbians that are in science and that they are still capable of having a science career regardless of what their sexual orientation is. (Jen, Interview 3)

Even though she does not state it directly, Jen is referring to the need for role models for young lesbian students.

Summary

Jen is a 28 year old lesbian, fourth year medical student, who came out when she was 19 years old, and she identifies as femme. Jen’s mother, personal traits, and mentor were key factors which influenced her interests in science. During high school she was introduced to LGBT topics while enrolled in a psychology course, and she also experienced coverage of LGBT topics in college while taking both women’s studies courses and psychology courses. Jen’s sexual orientation has not influenced her career decisions in anyway, but she feels other lesbian students might increase their interests in science if they knew other lesbians were successful in the field.
Participants with Established Science Careers

Both of the individuals in this category, Amy and Liz, have been working in a science career for more than five years. They are established in their career and have an understanding of what it means to be lesbian and to be in science. They are the oldest participants in this study and their experiences as a lesbian may differ from those participants in the previous categories.

Amy

Education and Work History

Amy is a 30 year old, pathologist assistant currently living in a large Midwest City. She grew up in a small rural community and identified her socio-economic status during her childhood to be below average. Amy attended a high school which had a student population of roughly 800-900 students. While in high school, she took several science courses: biology, advanced biology, physics, and chemistry.

Amy attended a large Midwestern public university and studied anthropology-zoology for her undergraduate degree. Biology, anatomy of chordates, inorganic and organic chemistry, and spring flora were some of the courses she completed for her degree. During her undergraduate education, Amy worked for the university’s natural history museum (mammal division) where she prepared skeletons and skins for the museum collection.

Upon graduation Amy began working for the hospital’s pathology department at the same university. She was responsible for accessioning and grossing small surgical specimens. Amy left the hospital to attend graduate school at a large, urban, Mid-Atlantic
university. She studied anatomy, pathology, microbiology, embryology, autopsy, and histology while earning a graduate degree in pathology.

After completion of her graduate degree, Amy moved to the large Midwest City where she currently resides. She began working immediately for a community hospital as a pathologist assistant and eventually moved on to another community hospital in the same city. Amy’s job duties include dissecting, describing, and submitting diagnostically important sections of surgical specimens. She also performs autopsies, which includes external and internal examination, evisceration, prosection, removal of the brain, organ evaluation and dissection, and submission of relevant sections for microscopic diagnosis. She has over five years experience in her field.

Sexual Identity

Amy identifies her sexuality as lesbian. She first began identifying as lesbian when she was 18 years old and has never identified her sexuality in any other way nor was she perceived to be lesbian by others prior to her coming out. Amy started the coming out process to her friends when she was 18. At the same time she also slowly started to come out to her family members, a process that took nearly two years. Amy has always been open about her sexuality at all of her places of employment. She is involved in the LGBT community wherein she participates in events such as fund raisers. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” Amy states she normally does not categorize herself that way, but she feels she would be somewhere in between. She also feels other people perceive her as in the middle of the continuum as well.
**Entering the Field of Science**

Amy feels her family specifically her parents were the most responsible for influencing her science career choices. They encouraged her to do what she wanted and also to do well in school. Amy points out her interest in science and science courses in high school led her initially into the field. Science maintains her interests because “you always get to learn something new because it’s always growing and changing.” Amy states the biggest challenge she has had to face in her career so far is just getting into the program which she needed in order to become a pathologist assistant. When she initially applied to graduate school, there were only four programs in the country who offered her degree. Amy feels desire is the factor which aided her the most to become successful in the field of science, “desire is the big thing because anybody can…say that they’re interested …but actually doing it and saying it are two different things.”

**High School LGBT Experiences**

Amy attended high school almost 12 years ago. She feels the image of gay and lesbian individuals held by the student population in her high school was extremely negative. Amy did not know anyone in high school who was out, but she does remember any mention of gay or lesbian individuals always being presented in a very negative manner. Amy recalls an incident during one of her classes involving a fellow student:

I remember in particular one kid that I’m friends with now, I mean he’s a wonderful kid but, he said something about…bringing this up in class and the teacher…was in on the conversation that all fags should be put on an island so that they all die. (Amy, Interview 2)
The teacher did not reprimand the student. Amy states, “It was not good to be gay at my high school.”

She does not recall any LGBT topics being brought up in the classroom content during her high school years. She points out, “And I think I would have remembered because I would’ve been like ‘Woo. Yeah. Gay people.’” Amy feels this lack of inclusion did not have any influence on her career aspirations because she does not believe it is relevant. She states that a person’s career choice should be influenced by interest and not sexuality.

Amy spent time with her teachers while involved in various after school activities such as softball, basketball, and study groups. Amy’s father and step-mother also worked for her school district and due to this situation Amy spent time with her teachers outside of normal school activities. With all of her contact with the teachers outside of the classroom, Amy states gay and lesbian individuals were never discussed. Once again, she feels this had no impact on her career aspirations because she has been interested in science since she was young.

When asked what she felt could be done by high school science teachers to help her or other LGBT students to become interested in science, Amy feels having someone as “a positive influence” and someone a student could relate to might help bring in individuals that do not have an innate passion for the topic as she does.

*College LGBT Experiences*

Amy describes the image of gay and lesbian individuals by the student population of her undergraduate college as a mixture of positive and negative. She feels most of the
people were very supportive of the LGBT community, but she did experience some negative situations. For example:

My freshman year I lived in the dorms and we were all trying to decide where we were going to live the next year when we were sophomores. So a bunch of us were going to live in a house with some kids, some boys that lived on like a different floor in our dorm. And then…all of a sudden the plans totally changed and we weren’t going to do that anymore. I was like okay, whatever…didn’t really care one way or the other. And then I found out like a week later that that happened because one of the boys was like “I don’t want to live with that fucking lesbian,” referring to me. (Amy, Interview 2)

Amy feels overall she did not have too many negative experiences due to her sexuality.

She did not have any interactions with her professors outside of the classroom, so any potential LGBT discussion she might have experienced had to be in a classroom situation. She does recall LGBT topics being covered in the content of the lessons taught by a couple of her college professors. Amy recollects discussing sexuality while enrolled in a primate behavior course, which at the time was focusing on Bonobo interactions. She also remembers LGBT topics coming up in a women’s studies course. Even though Amy experienced the inclusion of some LGBT topics in college she states the inclusion did not influence her career aspirations in any way.

When asked what she felt could be done by her college science professors to help her or other LGBT students to become more interested in science careers, Amy referred back to her response when asked the same question about high school science teachers.
She feels a mentor might help certain students, but for her it would not have made a difference.

*Connecting Sexuality and Science*

Amy indicates her sexual identity did not impact her interest in science and that her sexuality and interest in science are completely separate from each other. Amy also states she has never experienced any discrimination in the classroom or work environment based on her sexual orientation.

When asked how she thinks individuals become lesbian or gay, Amy points out:

I think that people just ARE. I don’t think it’s about becoming something because that to me implies that you were not that before. I think that…I never really felt like I was not gay. I think it’s more of people coming to be okay with it or accepting of it in themselves and then actually experiencing it as a lifestyle as opposed to deciding that they are or are not gay. They just…accept it in themselves. Or recognize it in themselves. (Amy, Interview 3)

She feels hormones and not an anatomical structure are the scientific basis for lesbian and gay individuals.

Amy believes these ideas about sexuality (specifically gay and lesbian sexuality) should be included in both high school and college courses:

I think it’s important to discuss the nature of homosexuality because obviously when kids are in high school especially, there are questions about it because they’re not sure… what’s going on with themselves. So I think that it’s important to discuss it because otherwise kids are going to not understand it as well or come
up with their own…idea that may be not be sure [meaning incorrect], so I think that facilitating that in some way would be good. (Amy, Interview 3)

While she is unsure as to how the topic would fit into the curriculum, Amy feels the discussion belongs in a science course.

When asked to suggest how to help more lesbian individuals become successful in science in hopes of them choosing a science career path, Amy explains having more people be open about their sexuality would help: “I think like if you had someone you admired or…felt you could relate to as a gay or lesbian individual it would help encourage you to pursue…certain career paths.” She acknowledges the potential difficulty for some teachers to be open about their sexuality but feels their openness could help students.

Summary

Amy is a 30 year old lesbian pathology assistant, who came out when she was 18 years old, and she identifies as being in the middle of the butch/femme continuum. Amy credits her parents and personal traits for establishing and maintaining an interest in science. She did not experience any coverage of LGBT topics while in high school, but she did explore LGBT topics in a women’s studies course and during a course on primate behavior while enrolled in college. Amy feels her sexual orientation has not influenced her career decisions in anyway, and she feels sexual identity and career choice are separate issues; however, Amy feels other lesbian students could have an increase interest in science if scientists and teachers were more open about their sexuality and therefore give the lesbian students someone to emulate.
Liz

Education and Work History

Liz is a 36 year old, intensive care unit (ICU) nurse currently living in a small southern suburban town. She grew up in the same town in which she currently resides and identified her socio-economic status during her childhood to be below average. Liz attended the county high school for only two and a half years before dropping out and eventually earning a GED. She described herself as a “stubborn teenager” who did not like attending school or studying and specifically did not enjoy getting up early. Liz also admits to participating in what she describes as “illicit activities” as a teenager, which added to her dropping out of high school. Her parents agreed to her dropping out on her 16th birthday as long as she agreed to obtain a GED, which she accomplished as soon as she was allowed to take the exam. During her short high school stay, Liz took one science course, biology.

Liz began working at a nursing home when she was 16. She worked as a nursing assistant at the same home for 12 years. Towards the end of that time she was only earning eight or nine dollars an hour and she felt she needed to earn more money. Liz admits nursing was the only thing she knew and the only thing she had ever done and decided to stick with the field and attend a nursing school. She began taking courses at a nearby community college and eventually earned an Associate of Science degree. Microbiology, anatomy, and physiology were some of the courses she was required to take.
Upon graduation, Liz began working for a large university hospital where she has worked for the last nine years. She is responsible for monitoring the numerical changes (vital signs such as heart rate, blood pressure, respiratory rate, etc.) and physiological changes (insulin drips, dopamine drips, etc.) of her extremely ill patients and reporting the changes to the physicians. She ensures her patients maintain homoeostasis (i.e., their vital signs stay within a “normal” range) and must be quick to recognize any changes in order to avoid dangerous and life threatening situations.

Sexual Identity

Liz identifies her sexuality as lesbian and began identifying this way when she was 13 or 14 years old. She has never identified her sexuality in any other way nor was she perceived as lesbian prior to her coming out. She began coming out to her family and friends when she was 20 years old. Liz also admits to being out about her sexuality at work since she began. She has never been involved in anyway with LGBT communities. When asked how she would categorize herself in terms of lesbian labels like “butch” or “femme,” Liz states she does not categorize herself in those terms, but others would say she is femme.

Entering the Field of Science

Liz states no one except herself influenced her science career choices. Her father, who worked on a farm, dropped out of school after the 8th grade and her mother, who graduated from high school, did not express any particular subject interests to her. Liz admits to enjoying science in school and also feels science was easy for her to learn. She states the biggest challenge she has had to face so far in her career was working full-time
while she took college courses. The emotional support of her family and friends is one of the main factors which have aided her to become successful in her field.

High School LGBT Experiences

Liz last attended high school 21 years ago. She states gay and lesbian topics were not brought up much among the student population at her high school: “…you didn’t talk about it much. I had a few friends in high school that were out but there were very few. And of course they were made fun of; they were picked on.” Liz admits to being extremely closeted during her high school tenure.

Liz does not recall any LGBT topics or individuals being covered within the content of the lessons taught by her high school teachers. She feels she would remember if they were covered because something like that would “stick out” to her. Liz also does not recall ever hearing her teachers mention LGBT individuals or topics during limited interactions outside of the classroom. When asked if there was anything her high school science teachers could have done to help her or other LGBT students to become more interested in science, Liz does not think anything would have helped her because she did not like high school in general.

College LGBT Experiences

Liz states the student population at the community college she attended was much more diverse than her high school. The college maintained a gay-straight alliance for students, but Liz was not a part of the group. She attributes her lack of involvement to both a “rocky relationship” with a controlling individual and her age at the time (25) compared to the other students involved in the group (late teens, early 20’s). Liz also
states that at the time she felt the group was more of a place to meet people for potential relationships, and not a place for people with similar experiences to gather and share those experiences and ideas with their community members. She never had any negative experiences due to her sexuality while at the college.

LGBT individuals or topics were not covered within the content of the lessons taught by any of her college professors. She was never taught about caring for LGBT patients even though one of her courses covered treatment of patients from differing religious and cultural backgrounds. Liz feels the nursing program at the community college could definitely benefit from some LGBT education and she recalls one particular incident at the hospital:

I had one particular patient [who] was dying of AIDS, end stage AIDS patient, and his family hadn’t had anything to do with him for years but yet they wanted to step in and make his medical decisions and stuff for him…when he was getting ready to take his last breath and push his partner out of the way…I knew what to tell him. I knew how to go about emergency medical power of attorney and stuff that most of the nurses I work with don’t. (Liz, Interview 2)

Liz states she is not sure if there is anything her college science professors could have done to increase other LGBT student’s interest in science. She feels it is a personal choice; however, she does admit something could be done, but she is unsure as to what that may be.
Connecting Sexuality and Science

Liz feels her sexual identity has nothing to do with her interest in science. She has also never experienced any discrimination due to her sexuality while on the job, but she does recognize the potential for patients to be discriminatory if her sexual identity was known by them.

When asked how she thinks individuals become lesbian or gay, Liz states:

That’s just who you are. You’re born that way…I don’t know that much about the scientific theories of it. I’ve not looked at it or studied it or thought much about it. I just know that I had a crush on a girl at a young age so I don’t really think about the theory part of it. (Liz, Interview 3)

Liz thinks the origins for sexual orientation should be taught in both high school and college science courses. She feels this would best fit in the curriculum during discussions on sexuality or whenever heterosexual content is covered.

When asked to suggest how to help more lesbian individuals become successful in science in hopes of them choosing a science career path, Liz states there is really nothing that can be done because you cannot convince someone to follow science who is not already interested in it as a career. She also feels sexuality has nothing to do with a career choice.

Summary

Liz is a 36 year old lesbian ICU nurse, who identified as lesbian when she was 13 or 14 years old, and she identifies as femme. She credits her family, personal traits, and potential financial gain for establishing and maintaining her interests in science. She did
not experience any discussions of LGBT individuals while enrolled in high school or college courses. Liz feels her sexual identity did not influence her career decisions, and she does not feel that sexual orientation and career choice have anything to do with each other. She also feels that nothing can be done to increase lesbian students’ interest in science because sexuality and career decisions are separate issues.

Comparing All Participants

This section contains the comparisons of all of the participants in this study. Initially, comparisons were made between the individuals in each category (i.e., the two individuals in the “participants new to science careers” were compared to each other). These comparisons did not lead to any fruitful revelations and have been purposefully left out in order to focus on comparing all of the participants regardless of the category with which they belong. The information is offered by utilizing the same format as the previous sections in order to maintain a continuity of presentation: sexual identity, entering the field of science, high school LGBT experiences, college LGBT experiences, and connecting sexuality and science. Detailed analysis of the participants’ data and their comparisons to each other can be found in the chapter that follows.

Sexual Identity

All six participants began to identify as lesbian either in their teens or early twenties (see Table 4.4). Most of the participants also came out to their family and friends when their sexual identity changed. Kate waited two years before she came out to her friends and then waited two more years before she came out to her family. Liz began to identify as lesbian during her freshman year in high school, but did not come out to
anyone until she was 20 years old. All of the participants are now open about their sexuality to anyone who inquires.

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<th>Age Ident. As Lesbian</th>
<th>Current Science Role</th>
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<td>15</td>
<td>3rd Year Medical Student</td>
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<td>Jen</td>
<td>28</td>
<td>Lesbian</td>
<td>19</td>
<td>4th Year Medical Student</td>
</tr>
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<td>Amy</td>
<td>30</td>
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<td>18</td>
<td>Pathology Assistant</td>
</tr>
<tr>
<td>Liz</td>
<td>36</td>
<td>Lesbian</td>
<td>13-14</td>
<td>ICU Nurse</td>
</tr>
</tbody>
</table>

Table 4.1: Comparison of all participants’ background information.

Entreering the Field of Science

All the participants listed either enjoyment/interest or parental/teacher influence which led them initially into science. Both of the participants who are now undergraduate students were the only ones to credit extracurricular high school science programs run by local universities. Liz is the only participant to mention potential financial gains for entering science. She did identify her socio-economic status as a child to be below average, but Amy also identified her socio-economic status as a child to be below average as well. Amy, Kate, and Jen all maintain an interest in science due to its challenging/changing nature. Ann enjoys the fact that she can see science all around her. Mary has a passion for engineering, while Liz maintains her interest in science due to her easy understanding of the topic. The ease of understanding is an indication of Liz having an innate talent for the topic.
Mary and Liz both cite financial challenges they have faced during their attempt to enter science based careers. Liz needed to work full-time to pay for college, and Mary is an out-of-state student at an expensive university. Kate and Jen, both medical students, cite gender challenges they have had to face. Kate felt her undergraduate program was a “man’s world” and Jen was specifically told women could not be doctors if they wanted a family. Based on the experiences of Kate and Jen, gender issues have not disappeared from science.

Amy, Kate, and Jen point to personal traits like drive and work ethic for being aiding factors in their science successes. Liz, Jen, and Mary cite family/role models as aiding factors. Quality teachers/professors were aiding factors for Ann and Kate. Not surprisingly, Ann and Mary both point to the extracurricular high school science programs run by local universities for aiding their successes. Liz was the only participant to mention that science was easy for her to learn (i.e., something she had a natural gift for). Based on previous research comparing women and men in the field of science, the fact that only one participant mentioned having a gift for learning science is not unexpected.

Amy, Kate, and Jen feel their parent(s) were the most influential to their science career choices. Kate and Jen’s parents served as science role models for them. Kate and Ann had teachers who greatly influenced their science career choices. Jen is the only participant to mention a specific lesbian role model who has been influential in her career choices. The importance of role models for students has been documented, but surprisingly for these participants only one person had a lesbian science role model. Liz
is the only participant not to have anyone influential in her career choices. Liz is also the only participant to drop out of high school.

High School LGBT Experiences

Mary and Kate are the only participants to be open about their sexual identity during some point in their high school career. The other participants either chose to remain closeted in high school (Liz) or did not identify as lesbian until college (Amy, Jen, and Ann). Amy, Liz, and Kate all feel the student population during their high school career had a negative image of LGBT individuals. Jen and Mary feel the LGBT students at their school either kept to themselves or were not discussed by the larger student population. Ann feels that gay men were accepted at her high school but lesbians had no place or were absent. This information reinforces the idea that high schools are institutions of homophobia.

None of the participants experienced LGBT topics or individuals covered within the content of the lessons taught by their high school science teachers. Mary self-selected an LGBT topic for her computer science course and was challenged by the teacher. Kate had a lesson on STDs, which touched on LGBT individuals, taught in a health class. Health classes are usually a part of the physical education course load, so this indicates that no LGBT topics were discussed in Kate’s science courses. Jen is the only participant who can recall LGBT topics being covered during the content of lessons taught by her non-science teachers. A psychology course covered different types of family units. The other participants all agree that if LGBT topics were covered they would remember due to the fact that the coverage would have mattered to them. Ann is the only participant to
experience discussions of LGBT topics and individuals while spending time with her psychology teacher outside of class. He told negative stories about his male teacher making passes at him and her psychology teacher often used homophonic slang around her. This teacher’s lack of LGBT content coverage within the classroom could be linked to his own negative feelings about homosexuality. With the lack of inclusion of LGBT topics and individuals both inside and outside of the classroom, none of the participants felt the situation influenced their career aspirations. The fact that these individuals were so adamant that they would have remembered LGBT topics taught during high school because the coverage would have mattered to them, but yet they fail to recognize the potential for the lack of inclusion to have had influence on their career aspirations is astounding. For the coverage to have mattered to them the lack of coverage should have some influence as well. The difficulty lies in understanding the influence of things that people are not exposed to or understanding the influence of a hidden curriculum which pushes the heteronormative view of sexuality. Amy and Liz feel there is no connection between being lesbian and choosing a career. Kate now understands the possibility of linking sexuality with career choices due to her lesbian sister’s experiences, but at the time she kept them separate as well. Ann feels the lack of inclusion of LGBT content and the negative out-of-class experiences with her psychology teacher may have influenced her career choices if she had identified as lesbian at the time.

College LGBT Experiences

Of all the participants, Kate is the only person to experience an undergraduate institution which was not accepting of LGBT individuals. Mary, Ann, Jen, Amy, and Liz
felt their undergraduate colleges were either open to LGBT individuals or sexuality was a non-factor to the student population. Once again, Mary, Jen, and Amy attended or are attending the same undergraduate institution.

Amy is the only participant to experience LGBT content covered within the curriculum of a college science course. Jen self-selected an LGBT topic for a paper, so LGBT topics or individuals was not specifically covered within the content of the course. Five of the six participants experienced coverage of LGBT topics or individuals within the content of lessons taught by their other college (non-science) professors. Mary, Jen, and Amy studied LGBT topics and individuals while enrolled in courses within the same department, Women’s Studies, at their undergraduate institution. Jen also took several psychology courses which covered LGBT topics. Ann and Kate both had literature courses which discussed gay and lesbian writers and writings. Liz is the only participant to not experience any mention of LGBT topics or individuals while enrolled in college. Liz is also the only participant who attended a community college.

Mary, Ann, and Jen feel the coverage of LGBT topics within their college curriculum influenced their career aspirations if only slightly. Mary is taking a year off from college in order to pursue volunteering within the LGBT community, and Ann and Jen both feel the content coverage made them understand how LGBT individuals could fit in society along with their heterosexual counterparts. This understanding led to more confidence with themselves and their career choices. Jen, Amy, and Liz do not think their sexuality has influenced their career aspirations in anyway, and Amy and Liz do not see a connection between sexuality and career influence. When Kate was younger, she, like
Amy and Liz, did not see a connection between sexuality and career aspirations, but now she admits there is a connection based on not only her experiences but also the experiences of her younger sister.

Kate and Jen are the only participants to experience any mention of LGBT topics outside of the classroom by their college professors. Both feel these out-of-class experiences had a positive influence on their career aspirations. The individuals who did not experience any mention of LGBT topics outside of the classroom by their college professors do not feel the lack of recognition influenced their career aspirations in anyway.

When asked what college science professors could do to increase science interests of LGBT students, Ann and Liz feel the professors could not do anything to increase interests. Amy feels mentors could potentially help some students, and Mary also feels LGBT individuals would be more interested if someone could show a connection between science/engineering and the LGBT community. Kate and Jen feel students would benefit from more guidance and counsel from the professors. Jen also feels the students should be encouraged to be more open about their sexuality.

*Connecting Sexuality and Science*

Jen, Amy, and Liz feel their sexual identity has not influence their career aspirations in anyway. Jen, however, has provided several examples of how her sexual orientation has influenced her career decisions, for example the LGBT topic coverage in her college courses and out-of-class LGBT discussions with a professor. Ann feels her sexual identity has not influenced her career aspirations either, but she recognizes the
potential influence when she officially chooses her nursing specialty. Mary states she is being guided away from her career for a time in order to aid the LGBT community. Kate thinks the masculine aura of science helped to attract her, and having a sexual identity which differed from her peers made it easier for her to enter a career path which was also different from her peers’ career path. Kate’s views go against several of the other participants, and she does not seem to find the potential connection between sexual orientation and career choice to be as objectionable.

Kate feels she was discriminated against by the mostly male student population within her undergraduate major due to her sexuality. She did not feel welcome by the students, but Kate did not experience anything negative from her college science professors. Kate is also the only participant to feel the students at her undergraduate institution maintained a negative attitude towards LGBT individuals. All of the other participants assert they have not been discriminated against in the field of science. Jen points out that she has purposefully kept her sexual identity separate from her career, so while she is open about her sexuality she attempts to keep her personal life away from her career. Mary feels that LGBT individuals are absent from discussions within her career field and therefore no discrimination can take place.

When asked how they thought individuals become lesbian or gay, all the participants feel that people are born lesbian or gay. Five of the six participants mentioned that even though people are born lesbian or gay some individuals do not accept their sexuality and suppress their same-sex attractions. Whether mentioned
directly or indirectly, these five participants are referring to a combination of nature and nurture.

All of the participants feel the origins of lesbian and gay individuals should be discussed within high school science or health courses. Amy and Ann think the coverage would help LGBT students who might be struggling with their own sexual identity. Ann goes on to state that the coverage within science would give credit to the topic of the scientific basis for lesbian and gay individuals. When asked what they thought could be done to help more lesbians to become successful in science in hopes of them choosing a science career path, Mary, Kate, Jen, and Amy all mention the importance of role models. The role models could help lesbians see that they have a place within the sciences and could also provide nurturing of student’s confidence. Amy and Jen still fail to recognize the connection between sexual orientation and career choices even though they feel lesbian role models would be important for getting other lesbian students interested in science. Jen and Ann both feel lesbians should be told to not allow their sexual identity to negatively influence their career choices. Liz does not think anything could be done to increase lesbians’ interest within science in hopes of them choosing a science career path because she feels sexuality and career choices are not related.
CHAPTER 5

ANALYZING THE RESEARCH QUESTIONS

Before explicitly examining the research questions the two major factors for subject participation need to be readdressed. The first criteria for participation required all individuals to identify their sexuality as lesbian, and based on the information obtained during the first interview, all six participants identify their sexuality as lesbian. The second criteria required participants to be attempting to enter a science based career or to have an established career in science. Five of the six individuals identified their career path as being in the life sciences and the other participant is following an engineering path. The fact that five of the six participants are working in or towards a career in a life science field should not be an indication of more lesbians attempting to pursue life science over any of the other branches of science. The snowball sampling approach utilized for this research study began with two initial contacts who just happened to be in a life science career themselves. The researcher made these contacts through her own pursuit of a life science career.

Once again the purpose of this study is to determine:

1. Among lesbian individuals following a science career path, what factors influenced their interest in science?
2. Particularly, did high school or college science courses have any impact on the lesbian participants’ interest in science? If so, how?

3. How did the participants’ sexual orientation influence their career decision?

4. What do lesbian individuals feel could be done to increase science interests of other lesbian students?

Factors That Influenced Interest in Science

Parents, teachers/professors, personal traits, high school extra-curricular activities, financial gain, and mentors were all mentioned by participants as being key factors to either obtain initial interest in science or maintain an interest in science (see Table 5.1 for an overview). All of the participants mentioned parental support as an aiding factor. Three of the six individuals had parents who were working in a science-based career (Kate, Mary, and Jen). The parents of the other remaining participants (Ann, Amy, and Liz) who were all in non-science based careers provided academic and emotional support to their children pursuing science. Three of the six participants (Kate, Ann, and Jen) mentioned teachers/professors as being an important factor which influenced their interest in science.

Personal traits such as enjoyment, curiosity, drive, challenge, and ease of understanding were mentioned by all of the participants. Five of the six individuals (Amy, Liz, Jen, Mary, and Ann) stated they enjoyed science. Three of the six participants (Kate, Amy, and Ann) felt their curiosity of the field drove them towards science. Three of the six participants (Kate, Jen, and Amy) also mentioned drive (desire) as a key factor
to fostering their interest in science. Only one participant mentioned either the challenge of learning science (Jen) or the ease of understanding science (Liz).

The fact that all of the participants except for Liz did not mention anything about having a gift for learning and practicing science is not surprising. Based on the findings of Spears (2008) the contributions made by women in science are often linked to hard work and not to a natural talent which is more often used to refer to contributions made by men. The comparison of letters of recommendation written for men and women applying to faculty research positions (Schmader, Whitehead, & Wysocki, 2007) also indicate that women’s science successes are more often credited to hard work as opposed to natural talents which are more often attributed to men.

Liz was the only participant to state potential financial gain as a key factor to her interest in science. Jen was the only participant to affirm she had a specific lesbian physician mentor during medical school who had been important to help Jen maintain her interest in her chosen science career path. Jen also feels there is no connection between sexual orientation and career decisions, so she fails to recognize the influence of her lesbian mentor on her career and therefore fails to recognize the connection between sexual orientation and career choices.

Lent (2002) found six reoccurring categories of influences on university and technical college students’ career choices: (a) interests, (b) direct exposure to relevant work activities, (c) vicarious exposure to relevant work experiences, (d) work conditions or reinforcers, (e) confidence of ability, and (f) leisure experiences. Almost all participants in the 2002 research also cited social support and encouragement as crucial
factors to success. Role models and mentors were mentioned with moderate frequency as being important factors of support for participants’ career choices. Portions of the findings of the 2002 research concur with the findings for the participants in this research study. The initial influence which pushed the participants towards entry into science as a career coincides with what has previously been observed with other students selecting a career path. Amy, Liz, Jen, Mary, and Ann all fall into the “interest” as an influence category. Mary and Ann both experienced high school extracurricular science programs which provided them with direct exposure to relevant work activities and vicarious exposure to relevant work experiences. None of the participants mentioned work conditions as an influencing factor and only one participant, Liz, mentioned anything about having a confidence in her ability to learn and perform science. Jen is the only participant to mention a lesbian role model as being important to her science successes, but all of the participants mentioned family and friends as being important in supporting their science successes. Even though the participants of the Lent study were identified by numerous categories (i.e., race/ethnicity, gender, years of college, etc.) the researchers did not report any comparisons made between individuals in these categories. The only comparison shown in the research was between the participants from a university and those from a technical school. Sexual orientation of the participants was not identified and therefore the possibility of understanding any potential connection between sexual orientation and career influences is not known.
<table>
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<tr>
<th>Factors</th>
<th>Mary</th>
<th>Ann</th>
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<th>Jen</th>
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Table 5.1: Factors that influenced science interests

Impact of High School and College Science Courses on Interest in Science

This particular research question can be divided into two portions based on the responses obtained from the participants: impact of science teachers and impact of LGBT curriculum integration. Two of the six participants (Kate and Ann) felt their high school science teachers made an impact on their interests’ in science due to the fact that these teachers took time to attempt to connect the science content to the students’ everyday lives; however, Kate and Ann fail to see that the teachers left out discussions of LGBT individuals and topics and therefore disregarded a major portion of their and other students’ lives. Jen was the only participant to mention college professors and teaching assistants as being vital to her interests in science. None of the participants mentioned any specific science curriculum at either the high school or college level as having an influence on their science interests (see Table 5.2 for overview). Most of the participants experienced no LGBT content integration in their science courses, but Amy did experience some LGBT content coverage during a primate behavior course.
Table 5.2: Impact of high school and college science teachers and impact of curriculum of both high school and college science and non-science courses.

<table>
<thead>
<tr>
<th></th>
<th>Mary</th>
<th>Ann</th>
<th>Kate</th>
<th>Jen</th>
<th>Amy</th>
<th>Liz</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School Teachers</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College Professors</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Science Curriculum</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non Science Curriculum</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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</tbody>
</table>

The lack of impact of science curriculum for these individuals can be related back to the lack of recognition of LGBT individuals and topics within these courses. The missing LGBT content in both high school and college science courses can be explained by simply examining the textbooks used to teach these courses. By reviewing textbooks, researchers (Snyder & Broadway, 2004) found that of the eight books examined none contained any reference to sexuality outside of the heterosexual norm except in three texts in the section covering HIV/AIDS, which is connecting homosexuality to a life-threatening disease. The absence of LGBT content in the curriculum is an indication that the schools are further contributing to the marginalization of their students (Crocco, 2002). Crocco (2002) collected over five years of data which examined students’ experiences with gender and sexuality while in school and found that the lack of recognition of gay and lesbian individuals and topics could be linked to the creation of an atmosphere of the heterosexual assumption (i.e., assuming everyone is heterosexual) and homophobia in the schools.

None of the participants felt the lack of coverage of LGBT topics and individuals in the science content of both high school and college science courses affected their interests in neither science nor following a science career path. Three of the six
individuals (Mary, Ann, and Jen) however were influenced by coverage of LGBT topics in non-science college courses. Mary is taking a year off from science in order to volunteer for the LGBT community, and Ann and Jen feel the LGBT content coverage let them know how they could fit into society as lesbians (i.e., they could be contributing members of society). The participants fail to recognize the influence the lack of coverage of LGBT topics in science courses had due to the difficulty in understanding the impact of something a person does not experience. How can someone readily gauge an influence of a non-lived experience?

Why are students being exposed to sexual identity topics in non-science but not in science classrooms? Sexuality topics in a science classroom are not perceived as normal due to “heteronormative common sense.” Teachers may not include LGBT topics into their classroom curriculum in order to keep their credibility because adding “non-normal” topics could cause a decrease in perceived authority (Fifield & Swain, 2002). The science teachers may not have been taught how to handle LGBT topics and LGBT students and therefore avoided the content. In a study (Rienzo, Button, Junn-jye, & Ying, 2006) that surveyed 124 school districts across the U.S., the researchers found that only 39% of school districts offered some kind of education about sexual orientation; this includes inclusion of LGBT topics in existing curricula and separate curricula for LGBT topics. Fewer than 3 out of 10 districts offered sexual orientation training to their teachers. Teachers may also stay away from LGBT content because the assumption can be made that any teacher willing to include LGBT topics must themselves be LGBT (Unks, 1995).
This research question (question #2) also connects directly back to Gloria Ladson-Billings and her ideas of Culturally Relevant Pedagogy (CRP) (1995). The participants claim the sparse coverage of LGBT topics and individuals in their high school science courses did not affect their interests in science. With the content that was covered, did the participants experience CRP? The first portion of CRP states that teachers must demand scholarly excellence of their students. Even though the participants did not mention this directly, five of the six individuals (Mary, Ann, Kate, Jen, and Amy) hold at minimum a bachelor’s degree and therefore the assumption can be made that scholarly excellence was demanded from them at some point. The possibility exists that these individuals excelled in school despite their high school teachers, but none of the participants remembered any situations in which their teachers were a hindrance to the individuals’ academic success.

The second portion of CRP states that teachers must connect student culture to the content of the curriculum. Jen experienced this connection while enrolled in a high school psychology course in which the teacher spent time discussing LGBT families when examining differing types of family units. Kate experienced a negative connection of an aspect of her culture with the high school health content in which the teacher mentioned gay individuals only in connection with HIV/AIDS. Mary tried to connect LGBT issues with the content of her high school computer science course and was challenged by the teacher.

The third portion of CRP pushes teachers to have students examine the cultural norms and values so that the students can garner the ability to critically assess the status
quo. Jen is the only participant who potentially experienced this during the one lesson in her high school psychology course which covered family units. She does not remember great detail about the lesson, but feels the way LGBT families were represented was as though they were “normal.” Kate’s experience with content connection to LGBT topics pushed the status quo (i.e., gay = HIV/AIDS). Mary attempted to challenge the status quo with her paper on gay marriage in a computer science course and was confronted by the instructor. Mary was not allowed to assess critically the status quo. Table 5.3 illustrates who experienced CRP (the – symbol indicates their experiences were negative).

<table>
<thead>
<tr>
<th></th>
<th>Mary</th>
<th>Ann</th>
<th>Kate</th>
<th>Jen</th>
<th>Amy</th>
<th>Liz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scholarly Excellence</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Connecting Culture</td>
<td>X(-)</td>
<td>X(-)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>to Content</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assess Status Quo</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Table 5.3: Experiences with culturally relevant pedagogy.

By examining the experiences of Jen and Ann, who both stated the coverage of LGBT topics in college made them more comfortable with who they are, the importance of CRP can be revealed. Jen and Ann were able to see their place in society by experiencing cultural connections to the content of the classes. Other LGBT students would benefit from these connections by allowing them to see that they are just as important to society and can have the same input to society as their heterosexual counterparts.

Sexual Orientation Influence on Career Decisions

The third research question attempts to discover how the participant’s sexual orientation influenced their career decisions. Three of the six participants (Mary, Ann,
and Kate) state their sexual orientation has influenced or will influence future career decisions, while the other three participants (Jen, Amy, and Liz) feel there is no connection between their sexual orientation and their career choices (see Table 5.4). Mary was not exposed to LGBT content coverage while in high school, and stated she does not think the lack of coverage influenced her career aspirations in anyway. After being exposed to LGBT content in college, Mary decided to take a year off from her career in order to pursue volunteering in the LGBT community. This is due to the fact that she cannot see a way to overlap her engineering career with her desire to use her skills to help LGBT communities. Mary equates career influence with action. This means that she received LGBT content coverage during college and is acting on that knowledge by stepping away from her career for a short time. Would Mary’s career choices have been different if she received LGBT content coverage while in high school? The lack of coverage in her high school career could have influenced inaction on her part, so she continued on the engineering path without any thought of the connections between career choices and sexual identity.

Ann sees how her sexual identity may influence the particular nursing specialty she will pursue because she will not want to put herself in a situation where her sexual identity could potentially interfere with her career. Kate sees science as a masculine endeavor and she feels that she was able to have different career goals from her peers in high school because her sexual identity was also different. Kate did not initially see how sexual orientation could influence career decisions until her younger lesbian sister started making career decisions which accounted for her sexual identity. Jen does not feel her
sexual orientation has influenced her career decisions at any point, and both Amy and Liz feel that sexual orientation and career decisions are two completely separate issues and have no impact on each other.

Most of the respondents in the Lehtonen study (2008) stated that their sexual orientation did not influence their career choice and the possible connection between sexual identity and career seemed objectionable to them. Amy, Liz, and Jen all fall into this line of thinking as well. These participants quickly answered “no” to any question which attempted to ascertain an influence of sexual orientation on career decisions. Mary, Ann, and Kate, however, recognize the possible impact of sexual orientation on career decisions even though in some instances they fail to recognize the connection. Mary and Ann, who are the participants still in undergraduate science, may be experiencing a social change in terms of the acceptability of admitting the influence of one’s sexual identity over all aspects of life. Kate initially thought the same way as Amy, Liz, and Jen until she was able to see the decisions her younger lesbian sister was making with her career. Kate is able to live vicarious through her younger sister and is viewing career decisions being made by someone from the same generation of students as Mary and Ann’s student generation.

<table>
<thead>
<tr>
<th></th>
<th>Mary</th>
<th>Ann</th>
<th>Kate</th>
<th>Jen</th>
<th>Amy</th>
<th>Liz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sexual Orientation Influence</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
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</table>

Table 5.4: Influence of sexual orientation on career choices.
How to Increase Science Interests of Other Lesbian Students

The final research question asks what lesbian individuals feel could be done to increase the science interests of other lesbian students. Four of the six participants (Mary, Kate, Jen, and Amy) mention role models as a way for lesbian students to see other lesbians who have been successful in pursuing a science career. Amy points out that current scientists and teachers need to be encouraged to be open about their sexuality in order to provide role models for lesbian students. Ann feels lesbian students should be encouraged to not let their sexual identity influence their subject interests, and this thought goes against her acknowledgement of the possible influence of sexual orientation on career decisions. Liz feels there is no way to help increase science interests of lesbian students because she believes people are either interested in science or they are not and nothing can be done to change their minds (see Table 5.5).

<table>
<thead>
<tr>
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<th>Mary</th>
<th>Ann</th>
<th>Kate</th>
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</thead>
<tbody>
<tr>
<td>Role Models</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>More Out Teachers</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Encourage Students</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Nothing</td>
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<td>X</td>
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</table>

Table 5.5: How participants would increase lesbian interests’ in science.

Jacobs (2005) points out the variables which can sway a student’s career decision, such as self-concept of ability, parental influence, lack of role models known in the field, and the need to create a supportive environment. Most of the participants’ ideas focus on only a portion of Jacobs’ variables, and Liz was the only participant to state that the variables are inconsequential because nothing could be done to increase the science interests of other lesbian students. Mary, Kate, Jen, and Amy feel role models working
directly in science fields and science educators are needed to help encourage more
lesbian students to follow a science career path. The idea of more “out” teachers as
presented by Amy is an attempt to create more potential role models for students.

DISCUSSION

The following discussion section is divided into five parts: lesbians and science,
gender issues and homophobia in science, coming out and school obstacles, teaching
LGBT students and science, and choosing a science career path. Connections to previous
research are made where applicable.

Lesbians and Science

The federal government is attempting to increase the quality of STEM education
in hopes of increasing the number of individuals interested in entering a STEM career
(National Science Board, 2007). Students from marginalized groups are seen as a great
resource for potential future scientists. In 2005 women represented only 26% of the
college-educated work-force in scientific and engineering occupations even though
women represent close to half of the total number of college-educated individuals in the
work force (National Science Board, 2008). Lesbians represent two categories of
marginalized individuals in science: women and sexual minorities. By examining lesbian
experiences in science, researchers can better understand science education as seen
through an alternative lens. The participants in this study have experienced difficulties
that previous women have experienced in science (i.e., abilities attributed to
drive/determination vs. a gift for science), but they have also experienced a different set
of issues based on their sexual identity (i.e., lack of role models).
Sex Issues and Homophobia in Science

Kate and Jen both experienced challenges in getting to this point in their career due to the fact that they are women, and the challenges they have faced are not unusual. Their experiences are similar to the experiences of other women participating in science as a career (Barres, 2006; Mielczarek, Smith, & Roberts, 2006). The issue of women’s science abilities being attributed to hard work versus a natural gift has already been discussed, but the topic needs to be connected directly to the other biological sex issues experienced by the participants in order to illustrate the multiple ways in which sex still affects science experiences. Even though women are making advances in the field of science (National Research Council, 2009) much work still remains.

Kate’s experiences with science have pushed her to assign a gender identity to the field: masculine. Kate is not the first person to do this. She assigns this gender identity based on the fact that she finds science cold and non-nurturing. She has had little exposure to other women in science, which reinforces Kate’s view of science as a masculine field. Even though more women are in science careers than ever before, has there been a change in the gender identity assigned to science? Based on Kate and Jen’s experiences, the correct response would be “no.”

No correlation could be made between the participants’ gender identity and any of their responses. Three of the six participants (Mary, Jen, and Liz) identified as femme and three identified as being in the middle of the butch/femme continuum; therefore, the idea that only butch lesbians pursue science careers does not fit in this instance. No other
connections can be made between the participants’ gender identity and their experiences with science.

None of the participants stated they experienced any direct homophobia from science faculty members or science institutions; however, Mary’s experience with her computer science teacher and Ann’s experience with her psychology teacher would indicate otherwise. For the most part sexual orientation was not a part of the science discussions experienced by the participants in and out of the classroom. As stated by Mary, sexual identity was ignored by her engineering department, but she would prefer to have her sexuality ignored versus the potential for it to be recognized and cause an unpleasant issue for her. Mary’s assumption is that if sexuality were discussed the potential exists for biases to manifest into her career field. Failure to recognize sexual identity furthers the marginalization status of LGBT individuals (Crocco, 2002).

Coming Out and School Obstacles

The individuals in this study are not outliers in terms of their sexual identity change and coming out process. Based on Anderson’s (1995) work which attempted to identify through other research when individuals first notice their same-sex attractions (around age 12-14) and the coming out process, these individuals changed their sexual identity and came out to their peers and family members in a maximum of eight years and some much less from when they first began to realize their same-sex attractions. Each participants’ change in sexual identity and their coming out process was unique, which is expected (Owens, 1998). Mary is the only participant who identified as bisexual before she identified as lesbian, and Jen is the only participant to identify as heterosexual before
she identified as lesbian. All of the participants came out to their friends first before coming out to their family members, but some took several years in between coming out to friends and when they officially came out to their family. The participants were roughly in the same age range when they eventually came out to everyone (late teens to early twenties). None of the participants reported a loss of family due to their coming out, which is often the focus of attention in scholarly reports due to the consequences of such a reaction (Beeler & DiProva, 1999).

Once an individual begins to recognize same-sex attractions they also begin to notice homophobic terms (Anderson, 1995). Amy, Liz, and Kate all experienced homophobic high school environments. Based on the GLSEN School Climate Survey (2005), their experiences and feelings are not unexpected. Kate also labeled the undergraduate university she attended as not welcoming of LGBT individuals. Colleges tend to be more open to LGBT students when compared to high schools, but not all colleges are the same in their acceptance (Owens, 1998).

Teaching LGBT Students and Science

Based on the participants’ experiences little to no LGBT content is being taught in high school or college science courses. The lack of LGBT content hurts both sexual minorities and their heterosexual counterparts because an open dialogue can potentially decrease homophobia (Lipkin, 1995). Textbooks are one possible explanation for this missing cultural connection due to the fact that many teachers rely on textbooks to guide their lessons and they are mostly absent of LGBT content (Snyder & Broadway, 2004).
The message sent to not only these participants but to other LGBT students is that no LGBT individual has contributed anything of value to the field of science (Unks, 1995).

As stated by Straut and Sapon-Shevin (2002) the teachers could also be guilty of thinking that all of their students are heterosexual, and therefore they continue to teach ignorant of the hegemonic norm. According to previous research (Rienzo, Button, Jiunn-jye, & Ying, 2006), teachers’ lack of training with how to teach students with differing sexual identities is also a major factor. With no training, teachers cannot be expected to be comfortable enough with LGBT content in order to make cultural connections as recommended by Ladson-Billings. Teachers also need to be aware of their own internal homophobia and keep those feelings from influencing their teaching of LGBT students and LGBT content. Ann’s high school teacher used homophobic slang, and this teacher’s lack of LGBT content coverage within the classroom could be linked to his own negative feelings about homosexuality, a phenomenon which has been observed in previous studies (Hall, 2006).

The fact that several of the participants experienced LGBT content coverage in non-science courses relates directly to Fifield and Swain’s (2002) ideas of the objectivity of science, which makes inclusion of LGBT topics very difficult. As stated earlier, sexuality topics in a science classroom are not perceived as normal due to “heteronormative common sense.” Teachers may not include LGBT topics into their classroom’s curriculum in order to keep their credibility because adding “non-normal” topics could cause a decrease in perceived authority. Also, as stated by Norman (1998) connecting culture and science is important for developing scientific literacy.
With more individuals recognizing at younger ages that they have same-sex attractions (Anderson, 1995), the inclusion of LGBT content into secondary classrooms is that much more important. Ann and Jen who both experienced inclusion of LGBT content at the college level stated that the coverage made them more comfortable/confident with who they are (lesbian) and led them to understand that they could contribute the same things to society as their heterosexual counterparts. Why should LGBT individuals have to wait until college to understand that others like them have made an impact on society?

As stated by Ann, the coverage of LGBT content specifically within a science classroom will lend credit to the topic. People tend to assign a higher value of “truth” to subjects covered within a science course. The coverage of the content would allow the students (heterosexual and homosexual) to have the opportunity to see the science behind sexual identity origins and further understand that sexual orientation is not a choice.

Sex in general is often a taboo subject outside of health classrooms. The inclusion of sexual identity origins research into secondary science classrooms is a major leap forward and one that many schools and teachers would be reluctant to make. The immediate inclusion of LGBT content does not need to contain an entire new unit on sexual orientation origins, but instead should be recognitions of the contributions made by LGBT individuals to the field of science. These recognitions of contributions should be made for all marginalized groups.
Choosing a Science Career Path

The factors that influenced the participants’ interest in science are similar to the factors which influenced other individuals in previous research (Lent et al., 2002); however, this previous research failed to account for sexual orientation when collecting their data and reporting their findings. Even though these women are successfully following a science career path most of them are attributing their successes to effort and not natural ability, which coincides with prior research on all women and not just lesbians (Schmader, Whitehead, & Wysocki, 2007; Spears, 2008). Confidence of ability has been found to be an important influencing factor for career decisions (Lent et al., 2002).

One important feature that has shown to be influential to science interests of participants in previous research is mentors and role models (Jacobs, 2005). Only one participant mentioned a specific lesbian role model who has been important to her successes. The lack of mention of lesbian role models by the other participants is a glaring issue when other studies have shown the importance of role models/mentors. Is it necessary for lesbian students to have lesbian mentors/role models? Research has shown that girls and boys benefit from having same-sex mentors (Spencer & Liang, 2009), but this research also fails to address the issue of equating sex (male/female) to gender (masculine/feminine). Partnering same-sex individuals in mentoring relationships may lead to matching people with similar relational styles (i.e., relationships with more empathy or activity engagement) (Spencer & Liang, 2009), but failure to recognize sexual orientation differences can potentially alter the openness and personal connection students may need from their mentor. Sexual identity cannot be ignored.
Previous research (Lehtonen, 2008) found that lesbians find the connection between sexual orientation and career decisions to be objectionable, and in this study half of the participants (Jen, Amy, and Liz) do not feel their sexual orientation influenced their career decisions. The participants also found the possible influence to be unpleasant. The participants of this study could be having the same thoughts as those in the Lehtonen (2008) study, who had a hard time accepting the all-encompassing nature of sexual orientation and did not want their sexual identity to influence them any more than it had already. The other half of the participants in this study were able to recognize and be comfortable with the fact that their sexual identity has influenced or will influence their career decisions. For the most part, these participants are more accepting of the ways that sexual identity can influence decision making; however, they are not always consistent with this line of thinking. Ann understands the connection between sexual orientation and career decisions but feels other lesbian students should be warned to not let their sexual identity influence their career choices. In general, they understand their sexual identity is a part of who they are and remain cognizant of its potential influence in all aspects of life. The influence of sexual orientation on career choices may not necessarily be obvious, for example someone stating that they do not want to become a teacher or a soldier due to the fact that they do not want to remain closeted about their sexuality is an obvious influence between sexual identity and career choices. If someone were to state they chose to work for a particular company based on that company’s previous track record with other LGBT employees and policies, this would also be an influence of sexual orientation on career choices. The potential impact on someone’s career could be minimal/non-existent or the
decision could also lead to someone missing out on career building opportunities (i.e., promotions) which may have been possible at other companies. The point being made here is that sexual orientation may or may not have a great influence on career choices, but individuals need to be aware that the possibility exists for sexual identity to influence more than just their sexual partner.

More than half of the participants suggested finding role models for other lesbian students in order to increase their science interests. As stated by Jacobs (2005) the presence or absence of role models may influence students when choosing a career path. The importance of role models has been documented and lesbian students are no different from the rest of the student population. Some people need to see others like themselves being successful in a career before they feel that field is open to them. Even though Jen and Amy state they do not think sexual orientation has anything to do with career choices, they both recommend finding specific lesbian mentors for students. They have failed to recognize their suggestions as a connection between career choice and sexual identity.

IMPLICATIONS

The implications for this research spans across four areas: the teacher education community, the K-12 community, the science community, and the LGBT community. Several of the issues overlap each community, so the implications will be mentioned more than once but will be specifically tailored for each group.
Teacher Education Community

The community of teacher education has several implications based on this research. First, teacher educators need to improve upon (or implement where absent) coverage given to teaching LGBT students and integration of LGBT content into lesson plans. Teachers need to be comfortable dealing with LGBT students both in and out of the classroom and they need to be aware of their needs (i.e., helping to find potential role models/mentors). Second, based on the experiences of Ann and Jen, teacher educators also need to ensure that their pre-service teachers are being taught not just about CRP but also how to properly implement this type of pedagogy into their classroom even if this type of material is absent from their school’s curriculum guide. Finally, teacher educators need to encourage carefully LGBT pre-service teachers to be open about their sexuality in the classroom. Some school districts may not allow teachers to be openly gay, but teacher educators need to ensure that the pre-service teachers understand the potential benefit to LGBT students, once again providing a potential role model/mentor for these students to emulate.

K-12 Community

The K-12 schools need to turn to their local community in order to find potential role models/mentors for their LGBT students. Once identified, these role models could be connected to classroom exercises or extracurricular activities (like a GSA) where LGBT students could interact with them. The importance of role models has been documented and these students should not be overlooked. Even though the textbooks are lacking in LGBT content this should not indicate that the content is not important or relevant. This
community needs to utilize previous recommendations on where to integrate LGBT content and alter their curriculum to include these marginalized students. School districts need to help make up for a lack of coverage of teaching LGBT students at the pre-service teacher level and should hold workshops which cover instruction on LGBT individuals. Workshops should also be held which cover CRP and how to properly integrate student culture into classroom content. Lastly, K-12 schools need to encourage teachers and other staff members to be open about their sexual identity. Some teachers are afraid to be open about their sexuality due to either written or unwritten rules which could lead to their termination. Schools need to alter their policy on openly gay teachers, which could provide much needed role models for the LGBT students.

Science Community

The first implication for the science community is the lack of LGBT content in textbooks. The participants in this study identified areas where LGBT content would fit in a science classroom and other researchers have identified areas where inclusion is possible (genetics, behavior, and mention of well known LGBT scientists) (Smith & Drake, 2001; Snyder & Broadway, 2004). LGBT students exist in science classrooms and their presence needs to be recognized; the importance of this recognition can be seen through the lived experiences of Ann and Jen. This implication connects directly to another implication which is a lack of research which provides a clear understanding of gay and lesbian origins. By having a better understanding of the origins of sexual identity, the material could be included into classrooms more readily. Finally, the science
community needs to recognize that female success regardless of sexual orientation in science is not due to just effort but also a gift for the topic.

LGBT Community

The two main implications for this community are to encourage more teachers and scientists to be open about their sexual orientation and to promote within the community that it is okay for someone’s sexual identity to influence their life decisions. The LGBT community needs to push for employment protection for openly gay individuals; teachers and scientists will not be open about their sexuality if they fear losing their job or credibility. Those individuals who are open about their sexuality should be presented to the rest of the community as an example (or role model). Finally, the community needs to let their members know that their sexual identity is a part of who they are and admitting that someone’s sexual identity has influenced major life decisions is not a bad thing. To account for sexual identity is to account for the whole person and not just a portion of who they are. Sexual identity is a defining factor for whom a person truly is, and if such a major portion of someone’s identity is disregarded then people are not making decisions that account for their whole being.

LIMITATIONS

Three main limitations exist for this study: financial, small participant numbers, and majority of participants from life science fields. The researcher did not have access to any grant money to complete the project; therefore, all expenses came from the researchers personal funds. The lack of financing led to a majority of the interviews being conducted over the telephone utilizing recently purchased recording equipment. The
interviews which were conducted over the telephone did not allow the researcher to document facial expressions or body language when questions were being posed. The lack of in-person interviews could also have decreased the participants’ openness to interviewer due to a decrease in personal connection.

Due to the fact that only one researcher was conducting the interviews and analyzing the data the number of participants needed to remain small. Because this study was dissertation research, the researcher needed to be able to conduct the interviews within a certain timeframe; therefore, only a small number of participants were possible.

The final limitation, majority of participants from life science fields, is also connected to the small number of participants. The researcher utilized a snowball sampling approach to identify potential participants and the initial contacts for this study were individuals from life science fields. As stated earlier, the researcher has a background in life sciences. If a larger number of participants had been needed, the researcher would have eventually made contact with people in other areas of science. The possibility exists that lesbian individuals in other areas of science could have differing experiences when compared to those from the life science area.

SUGGESTIONS FOR FURTHER RESEARCH

Several suggestions based on this project to further other research have been identified. First, this research project should be expanded upon in order to include lesbian participants who are not associated with a life science career but have or are pursuing careers in other areas of science. The potential exists for lesbians in other areas of science to have vastly differing experiences from their life science counterparts. The actual
The number of participants should also increase in order to analyze the experiences of numerous lesbian scientists and not just a select few. Research should also turn towards lesbian individuals who did not select a career in science in order to determine what affected their decisions. Did these lesbians in other areas not choose science because of a lack of perceived representation in both content and role models? In general, more of the interviews should be conducted in person in order for the development of a potential personal connection between the interviewer and interviewee. A personal connection could lead to an increased comfort level and therefore more open responses to the interview questions. The next suggestion is to implement a mentor/role model program for lesbian students interested in science as a career. The mentor program could be monitored over time and any potential impact could be observed and potentially utilized to justify other such programs on a more permanent basis. Finally, researchers should look to the other members of the LGBT marginalized group who are following a science career to see if their experiences and needs are similar to the lesbians in this study. By understanding their experiences scientists and educators can make changes in order to remove LGBT individuals’ marginalized status.
<table>
<thead>
<tr>
<th>Demographics</th>
<th>Research #1</th>
<th>Research #2</th>
<th>Research #3</th>
<th>Research #4</th>
</tr>
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<tr>
<td>Age</td>
<td>Q.1</td>
<td></td>
<td></td>
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<tr>
<td>Early Life</td>
<td>Q.2</td>
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<td>Q.3</td>
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<td>Q.4</td>
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<td>HS LGBT Image</td>
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<td>Coll. LGBT Image</td>
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<td>Increasing Science</td>
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<td>3.6-3.8</td>
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</tbody>
</table>

Table 3.1: Research questions and interview questions planning matrix.
APPENDIX A

DEMOGRAPHIC QUESTIONNAIRE

1. What is your birth date? ______day ______month ______year

2. Where did you grow up? Describe the community (Rural, urban, suburban?).

3. Please mark with an X on the continuum the socio-economic status of your parent(s)/guardian(s) during your childhood.

   Low---------------------------------------------------------------High

4. Please fill out the following chart with your educational information:

<table>
<thead>
<tr>
<th>High School Name</th>
<th>- Years Attended</th>
<th>- Science Courses Studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>College/University Name (1)</td>
<td>- Years Attended</td>
<td>- Science Courses Studied</td>
</tr>
<tr>
<td>- Degree programs attempted</td>
<td>- Degree programs completed</td>
<td></td>
</tr>
<tr>
<td>College/University Name (2)</td>
<td>- Years Attended</td>
<td>- Science Courses Studied</td>
</tr>
<tr>
<td>- Degree programs attempted</td>
<td>- Degree programs completed</td>
<td></td>
</tr>
<tr>
<td>College/University Name (3)</td>
<td>- Years Attended</td>
<td>- Science Courses Studied</td>
</tr>
<tr>
<td>- Degree programs attempted</td>
<td>- Degree programs completed</td>
<td></td>
</tr>
</tbody>
</table>

Please add any other colleges or universities that you attended.
5. Describe your work history as it pertains to science or feel free to provide your CV if applicable.
APPENDIX B

INTERVIEW QUESTIONS

Three part interview questions

Interview One

Introductory Statement: The purpose of this study is to examine successful lesbian individuals in science careers or college science majors to determine not only what made them successful, but also how that information could be utilized to support other lesbian students interested in science.

1. What initially led you into the field of science?
2. What keeps you interested in science?
3. What challenges have you faced in getting to this point in your career?
4. What factor(s) have aided you to become successful in the field of science? Describe them.

Transition statement: Now I am going to switch topics in order to obtain some more background information this time specifically about your sexual identity.

5. How do you label your sexual identity?
6. When did you first identify that way?

7. Have you ever labeled your sexual identity in another way?

8. When did you come out, if at all, to your friends? Family? Co-workers?

9. Were you perceived as lesbian prior to your coming out? If so, by whom?

10. Did you or do you have any involvement with the LGBT communities? If so, in what capacity?

**Interview Two**

The participants will be provided a transcript of the previous interview to read.

1. Is there anything you would like to add to what we discussed during our last interview?

2. How long has it been since you were in high school? Describe what the image was of lesbian/gay individuals by the student population in your high school.

3. Were any LGBT individuals or topics covered within the content of lessons taught by your high school teachers? If so, what was covered?

4. Were any LGBT individuals or topics covered within the content of lessons taught by your high school science teachers? If so, what was covered?

5. If LGBT individuals or topics were covered in class, how did that influence your career aspirations?

6. Did you spend time with teachers outside of the classroom? If so, please describe. Describe any references to LGBT individuals or topics by any of your teachers in high school outside of the classroom.
7. Did you spend time with your science teachers outside of the classroom? If so, please describe. Do you recall specifically your science teachers ever making any mention of LGBT individuals or topics outside of the classroom? If so, in what way?

8. If LGBT individuals or topics were covered out of class, how did that influence your career aspirations?

9. Is there anything specific that you think your high school science teachers might have done to help you or other LGBT students to become more interested in science?

Transition Statement: I am going to ask the same set of questions now except this time the focus will be on college experiences.

10. Describe what the image was of LGBT individuals by the student population in your college.

11. Were any LGBT individuals or topics covered within the content of lessons taught by your college professors? If so, what was covered?

12. Were any LGBT individuals or topics covered within the content of lessons taught by your college science professors? If so, what was covered?

13. If LGBT individuals or topics were covered in class, how did that influence your career aspirations?

14. Describe any references to LGBT individuals or topics by any of your professors in college outside of the classroom.
15. Do you recall specifically your science professors ever making any mention of LGBT individuals or topics outside of the classroom? If so, in what way?

16. If LGBT individuals or topics were covered out of class, how did that influence your career aspirations?

17. Is there anything specific that you think your college science professors might have done to help you or other LGBT students to become more interested in science careers?

Interview Three

1. Is there anything you would like to add to what we discussed during our last interview?

2. Tell me a little about the person(s) who influenced your science career choices.

3. Talk about how your sexual identity has influenced your interest in science.

4. How do you categorize yourself in terms of lesbian labels like butch or femme? How do others perceive you?

5. Describe for me any discrimination you felt in the field of science due to your sexuality identity.

6. How do you think individuals become lesbian or gay? What are your thoughts about the scientific basis for lesbian or gay individuals?

7. Could or should any of these ideas be included into a high school or college science course? If so, how do you suggest these ideas should be included?

8. What are your suggestions to help more lesbian individuals become successful in science in hopes of them choosing a science career path?
APPENDIX C
The Ohio State University Consent to Participate in Research

Study Title: Support of marginalized students in science: An examination of successful lesbian individuals in science career paths

Researcher: Karen Irving

Sponsor: Not applicable

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate.

Your participation is voluntary.
Please consider the information carefully. Feel free to ask questions before making your decision whether or not to participate. If you decide to participate, you will be asked to sign this form and will receive a copy of the form.

Purpose:
The purpose of this study is to examine successful lesbian individuals in science careers or college science majors to determine not only what made them successful, but also how that information could be utilized to obtain more lesbian students interested in science and enter science career paths. In an attempt to support future lesbian scientists, research must turn to lesbian individuals who have chosen a science career path. You are being asked to participate because as a lesbian scientist you can provide road markers for those wishing to follow your path as well as highlight barriers you were able to overcome.

Procedures/Tasks:
As a participant in the study you are asked to complete a demographic questionnaire followed by three one-on-one interviews. These interviews can be conducted over the telephone or in-person. The interviews will be audio-recorded and a copy of each transcript will be provided to you. After all interviews are complete you will be provided a copy of the document that sums up your remarks over the questionnaire and three interviews.
Duration:
The demographic questionnaire will take less than one-half hour to complete and the interviews will range from one half-hour to one hour each. The entire process will occur over a period of one month or so that no more than two weeks passes between each interview.
You may leave the study at any time. If you decide to stop participating in the study, there will be no penalty to you, and you will not lose any benefits to which you are otherwise entitled. Your decision will not affect your future relationship with The Ohio State University.

Risks and Benefits:
Pseudonyms for all participants, schools, and towns will be used in order to maintain anonymity for all of the individuals involved. You will not benefit directly from participating in the study.

Confidentiality:
All audio files from interviews and other document files will be kept on a secure computer drive. Consent forms and other hard-copy documents will be kept in a locked cabinet. All documents will be maintained for three years.
Efforts will be made to keep your study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law. Also, your records may be reviewed by the following groups (as applicable to the research):

- Office for Human Research Protections or other federal, state, or international regulatory agencies;
- The Ohio State University Institutional Review Board or Office of Responsible Research Practices;
- The sponsor, if any, or agency (including the Food and Drug Administration for FDA-regulated research) supporting the study.

Incentives:
You will not be paid to participate in the study.

Participant Rights:
You may refuse to participate in this study without penalty or loss of benefits to which you are otherwise entitled. If you are a student or employee at Ohio State, your decision will not affect your grades or employment status.

If you choose to participate in the study, you may discontinue participation at any time without penalty or loss of benefits. By signing this form, you do not give up any personal legal rights you may have as a participant in this study.
An Institutional Review Board responsible for human subjects research at The Ohio State University reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

Contacts and Questions:
For questions, concerns, or complaints about the study you may contact Karen Irving (614-292-1229; irving.8@osu.edu) or Judith French (614-507-4055; french.541@osu.edu).

For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact Ms. Sandra Meadows in the Office of Responsible Research Practices at 1-800-678-6251.

Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

__________________________________________         _____________________________________________
Printed name of subject      Signature of Subject

________________________________ _______________
Date and Time

Investigator/Research Staff

I have explained the research to the participant or his/her representative before requesting the signature(s) above. There are no blanks in this document. A copy of this form has been given to the participant or his/her representative.

___________________________________________        ______________________________________________
Printed name of person obtaining consent     Signature of person obtaining consent

________________________________ ________________
Date and Time
REFERENCES


