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Self-Injurious Behavior: Influences on Self-Harm and Anorexia

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Abstract

Self-injurious behavior (SIB) has been steadily increasing. In the United States, lifetime prevalence of SIB, not including eating disorders, is found to range from 12% to 32.7% in secondary schools (Jacobson, as cited in Whitlock, 2010). Eating disorders in the United States are also on the rise; “as many as 10 million females and 1 million males” are suffering from anorexia nervosa and bulimia nervosa (National Eating Disorder Association, 2008, para. 1). In addition, it is believed that “over half of teenage girls and one third of teenage boys use unhealthy weight control behaviors such as vomiting, skipping meals, laxatives, and fasting” (Neumark-Sztainer, 2005, p.5).

It is the purpose of this paper to provide further insight into the realm of SIB and anorexia, describing the characteristics that are present in teens and young adults with these disorders, the clinical implications and prevalence of these problems, and factors such as the internet use and the presence of co-existing disorders that may influence these behaviors among teens and young adults in the United States today.

Self-Injurious Behavior: Influences on Self-Harm and Eating Disorders

Self-harm is called many things including self-mutilation, self-inflicted violence, parasuicide, self-abuse, and self-injury. Self-injurious behavior (SIB) definitions vary widely from culture to culture and in the United States many different definitions exist. SIB has been defined by the International Society for the Study of Self-Injury as “the deliberate, self-inflicted destruction of body tissue without suicidal intent and for purposes not socially sanctioned” (ISSS, 2007, para. 3). The Remuda Review defines SIB as “any socially unacceptable behavior involving immediate, deliberate, direct, and usually repetitive physical injury to one’s own body, resulting in mild to moderate harm, usually without suicidal intent, and not due to psychiatric organicity” (Remuda Review, 2005, para. 8). For the purpose of this review, self-injury will be defined as deliberate damage of one’s own body or body part without suicidal intent. This includes the idea that eating disorders are a form of self-injury. This review attempts to look at the growing popularity of SIB and what factors are influencing SIB, including eating disorders

While an eating disorder such as anorexia may be classified as SIB, there are several variations of anorexia and many definitions that exist to define it; all of which emphasize the body distortion that a sufferer experiences. Anorexia is one of the most common types of eating disorders and is defined as a “disorder where the individual becomes preoccupied with an unhealthy pursuit of weight loss that eventually leads to distortion in body image” (Princeton University Health Services, 2009, para. 4), and as “body image distortion in which dread of fatness persists as an intrusive, overvalued idea” (Nicholls & Viner, 2005, para 5.). These definitions were chosen because they address the extreme body distortion seen by someone with anorexia while omitting individuals who may not have an eating disorder, such as those who are naturally under weight or who may have other illnesses.

A Brief Overview of the prevalence Self-Injury and Anorexia

Although self-injury and anorexia have probably been around a very long time, much more emphasis has been placed on these types of disorders in recent years as they have become increasingly prevalent in adolescents and young adults.

Self Injury has been increasingly seen by clinicians all across America. Many who self-injure are secretive about the behavior but it is estimated “15-22% of all adolescents and young adults have intentionally injured themselves at least once in their lifetime” (Roan, 2008, para. 5), that “1% of adults self injure” (Roan, 2008, para. 6), and “nearly 70% of counseling center directors report increases in cases of self-injury such as deliberate cutting or cigarette burning of body tissue” (Marano, 2004, para. 2). “Psychologists believe that self injury is seen as a way to release feelings, calm down, or translate overwhelming emotional pain into something more obvious and physical like a cut or burn. One thing many self injurers have in common is a history of sexual abuse—more than half were sexually abused at some point in their lives, while many others were subjected to other forms of physical and/or emotional abuse” (Reilly, 2003, para. 4).

Many people with anorexia also practice self-injury. It is estimated that approximately 35% of those suffering from anorexia and other eating disorders self injure (Turner, 2002). It is possible that both eating disorder behaviors and the act of injuring oneself may “help cope with, block out, and/or release built up emotions” (CaringOnline, 2010, para. 4). Those suffering from anorexia often view themselves as worthless. His/her sense of worthlessness often stems from a history of childhood emotional and physical abuse. Those who suffer from anorexia may seek to forget about past experiences by changing how they look or how they have now come to believe they look through refusal to eat.

The National Eating Disorders Association reports that 80% of American women are dissatisfied with their appearance and that 40% of newly identified cases of anorexia are in girls 15-19 years old (NEDA, 2005). With numbers such as these and increasing pressure from society, anorexia cases and self injury are both on the rise.

Misconceptions, behaviors, and treatment suggestions for self-injury

Self injury is often misconceived to be a disorder that persons choose to do because they are crazy, stupid, or seeking attention. Many who know someone who self injures question why he/she can't just stop, why he/she began in the first place, and why the person does not seem to want help. Those who injure often feel like they can't stop themselves, that self injury is their only escape or that if others find

out they will make fun of them or believe they are crazy. Some who self-injure also fear that if they are found out, they will be made to stop by force.

Studies have suggested that “when people who self-injure become emotionally overwhelmed, an act of self-harm brings their levels of psychological and psychological tension and arousal back to a bearable baseline level almost immediately” (Martinson, 1998, para. 7). In other words, when people feel overwhelmed and then act on their desires to self-injure, they immediately find themselves feeling better and more capable of coping with their emotions. Often this reinforces the behavior and it continues. Those who self injure most often use cutting, burning, or head banging. However, many forms of self-injury exist including carving, scratching, branding, marking, burning/abrasions, biting, bruising, hitting, picking the skin, and pulling hair (Martinson, 1998). The tools self-injurers use may range from a razor blade, a piece of plastic, the corner of a desk, aluminum foil, needles, pens, or any other object they can reach easily when the urge to injure is too great to control.

The type of self-injury may differ from person to person. However, it usually signifies a deeper problem for the individual. The person may have been abused earlier in life, may be dealing with a significant loss, may be feeling overwhelmed, may be confused about his/her sexual orientation or any number of other factors may be in effect. It is important to realize, however, that nearly 50% of self-injurers report physical or sexual abuse during their childhoods and also report that “they were discouraged from expressing their emotions, especially anger and sadness” (Canadian Mental Health Association, 2010, para. 8).

Since the 1990’s many popular icons have revealed self injurious habits in various media outlets including Johnny Depp, Fiona Apple, Angelina Jolie, Courtney Love, Princess Diana, Christina Ricci, and Sid Vicious to name a few. The concept of self-injury has shown up in a significant number of “movies, music, and news articles with scenes or themes of self-injury” (Conteria, Lader, & Whitlock, 2007, para. 3). A Google search of the terms self-injury, self-harm, self-mutilation, or cutting, along with any other number of terms associated with self-injury brings back millions of search results making information readily available at the click of a mouse, whereas twenty years ago such information would

not have been as readily available. Searching the term self-injury, self-harm, or any other variation of self-mutilation, brings up search results of songs, photos of celebrities who have engaged in self-injury, pictures of harm and blood, and millions of other items involving self-injury.

Many members of society may mistakenly believe that those who self-injure are suicidal and flirting with the idea of death and killing themselves. Cornell University says that self-injury is typically not a suicidal gesture and that it may actually be a way of avoiding suicide (Cornell Research Program, n.d.). However it is always wise to err on the side of caution; “individuals who engage in self-injury are most likely feeling a lot of pain and may be experiencing symptoms of anxiety or depression” which can later lead to suicide (UWEA, 2005, para. 3). Another common misconception is that asking those who self-injure if they are contemplating suicide will cause them to actually commit suicide. Research has shown that by asking people if they are considering harm, it may help them to know they are cared about and open up communication for them (UWEA, 2005). The Cornell University Research Program on Self-Injurious Behavior in Adolescents and Young Adults (n.d.) outlines 15 misconceptions about people who self-injure. Some of these include that while many believe that only females self injure, approximately 40% of those who self-injure are male. Others believe that self-harm is only a disorder of teenagers. Cases of self harm have been reported in those as young as seven years old and can last or start well into adulthood (Cornell Research Program, n.d.).

It is also often believed that self-harm is an attention seeking behavior. If someone is self-injuring, even if it is for attention, that person clearly needs help, but the majority of people who self-harm go to great lengths to hide their scars, cuts, or burns. Many also believe that those who self-injure have borderline personality disorder or other mental disorders. A recent research found that almost half of college students with current self-injurious behavior show no other identifiable mental illnesses (Cornell Research Program, n.d.).

A few more misconceptions include that all self-injurers have been abused. While more than half have been abused, certainly not all self-injurers have. Others believe that those who self-injure are dangerous to others. Self-injury is a private activity and many who practice it are accustomed to turning

their anger and frustration inward rather than outward. Self-injurers are typically only a threat to themselves. Self-injury can become a sort of addiction for those engaging in the behavior. There is evidence that self-injury releases endorphins in the brain, a process which increases the possibility of becoming addicted to self-injury (Cornell Research Program, n.d.).

Even though self-injury can become addicting and individuals may find it hard to deal with their disorder, there are a number of treatment options and coping strategies that exist. Self-injury is treatable; however, it is only treatable if the person in treatment wants help. No one can force another person to stop self-injuring, but offering a good support network is helpful. Many suggestions for those who wish to stop self-injuring have been put forward in literature from Cornell University. These include responding to urges by instead cleaning, hitting a punching bag, dancing, banging pots and pans, running, swimming, and any other type of exercise to keep the person occupied when angry. The Cornell Research Program (n.d) also suggests that when a person suffering from self-injury is feeling depressed, that they take a hot bath, curl up with cocoa and a book, baby themselves somehow, play with a pet, make a list of things that make them happy, listen to soothing music, call a friend, or even just watch TV. Finally the Cornell Research Program (n.d.) suggests a person who is craving self-injury may do also such as listing random uses for the object they self-injure with, interacting with other people, taking a cold bath, or just taking time to focus on breathing (Cornell Research Program, n.d.).

Self-injury has grown in prevalence over recent years without a doubt, but there is no certain way to treat it. Unfortunately, lack of information on self-injury has hampered the creation of information materials and/or treatment options. The S.A.F.E. Alternatives program in the Linden Oaks Hospital in Edward, Illinois is one of the only existing inpatient treatment programs specific to self-injury in the United States. With little known about how to treat self-injury, less known about how to identify those at risk, and even fewer treatment facilities available, future research is needed to help those who are at risk and those who are suffering.

Internet Usage for Self-Harm Information

It seems reasonable to assume that the internet may provide information and ideas, potentially either helpful or detrimental, to those who self-injure or who are considering self-injury. “The internet has provided an invaluable resource in allowing sufferers to find help. It permits them to seek advice and guidance anytime, any day, anywhere. However, this constant access is a double-edged sword. Whilst providing opportunities to seek help to get better, the Internet also provides ways to maximize the detrimental effects of self-harming whether it is to commence or to continue” (Morris, 2009, para. 4). The internet contains many recovery sites, which no one wishes to be removed; however, it also contains many sites advocating the use of self-harm; providing tips and tricks for those who wish to self-injure and ways to avoid detection. Counter-productive sites such as this require more investigation (Morris, 2009).

Currently there is no expressly written legislation in any country that addresses websites with pro-eating disorders or pro-self-harm content. “Attempts have been made around the world, but as of November 2009, no laws had been passed” (Morris, 2009, para. 11). While some sites such as Facebook state that the promotion of self-harm, including eating disorders is a violation of their Statement of Rights and Responsibilities, it is still impossible to ensure that all pro-self harm websites and pro-eating disorder sites are removed from their pages. Others such as Myspace and LiveJournal are also taking a stand against these types of materials on their social websites, however, with the limitations on one social site, hundreds more pop up elsewhere across the Internet.

Many people use the Internet as their primary source of research and education. If a young child or teenager were to search self-injury, self-harm, or cutting on Google or any other search engine, they would be faced with hundreds of thousands of websites, some containing valuable self-help information and many more containing damaging, promotional material advocating self-harm. Whether these sites actually cause self-harm or not warrants further research, but education remains vital to ensure that children and young adults keep a positive self-image and seek professional help when considering self-injury. It is important to inform children that they should not post material to encourage others to engage in such behaviors as self-harm (Morris, 2009). Future research and legislation may be the only way to

ensure that pro-self injury websites and pro eating disorder sites do not make their way onto the Internet, and even then, discussions will be unable to be monitored 100% of the time.

Misconceptions, behaviors, and treatment recommendations for anorexia

Like self-injury, anorexia is often misunderstood. Many people feel that those suffering from anorexia are stupid, trying to kill themselves, seeking attention, or just simply need to sit down and eat a good meal. It is not, however, that simple. No one is really sure what causes eating disorders, although there are many theories about why people develop them. Many people who develop eating disorders are between 13 and 17 years old (The Nemours Foundation, 2010). The Nemours Foundation (2010) focuses on social factors, noting that “we’re overloaded by images of thin celebrities; people who often weight far less than their healthy weight and who may have histories of eating disorders” (“What Causes Eating Disorders,” para. 4). Given these factors, it’s easy to see why sufferers may develop a fear of weight gain even if it’s a healthy weight gain.

Eating disorders such as anorexia are best viewed as serious medical illnesses. Like self-injury, anorexia often coexists with other psychological factors such as stress, anxiety, depression, and sometimes substance use. People with anorexia usually weigh at least 15% less than their normal weight for their height and may not have enough body fat to keep their organs and other body parts healthy (The Nemours Foundation, 2010). Anorexia sufferers often experience their bodies going into “starvation mode and the lack of nutrition can affect the body in many ways: a drop in blood pressure, pulse, and breathing rate, hair loss, fingernail breakage, loss of periods, lightheadedness and inability to concentrate, anemia, swollen joints, and even brittle bones” (The Nemours Foundation, 2010, “Effects of Eating Disorders,” para. 2). It is important to note that these physical symptoms can also result from other medical disorders and so are not in themselves grounds for diagnosing anorexia.

Research on anorexia may be easier than research on self-injury, because a diagnosis of anorexia and early predictors are easier to identify and document. Sometimes a person with anorexia simply starts out trying to lose weight but the urge to eat less at meals spirals out of control. The person gradually develops an intense fear of being fat or he/she thinks he/she is fat when he/she is not and he/she begins to

compulsively count calories in everything he/she eats. He/she may also begin to develop an almost obsessive compulsive like disorder and restrict food intake at an unhealthy level (The Nemours Foundation, 2010).

Signs of eating disorders may begin at a much earlier age than originally realized. In 1990, the average age of when a girl went on her first diet was 8 years of age and 51% of girls between the ages of 9 and 10 said they felt better about themselves when they were adhering to a diet (Rader Programs, 2010). Other research has shown that 81% of ten year old girls are afraid of becoming fat, over one half of normal weight girls consider themselves to be fat, 42% of girls in first through third grades want to be thinner, and when offered the choice to pick a shape they believe would fit them, 30% of women choose an ideal body that that is 20% underweight and an additional 44% choose an ideal body shape that is 10% underweight (Rader Programs, 2010). The results from these studies are staggering. Young girls who are merely 6 years of age are already afraid of becoming fat and those who are age 8 are already adhering to diets, while decades ago their weight would not have been a primary concern.

American society places a great deal of emphasis on being thin. Even mannequins in outlet malls are required to be thin. One study showed that if mannequins were to be the weight and size they are portrayed to be, they would have ceased to menstruate. In the United States, the average woman is 5'4" and weighs 140 pounds while the average model in the U.S. is 5'11" and weighs a mere 117 pounds. Also, one study found that as many as 25% of Playboy centerfolds have met the criteria for anorexia. Many models and actors are between 25-30% below their ideal weight and society is under the impression that these are acceptable weights (Rader Programs, 2010). Early predictors and information could help American women avoid the repercussion that such disorders as anorexia bring.

Seventy-seven percent of children first learn about dieting from a family member. To fight misconceptions about weight loss and anorexia, Rader Programs offers suggestions such as being realistic about the size of the average woman and instead of trying to do extreme diets and workouts, be realistic about what weight you should be to keep yourself healthy. They also suggest finding new ways to appreciate your body by viewing it as an instrument and not an ornament. Rader Programs suggest

pampering your body, finding time to exercise, surround yourself with support if you're afraid of spiraling out of control, removing the scales from your home, and eating meals with your family (Rader Programs, 2010). These suggestions are not intended to substitute for the opinions and treatment of a medical professional.

Those suffering from anorexia often primarily want to be seen as thin and beautiful. They do not begin their disorder with the intention to become anorexic; Instead, they gradually become so preoccupied with the idea of losing weight and being thin that they find themselves out of control and with a distorted image of themselves. Therapy and/or counseling are critical in treating those with anorexia; in most cases it is not something that can be managed via self-help. Rader Programs says that like all bad habits, unhealthy eating patterns become harder to break the longer a person has them. It is critical when treating eating disorders to recognize and address the problem as soon as possible. Eating disorders can do a lot of physical and emotional damage if left untreated and anorexics tend not to get better by themselves (Rader Programs, 2010).

Unfortunately, anorexia has one of the highest mortality rates of all mental disorders. Experts believe that between 5-20% of those who have untreated eating disorders will not survive the disorder (Dombeck, Engel, & Reiss, 2007). Those suffering from anorexia refuse to maintain a body weight that is normal for their age and height and they misunderstand the seriousness of their weight loss (Dombeck, Engel, & Reiss, 2007).

Like self-injury, "secrecy is very common in girls who are struggling with anorexia nervosa because they do not want their weight loss to be interrupted and also because they are typically ashamed and embarrassed about their behavior" (Dombeck, Engel, & Reiss, 2007, "Characteristics of Anorexia Nervosa," para. 7). Also, like self-injurers, anorexia sufferers may wear baggy clothing to hide their bodies. "In order to lose more weight and give the impression to others that they are eating, they often restrict their intake to fluids and low calorie food choices such as plain lettuce. They may also use laxatives, diet pills, and excessive exercise in secret to continue shedding pounds" (Dombeck, Engel, & Reiss, "Characteristics of Anorexia Nervosa," 2007). Much like those who self-injure, those suffering

from anorexia often let their entire lives, schedules, and behaviors revolve around their disorders in order to help keep it secret.

Between 5 and 10 million Americans have anorexia or bulimia. The National Institute of Mental Health estimates that 5 to 10% of the U.S. population has an eating disorder and those eating disorders are particularly common among women (Dombeck, Engel, & Reiss, 2007). Only about 10% of patients diagnosed with anorexia or bulimia are male, however, these estimates are likely to be low since “males are more likely to deny having an eating disorder and less likely to seek help than women” (Dombeck, Engel, & Reiss, 2007, “Prevalence, Onset and Course of Eating Disorders,” para. 3).

“Individuals with anorexia tend to be quite competitive and quite driven to succeed. They tend to compare their appearance and accomplishments against unrealistic standards and typically find themselves lacking” (Dombeck, Engel, & Reiss, 2007, “Causes of Eating Disorders,” para. 3). Those suffering from anorexia are unaware of their distorted views on their appearance. They often punish themselves by restricting their food intake. Due to their competitiveness, when those suffering from anorexia fail to meet their goals, they take it out on themselves through self-punishment (Dombeck, Engel, & Reiss, 2007). “Sometimes, self-punishment is related to dangerous, destructive behaviors variously called self-mutilation, para-suicidal gestures, or self-harm. These behaviors can occur in individuals who are depressed or anxious, lack alternative coping skills, or need attention and nurturing” (Dombeck, Engel, & Reiss, 2007, “Eating Disorder Maintaining Factors,” para. 4).

Depression, anxiety, anger, sadness, great loneliness, and emptiness are all factors that are common in people suffering from eating disorders, putting them at greater risk for engaging in self-injurious acts (Dombeck, Engel, & Reiss, 2007). “In addition to starving themselves, people with anorexia may purposely try to harm themselves by cutting or burning themselves, picking at wounds, pulling their hair, banging their head, trying to break their bones, or engaging in high risk, extreme behaviors” (Dombeck, Engel, & Reiss, 2007, “Eating Disorder Maintaining Factors,” para. 4). Because of this overlap, more research is needed on anorexia and self-injury and how they often develop in the same individual. Both disorders occur in only about 1% of the entire U.S. population, however, there is an

estimated 50% overlap between the two disorders suggesting that those suffering from anorexia and self-injury experience similar thoughts, and behaviors (Dombeck, Engel, & Reiss, 2007).

Those suffering from anorexia, just like those suffering from self-injury, often find themselves using the internet as a means of communication, research, and help for their disorders. Unfortunately, they may not always find support for recovery. A simple Google search of anorexia often returns hundreds of websites that are actually pro-anorexia. These sites are often called “pro-ana” websites and offer tips, tricks, advice, and any number of things for a person suffering from anorexia. These pro-ana sites give suggestions on how to lose weight faster, how to prevent certain health repercussions, how to hide the disorder from family members, and even lists of excuses to tell others who are concerned for the individual’s health. Pro-ana sites are the exact opposite of what those recovering from anorexia are looking for.

Pro-ana websites are not for those who are in recovery or who see themselves as ill. It is thought that nobody wants to be anorexic, that anorexia is a disease, and that sufferers want to get better. Pro-ana sites portray the exact opposite of these ideas. They portray anorexia as a battle of strength, sacrifice, and a trial to show how much will power the individual has. Pro-ana sites even go so far as to distinguish between anorexics and rexies; rexies are generally regarded as strong, fearless, individuals who are part of an elite group of perfectionists who will never die while anorexics are regarded as weak willed, fragile, and who are seeking attention (SIRC, 2009). Service providers and social networking sites have tried to remove such information from the Internet but site creators are becoming more efficient and creating disclaimers on their sites warning that the site is not for sufferers, that if an individual does not want to read what is contained on the site then they should leave the site, and that the site is not advocating disorders, it is merely providing an outlet for those who do advocate it to gather together and share their history, stories, and battles (SIRC, 2009).

Current research on pro-anorexia websites has shown that adolescents with eating disorders who visit pro anorexia or pro bulimia websites correlated with longer disease duration and more hospitalizations. Additionally, 96% of teens diagnosed with an eating disorder who viewed such sites

learned new purging techniques. About 50% of teens who visited sites recovery websites also learned new ways of hiding their anorexia. Another study that compared the viewing of a pro-ana web site with female fashion web sites with average sized models found that participants exposed to the pro-ana sites had a greater negative effect, lower social self-esteem, and lower appearance self-efficacy after viewing the web site than those who viewed other sites (Van Pelt, 2009).

“Two-thirds of adolescent girls seek health information online. Nearly half of this group is seeking ways to lose weight and a fourth is looking for information on eating disorders” (Van Pelt, 2009, para. 4) Sadly, many online websites that appear to be supporting recovery of an eating disorder are actually pro-anorexia or pro-bulimia websites; for those seeking recovery, these sites can cause devastation and relapse (Van Pelt, 2009). It’s unfortunate that more has not been able to be done to combat these types of websites. Facebook, Myspace, Xanga, LiveJournal, and even Yahoo and Google have removed a significant amount of such sites but more are created every day causing a world-wide dilemma that needs to be further researched and controlled.

Self-injury and anorexia are both disorders that have likely existed for a long time. However, more recently, both disorders have been seen by clinicians at an alarmingly increasing rate. The Remuda Ranch (2005) says that “unlike other co-occurring problems that tend to be explored, self-injurious behavior is a real-time burgeoning phenomenon among eating disorder patients” (Remuda Ranch, 2005, para. 2). “Amongst those who are suffering from eating disorders, self harm is very common and some people argue that they stem from very similar roots” (Anorexia Bulimia Care, 2008, para. 2). Self-Injuring teenagers are increasingly more likely to have an eating disorder; as many as 50% of those who self-injure have or have had an eating disorder and with such a strong overlap of self-injury and eating disorders, further research is needed to see if there are other commonalities among the two disorders, if it is possible to find common characteristics that may indicate someone is at risk, and to determine whether those who stumble upon websites advocating these disorders are at a greater risk of developing the disorders.

With the many misconceptions, negative stigma, and outrageous ideas on self-injury and anorexia, it is often difficult for someone who self-injures or someone who suffers from anorexia to admit that they have a problem. Self-injurers and sufferers of anorexia may come from all walks of life and hold prestigious jobs without anyone around them realizing something is wrong. They will hide their scars, cuts, or burns, their small bodies and protruding bones, and it is often difficult to tell who self-injures and who does not as well as someone who suffers from anorexia or someone who is simply ill from some other health concerns. It is often difficult to tell who is self-injuring or who is suffering from anorexia nervosa simply by looking at them. For these reasons, further research is needed to determine what initially leads to self-injurious behavior, what causes those who self injure to develop anorexia or those with anorexia to engage in self-injury, and how it would be best for those suffering to cope with their disorder and seek help. Also, with the rise of Internet websites advocating pro-anorexia and self-injury, further research and legislation is needed to prevent these websites from causing further damage and delay of treatment of self-injurious behavior and anorexia nervosa. In addition to monitoring pro-self-harm and pro-anorexia websites, further research on the impact of self-help websites is also needed since they often contain information that sufferers use to continue to hide their behaviors.

Method

Participants

One hundred thirty three human undergraduate students participated in the study. One hundred twenty one participants were eighteen years of age or older. Twelve participants chose not to answer their age. Sixty one participants were female and sixty one participants were male. Eleven participants chose not to answer their gender. Ninety eight participants identified themselves as being white or Caucasian, thirteen identified as being African American, three participants identified as being Hispanic/Latin American, three identified as being Asian or Pacific Islander, one participant identified as Cambodian/Loatian Vietnamese, one identified as being multiethnic, one participant identified as other, and thirteen participants chose not to answer ethnicity. Forty participants were freshman, twenty eight were sophomores, thirty two were juniors, and twenty were seniors. Eleven participants chose not to

answer their class ranking. Eighty three participants were full time on campus, thirty seven were full time off campus, one participants was part time off campus, one participant preferred not to answer, and eleven participants did not respond. All participants were either part of undergraduate business or psychology courses. The students were given extra credit to participate in the study.

Materials

An informed consent form was used to instruct participants of their rights and what they would be doing in the study (see attached consent form). Additionally, a four part questionnaire was used to examine the prevalence of self-injury and anorexia at the undergraduate institution. The questionnaire contained questions about participants' general background information, overall thoughts and wellbeing, and questions to determine if participants engaged in self-injurious and/or anorexia behaviors.

Procedure

Approval to conduct the research was requested from the Human Subject Review Board at Concord University and approved. All participants were part of undergraduate courses in psychology and/or business administration. A researcher entered the classroom and asked the participants to participate in an in-class research study. Participants were told they would receive extra credit for participating.

The researcher passed out informed consent forms to each participant and read the form to the participants. The participants were asked if they had any questions and told to keep the consent form for their records. Afterwards, the researcher passed out a four part questionnaire and explained to participants that it was voluntary that they fill out the questionnaire and that should they wish to stop at any point, they may do so. The participants were instructed to fill out appendix A and appendix C on the questionnaire and to read the questions carefully as they may be eligible to fill out appendix B and appendix D based on their answers to the previous two appendices. Participants were also asked to use the lines provided on the survey to inform the researcher of any thoughts they had about self-injury and/or anorexia or if they knew a friend who was suffering.

If participants had any questions, they were asked to direct them to the researcher or the research mentor and were given contact information. Participants were also informed that should they wish to utilize counseling services, a list of services would be made available to them. After participants completed the survey, they were asked to return the surveys to the desk at the front of their classroom, being sure their answers were turned face down. After all participants turned in their surveys, they signed a roll sheet for extra credit. All participants were thanked for their participation in the study and the researcher left the classroom.

Results

Analysis of the data showed that of one hundred thirty three participants at the undergraduate institution, no participant claimed to be under a physician's care for anorexia. Also, no participants acknowledged being in recovery or currently suffering from anorexia. A larger sample of students may have been needed to see any results in this category.

Additionally, of one hundred thirty three participants at the undergraduate institution, six participants indicated that they were either under a physician's care for self-injury, currently practicing self-injurious behaviors, and/or were in recovery from self-injury. Of the six participants who admitted to self-injury either past or present, five reported that their current emotion was "contentedness." One participant reported that their current emotion was "sadness." When rating self-control, two participants reported that they felt their self-control to be a "ten", the highest rank indicating the most self-control, two participants a "nine", one participant a "six", and one participant a "one". When rating self-esteem and confidence one participant rated their self-esteem and confidence a "nine" out of ten, three participants reported an "eight", and two participants reported a "five." When rating their overall well-being, three participants reported themselves a "nine" out of ten, two participants reported an "eight", and one participant reported a "four." When rating their concern with their self-injury on the day of the survey five participants reported their concern the lowest with a "one" out of ten and one participant rated their concern a "two." Only two of the self-injurious participants chose to write anything. One participant

simply wrote that they were content and only having good thoughts that day while the other participant chose to write she was in recovery but had been using alcohol to help her cope.

Discussion

Prevalence of self-injury has been shown to vary with age. In the adult population it is around 1%. In the United States, lifetime prevalence of SIB, not including eating disorders, is found to range from 12% to 32.7% in secondary schools (Jacobson, as cited in Whitlock, 2010). Eating disorders in the United States are also on the rise; “as many as 10 million females and 1 million males” are suffering from anorexia nervosa and bulimia nervosa (National Eating Disorder Association, 2008, para. 1). Anorexia is also found to be at a prevalence of around 1% for the total population in the United States. In the current study these results were not found. A larger sample of subjects may have produced results more closely related to those of the general public as reported by our sources. In the current study it might have been expected to have 1-2 subjects report that they were suffering from anorexia so the results are not surprising that no participants reported anorexia. However, some researchers have suggested the number for anorexia may be higher than 1%, a contention our study does not support. In the current study, no participants admitted to participating in or suffering from anorexic behavior and six admitted to suffering or previously suffering from self-injurious behavior.

Self-injury was slightly higher than expected, at about 5% of the sample, however this may be because mostly undergraduate psychology students participated or because of some other unknown variable. Further research would be interesting to explore this prevalence of self-injury at the undergraduate institution surveyed. Future studies may be used to examine students thoughts on self-injury and anorexia, thoughts on legislation preventing websites and other media from publishing pro-self-injury and pro-anorexia literature, and on how students first learned of anorexia and self-injury. Future research may also provide insight into more effective ways for young adults to cope with self-injury and anorexia.

Self-injury can be defined as any behavior that an individual willingly engages in to harm themselves as a form of relief, comfort, or a release. Self-injurious behavior (SIB) definitions vary widely

from culture to culture and in the United States many different definitions exist. SIB has been defined by the International Society for the Study of Self-Injury as “the deliberate, self-inflicted destruction of body tissue without suicidal intent and for purposes not socially sanctioned” (ISSS, 2007, para. 3). Anorexia may also be defined many ways. People with anorexia usually weigh at least 15% less than their normal weight for their height and may not have enough body fat to keep their organs and other body parts healthy (The Nemours Foundation, 2010). The significance of the current study is that it shows that although anorexia was not prevalent in the current study, self-injury was prevalent at about 5% at the undergraduate institution surveyed. Future research with larger samples may provide more insight into young self-injurers’ behavior. The current findings, at least, should encourage institution and other universities to have more resources available.

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10.1371/journal.pmed.1000240

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Self-Injurious Behavior: Influences on Self-Harm and Anorexia
Natasha Cline: clinen11@mycu.concord.edu
Mentor: Dr. Karen Griffee: griffeek@concord.edu
Concord University—Department of Psychology

You are being invited to participate in this research survey to examine the prevalence of self-injury and anorexia among Concord students.

This survey has been approved by the Human Subjects Review Board at Concord University. If you choose to participate in the survey, your name will only be used for extra credit.

You will need about ten minutes while you complete the survey(s).

You may stop participation at any time. Please be sure to write on the survey that you do not wish to finish the survey.

Concord University, its employees, the researcher, and the research mentor are not liable for self-injurious behaviors that you may engage in during or after the survey. You will be given a list of resources with your survey that you may choose to use. These resources include physicians, counselors, and other medical professionals.

If you have questions at any point during the study you may contact the researcher at the given e-mail address. You may also contact the research mentor at their given contact information.

**If you have any questions about your rights as a study participant or want to report any problems or complaints you may contact the Concord University Human Subjects Review Board.*

All information for this study will be kept for an indefinite amount of time by the researcher and the research mentor.

If at any point you wish to stop participation, you may simply write on your survey that you do not want to continue participation and turn in your survey. Any completed information from the survey may still be used but no further data will be continued to be collected.

Important: Please keep this document where you can find it easily. It will help you remember what we discussed today. If you wish to receive more information on this study, you may contact the researcher or research mentor.

Appendix A

Please do not put your name on the questionnaire. If at any point you feel you are unable to continue or wish to stop participation in this survey please feel free to leave at anytime. No explanation is necessary. Also, if you require counseling services or would like to request them, a list of resources will be made available to you.

1. **Are you currently under a physician's care for Anorexia:**

A. ___ Yes ___ No

2. **Do you currently consider yourself to be suffering from Anorexia:**

A. ___ Yes ___ No

3. **Are you currently in recovery of Anorexia:**

A. ___ Yes ___ No

(If your answer to any of questions 1-3 were yes, please fill out Appendix C)

4. **Age:**

A. ___ 18 years of age or older

B. ___ 17 years of age or younger

5. **Gender:**

A. ___ female

B. ___ male

C. ___ prefer not to answer

6. **U.S. ethnic code:**

A. ___ White (Non-Hispanic)

B. ___ Cambodian, Laotian, or Vietnamese whose family immigrated after 1975

C. ___ Other Asian or Pacific Islander

D. ___ American Indian or Alaskan Native

E. ___ Hispanic/Latin American

F. ___ Black/African-American

G. ___ Prefer not to answer

7. **College rank:**

A. ___ freshman

B. ___ sophomore

C. ___ junior

D. ___ senior

E. ___ prefer not to answer

8. **Enrollment status:**

A. ___ Full time on campus

B. ___ Full time off campus

C. ___ Part time off campus

D. ___ Prefer not to answer

Appendix B

Anorexia Urges form and Questionnaire

This form will be used to summarize your thoughts, feelings, and overall wellbeing.

Overall Wellbeing, emotions, and any other thoughts/feelings.

How satisfied are you with your weight today?

1 being not very satisfied and 10 being extremely satisfied with your weight today.

1 2 3 4 5 6 7 8 9 10

How would you rate your overall feelings of confidence & self-esteem today?

1 being not very confident at all and 10 being extremely confident today.

1 2 3 4 5 6 7 8 9 10

How would you rate your overall feelings of wellness today?

1 being not feeling very well at all and 10 being feeling extremely well today.

1 2 3 4 5 6 7 8 9 10

How would you rate your concern with how many calories you consumed today?

1 being not really concerned at all and 10 being extremely concerned with consumption today.

1 2 3 4 5 6 7 8 9 10

Which of the following best describe the emotion you are feeling today?

Please select only 1. If necessary use the comments section to explain.

Content	Surprised	Happiness	
Anger	Disgust	Sadness	Fear

General Comments: How are you feeling today? What are your thoughts today? Is there anything of particular interest that you wish to share about your experiences today?

Appendix C

Please do not put your name on the questionnaire. If at any point you feel you are unable to continue or wish to stop participation in this survey please feel free to leave at anytime. No explanation is necessary. Also, if you require counseling services or would like to request them, a list of resources will be made available to you.

1. **Are you currently under a physicians care for self-harm behavior:**
A. ___ Yes ___ No
2. **Do you currently consider yourself to be participating in self-harm behavior:**
A. ___ Yes ___ No
3. **Are you currently in recovery of self-harm behavior:**
A. ___ Yes ___ No

(If your answers to any of questions 1-3 were yes, please fill out Appendix D)

4. **Age:**
A. ___ 18 years of age or older
B. ___ 17 years of age or younger
5. **Gender:**
A. ___ female
B. ___ male
C. ___ prefer not to answer
6. **U.S. ethnic code:**
A. ___ White (Non Hispanic)
B. ___ Cambodian, Laotian, or Vietnamese whose family immigrated after 1975
C. ___ Other Asian or Pacific Islander
D. ___ American Indian or Alaskan Native
E. ___ Hispanic/Latin American
F. ___ Black/African-American
G. ___ Prefer not to answer
7. **College rank:**
A. ___ freshman
B. ___ sophomore
C. ___ junior
D. ___ senior
E. ___ prefer not to answer
8. **Enrollment status:**
A. ___ Full time on campus
B. ___ Full time off campus
C. ___ Part time off campus
D. ___ Prefr not to answer

Appendix D

Self-Injury Urges form and Questionnaire

This form will be used to summarize your thoughts, feelings, and overall wellbeing.

Overall Wellbeing, emotions, and any other thoughts/feelings.

How satisfied are you with your level of control today?

1 being not very satisfied and 10 being extremely satisfied with your level of control today.

1 2 3 4 5 6 7 8 9 10

How would you rate your overall feelings of confidence & self-esteem today?

1 being not very confident at all and 10 being extremely confident today.

1 2 3 4 5 6 7 8 9 10

How would you rate your overall feelings of wellness today?

1 being not feeling very well at all and 10 being feeling extremely well today.

1 2 3 4 5 6 7 8 9 10

How would you rate your concern with the amount of times you injured today?

1 being not really concerned and 10 being extremely concerned with the amount I injured today.

1 2 3 4 5 6 7 8 9 10

Which of the following best describe the emotion you are feeling today?

Please select only 1. If necessary use the comments section to explain.

Content	Surprised	Happiness	
Anger	Disgust	Sadness	Fear

General Comments: How are you feeling today? What are your thoughts today? Is there anything of particular interest that you wish to share about your experiences today?

Water Balance as a Potential Idioblast Function in Leaves of *Schistanthe*

Melanie Taylor

Dr. Erik Nilsen and Dr. Douglas Creer

Major: Biology

Abstract

Idioblasts are large cells, with no known function, found in the leaves of tropical *Rhododendron* species in the subgenus *Schistanthe* (formerly known as *Vireya*). Several hypotheses have been proposed for idioblasts in *Schistanthe* including protection against water loss, herbivore defense, and temperature balance. We sought to determine if the function of idioblast cells in leaves of *Schistanthe* is to act as a buffer against water loss. We measured idioblast expression, stomatal density, and leaf capacitance in a number of specimens. We hypothesized a positive correlation between idioblast expression and both leaf capacitance and stomatal density. We found a weak negative correlation in both cases. Species with high idioblast expression had low capacitance, but there otherwise seemed to be no correlation among the variables we examined. We have eliminated water balancing as the likely function of idioblasts in *Schistanthe*. Attention should now focus on one of the alternative hypotheses.

Introduction

Idioblasts are plant cells that differ markedly from the cells around them and the cells from which they are derived (Barlow and Lück 2008). Idioblasts have been described in a number of taxa in which their functions vary considerably; these functions include water retention, plant defense, and oil secretion/storage (Lersten and Curtis 1995, 1997, 1998). Idioblast oil cells in avocados have a defensive role and have been proposed as a source of pesticide (Rodriguez-Saona et al. 2005). Some idioblasts are known to form calcium oxalate crystals in plants which may serve an anti-herbivory role (Yan and Su 2006). Khafagi (2007) suggests that idioblasts of harmful plants can be used as highly efficient sources of alkaloids. Phenolic compounds secreted by idioblasts of *Alchornea triplinervia* have been shown to have an antibacterial effect on *Staphylococcus aureus* (Calvo et al. 2010). Yan et al (2008) found that crystal idioblasts in some C4 plants are located in water storage tissues. The function of these cells is unknown, but their location suggests a function in water balance.

Schistanthe is a tropical subgenus of *Rhododendron* with 310 known species that are native to southeastern Asia and range from Thailand to Australia (Brown et al. 2005). *Schistanthe* was formerly known as the section *Vireya* (Craven et al. 2010). Nilsen and Sheckler (2003) found large idioblasts in the epidermis of leaves in the *Schistanthe* section of *Rhododendron*. They sampled other non-*Schistanthe* species of *Rhododendron* and found them not to have any comparable idioblasts. Further, they found that the size, abundance, and epidermal location of these idioblast cells differed between species of *Schistanthe*. They suggested some potential functions of these cells including leaf water balance, light refraction, and herbivore defense.

Among these various hypotheses, we chose to test the hypothesis that idioblasts function to maintain water balance. We did this by comparing idioblast size and expression, stomatal length and density, and leaf capacitance. Plants lose water through their stomata during transpiration. If idioblasts function as a buffer to prevent water loss, we expect to see a positive relationship between idioblast expression and number/size of stomata. We also expect to see a positive relationship between idioblast expression and leaf capacitance. Capacitance is the water potential decrease during water loss.

Materials and Methods

Idioblast Expression

We used previously prepared sections of leaves from 60 plants representing multiple species of *Schistanthe* (Appendix 1). We cut ribbons of 12 μm thickness of these sections using a microtome (Microm model HM340E). We adhered these ribbons onto microscope slides, dual-stained them using safranin and fast green, and mounted them. We examined each slide using a light microscope (Olympus model BX50) and photographed it with a mounted digital camera (Olympus model DP-10). We also took photographs of stage micrometers to calibrate image size. We transferred these photographs to a computer and viewed them using an image analysis program (Image J, U. S. National Institutes of Health, Bethesda, MD, USA). We counted all idioblast cells in each photograph and measured their length and width. The area of each idioblast was determined in Microsoft Excel using the equation for an ellipse, and the areas were summed to determine the area occupied by idioblasts. We used the length and width of the total section in the photograph to determine total section area. Using these measurements, we calculated idioblast expression as the percentage of the whole leaf section area occupied by idioblasts.

Stomatal Density

We used previously prepared impressions of leaf surfaces from each plant. Five impressions had been made from each plant and mounted onto microscope slides. Using a light microscope with a mounted digital camera as described above, we took five photographs randomly from each slide. Using the Image J image analysis program described above, we counted and measured the length of the stomata in each photograph. Stomatal density was found by calculating the number of stomata per mm^2 of image area.

Capacitance

To find leaf capacitance, we used living plants, took three leaves from each, and saturated them with water. Once saturated, we weighed the leaves and placed them individually inside a pressure chamber (PMS Inc. Corvallis Oregon, model 1000). As pressure increased, we watched the petiole of the leaf to see at what pressure water began to flow back through the xylem (balancing pressure). We

periodically took the leaves out of the pressure chamber, weighed them, and placed them back into the pressure chamber. These weight and pressure values were recorded and used to create pressure-volume curves. After recording 8-10 sets of values, we removed the leaves and oven dried them to determine constant dry weights. Relative saturation deficit was calculated as: (periodic fresh weight-dry weight of leaf)/total water content of leaf. This slope of the relative saturation deficit vs. balancing pressure was calculated, using Microsoft Excel, and taken as a measure of bulk leaf capacitance

We performed statistical analyses on our results using two software programs. A bivariate correlation coefficient test was used to find p-values using SPSS. A simple, quantile regression was used to analyze correlations in graph format using Sigmaplot.

Results

When we compared idioblast expression to leaf capacitance, we found a significant negative relationship ($p=0.003$, Fig. 1). Capacitance varied in the samples with 5-15% idioblast coverage, but in samples with greater than 20%, capacitance was very low. We compared idioblast expression to stomatal density and found a negative trend ($p=0.057$). In plants with greater than 20% idioblast coverage, stomatal density was in the mid-range of the total variance (Fig. 2). We compared idioblast expression to stomatal length and found no correlation ($p=0.929$). We found no correlation ($p=0.182$) in a comparison of idioblast size to capacitance.

Discussion

There is a significant negative relationship between idioblast expression and leaf capacitance (Fig.1). Plants with a particularly high number of idioblasts had a very low capacitance and are therefore intolerant of water loss. Two species in particular, *Rhododendron bryophyllum* and *R. multicolor*, have very high idioblast expression and low post-turgor capacitance. All the plants with greater than 15% idioblasts in section belong to these two species. Multiple samples from these two species caused an exaggeration of the significance of this relationship. Among plants with less than 15% idioblasts in section, there is wide variation and no apparent relationship (Fig 1). There is a negative trend between

idioblast expression and stomatal length (Fig.2). These findings are contrary to our hypotheses and indicate that idioblasts in the leaves of *Schistanthe* do not function against water loss.

Further research into the function of these cells may look into other aspects of water relation to the plants, such as hydraulic flow and stomatal conductance. Nilsen and Sheckler (2003) posited several functions for these idioblasts such as water balancing, herbivore defense and temperature balance. We have eliminated water balancing as a likely function.

It should be noted that idioblast cells stain differently than their surrounding cells. Idioblasts retain safranin, which readily stains organic polymers which may function in herbivore defense (Nilsen and Scheckler 2003). Herbivore defense has been attributed to idioblasts in other plants such as *Arabidopsis* (Husebye et al. 2002). This suggests that herbivore defense is a good candidate for the next hypothesis to investigate.

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Idioblast Expression vs. Capacitance

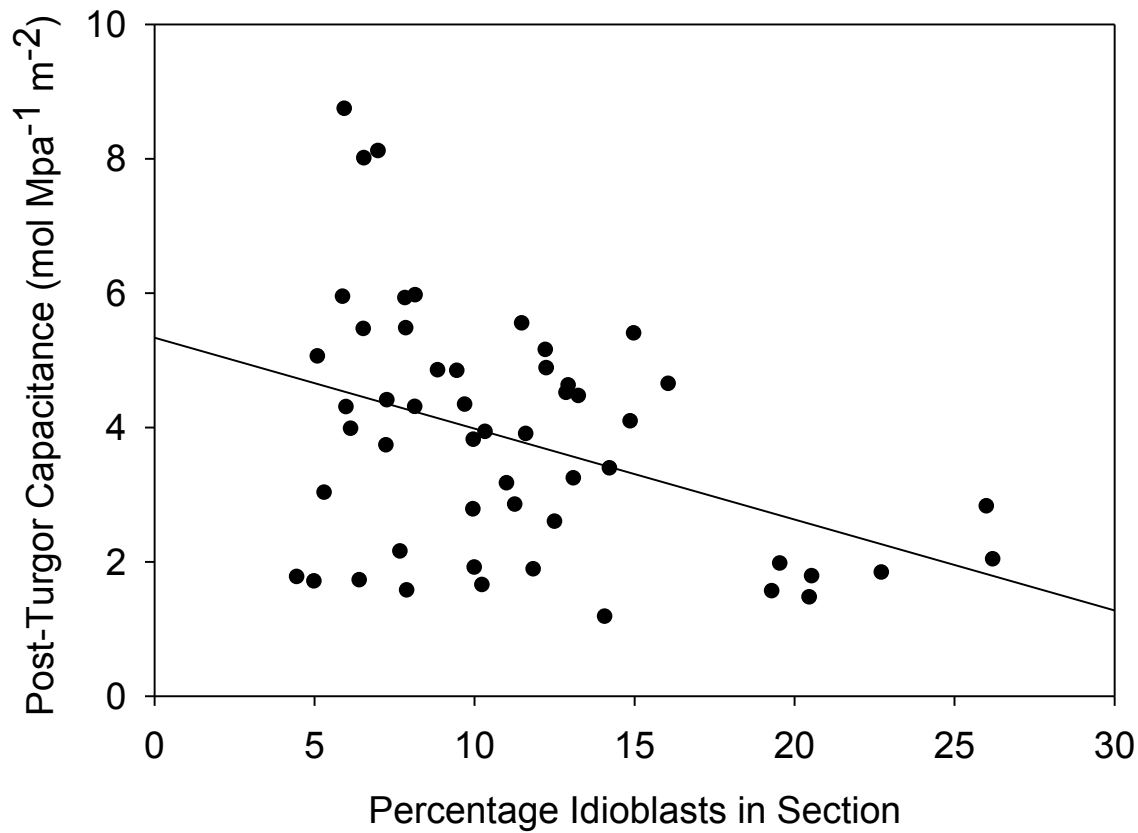


Figure 1: Percentage of idioblasts in section compared with post-turgor capacitance showing a negative correlation ($p=0.003$). The seven points on the right of this graph belong to two species, *Rhododendron bryophyllum* and *R. multicolor*, which have particularly high numbers of idioblasts combined with low capacitance. Their presence exaggerates the significance of correlation.

Idioblast Expression vs. Stomatal Density

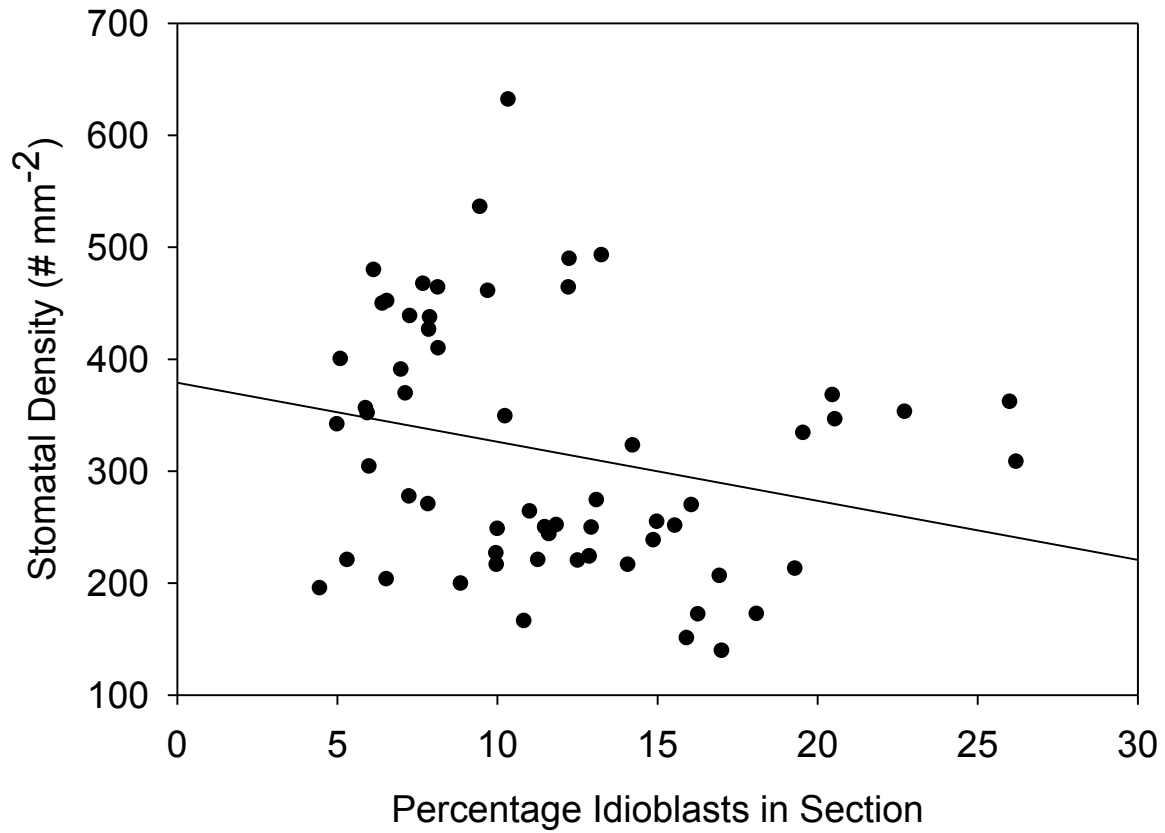


Figure 2: Percentage of idioblasts in section compared to stomatal density. A weak, negative trend ($p=0.057$) is shown with a large degree of scatter.

Appendix 1: Mean percentage of idioblasts for each plant used for data collection. Each row represents one plant.

Species	Mean Idioblast Expression (% of total leaf volume)	Standard Deviation
<i>Rhododendron aurigernum</i>	4.48133	0.503202
<i>R. aurigeranum</i>	10.36331	2.576417
<i>R. aurigeranum</i>	11.6391	4.249111
<i>R. bryophyllum</i>	19.57746	2.861023
<i>R. bryophyllum</i>	20.57032	3.934001
<i>R. bryophyllum</i>	26.03324	5.771902
<i>R. bryophyllum</i>	22.7508	1.494938
<i>R. bryophyllum</i>	20.49336	1.197791
<i>R. celebicum</i>	15.94086	1.539664
<i>R. celebicum</i>	12.89501	3.168017
<i>R. celebicum</i>	17.02868	2.651096
<i>R. crassifolium</i>	5.338084	1.173968
<i>R. crassifolium</i>	6.560444	1.643805
<i>R. crassifolium</i>	8.881641	1.831667
<i>R. goodenoughii</i>	7.154948	1.50225
<i>R. goodenoughii</i>	5.017388	0.720513
<i>R. goodenoughii</i>	7.706587	0.635996
<i>R. jasminiflorum</i>	14.89872	2.84634
<i>R. jasminiflorum</i>	9.985051	1.98384
<i>R. jasminiflorum</i>	12.53517	2.357619
<i>R. javanicum</i>	16.96775	0.289865
<i>R. javanicum</i>	16.29534	4.61281
<i>R. javanicum</i>	15.57458	2.723502
<i>R. kochii</i>	6.434222	1.453076
<i>R. kochii</i>	7.915742	1.422167
<i>R. laetum</i>	10.27062	2.760849
<i>R. laetum</i>	14.25081	2.282131
<i>R. laetum</i>	13.2825	6.776457
<i>R. laetum</i>	8.179745	1.718392
<i>R. laetum</i>	11.29685	1.934866
<i>R. macgregoreae</i>	8.169943	2.040498
<i>R. macgregoreae</i>	9.729554	3.38943
<i>R. macgregoreae</i>	6.579302	0.759263
<i>R. macgregoreae</i>	6.167696	1.052821
<i>R. macgregoreae</i>	5.127097	1.033472
<i>R. macgregoreae</i>	7.016813	1.165131
<i>R. multicolor</i>	18.12561	1.729194
<i>R. multicolor</i>	26.23101	6.300225

<i>R. multicolor</i>	19.32305	4.406515
<i>R. orbiculatum</i>	7.861693	0.779781
<i>R. orbiculatum</i>	5.914875	0.946775
<i>R. rarilepidotum</i>	7.887838	1.535732
<i>R. rarilepidotum</i>	12.24903	4.347945
<i>R. rarilepidotum</i>	12.27006	3.34801
<i>R. rarilepidotum</i>	7.293781	1.797347
<i>R. rarilepidotum</i>	9.480425	2.046234
<i>R. robinsonii</i>	11.03789	3.912365
<i>R. robinsonii</i>	13.12416	1.670819
<i>R. robinsonii</i>	15.00834	3.935047
<i>R. verticillatum</i>	12.96306	2.161254
<i>R. verticillatum</i>	10.00189	1.20794
<i>R. verticillatum</i>	11.51169	1.36984
<i>R. yongii</i>	7.270599	1.178706
<i>R. yongii</i>	6.020499	0.633103
<i>R. yongii</i>	5.964436	1.154851
<i>R. zoelleri</i>	10.85807	2.532326
<i>R. zoelleri</i>	14.10336	1.852757
<i>R. zoelleri</i>	11.87377	2.165628
<i>R. zoelleri</i>	10.02664	1.121688
<i>R. zoelleri</i>	16.08849	5.196424

PHYSICALISM vs. DUALISM:

A Re-Interpretation of the Christian Scriptures

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Major: History with an Emphasis in Philosophy



Michelangelo, *The Creation of Eve* (1508-1512).

ABSTRACT:

This research analyzes arguments for the nature of the Christian Spirit or *pneuma*. I have examined biblical and historical texts in their own languages, paying attention to the etymology of words. I have also examined philosophical arguments for the existence and nature of the soul. All primary sources have been analyzed using the tools of logic to check for validity and soundness. My hypothesis is that there is a conflict between physicalism, dominant in the sciences, and dualism, dominant in the Judeo-Christian tradition, but it is an unnecessary conflict. This conflict has led many to posit that science and religion can have no commonality. But I believe a reunion is plausible by incorporating a physicalist interpretation of the Christian scriptures. I will show that a physicalist interpretation of the Christian *pneuma* is not only more philosophically credible than a dualistic interpretation, but that it is also just as theologically viable.

INTRODUCTION

Since the time of the Enlightenment there has been a growing rift between the claims of religious traditions and the claims of science. This rift has halted meaningful dialogue and has polarized both fields to the point of the participants being antagonistic toward each other. The problem, as it stands, is largely a matter of ontology and at the outset seems insurmountable. Religion has been historically dualistic, claiming that there are material substances and immaterial substances. We will talk later about the different views of dualism, but for now it will be sufficient to say that substance dualism argues for two substances, neither dependent upon the other. In other words, the material cannot give rise to the immaterial and the immaterial cannot give rise to the material. Another form of dualism is property dualism, which argues that the immaterial is a property of the material. In this view the immaterial is attached to the physical, specifically the brain. Standing in stark opposition to these dualistic views are the physicalistic claims of science. Operating within the guidelines of the scientific method, scientists study quantifiable material things. This leaves no room in the human ontology for an immaterial thing or substance. The argument is not that immaterial things do not exist, but rather if they do we would lack access to them. By definition, scientists argue that if something is immaterial it would fall outside the sensory experience of seeing, touching, tasting, feeling, and smelling. Because of the radically different claims of both physicalists and dualists, no meaningful dialogue has taken place, and there seems to be no cohesive worldview uniting the contenders.

PRELIMINARY ISSUES

To evaluate the physicalist and dualist claims accurately we must look at the influences that were facing the early Church and the early Christians. As the “sect” of Christianity began to grow in Jerusalem, opposition was shortly to follow. “Acts of the Apostles”, the historical account of the early activity of the Christian Church, records the persecution as being so great that many would leave Jerusalem and begin establishing Christian congregations throughout the province of Asia Minor.¹ This dispersion would eventually meet a revival of Platonic philosophical ideas called Neo-Platonism, led by

¹ Acts 8:1, John 16:32-33.

the Greek philosopher Plutarch. Plutarch would use the God of Plato's *Timaeus* as "maker and father" to be the maker of material things and father of the soul.² This soul, which was created by God, would make man a part of God himself. Numenius, another Neo-Platonist with Gnostic influence, would use Plato's "maker and father" to mean two Gods: "father" is the supreme transcendent God, and "maker" is the Son. This implies the Gnostic idea that the Neo-Platonic "father" could have nothing to do with material things, and yet the "son" clearly could.³ So the literal Neo-Platonic interpretation of *Timaeus*, coupled with many literal parallels found in Genesis of the Jewish Scriptures, would push many newly Hellenized Christians into the philosophical and dualistic world of Plato, supplanting a Stoic worldview.

But the early Christian and Jewish Stoics began at a different point than that of the Platonists. They began by asking the fundamental question, "What is real?" The answer, they concluded, was that Plato's "that which is" was suitable, but somewhat insufficient.⁴ They added that only bodies can act or be acted upon, thus only bodies exist, and incorporeal things are "figments of the mind." For the early Christians this meant that for God to be the God of the Jewish and Christian scriptures, active in creation and maintaining causal ability in the world, that God must be somehow material. If God was not material, then God would be merely conceptual, lacking any causal ability in the physical world.⁵ This was the view that the early Church writer Tertullian adopted, while rejecting the Gnostic spark. To make this view cohesive, the Stoics claimed that God was aligned with eternal reason, *logos*, or intelligent designing fire which structures matter in accordance with its plan.⁶ This plan is enacted time and time

² Whittaker, John. "Plutarch, Platonism and Christianity." In *Neoplatonism and Early Christian Thought*, (London: Variorum Publications, 1981), 51.

³ The gender of the language in Acts 17 is worth mentioning here. The "unknown God" described as amorphous by the Greeks was clarified by Paul as being masculine and knowable. Rather than being "unknown" and removed from creation, Paul says that God is revealed as both God and Creator. To further this idea, I John 4:7 says that to know God we must become like he is. But if God is not like man, hence immaterial, how can we know him?

⁴ Stanford Encyclopedia of Philosophy. "Stoicism." *Stanford Encyclopedia of Philosophy Web site*. February 7, 2008. <http://plato.stanford.edu/entries/stoicism/> (accessed June 21, 2010).

⁵ Verbeke, Gerard. *The Presence of Stoicism in Medieval Thought*, (Washington, D.C.: The Catholic University Press of America, 1983), 23.

⁶ Stoic cosmology and the concept of the "designing fire" can be seen clearly in Acts 2 and III Peter 3 of the Christian scriptures. In Acts 2 we have the four elements of Stoic cosmology: fire (cloven tongues of fire), wind (the sound of a mighty rushing wind), water (the baptism that ensued), and earth (where all of this was happening). In II Peter 3 the world is destroyed and reborn in the Stoic idea of a new conflagration.

again, beginning from a state in which all is fire, through the generation of the elements, to the creation of the world we are familiar with, and eventually back into fire in an endless cycle of recurrence. This cosmology would help to develop the idea of the Christian *pneuma*, which was manifested in *tenor* (inanimate objects), *physique* (plants), *psyche* (animals), and *pneuma* (rational animals). They assigned to *physique* and *psyche* all the purely physiological life functions of a human animal like digestion, breathing, and growth. To the *pneuma* they assigned things like thinking, planning, and deciding. Since the *pneuma* is a body, the Stoics had a materialist theory of mind. The *pneuma*, or the soul, is subject to generation and destruction, but if it was strong enough, through the development of virtue, it would survive until the next conflagration.⁷

BIBLICAL TEXTS CONCERNING THE NATURE OF THE SOUL

Now that we understand the context and influences upon early Christianity, let us turn our attention to the Biblical texts concerning the nature of the soul. There are four words in biblical Hebrew and Greek that are translated as soul, but also translated as other things as well, leading to confusion and exegetical misunderstandings. Two of those words are seen in the idea that the *soul* can be described as life, or breath, or neck. This is captured in the Hebrew word *nephesh* and the Greek word *psyche*.⁸ So in a general sense, all living things have a soul, meaning that they have life in them. When the physical processes of the body cease; when breathing stops; life stops. Also, when food, water, and other natural cravings do not pass through the “throat” life ceases. This is seen in Genesis 2:7 when God breathed the breath of life into man, thus making him a living soul, or more literally, a living creature.⁹ So it is very appropriate that *nephesh* is often translated as breath or neck, but there seems to be no credible reason why soul or spirit is used in subsequent English translations arising from the Hebrew text. This same idea is carried into *psyche* as well, with a clear indication of the value of the physical life that each possess.

⁷ Stanford Encyclopedia of Philosophy. "Stoicism." *Stanford Encyclopedia of Philosophy Web site*. February 7, 2008. <http://plato.stanford.edu/entries/stoicism/> (accessed June 21, 2010).

⁸ In the Septuagint *psyche* is used to translate *nephesh*, so there is a close correlation between the words.

⁹ Other uses of *nephesh*: Genesis 1:30 attributes *nephesh* to all living animals, Psalm 88:3 refers to *life* as *nephesh*, Genesis 35:18 records *nephesh* as departing when breathing stops, and in I Kings 17:21 Elijah prayed that the *nephesh* would return to the widow's son.

Matthew 16:26 asks this question to help point out the value of physical life, or *psyche*: “What good is it if a man gains the whole world, but loses his soul (*psyche*)?”¹⁰ Chouinard expounds on that scripture and says that not only does this indicate a great value in our physical lives, but that the question “assumes the primacy and ultimate value of one’s soul over even the possibility of taking possession of the entire world. When weighed in the balance, possession of all the world has to offer cannot possibly transcend the value of one’s life.”¹¹

Second, there is the idea of spirit or soul, captured by the Hebrew word *ruach* and the Greek word *pneuma*, which is the primary focus of this research. *Ruach* and *pneuma* are both translated as wind, and are akin to breathing, blowing, and can also mean a breath.¹² But this definition is rather vague and leaves us wondering what else can be extrapolated from the biblical texts. The uses of *pneuma* in the Christian texts are numerous, but not insurmountable when considering that the definite article makes the majority of the uses about the Holy Spirit, or the third part of the Godhead, rather than the individual soul or spirit.¹³ But even at this, there are numerous usages concerning the individual soul that still need sorted out. According to Vine’s Expository Dictionary of Biblical Words the soul is the invisible and immaterial part of man. It is the sentient element in man by which he perceives, reflects, feels, and desires. This definition comes from several different functions of the *pneuma* that we see in the Christian scriptures.¹⁴ I shall point out later that this definition is problematic for a number of reasons, but now that we understand the usages of the words in question, let’s look at some cursory examples of how they are used in the Christian texts.

¹⁰Other uses of *psyche* can be found in Luke 12:19 where the Rich Man talks to himself and uses the *psyche* to do so. Also in Revelation 6:9, 20:4 there is a reference to the martyrs who offered their physical lives, their *psyche*, for the cause of Christianity, and are waiting to be avenged.

¹¹Larry Chouinard, *The College Press NIV Commentary on Matthew*, (Joplin: College Press, 1997), 307.

¹²In the Septuagint *pneuma* is used to translate *ruach*, so there is a close correlation between the words.

¹³Jesus teaching Nicodemus in John 3 is an exemplary illustration of this.

¹⁴For example: Matthew 5:3 mentions being “poor in spirit”, Matthew 26:41 mentions that the “spirit is willing, but the flesh is weak”, and in Acts 17:16 Paul’s spirit was stirred because of all the idols in Athens.

THE SOUL AND THE BODY

The relationship between the soul and the body, as seen in the Christian scriptures, is at best difficult to understand. It seems as if the texts concerning the soul and its relationship to the body fall into one of four categories. The first category is that the human body possesses a relationship with the soul, but it somehow different from the soul. In Matthew 10:28 Jesus says, “Do not be afraid of those who kill the body but cannot kill the soul. Rather, be afraid of the One who can destroy both soul and body in hell.” Clearly, it seems that Jesus makes a distinction between the body and the soul, but how much of that distinction is related to the context of the passage? Chouinard says that “the intent of Jesus’ words is not to argue for an extreme dualistic understanding of human nature, i.e., that humans can be separated into two related parts, body and soul. Rather the point is that while those who persecute the disciples can harm the body, but they have no power over the total person, composed of both body and soul.”¹⁵ In other words, some men have the power to terminate the physical life, but it is God only who possesses the ability to destroy the total person. This division of body and soul can also been seen in the passage where Stephen was being stoned to death after preaching and teaching about the resurrected Jesus, and prayed that God would receive his spirit after the body was physically dead.¹⁶ So the idea of the body housing the spirit or soul is clearly identified, but always in the context of explaining something else, so we have little room to make concrete applications concerning he relationship that both share with one another.¹⁷

The next category of biblical texts involves passages that indicate the soul continuing in an intermediate state while awaiting the resurrection of the body. In the Hebrew letter the writer is giving a description of the heavenly Jerusalem and describes the presence of righteous men “made perfect.”¹⁸ This “perfection” has the idea of completeness rather than the absence of error, but one can clearly extrapolate

¹⁵ Chouinard, *The College Press NIV Commentary on Matthew*, 193.

¹⁶ Acts 7:59.

¹⁷ Other passages lend support to the ambiguous nature of the body/soul relationship: Luke 8:55 gives an account of the soul of a dead girl returning to her physical body, I Corinthians 5:5 when a sinful man is rebuked and removed from fellowship so that his soul might be saved on the last day, and James 2:26 tells us that the body without the spirit is dead.

¹⁸ Hebrews 12:23.

that the soul exists outside of the body. Paul, in his second letter to the Corinthians, describes his turmoil over wanting to be with the Lord after his physical death, and wanting to continue to live so that he could continue to teach the early Church. He points out here that “to be absent from the body is to be at home with the Lord.”¹⁹ Again, a clear distinction between the soul and the body is made, and even in this case the identity of the person is based upon the soul and not the body.²⁰

The next category of scriptures refers to the body and the soul as one. The Psalmist says that with the spirit we live, without it we return to the ground and to the dust.²¹ King Solomon also gives us an account that says that the spirit works within the body in a way that we cannot understand, just like you know that a baby is in a woman’s womb, but you can know little about it outside of the knowledge that it is there.²² It seems that the context here is that the body without the spirit is dead, but also that the spirit without the body is dead as well.

Finally, there is the Pauline tripartite physiology where we have an account of the body, soul, and spirit existing as one.²³ This seems to be an ancient account of the human ontology in which there is a difference in the physical body, the life that animates it, and the soul that the body houses. This is more complicated than the other accounts because it divides the person into three parts, but when we are thinking we are not aware of any part of ourselves that is doing the thinking. In other words, we do not observe introspectively that our brain is thinking, so we tend to think of ourselves as a whole rather than compartmental.

If anything, we can tentatively conclude that textually there is ambiguity concerning the role and nature of the spirit/soul. Looking at the etymology of the words *nephesh*, *ruach*, *psyche*, and *pneuma* have only shown that the English translations of the Bible have given birth to a host of difficulties by translating some instances as wind, some as air, some as soul, and some as spirit. Also, there is ambiguity in how we can categorize the information we glean from the text concerning the soul. The information

¹⁹ II Corinthians 5:5.

²⁰ More passages concerning the separation of the soul existing outside the body: Luke 23:6, Philippians 1:21-24.

²¹ Psalm 104:29-30 and Psalm 146:4.

²² Ecclesiastes 11:5.

²³ I Thessalonians 5:23.

seems to be more contextually driven, rather than seeking to give the reader an actual and factual account of the soul. Now we must turn our attention to the philosophical arguments of dualism and physicalism to help us understand the role and nature of the soul.

DUALIST ARGUMENTS FOR THE EXISTENCE AND NATURE OF THE SOUL

Dualism contrasts with other ontological accounts like monism, which argues for only one fundamental thing, and pluralism, which argues for many kinds of things. According to the Stanford Encyclopedia of Philosophy, dualism is the theory that the mental and the physical are in some sense, radically different kinds of things. Dualists, therefore, start with the assumption that the immaterial mind cannot be treated as part of the material world. Dualism in its early form was espoused by Plato. Plato believed that the true substances are not physical bodies, which are ephemeral, but the eternal Forms of which bodies are imperfect copies. These Forms then take on the role of universals or concepts. So it is clear that dualism existed well before the 17th century and the time of René Descartes, and was certainly viable in the 4th century when Christianity merged with a revival of Platonic philosophy known as neo-platonism, but it was through the work of this French philosopher that it achieved a new credibility within the Church like it had not received before. Descartes advocated for what is known as substance dualism, which says that the mind is the “substance” of the person, and the body is in a strict sense accidental.²⁴ He does this by showing that he can doubt the existence of anything, including that he has a body, but he cannot doubt that there is something doing the doubting. Descartes said of this doubting thing, “I do not observe that any other thing necessarily belongs to my nature or essence except that I am a thinking thing, I rightly conclude that my essence consists in this alone...and although I have a body to which I am very closely united, nevertheless...it is certain that I, that is to say my mind, by which I am what I am, is entirely and truly distinct from it.”²⁵ We can clearly see that there is a clear and sharp distinction between the immaterial mind and the material body. Descartes also argued that since the material cannot give rise

²⁴ Paul Badham, *Christian Beliefs About Life After Death*, (New York: Macmillan Press, 1976), 99.

²⁵ Badham, *Christian Beliefs About Life After Death*, 101.

to the material, i.e. the brain cannot give rise to the mental states, there must be something in the human ontology to account for them; Descartes posited the immaterial soul.

Property dualism is somewhat different than substance dualism. Property dualism, according to the Stanford Encyclopedia of Philosophy, occurs when “the ontology of physics is not sufficient to constitute what is there. The irreducible language is not just another way of describing what there is, it requires that there be something more there than was allowed for in the initial ontology.” Property dualism, then, seeks to account for things such as qualia or the qualitative phenomenal experience, and posits that since those things are not easily catalogued by physics that they are somehow immaterial substances.

There is also a newer division of dualism that has become increasingly popular known as emergent dualism. Emergent dualists argue that organisms having complex nervous systems automatically generate conscious and non-physical subjects for those states.²⁶ So their arguments make the immaterial radically dependent upon the brain. It is the brain that gives rise to mental states, the soul, and the qualia, but it is yet “somehow” separate from these things. This account of mind seems to have developed as a way to circumvent many of the problems associated with property dualism and substance or Cartesian dualism.

Dualism has caught on so well within the religious traditions of the world, especially Christianity, for a number of reasons. The biggest of those being that it is very amenable to the concept of eternity. One of the basic tenets of the Christian faith is the promise of an eternity in heaven, but to many Christians this is a difficult notion to understand without there being something in the human ontology that is eternal and will live past the physical death of the body. It is the immaterial soul that bridges this gap for the dualist. If the soul is immaterial it is by definition eternal and immutable.

This immutability also lends well to a personal identity persisting across time. According to the Flux Doctrine, everything in the external world is constantly altering; no object retains all of its

²⁶ Dean W. Zimmerman, “Christians Should Affirm Mind-Body Dualism,” in *Contemporary Debates in Philosophy of Religion*, ed. Michael L. Peterson; Raymond J. Vanarragon et al. (Malden: Blackwell Publishing, 2004), 317.

component parts from one moment to the next. So how can personal identity through change be accounted for? The Mereological Theory of Identity (MTI) suggests that the identity of an object depends on the identity of its component parts. This view is illustrated accordingly:

“For any compound objects, x and y , $x = y$ only if every part of x is a part of y , and every part of y is a part of x . I.e., an object continues to exist (from time₁ to time₂) only if it is composed of all the same components at t_2 as it was at t_1 . Sameness of parts is a necessary condition of identity.”²⁷

We know that the body is in a state of constant change, but it seems that if identity persists through time then we must somehow deny MTI. This is not the dualist solution, however. The dualist argues that it is the soul that determines the true person, and since that soul is eternal and immutable, there is no reason to deny MTI and search for an alternative source of personal identity persisting through time. This lends itself well to the Western sense of identity where individual autonomy is stressed, and the idea that we are somehow more than the sum of our parts.

Dualism offers another benefit; the individual has the ability to make free-willed decisions in a universe that is causally closed. Modern physics argue that we live in a world of cause and effect, and that physical things are acted upon by other physical things leading to determined outcomes. If we are to break the causal chain there must be something within the human ontology that is not itself bound by the laws of physics. The dualist posits that the immaterial soul becomes the change causing agent, and since it is immaterial it can operate in ways that are non-determined.

PROBLEMS WITH DUALISM

While dualism certainly has its strengths, it is definitely not without its problems. I will now explore four of the major problems that dualism faces and fails to account for, or at best fails to give a proper account of.

The first of these problems is the Mind/Body Problem. Dualism posits that there are two types of substances, material and immaterial, i.e., there are immaterial minds/souls and there are physical bodies.

²⁷ Marc Cohen, “Identity, Persistence, and the Ship of Theseus,” University of Washington, accessed June 6, 2010, <http://faculty.washington.edu/smcohen/320/theseus.html>.

But this relationship between the immaterial and material is very problematic. Given that immaterial things lie outside of our sense perception, how can we know they are there, and much less assign them causal relationships in the physical world? If immaterial things exist in the world then by definition we have no access to them. But if we claim access to them, then we must resign that access to be purely mental or conceptual. According to John Searle, this just does not seem to work. Searle says, “How does anything in the body cause anything in the mind? How does anything in the mind cause anything in the body? Yet, it seems we know that there are causal relations.”²⁸ He offers two explanations to help illustrate the problem: If someone steps on our toe, we feel pain. Stepping on the toe is a physical event in the physical world, and yet the pain is a mental event that occurs within the mind. He also says that the causal relations go in the opposite direction, that if we have a thought in the mind to raise our arm, the arm goes up in the physical world. It is this relationship that the dualist cannot account for. Descartes’ infamous solution was to look for this exchange in the human physiology, which he determined took place in the pineal gland. Given the 17th century understanding of anatomy, his solution was ambitious. The pineal gland was only found on one hemisphere of the brain, and since no account could be given of its function, Descartes concluded this is where the exchange between the immaterial and material took place. This solution is far from convincing.

The Self and Personal Identity is another problem that dualists have. While many argue that dualism answers questions of personal identity better than other philosophical worldviews, I argue that their account of the true substance of the person is not complete. It is easy to say that the soul provides for a stable identity across time, but proving that is more difficult. To borrow an illustration from Searle, “I am now working on a set of issues while looking out at a lake in Sweden. A month ago I was working on related problems while looking at the ocean off California. The experiences are quite different, but I think of both of them as mine. Why? With what justification?”²⁹ The dualist answer to Searle is that the body has nothing to do with personal identity. Personal identity, according to the dualist, is derived from

²⁸ John R. Searle, *Mind: A Brief Introduction* (New York: Oxford Publishing, 2004), 11.

²⁹ Searle, *Mind: A Brief Introduction*, 17.

the mental substance and not the physical. But this leaves a mess to try and figure out. It is the body that senses the experience, but bodies come and go, so how can that experience of the body be attributed to the immaterial self? A better solution account of personal identity is through spatio-temporal continuity (STC). STC says that a persisting object must trace a continuous path through space and time. And tracing a continuous path is compatible with a change of parts, i.e. a physical body that is in a constant state of flux, so long as the change is gradual and the form or shape of the object is preserved through the changes of its component materials.³⁰ So the problems associated with MTI appear to be resolved with STC.

The Free Will Problem also needs a better account under dualism. This problem is closely related to the mind body problem, but there is a distinction to be made. Dualists argue that the mind is the change-causing agent that has the ability to break the causal laws of physics and begin a new causal chain. But if the mind is immaterial, and free-will is a feature of the mind, how can the mind have any effect on the physical world, if the physical world is completely determined?³¹

There are many more problems with dualism than the ones we have mentioned.³²The problems with dualism are insurmountable and there is a widespread consensus among professional philosophers that dualism fails. With this in mind, let us turn our attention to the physicalist arguments for the existence and nature of the soul.

PHYSICALIST ARGUMENTS FOR THE EXISTENCE AND NATURE OF THE SOUL

Physicalism, or materialism, is described by the Stanford Encyclopedia of Philosophy as “the thesis that everything is physical, or as contemporary philosophers sometimes put it, that everything supervenes on, or is necessitated by, the physical.” Physicalism has a long history to explore.

Gerard Verbeke, in *The Presence of Stoicism in Medieval Thought*, gives us several influential materialist accounts of the soul, but I want to focus on one of the more influential, the early Church writer

³⁰ Marc Cohen, “Identity, Persistence, and the Ship of Theseus,” University of Washington, accessed June 6, 2010, <http://faculty.washington.edu/smcohen/320/theseus.html>.

³¹ Searle, *Mind: A Brief Introduction*, 16.

³² John Searle in *Mind: A Brief Introduction* gives a good account of twelve of the biggest problems facing dualism.

and theologian Tertullian. It seems as if Tertullian adopted a stoic materialism without hesitation. He said that the soul was not a particle of immanent divine reason, but was *spiritus* which corresponds to the stoic pneuma. Tertullian then terms the soul as *flatus* or breath, which corresponds to the *psyche*. The relationship between the two is a dependent relationship where the *flatus* is dependent upon the *spiritus*, meaning that the human soul is a copy of divine perfection. Tertullian also thought that God was corporeal, but not on the same level as the sensible world. If God was incorporeal he would be like space and time, and other incorporeal things, with no creative or causal ability in the external world. To prove this he provides us with a cohesive view of the nature and role of the soul based upon what the Christian scriptures said was the destiny of souls after death. If the unrepentant soul was to be punished after death, then it must be corporeal. If otherwise, the immaterial soul would lie outside the realm of a literal hell, and could not be punished. He also said that the soul is a material breath, but is nonetheless uncomposed, indivisible, and immortal. So after death the soul persists and can never be dissolved. This might sound problematic to us, but it is no more problematic than the dualist account of the soul persisting after the physical death. The dualist has to call on the existence of an immaterial soul that lies outside of our sense perception to fulfill the scriptural requirements for the destiny of souls after death, but Tertullian's account at least deals in the material realm of things that we can perceive and interact with, thusly making it more sound and plausible.

As previously noted, it seems that the scriptures are ambiguous in nature concerning the role and nature of the spirit, but I do not believe they are divided on the issue. There is no strong support one way or another, no creedal support, and therefore no reason to think that the early Christians were divided on the physicalist/dualist debate.³³ So appealing to sources such as Tertullian to see what the early, and seemingly unanimous, view on the soul is critically important.

PROBLEMS WITH PHYSICALISM

If physicalism is to be held as a viable account of the human ontology, it must first overcome three major objections raised by the dualist. The main argument is that physicalism fails to adequately

³³ Hud Hudson, *Materialist Metaphysics of the Human Person*, (Ithaca: Cornell University Press, 2001), 174.

account for qualia and consciousness. We have previously defined qualia as the quality, or felt experience of empirical stimuli. To illustrate the argument let us look at Jackson's knowledge argument.³⁴ Jackson uses a thought experiment to have us imagine a neuroscientist named Mary, who knows everything there is to know about color perception. Her physical knowledge of color perception is total and complete, but she has been brought up in a totally black and white environment. Having never experienced color before, Jackson argues that her complete physical knowledge of color perception cannot include the first person experiential knowledge, that is she could not know about the qualia she experiences when she is exposed to color and has a first person experience of it. Jackson's argument looks like this:

P1. Mary (before her release) knows everything physical there is to know about other people.

P2. Mary (before her release) does not know everything there is to know about other people, because she learns something new upon being released and experiencing color for herself.

Conclusion. There are truths about other people (and herself) that escape the physicalist theory and account of mind.

Clearly, given the structure of the argument, the conclusion is valid, but it is not sound. All that Jackson clearly illustrates with the thought experiment is the difference between propositional knowledge and experiential knowledge. Mary does not learn anything new in P2, she merely acquires experiential knowledge, or a first-person subjective account of the experience. There is no reason to posit that the experience proves the existence of immaterial qualia, but only that her account of knowledge has changed. Jackson has also made a category error. He uses epistemological premises in the argument, but arrives at a metaphysical conclusion.

Meaning and Intentionality is another argument against physicalism. The Stanford Encyclopedia of Philosophy defines the intentionality of mental states by saying that it is "their aboutness, their capacity to represent the world as being a certain way." In other words, we do not just think, we think about something. We do not just believe, we believe something about something. Dualists argue that this is what is missing in a physicalist account of mind. But this seems to just be a matter of semantics. Searle

³⁴ Frank Jackson, "What Mary Didn't Know," *Journal of Philosophy*, 83: 291-5.

dismisses this argument by saying that “all mental representation is under representational aspects. Causation also has aspects but they are not representational aspects. You cannot analyze mental concepts in causal terms because the representational aspectual shape of the intentional gets lost in the translation.”³⁵

The final argument presented against physicalism is the argument from Methodological Issues. This argument, as posed by Noam Chomsky, says that physicalism is not false, but that the entire physicalist account of mind is misguided. The Stanford Encyclopedia of Philosophy calls this type of rebuttal Methodological Naturalism, for it seeks an understanding of consciousness and experience through the natural methods of science. Chomsky’s second contention is that the physicalist philosophy of mind seeks to understand the mind through metaphysics, but there is nothing metaphysical about the naturalistic approach and does not lend well to philosophical investigation, but this critique of physicalism is purely linguistic. Even if Chomsky’s assessment is accurate, it does little to refute physicalism.

In the end, the dualistic challenges to physicalism are lacking at best, and are easily refuted. There is a widespread consensus among philosophers that the arguments for physicalism are successful, so physicalism succeeds.

CONCLUSION

Since the brain can account for mental states, there is no need to posit the existence of an immaterial entity to account for them, thus we can use Ockham’s razor and remove them from the argument. There is no evidence in the human ontology that an immaterial soul exists, and the dualists provide no reason for us to give up on the physicalist thesis.

Christianity is inherently physical. When tracing the story of Jesus through the New Testament we can clearly see that the major tenets of Christianity are based upon physical events. The incarnation, Jesus coming as God in the flesh, was completely physical. The crucifixion was a physical event. The resurrection of Jesus from the tomb was a physical resurrection, and by extension, the future resurrection

³⁵ Searle, *Mind*, 66.

of the Christian is a bodily resurrection as well. Here is what Paul says concerning the resurrection in I Corinthians 15:12-19...

¹² But if it is preached that Christ has been raised from the dead, how can some of you say that there is no resurrection of the dead? ¹³ If there is no resurrection of the dead, then not even Christ has been raised. ¹⁴ And if Christ has not been raised, our preaching is useless and so is your faith. ¹⁵ More than that, we are then found to be false witnesses about God, for we have testified about God that he raised Christ from the dead. But he did not raise him if in fact the dead are not raised. ¹⁶ For if the dead are not raised, then Christ has not been raised either. ¹⁷ And if Christ has not been raised, your faith is futile; you are still in your sins. ¹⁸ Then those also who have fallen asleep in Christ are lost. ¹⁹ If only for this life we have hope in Christ, we are of all people most to be pitied.

But does Christianity need a physical resurrection if dualism is true? If the true essence of the Christian is the immaterial soul, and the soul is only trapped by the physical body, how can a physical resurrection do anything but inhibit the soul once again? But if we are physicalists, then the resurrection is vitally important; it is everything. It is only in the resurrection that death and sin are defeated. In the resurrection Paul assures the Christian that we will receive a new resurrection body, one that is not like the old body, but rather a new spiritual body, meaning that it is incorruptible. There is no need to posit this new body as incorporeal. As we have already established, the resurrection of the spiritual body when the spirit has existed in heaven since the death of the physical body is not coherent. The blessing of the resurrection is this new spiritual corporeal body that is imperishable and will allow us to spend an eternity with God. Here is Paul's account of that body in I Corinthians 15:35-44...

³⁵ But someone will ask, "How are the dead raised? With what kind of body will they come?" ³⁶ How foolish! What you sow does not come to life unless it dies. ³⁷ When you sow, you do not plant the body that will be, but just a seed, perhaps of wheat or of something else. ³⁸ But God gives it a body as he has determined, and to each kind of seed he gives its own body. ³⁹ Not all flesh is the same: People have one kind of flesh, animals have another, birds another and fish another. ⁴⁰ There are also heavenly bodies and there are earthly bodies; but the splendor of the heavenly bodies is one kind, and the splendor of the earthly bodies is another. ⁴¹ The sun has one kind of splendor, the moon another and the stars another; and star differs from star in splendor. ⁴² So will it be with the resurrection of the dead. The body that is sown is perishable, it is raised

imperishable; ⁴³ it is sown in dishonor, it is raised in glory; it is sown in weakness, it is raised in power; ⁴⁴ it is sown a natural body, it is raised a spiritual body.”

It is evident to see that when you read passages such as this from the imported dualistic philosophy, confusion ensues about what a “spiritual” body is, but when taken in the proper context it is better understood theologically and philosophically to interpret in the context of a stoic worldview. So not only is a physicalist Christianity plausible, it is more desirable when considering that the major promises found in the scriptures need to be physical before they can be fulfilled.

Waterfalls as Barriers on Stream Fish Communities in Southern West Virginia

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Biology Major

Abstract:

We examined the effects of waterfalls as barriers on local fish communities in streams. Fish and benthic macroinvertebrate communities were sampled upstream and downstream of waterfalls on Brush Creek and Pipestem Creek in southern West Virginia. To sample the fish communities, we used a backpack electroshocker to non-lethally collect fish along a 100m reach for two hours. Macroinvertebrates were collected by the kick-sampling method which involved the disturbance of substrates to loosen invertebrates, allowing them to flow into a net. At Pipestem Creek, seven species of fish were found downstream of the waterfall, including *Campostoma anomalum* (central stoneroller), *Phoxinus oreas* (mountain red-belly dace), *Alosa kessleri* (black nose dace) and the other four species found at the upstream site including *Etheostoma flabellare* (fantail darter), *Coregonus artedi* (creek chub), *Lepomis macrochirus* (bluegill), and *Gila coerulea* (blue headed chub). Upstream from the waterfall on Pipestem Creek, four species were found, fantail darter, creek chub, bluegill, and blue headed chub. The total density of fish was much higher downstream of the waterfall. The invertebrate community was nearly the same at both Pipestem Creek sites. The upstream site at Brush Creek had four species; the downstream site was not sampled. We measured the dissolved oxygen, conductivity, and pH at each site. No significant differences between water chemistry parameters were found among the sites. We found that there was a difference in the diversity and density of fish fish communities downstream and upstream of waterfalls. The waterfall most likely prevented many species from dispersing upstream.

Introduction:

Barriers influence the dispersal and movement of fish. Both natural and manmade barriers can impact the fish community composition. The New River watershed in central Appalachia has a lower diversity of fish due to limited dispersal upstream from a large waterfall near its confluence with the Kanawha River in West Virginia (Hocutt and Denoncourt, 1978). Robinson (2002) found that waterfalls along the Toxaway River in North Carolina prevent the upstream dispersal of some fish species. He found that species diversity changed from 23 to 4 species over a distance of 10 km upstream that crossed several waterfalls. Head-water streams isolated by acid mine drainage had much less diversity and density of fish (Stoertz et al. 2002). The invertebrate communities were unaffected because of the adult flight stage in majority of the invertebrates. In addition to the diversity and density of fish, fish species above the cascades in Sabah, Malaysia were found to be predominantly herbivores and much smaller in size than reaches downstream (Martin-Smith and Laird, 1998).

Barriers to fish dispersal can directly affect predation within these fish communities. Not only does it affect their food source, but it also takes its toll on the predators that prey upon them. An experiment in Espi'ritu Santo, Puerto Rico showed that freshwater shrimp (*Atya lanipes*) migrate to a region of the stream above a natural waterfall where they were free from fish predation. This shrimp species was not a natural part of the fish' diet, and when samples were taken, they were never seen in the stomach of the fish species even though the fish had no objections to them in their diet (Hein et. al. 2010). In several streams, galaxiids are only seen above waterfalls streams that are impassable to trout in order to avoid predation (Creed 2006). Due to the barrier, in both cases, the trout species have no other option than to feed off of the species below the falls. Brook trout in particular will migrate downstream below waterfalls or other barriers (culverts etc.) placed before them (Adams et. al. 2001). These brook trout cannot migrate upstream past any slope exceeding a three to five percent inclination, and results in segregated communities (Poplar-Jeffers et. al. 2009). The segregation caused by these waterfalls not only prevents fish from migrating, but also some parasites that live off of these fish species. The waterfalls will cause a break in the parasite community where fish migration is not possible, and reinforces the

segregation implied by the waterfalls (Barger et. al. 2001). One particular effect you see from long term segregation is a strong influence preventing genetic drift (Wofford et.al. 2005). Genetic drift allows species to mate and spread genes over a distance they are capable of migrating to. Eliminating this drift will cause serious stress on the fish communities, and will make necessary adaptations much harder to obtain. Dams also prove to show similar segregation effects. Fish communities upstream of a dam tend to consist of fish that thrive in deeper and slower water, where as fish surviving below the dam are those that thrive best in swift shallow conditions (Balon et. al. 1983). Human interventions such as stocking help to regulate this segregation, but even with stocking, serious complications such as the invasion of noxious species tends to occur more frequently (Rahel 2007).

We examined waterfall barriers that segregate species on both ends of the barrier. Waterfalls provide natural barriers to several species within a stream, and in particular the dispersal of most fish species. Geological characteristics are key to holding the structure of the falls. If the bed is very rocky, it might be more likely to hold up for longer periods of time, where as if the bed is soft and made mostly of deposits, the chance of the falls collapsing or wearing down will increase. Any drastic alteration such as this can alter, eliminate, or form waterfalls. In this study, a waterfall barrier is considered to be any falling body of water that could inhibit the migration of a fish species. These waterfalls fall into the category of dispersal barriers, which is any natural obstacle allowing falling water to prevent dispersal from one part of the stream to another. These dispersal barriers are a contributing factor that leads to the decrease in fish diversity and density (Poplar-Jeffers et. al. 2009). We examined the fish communities downstream and upstream of two waterfalls in southern West Virginia. We predicted that diversity and density would be lower upstream from the waterfalls.

Materials and Methods:

Two streams with waterfalls were studied, Brush Creek (Figure 1) and Pipestem Creek (Figure 2). Both of these sites are located in Southern West Virginia in Summers and Mercer County. Brush Creek has a combination of velocity and depths. It has a high riffle frequency with many attachment sites for invertebrates. A large amount of undisturbed riparian vegetation surrounds it with stable banks. The

stream is very wide and contains many rocks and crevices for fish to hide and thrive. Pipestem Creek conditions are relatively the same as Brush Creek with the exception of stream width and velocity. Pipestem Creek is not nearly as wide or as fast flowing as Brush Creek. The waterfalls at both sites are roughly 9m high.

Figure 1. Location of study site along Brush Creek in southern WV.

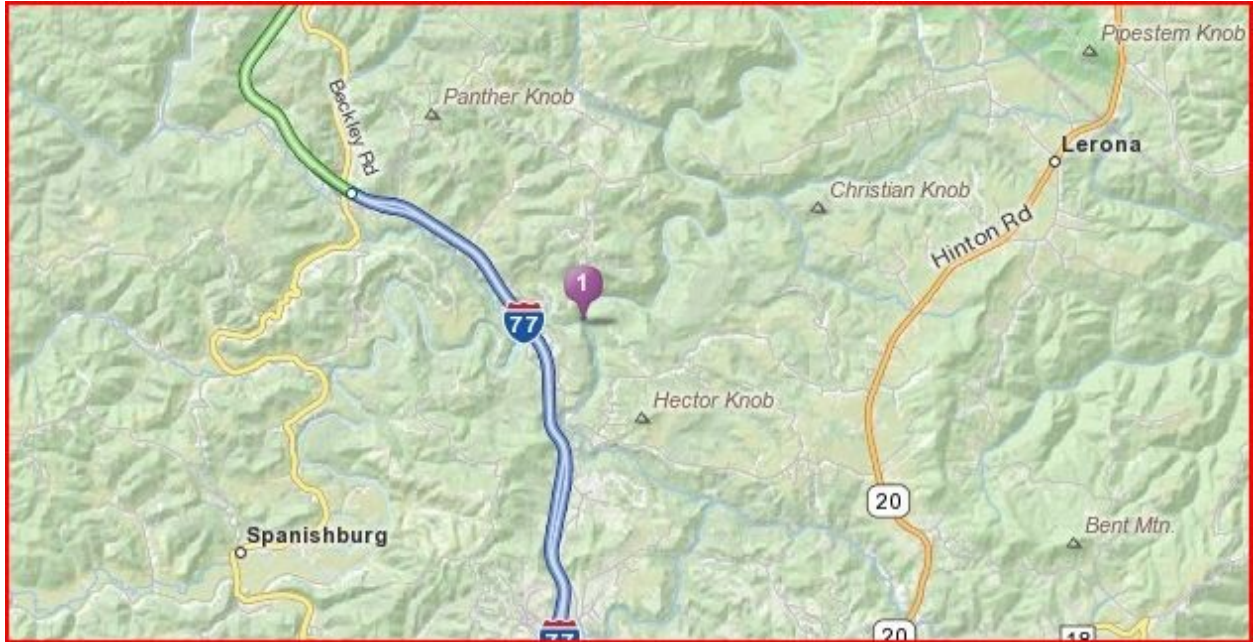


Figure 2. Location of study site along Pipestem Creek in southern WV.



Fish were sampled from two sites within each of these streams. A Smith and Root LR-24 backpack electroshocker was used to nonlethally stun the fish. The stunned fish were collected, identified, and counted. The backpack electroshocker was used for two hours per site to net as many fish as possible in that time frame. After the stunned fish were netted, they were placed into buckets with portable aerators. After identifications were made, the collected fish were allowed to fully recover from their stunned state, and release back into the stream. Voucher specimens were collected to confirm the identification of species. Tricaine 222 was used to humanely euthanize these fish.

Macroinvertebrates were collected with a kicknet in which a net was placed below a riffle and disturbances were made to the substrates in the riffle to loosen invertebrates into the collecting net. These disturbances were made for 5 min. per sample. The specimens were picked from the net for 15 min. and collected into a container. Any invertebrates not collected from the net in this time frame were released back into the stream. Macroinvertebrates were collected at 5 riffles per site and combined into a single sample. Macroinvertebrates were preserved with ethyl alcohol, and identified to family level in the lab.

The pH, dissolved oxygen, and alkalinity were measured at each site using an YSI Professional Pro Multiprobe Meter. For each fish sample we determined the diversity, density, and feeding preference of the each fish species. Macroinvertebrates were evaluated using EPT, HBI, and the number of family taxa.

Results:

At Pipestem Creek 222 fish were sampled at the downstream site, and 56 fish from the upstream site. Four species were found in the upstream site including *Etheostoma flabellare* (fantail darter), *Coregonus artedi* (creek chub), *Lepomis macrochirus* (bluegill), and *Gila coerulea* (blue headed chub; Table 1). The blue headed chub was found only in the upstream section, and the other three species were found in both sections. There were seven species found in the downstream site including the *Campostoma anomalum* (central stoneroller), *Phoxinus oreas* (mountain red-belly dace), *Alosa kessleri* (black nose dace) and the other four species found at the upstream site (Table 1). Diversity and density in the fish communities were higher in the downstream section of the stream.

Fish data were collected in the upstream section of Brush Creek. There were 3 species of fish found in this site, including central stoneroller, creek chub, and blacknose dace (Table 1). The majority of fish in this portion of the stream were central stoneroller making up 75% of the population found. Because of logistics and unsuitable stream conditions during the spring of 2011, we were unable to collect a sample downstream of the waterfalls on Brush Creek.

There were 154 invertebrates collected from the Pipestem Creek upstream site and 9 total taxa. The EPT taxa richness was 6, and the percent EPT was 84.4%. The HBI was 3.72, and majority of the taxa found were filterers and collectors. At the downstream site, we collected 143 invertebrates from 10 different taxa. The EPT taxa richness was 6, and the percent EPT was 96.5%. The HBI was 3.73, and majority of the taxa were filterers, collectors, and predators.

At the Brush Creek upstream site, we collected a total of 271 macroinvertebrates, 14 different taxa, and determined our EPT taxa richness was 5. The majority of these taxa were collectors and scrapers. The percent EPT was 39.9%, and the HBI was 4.32. At the downstream site, we collected 322 invertebrates, and 11 different taxa. The EPT taxa richness was 4, and the percent EPT was 27.3%. The majority of macroinvertebrates in this site were collectors and scrapers as well.

Water chemistry data show that there is little difference between the parameters of the upstream and downstream sites. Pipestem downstream site had a dissolved oxygen concentration of 6.9mg/L, a pH of 7.9, and conductivity of 205.7uS/cm. The upstream site showed little difference with dissolved oxygen and pH with values of 7.4mg/L and 7.7, but there was a significant difference in the conductivity yielding 130.8uS/cm. At Brush Creek the dissolved oxygen levels were 7.9mg/L (down) and 8.6mg/L (up). The pH was 8.3 (down) and 8.6 (up), and the conductivity was 371.8uS/cm (down) and 376.7uS/cm (up).

Table 1. Fish community at downstream and upstream sites from Pipestem Creek and the upstream site from Brush Creek.

	Pipestem		Brush Creek
	Downstream	Upstream	Upstream
Central Stoneroller	63	0	6
Blacknose Dace	41	0	1
Creek Chub	85	44	21
Fantail Darter	4	6	0
Mountain Redbelly Dace	28	0	0
Bluegill	1	2	0
Blueheaded Chub	0	4	0
Total	222	56	28

Discussion:

We predicted that waterfalls would prevent dispersal of some species of fish, resulting in a lower diversity and density of fish above the falls. At Pipestem Creek, seven species found in the downstream section compared to four species found upstream of the waterfall. We found a greater density of fish in the downstream section at Pipestem Creek. This data is similar to that of Robinson (2002), where the diversity changed from 23 to 4 after sampling across several waterfalls. Stoertz et al. (2002) study also contained similar results, where density and diversity of the fish populations were significantly lower upstream of the isolated areas. The diversity and density of invertebrates found between the downstream and upstream sites were similar at Pipestem Creek. Therefore, the food resources for fish appear to be similar in both portions of the stream. Water chemistry parameters show little to no difference as well. The subtle differences between the invertebrates and water chemistry parameters in Pipestem Creek suggest that the waterfall, as a barrier to dispersal, is the main reason for the differences in the fish

communities. Fish can be found upstream even though dispersal is not possible. This is because of relic populations, which have persisted before the formation of waterfalls. Other sources may include release of bait fish by anglers.

The height of the falls prevents most upstream dispersal of fish. Brush Creek data also suggests that there might be a difference in the upstream and downstream fish communities. The water chemistry data is the same, but a much more diverse and dense amount of invertebrates downstream of the waterfall on Brush Creek suggests that there may be a more diverse community of fish. The upstream site at Brush Creek consisted of primarily herbivores that scrape algae from rocks due to the low diversity and density of invertebrates.

Significant sources of error need to be accounted for. The voltage set on the electroshock backpack could have been too low, resulting in only larger fish in the samples. More sample sites could be used to further the patterns observed in this study. The use of fishing seines or minnow traps to increase the sample size as well as sample fish species that are less likely to be stunned by the electroshocking.

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*“An Examination of Post-Colonial Africa in the Context of the
Nigerian and Somali Experiences”*

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Manuscript

ABSTRACT

This research compares post-colonial Nigeria and Somalia. While most view a shared national religion and ethnicity as building blocks of national stability, this is not the case in Somalia. I hope to explain why Somalia, with a Muslim majority and dominant ethnic bloc cannot function as a state, while more diverse Nigeria is a powerful African country. I analyzed studies of post-colonial Africa, Nigeria, and Somalia, then conducted research centering on multiple aspects of these two countries.

INTRODUCTION

After the Second World War the major European imperialistic powers saw fit to relinquish some of their colonial possessions for many different reasons. Given the fact that many Africans fought under these colonial powers in the name of freedom, after the war they came to realize that they could do the same to attain their own independence. During this era many Africans became educated in the European ways to the point where they were capable of organizing Workers' Unions and these gave birth to political activism and political parties. Past and contemporary Scholars have discussed a wide range of issues ranging from the systems of government, ethnicity, religion, economy, history and the effects colonialism on the African continent.

The study of Post-Colonial Africa has been a very important topic among historians, political analysts, economists and foreign policy experts with Nigeria and Somalia having been two of the most interesting and dynamic countries . This research draws on an examination of a diverse Nigeria with a population of about 130 million, speaking between 150 to 250 different dialects, and with a split between Muslims, Christians and traditional African animists but still delivering basic amenities to its citizenry. The most populous and second largest economy in Africa possesses a very strong economy, a very powerful military and a functioning federal government. Since independence, Nigeria has been a very powerful and influential country in Africa, it helped create the Economic Community of West African States (ECOWAS), which helps to ease and harmonize trade and investment among its 15 member countries. The Nigerian economy is one of the most developed economies in Africa. According to the UN classification,

Nigeria is a middle-income nation with developed financial, communication and transport sectors. It has the second largest stock exchange in the continent.³⁶

Also, Nigeria has provided the chunk of troops for the United Nations peacekeepers in many unstable African countries like Sierra Leone, Sudan and has pledged to do the same in Somalia.

On the contrary, a very homogeneous Somalia, once heralded as the only true nation-state in Africa with 85% of its population belonging to the Somali tribe cannot deliver basic needs to its populace, possesses a very dysfunctional and chaotic government run by clansmen, and is a failed state and a harbor for terrorist organization and sea pirates. Gerrie Swart, a research associate with the Unit for African Studies, lamented on these problems facing Somalia and stated that

Without an agreement on reconciliation efforts, the location of the seat of power and governance, and the lack of a much-needed national security and stability plan, it can rightly be asserted that Somalia continues to be a failed state with scant prospects of that status changing in the very near future unless serious interventions are initiated to bring crucial actors in the crisis to the negotiating table.³⁷

Somalia is a state at war with itself, different factions and clans fighting amongst each other for territorial control and there are no serious signs of reconciliation or national unity.

³⁶ Economywatch. (n.d.). *Nigerian Economy*. Retrieved March 25, 2011, from Economy watch: economy watch.htm

³⁷ Swart, G. (2006). Somalia: A Failed State Governed by a Failing Government? *Holler Africa*, 6.

The problems that Nigeria and Somalia are facing today are not unique to them; they are African problems and after independence many African countries found it hard to work together due to ethnic and clan differences and lack of the know how to run a country without instructions from their colonial masters. In the words of the famous Nigerian writer and New York Times contributor, Chinua Achebe

If you take someone who has not really been in charge of himself for 300 years and tell him, "O.K., you are now free," he will not know where to begin.³⁸

The Post-Colonial problems in Africa are a result of a people who have forgotten how to rule themselves and forgotten their traditional ways of doing things and then came independence which most of them were not really ready to handle efficiently. All the above factors led to the civil wars and genocides that are happening in places like Sudan today where the Arab minority is massacring the majority black population and these are not isolated incidents because in the late 1990's a similar incident happened in Rwanda where the Tutsis were brutally killed by the Hutus. And after 50 years of self-governance, today most African countries are experiencing massive poverty and their economies are in shambles. But there is hope for optimism in Africa for example in oil rich Nigeria and Angola where after decades of unrest their economies are bouncing back and they might lead the way for a new Africa.

In this research I analyzed previous and contemporary studies and then conduct research that centers on the historical, political and economic aspects of these two countries in particular and Africa in general. Furthermore, I gather my sources from a wide range of authors, commentators, and seasoned international journalists and newsmakers. All of my sources were

³⁸ Achebe, Chinua (2011) *Nigeria's Promise, Africa's Hope*. New York Times

collected from journals, magazines and books. My goals for this research are to improve public understanding and awareness about the historical, cultural, political and economic aspects of Post-Colonial Africa in the context of the Nigerian and Somali Experiences and explore the possibilities and come up with answers to these problems facing these countries. Also, I explore and ask specific questions to why Somalia is a failed state, the effects of colonialism on Africa in general and Nigeria and Somalia in particular and how these problems and challenges facing the continent and these countries can be resolved.

THE NIGERIAN EXPERIENCE

The Federal Republic of Nigeria is located on the West Coast of Africa with 36 states; it gained its independence from Great Britain and joined the Commonwealth of Nations on October 1, 1960. The country known today as the Federation of Nigeria existed as a number of independent and national states with cultural, religious and traditional differences for centuries until the Berlin conference of 1884, this was when the British decided to bring these ethnic and tribal regions into one single state. Nigeria, the giant of Africa, the second largest economy and the most populous country in Africa and one of the most powerful, if not the most powerful country in Africa. With a population of 130 million, it has demonstrated to be a real powerhouse in Africa. Even though, they have their own internal turmoil due to religious and ethnic divisions, it has demonstrated to be a country of great strength and a pioneer in many fronts.

Nigeria's strength lies in its diversity and high literacy rate in African standards and it is a strong state because of its strong military which leads the way in regional and global peacekeeping missions and its burgeoning economy. The Federal Republic of Nigeria is one of the most complex and ethnically diverse countries on earth. The country has between 150 to 250 different dialects, a population of about 130,000 million, and a religious divide between

Christians, Muslims and traditional Animists. A budget of \$23.4 billion, of which recurrent expenditures constitute \$11.1 billion, capital expenditures \$7.4 billion, statutory transfers \$1.4 billion, and debt service \$3.2 billion and a GDP of 10.4%. Most of the countries revenue is generated from its oil but the people living around the oil producing region of the Niger Delta are not benefitting from it, instead it is been mismanaged by the corrupt powerful chiefs and bureaucrats.

Nigeria's military is one of the most powerful if not the most powerful in Sub-Saharan Africa and since independence it has sent troops to various places in peace keeping missions when called upon. And this was demonstrated when they intervened single handedly in Sierra Leone in the late 20th century into the early parts of the 21st century and put a stop to a civil war that destabilizes the whole West African region. They have also been involved in various peacekeeping missions around the world including peace keeping missions in Chad, Lebanon, Bosnia Herzegovina, Cambodia, Iraq, Kuwait, Western Sahara, Liberia, Angola, and Rwanda. Nigerian troops have also served in Somalia, Mozambique and The Congo, India, Pakistan (Kashmir). According to the Nigerian Village Square, a Nigerian news organization,

The role of Nigeria in Peace Building, Conflict Resolution, and Peacekeeping since 1960" over the past twenty five years, Nigeria has emerged from a relatively obscure position under colonial domination to a major power in international affairs. This position as well as the commitment underpinning it has been expressed more successfully in defense of Africa. ...³⁹

³⁹ Ibegwu, C (2006). Nigeria's Role In Regional Peace-Keeping, Peace Making, Conflict Resolution & Economic Opportunities. Nigeria Village Square

The Federal Republic of Nigeria is undoubtedly a very strong state given its leadership positions, strong economy, strong army and multi ethnicity.

Nigeria has the second largest economy in Africa, according to EconomyWatch.com, the largest online economics community in the world, an online site which covers the economy, investment, personal and global finance, statistics databases and directory listings. The Nigerian economy is heavily dependent on the petroleum sector; they stated that Nigeria is the 12th largest petroleum producer in the world.

The country ranks 33 in the world in terms of Gross Domestic Product and its per capita income is US \$ 2,400, it accounts for about 80% of their Gross Domestic Product and well above 90% of their exports.⁴⁰

Their biggest obstacle is poverty the country ranks “151 out of 177 of the UN Development Index.” In recent years the government initiated strategic reforms to fight poverty but due to high level corruption this efforts remain to be successful. After independence, Nigeria prospered economically but most of its citizens were living below the poverty line due to mismanagement of funds, corrupt leaders and many military coup d'états. From independence the country never had a single democratic transition of leadership until the reemergence of Olesegun Obasanjo, who stepped down after the end of his term. And today, Nigeria still faces similar problems of corruption and ethnic and religious violence.

Multi ethnicity, a strong economy and a powerful army does not mean that their model or system of government is flawless. For most of its young history the country has been run mostly by powerful Muslim military autocrats and this has resulted in violation of universal adult

⁴⁰ Economywatch. (n.d.). *Nigerian Economy*. Retrieved March 25, 2011, from Economy watch: economy watch.htm

suffrage, democracy, human rights and led to massive corruption. Nigeria walks a very fine line when it comes to its system of governance. Post –Colonial Nigeria has tried many different models of governance differing from president to president. Two of the most known systems that they have experimented with are the authoritarian approach which is mostly exclusionary and the democratic approach which is inclusionary in nature. First, the authoritarian approach, this approach to nation building typically violated the principles of proper political representation and resource distribution. Most of the institutional innovations in Nigeria have been made by progressive military governments that have pursued the inclusionary approach to nation building. In terms of ethnic representation and resource distribution, the record of the governments that pursued the exclusionary approach is mixed. And the second system is the democratic approach, which is deemed by many political observers as the best path to nation building in a multiethnic country. As in the case of the Nigerian experience with nation building, it is difficult to pursue a non-democratic means of reform without provoking internal unrest and international condemnation.

The problems that Nigeria is facing today are the same problems that many African countries are experiencing, one is that the former European powers bundled up ethnic groups and old kingdoms together for their own personal interests disregarding any local boundaries whatsoever and Nigeria was the country that was mostly affected by this because of its huge population and many ethnic groups. And after independence, the Nigerian Federation faced its biggest problem to hold onto a country that was on the brink of an ethnic war and secession. Nigeria's strength lies on its multi ethnicity but its main problem also lies in the same diversity. And this became evident in July of 1964 when the Biafran region which is mostly Christian Igbos decided to secede from the federation. The war was a result of a fragile peace since

independence which has its roots in the geographical, historical, cultural and religious differences of the country. And this war ended in 1969 when the leader of the Biafran militia left the country and up to date the issue of secession is widely spoken of by the Eastern Nigerians who still want their own independent homeland from Nigeria.

THE SOMALI EXPERIENCE

Somalia, located in the Horn of Africa, is an area slightly smaller than the size of Texas; with Somalis constituting 85% of the population and are divided into six major clan-families, the Daarood, Isaaq, Hawiye, Dir, Digil and Rahanwayn; each of which comprises numerous sub-families and lineages. It has a population of about 10 million and gained its independence from Italy and Great Britain respectively in 1960. Nine years after independence their President Shermarke was assassinated by the military under the leadership of General Mohamed Siad Barre, whose reign became a socialist state, most of the major institutions were nationalize and ruled under a so call ‘scientific socialism’ which was modeled after china, the Soviet socialist republic of Russia and guidance from the Quran. Muhammad Siad Barre’s era was marred by many human rights abuses towards Clan opposition and this led to major allies like the United States cutting diplomatic and economic ties with them. His downfall began when he invaded the Somali dominant Ogaden province of Ethiopia which he wanted to annexed to Somalia. He was defeated in 1977 by the Soviet backed Ethiopian army and many proud Somalis seen this as a sign of weakness and were very disappointed and thus the road to secession by the northern clans. He fled the country leaving the country in a quagmire without a centralized leadership, this led to many different clans and factions to form their own governments and this led to the dysfunctional system of government which Somalia is still going through. On 17 May 1991, the independent Republic of Somaliland was declared. The Republic of Somaliland declared its

borders to be that of the former British Somaliland and another region named Puntland also declared its autonomy from the Mogadishu Somalia.

Somalia went from a socialist republic to an Islamic clan system of government similar to the ones the Arabs were living under after the death of the Prophet Muhammad. And the lack of a centralized authority has allowed many foreign forces to assert their influence in this fragile and divided country by giving support to various clans and warlords. Countries like Libya, Ethiopia, Yemen, Egypt and Eritrea have supported various clans and transitional groups and the latest group to come to the fray is Al Qaeda who formed an alliance with the local terrorist organization “Al-Shabaab”. Somalia’s biggest foreign rival since independence has been Ethiopia who has repeatedly invaded Somalia to protect its ethnic Somali dominated “Ogaden” region from Somalia. In July 2006, the Ethiopian army once again invaded and defeated the Islamic Courts Union of Somalia but they withdrew all their forces by January of 2009. And because of a lack of a centralized leadership, the country is a Mecca for terrorists and sea pirates. Somalia is one of the most dangerous and lawless states on earth, a country that has failed to produce a centralized authority or government in almost two decades. But this was not always the case in the Horn of Africa, when the Somali people gained their independence this new nation was heralded as the only true nation-state in Africa because of its homogeneity. Today this homogenous society fails to live up to its expectations and it is thus a failed state.

Why do nation fail? Robert I. Rotberg, a well renowned international relations scholar notes in his book that nations fail, because they are convulsed by internal violence and can no longer deliver positive political goods to their inhabitants. Their governments lose legitimacy, and the very nature of the

particular nation-state itself becomes illegitimate in the eyes and in the hearts of a growing plurality of its citizens.⁴¹

This is true in the case of Somalia, the last functioning centralized government lost the support of the masses, and it was widely viewed as an illegitimate government both locally and internationally. Furthermore, when a nation state cannot provide basic security to its citizens then there is going to be a revolt from the citizens and which gives power to military and local forces to control power and which will eventually produce an undemocratic government hence the road to failure. Also when citizens don't have their say in how their country is governed by fully participating in the political process this usually leads to chaos and internal turmoil. Many failed states lack the capability to provide medical and health services, good schools and infrastructures. Geography, physical or economic constraints also contribute to why states fail. Religious, ethnic, linguistic and other inter communal tensions are very common in failed states. Somalia tops the list of failed states, out of 177 countries indexed by *Foreign Policy Magazine* and The Fund for Peace, Somalia was given the highest score on 12 indicators including delegitimization of the state, security apparatus, and factionalized elites. Experts and observers have come up with many different scenarios to why a nation with predominantly one ethnic group, religion, culture, history and language could be in such a situation. Some have blamed the elites who try to manipulate clan loyalties to intensify the skirmishes to make them wealthy. Other experts blamed it on the Somali clan structure where retaliation to offenses made by other clans can easily lead to a full blown out warfare. Furthermore, others blamed the problem on the long-standing tensions between the nomadic pastoralist clans and the Bantu or Afro speaking

⁴¹ Rotberg, Robert, I (2003), Failed States, Collapsed states. When States Fail: Causes and Consequences.

servants while others blamed it on the colonial powers that ran the territory for decades and pitched clans against one another.

Somalia's strength lies in its homogeneity, like the People's Republic of China where the majorities of the people speaks Han and are majority Buddhist, Somalia is a nation that is ethnically dominated by the Somali tribe and are majority Muslims. In the case of China this helped them to propel their present economic status and if Somalia can be reunited and reorganized again there is a bright future for this tight knit country. In recent years many efforts have been made by African Union and the United Nations to form a centralized government in Somalia and in 2004 a Transitional Government was formed under the auspices of the Kenyan government and Abdullah Yusuf Ahmed as its President. This centralized government has proved to be very dysfunctional and has failed to bring the country together, this is how the then United Nations Secretary General described the situation in Somalia in 2006, he stated that,

There has been no progress in ameliorating the contention between leaders of the transitional federal institutions on four broad issues: the relocation of the transitional federal institutions, a national security and stabilization plan, national reconciliation and the peace support mission envisaged by the African Union/Intergovernmental Authority on Development (IGAD).⁴²

Somalia is definitely a country in an abyss and one of the biggest problems to the Somali divide is religion, even though the majority of its citizenry are Sunni Muslims the country still have to deal with radical Islamists. Some Muslims seem to interpret the Quran in a very strict and conservative way and in the case of Somalia some warlords have proposed an Islamic legal

⁴² Swart, G. (2006). Somalia: A Failed State Governed by a Failing Government? *Holler Africa*, 6.

system “Sharia” and this remains the only system of law in Somalia today. And the country’s economy is believed to be in shambles which is being driven by its political divisions. Local businesses still thrive and telecommunication is believed to be a very successful economic apparatus in the country because of the demand for cell phones. But its biggest important sector is Agriculture which is believed to be doing poorly because of the climate and the civil war.

COMPARATIVE ANALYSIS

The differences between Nigeria and Somalia are staggering, Nigeria, a very diverse federal republic and an economic and military powerhouse of Africa and Somalia, a very homogenous society, a stateless country with a very weak central government and a country on the brink of becoming the Afghanistan of Africa. A diverse Nigeria is the most populous country in Africa with a population of about 130 million and a Christian, Muslim and traditional animists divide. Their country’s economy is considered to be the second largest in Africa and their political system is not a Jeffersonian democracy but it is so far working for the country. On the contrary, a very homogenous Somalia, majority of who are Muslims and Somalis have been fighting among each other for the past two decades and lacks a centralized and functioning government leaving the country in a grave security, political and humanitarian crisis. What Nigeria has been able to do along the years is something that should be a model for many African countries, for example, they started a system called “Zoning” which rotates the presidency every cycle between the north and the south. As expertly explained by the Council on Foreign Relations John Campbell, a Ralph Bunch Senior Fellow of African studies, Given Nigeria's size and diversity, managing the complex web of interests and identities has challenged governance since colonial times. In general, control of the state has been accomplished through various forms of power sharing. Within the ruling People's Democratic

Party, from 1999 to 2011, Nigerian elites reached an informal agreement, often referred to as 'zoning.' It provided for the rotation of the presidency between the North and the South. When the president was a southern Christian, the vice president was a northern Muslim, and vice versa.⁴³

In the case of Somalia they are not faced by either ethnic or religious differences because almost the entire country adhere to the Islamic faith and belongs to the Somali tribe, but rather a problem rooted deeply in clan and regional differences. The fighting factions are unwilling to come together to help in the rebuilding and formation of a central and united government, they are more interested in regional and clan alliance. This is how Bronwyn E. Burton, a democracy and governance specialist at the Council on Foreign Relations described the Somali saga in her book "Somalia a new approach",

Even among failed states--those countries unable to exercise authority over their territory and provide the most basic services to their people--Somalia stands apart..... Poverty and insecurity are endemic. Less than 40 percent of Somalis are literate, more than one in ten children dies before turning five, and a person born in Somalia today cannot assume with any confidence that he or she will reach the age of fifty.⁴⁴

To add more insult to injury, some regions like Puntland and Somaliland have announced autonomy and independence from the Somalia. And finally, these two countries have different economies, while Nigeria relies heavily on its oil industry for its export, Somalia is somewhat an

⁴³ Campbell, J (2011). Nigeria's North South Distinction Is Important. Council On Foreign Relations.

⁴⁴ Burton, B.E (2010). Somalia a new approach. Council on Foreign Relations. P1.

agrarian society where about half of its exports are agricultural. The literacy rate in Nigeria is far higher than that of Somalia; Nigeria has a lot of higher learning institutions within its 36 states while Somalia has a handful of higher learning institutions.

THE AFRICAN EXPERIENCE

The Nigerian and Somali experiences are problems are not isolated incidents in Africa, one can say that they are African problems. One problem that always comes up when we talk about Africa is Colonialism and this has been blamed for most of Africa's problems today but there are also other contributing factors to Africa's problems. And these problems are tribal, economics, regional, religious, political and historical in nature. Let's talk about ethnicity for example; ethnic problems have been the biggest problem in Africa long before the arrival of the Europeans. The rest of the world came to know this in the late 1990's when about a million people lost their lives in the Rwandan Genocide, where the Hutu majority embarked on a killing spree of the Tutsi minority. In relating to our case study, both Nigeria and Somalia have experienced ethnic tensions but more of Clan tensions in the case of Somalia. Just after independence, Nigeria fought a civil war which was basically an ethnic war between the three major ethnic groups. In the case of Somalia, it's about Clan control and dominance, most of Somalia is run by Clansmen who pay allegiance to only their clans rather than their country.

Most of Africa's problems today can be blamed on European colonialism; in 1884 the eight major colonial powers converge in Berlin under the auspices of the then German Chancellor Otto Von Bismarck. At this conference, almost 80% of Africa was under some type of traditional African rule. At this Conference the major European imperialist powers partitioned and divided Africa among themselves without any african representation or consultation. This so called "scramble for Africa" created new frontiers in old kingdoms, nation- states, tribes and

among ethnic groups and this led to dysfunctional, disjointed, complicated and fragile countries today. And these European powers left the countries in shambles creating divisions among the people by favoring and pitching one tribe against the other. After independence most of these new countries found it hard to work together as a nation due to lack of patriotism and nationalism.

In their 1984 publication Russ Hoyle, John Borrell, Marsh Clark and Peter Hawthorne talked about a continent that was confronted with the realities of self governance and this was something that these new countries were not able to tackle effectively hence the title of the article “A continent gone wrong.” They discussed the old guards who came to power after independence who believed that it was incumbent upon them to lead their countries forever.

They gave an analogy which reads,

Uhuru! The Swahili clarion call for freedom from the European colonial powers has brought independence but little liberty for millions of black Africans. The rallying cry "One man, one vote" has been transformed into reality, but it has suffered an ironic distortion. Many Africans now have one vote, but often it can be cast for only one man. ⁴⁵

At the dawn of independence Africans were celebrating the end of European rule and had the belief that their lives would be better under African leaders some of whom turn out to be worse than the former colonial masters. This was rather a common problem in Africa, let's take Zimbabwe for example where their nationalist leader Robert Mugabe who has been president since independence and has won all elections most of which the international community claimed to be fraudulent. These new fragile democracies have become a harbor for leaders whose main aim is to hold on to power and dictate the lives of their citizens.

⁴⁵ Hoyle, R; Borrell, J; Clark, M; Hawthorne, P. (1984). A continent gone wrong. Time magazine. P1

Economically, the whole continent has suffered since the Europeans left and there are very few bright spots in Africa economically then and now. Almost the entire continent is dependent of foreign debt and it lacks basic infrastructures like good hospitals, schools and very bad roads. For example

When Zaïre, then known as the Belgian Congo, gained its independence in 1960; it had 58,000 miles of good roads; now only 6,200 miles are passable.⁴⁶

Africa lags behind in many areas and development is one of the things that the African continent has been stagnant on since independence.

African politicians and bureaucrats who facing a disorganized peasantry chose agricultural and industrial policies which served their own benefits rather than their country's development.⁴⁷

African countries have weak institutions and adopt poor policies because of their ethnic diversity, several experts have proposed a political theory of Africa's stagnation according to which African leaders, having inherited artificial polities from colonialism, resort to neo-patrimonial strategies to foster their power and prevent the dislocation of their peasant societies. But there are new burgeoning economics in Africa like Nigeria and Angola. In Angola they started to utilize their natural resources like diamonds which boosted their economy and they finally ended a civil war which ravaged the country.

And finally, the lack of good learning institutions and environment and the so called African Brain-Drain,

In 25 years, Africa will be empty of brains.⁴⁸

⁴⁶ Hoyle, R; Borrell, J; Clark, M; Hawthorne, P. (1984). A continent gone wrong. Time magazine. P2

⁴⁷ Englebert, Pierre (2000) Pre-Colonial Institutions, Post-Colonial States, and Economic Development in Tropical Africa. Political Research Quarterly, Vol 53, No. I, pp. 7-36.

⁴⁸ Tibeje, A. (2006). Brain Drain and capacity building in Africa. IDRC. P1.

That was the urgent warning by the United Nations Economic Commission for Africa's assessment of the current African brain drain problem. Statistics regarding the continent's brain drain is hard to find but as an African I can give my take on this issue, I was born and raised in the Gambia a country of about a million and a half people in west Africa. This issue of brain drain has been going on in Gambia since colonial times, most of the educated few at that time became automatically British citizens under colonial rule and the majority of these folks attended colleges in Britain and after graduating they stayed and worked there. And today, many of my peers are overseas as students and professionals working in foreign countries and this has massive ramifications on Gambia in particular and Africa in general. This led to lack of scientists, doctors, economists, educators and due to these factors Africa has been lagging behind in many important fronts that are necessary to development. According to USAID,

Primary school enrolment in African countries is among the lowest in the world. Limited funds and a lack of adequate teachers, classrooms, and learning materials adversely affect the educational environment throughout most of Africa.⁴⁹

Africa lags good schools, the lack of teachers; the cost of education and the lack of higher learning institutions are to blame for this.

CONCLUSION/ RESULT

The research talks about Postcolonial Africa in the context of the Nigerian and Somali experiences and answers the questions to why Somalia is a failed state, the effects of colonialism on Africa and how these problems facing the Africa continent can be solved. Somalia tops the list of all failed states and there are many factors to why this once peaceful nation state is headed

⁴⁹ USAID. (2008) Sub-Saharan Africa. Africa Education Initiative.

south. And these are as a result of a long a civil war among clan members which claimed the lives of hundreds of thousands of people. The European colonial systems which divided the country into sections for their own national interests and this led to many factions after the end of colonialism. The biggest problem in Somalia is its lack of a centralized functioning government, presently the transitional government of Sheikh Sharif Sheikh Ahmed has no authority over its citizens and this lack of policing has led to the statelessness and lawless today. Somali pirates roam the Indian Ocean and seized ships and because of the government's lack of ability to assert its authority this kind of behavior have spiked dramatically and also hurt their economy a lot. Furthermore, the spread of radical Islam and the use of Sharia law in the country have led to many skirmishes between the so called moderate Muslims against these radical forces. Islamist radicals felt betrayed by the government, which they believed sought to dilute the purity of their Islamic vision

Our second question deals with the effects of colonialism in Africa. The effects of European colonialism on Africa cannot be overemphasized and there are both advantages and disadvantages to this continuing development. From an African perspective the advantages of colonial rule were very minute but they were still very instrumental in many fronts. The advantages to colonial rule are that, one, western style institutions were built and these institutions produced many African leaders and this institutions are still being used in Africa. Also, there are many infrastructures, like roads, rail roads and government facilities that Africans are using today.

At the Berlin Conference in 1884, the European imperialist powers decided to divide Africa among themselves with no regards to old African boundaries and institutions. This so called 'Scramble for Africa' became the defining moment in African history, this new

boundaries brought together many different African peoples who do not share the same culture, religion, history and geography. After these divisions were made Europeans exploited both human and economic capitals in Africa, they used the people to fight in wars, labored their farms, construct railroads and literally these indigenous people became subjects of their colonial masters. After the Second World War the Colonial powers decided to forego their colonial possessions and this triggered the quest for independence from many African countries. At this point in time Europe lacks the financial prowess to continue its imperialistic ventures, so it decided to give these countries their independences. Africans were now transitioning from colonial rule to self-rule and this was the start of many problems to come, because most African countries were not ready and lack the know how to run a country. This new found freedom didn't last long because just after independence many African leaders embarked on nepotism and exclusionary systems of governments and favored mostly their ethnic groups. This led to civil wars and coup d'états which are still prevalent in Africa today.

The final question is how these problems that are facing these African countries could be resolved? First of all African governments need massive restructuring of their political and economic systems, many African governments have been very tribal and very exclusionary in nature. Most of these regimes rule with iron fists and rig the ballots most of the time. The Africa political system should be more inclusionary and run free and fair elections. Also, most African economies are very bleak due to poor economic policies and one way to boost their economies is by opening their markets and quit relying on foreign aid. The problem with foreign aid is that it made Africans somewhat lazy, let's take China for example, this was a third world country when most of these African countries got their independence and it is now the second largest economy because of its investment in education, hard work and reduction of foreign aid.

Furthermore, foreign aid leads to corruption because corrupt African governments misuse these aids for their own personal use and this doesn't help the cause at all. Another solution to the Africa problem is the issue of accountability; this is a huge problem in Africa which can be resolved by setting up accountability commissions to investigate the embezzlement of funds by public servants. This was experimented in Nigeria and few other African countries turn out to be somewhat successful and I believe that it should be implemented in at a continental level. Education is one front that Africa is lagging behind, the illiteracy rate is astronomical and the lack of good educational facilities and higher learning institutions are hampering the continent's progress. African governments should invest more in education and lower the cost of education because most of their citizens can't afford the fees attached to it. Also, Africans should set up policies that would discourage the emigration of their educated and learned; they should implement policies that would attract talent which would eventually stop the so called "African Brain Drain". Also, Africans should avoid being exploited when it comes to their natural resources, with all the natural abundance they still can't utilize them to their advantage.

And finally, what we have learned from this study is that homogenous societies do not always translate to successful and peaceful societies but rather chaotic and very dysfunctional societies as we have seen in the case of Somalia. We have also learned that a diverse society where the majority of the people have a different culture, history, geography and religion can work together for the interest of their country as in the case of Nigeria. And that inclusionary systems of governments tend to be more prosperous and peaceful than exclusionary governments. The research also shows that the problems of post-colonial Africa are as a result of colonialism that brought together different peoples to form new countries. Africa's problems are deeply rooted in religion and ethnicity, as we have seen in this research; most of the civil wars in

Africa can be blamed on either ethnicity or religion in which Somalia and Nigeria are not immune to.

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Abstinence-based Versus Comprehensive-based Sex Education

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Social Work

Abstract

Sexuality education for children and young adults is one of the most debatable issues among policy makers and educators. Abstinence and comprehensive-based sex education is also controversial among many in society. This study explored adolescents' preferences of sex education. It also examined the correlation between sexually active teens and the types of sex education. A survey was administered to introductory courses at Concord University. There were 328 respondents among thirteen classes who answered a short survey concerning their sexual activity, what type of sex education they received, demographic location, socioeconomic statuses, parenting styles, parent and child communication, religious affiliation, age, gender, race, and sex class educator. This study shows that comprehensive-based sex education is the preferred type of sex education among college students at Concord University, but comprehensive-based does not prove to be more effective in preventing sexual intercourse.

Introduction and Statement of the Problem

Abstinence-based and comprehensive-based sex education is a controversial topic among many people throughout society, particularly high school students and their parents. The sex education debate in America takes on special relevance because sex and related topics are a reality in the lives of many young people. Studies have found that abstinence-based sex education is not teaching students the precautions needed when deciding to participate in sexual intercourse (Grunseit, Kippax, Aggleton, Baldo, & Slutkin, 1997; Collins, Alair, & Summers, 2002; Underhill, 2007). Others say comprehensive-based sex education is encouraging students to become involved with sexual activities (Collins & Stryker, 1997; Toups & Holmes, 2002). Even though many debates are between government officials, parents, administrators, and religious leaders, the question that needs to be asked is what do the students want? This study explored the preferences of students regarding sex education. Results may help us understand what students want and need to be taught in the classroom when it comes to sexual activity. With the preferred type of sex education being taught to students, rates of teenage pregnancy and STD's are expected to decline. This study also explored whether there is any correlation between teens who are sexually active and the type of sex education they received, along with other variables that include demographic location, socioeconomic statuses, parenting styles, parent and child communication, religious affiliation, age, gender, race, and sex class educator.

Definition of Terms

- Sex education will be defined as a word used to describe a class that is taught to middle school and high school students about sexual intercourse and other related topics about sex.
- Abstinence-based sex education will be defined as a sex education class that strictly

enforces "no sex until marriage." There is no type of protected measures taught in the classroom.

- Comprehensive-based sex education will be defined as a sex education class that not only teaches abstinence, but also teaches teens the precautions needed when becoming sexuality active (condoms, birth control, etc ..).
- Teenager in this study will be defined as anyone between the ages of twelve and nineteen years of age.
- Sex will be defined as any type of sexual intercourse such as vaginal, oral, or anal.

Introduction

In today's society, sex education, which is sometimes called sexuality education or sex and relationships education, “is the process of acquiring information and forming attitudes and beliefs about [sex](#), sexual identity, relationships and intimacy; it is also about developing young people's skills so that they make informed choices about their behavior, and feel confident and competent about acting on these choices” (Avert, 2010). The topic of sex education in America is relevant to today's society as teenagers participate in or hear about sexual activity on a daily basis. The content of sex education curricula in America varies widely by region, by school district, and even sometimes by the classroom.

Although the teen pregnancy rate has declined over the past few years, the United States still has the highest rates of sexually transmitted diseases and teen pregnancy of any industrialized country in the world. There are many teenagers, ages 12 to 19 years of age that participate in sexual activities each year in the U.S. According to the West Virginia Department of Education (2007), a Youth Risk Behavior Survey was conducted to show to that an estimated 53.4% of high school students in the year 2007 engaged in sexual activity. In a recent survey of

parents asking whether or not sex education was important to teach students, "93% of parents with high school students and 91 % of parents with middle school students believed it was very important" (SIECUS Report, 2004, p.39). Many parents believe that their teenager needs some type of education about sexual activity. In West Virginia, over 92% of middle and high schools taught abstinence as the most effective method to avoid pregnancy, HIV and STDs in a required health education course (WVDE, 2007).

There are two programs, abstinence-based sex education and comprehensive-based sex education that are useful when teaching teenagers about the precautions of sex. Most parents reported in 2004 "that it is appropriate to teach students about many subjects that are considered controversial, including abortion, masturbation, and sexual orientation" (SIECUS Report, 2004, p.39). This type of education leans more towards a comprehensive-based sex education, rather than abstinence-based. Sex education is becoming ever more political, with the federal government giving money to sex education programs. Most people do not support this policy. In 2007 alone, "the U. S. government spent over \$241 million in federal funding on abstinence based sex education" (Bruggink, 2007, p.4). The purpose of this study is to find the preferred type of sex education, abstinence or comprehensive, that should be taught among teenagers, ages 12-19, in public schools.

Sex and Consequences among Young People

There are consequences that young people have to consider when deciding to have sex; sexually transmitted diseases (STD's), teen pregnancy, and single parenthood. In the United States, although "15-24 year-olds represent only 25% of the sexually active population, they account for nearly one-half of all new sexually transmitted infections, and rates are higher among young women and minorities" (Kohler, Manhart, & Lafferty, 2007, p.344-345).

Compared with male adolescents of the same age, rates of STD's among women are more than twice as likely. There is an average of 38.6 million people worldwide who are HIV infected (Underhill, 2007).

There are nearly one million teenage girls that get pregnant each year in the United States along with about half a million teen births, the highest of any industrialized country; approximately one-third of all girls will become pregnant before they reach the age 20.8. (Kjepacki & Oligney, 2005). More than 50% of these pregnancies will lead to the departure of the father once they have impregnated their partner. The U.S. Centers for Disease Control and Prevention (CDC) conducted a survey that showed sexual activity among school-aged youth have fell from 53% in 1993 to 50% in 1999 (Collin, Alagiri, & Summers, 2002).

There are many adolescents that place themselves at risk of STDs and unplanned pregnancy; nearly two-thirds of high school seniors have had sexual intercourse, with 21% of them having four or more partners (Basen-Engquist, et al., 2001). Among the seniors reported having sex in the last three months, 43% said they did not use a condom upon intercourse, and only 17% was on the birth control pill. One reason may be because of embarrassment (Basen-Engquist, et al., 2001). A study done by researchers in China, Canada, and Republic of Korea investigated “embarrassment related to condom purchase, carry, storage, use, and disposal in [the] three countries” (Moore, et al., 2007). Because of global importance of sexual and reproductive health, researchers investigated embarrassment using an international sample. Individuals for the sample were selected by interception at public facilities such as shopping malls, bus stations, etc. (Moore, et al., 2007). Participants had to be between the ages of 18-40, had too of had sex, and had too of purchased condoms at some point in the past two years; upon meeting qualifications, a paper and pencil survey was distributed.

In the study mentioned above, there were three-hundred and six sampled in China, 301 in Korea, and 497 in Canada. In China and Korea, the stages that showed to be the most embarrassing were pre-purchase, during purchase, and carrying, while the least embarrassing was storing and disposing of the condom. For Canada, purchasing stage was the most embarrassing and using was the least embarrassing (Moore, et al., 2007). Overall, condom embarrassment was low; China 32%, Korea 45%, and Canada 28%. These findings suggest that a need to expand public health, along with sexual education.

A nationwide survey was conducted by the National Center for Health Statistics from January 2002 to March 2003 (Kohler, Manhart, & Lafferty, 2007). The information collected included basic demographics such as attitudes, knowledge, and beliefs regarding family planning issues, and self-reported sexual behavior and previous diagnoses of sexually transmitted diseases. The survey was originally designed to reach people from ages 15-44, and had a total number of 12,571 male and female individuals across the United States to participate. People reporting sexual orientation other than heterosexual was excluded, as well as respondents who were married. To assess the effect of formal sex education on teen pregnancy and STD risk, the sample was restricted to never-married heterosexual teenagers, 15-19 years of age. Results concluded that 9.4% of the participants reported that they had not received any type of sex education, 23.8% reported having abstinence-based sex education, and 66.8% having comprehensive-based sex education (Kohler et al., 2007). Relationships between demographic characteristics revealed differences between type of education received with respect of age, income, residence, and family unit. Individuals receiving no type of sex education tended to be from low-income families, black, and from rural areas, abstinence-based sex education were usually younger, white, low-to-moderate families, and those participates

receiving comprehensive-based sex education were somewhat older, white, from urban areas, and from higher-income families (Kohler, et al., 2007). Among participants, 7.3% reported pregnancy (no statistics show whether the raising of the child was between both partners or by a single parent) (Kohler, et al., 2007). Pregnancy was shown to be associated with teens of older ages, black race, and lower household income. Adolescents who reported receiving comprehensive-based sex education were less likely to report pregnancy. According to Kohler et al. (2007), only 3.4% of teens reported any STD diagnoses, and were more common among females than males. Again, STD diagnoses tend to be associated with low-income families, black race, and of an older age. Kohler's et al. (2007) research suggests that neither abstinence-based nor comprehensive-based sex education was associated with STD's.

A study conducted by staff at the University of Texas Medical Branch found that youth were more influenced by their parent's decisions about sex than anyone else. In a recent nationwide survey, 87% of youth ages 12 to 14 said that "it would be much easier to postpone sexual activity and avoid teen pregnancy if they were able to have more open, honest conversations with their parents about sex, contraception, and pregnancy" (Lederman, Chan, Roberts-Gray, 2008, p.137). One of the key strategies for lowering the risk of sexually transmitted diseases and unplanned pregnancy is to involve parents and adolescents in prevention education programs. Lederman et al. (2008) suggests that parent-child involvement can have positive outcomes on a child's knowledge and attitude about sexual behavior, as well as develop parent-child communication.

A recent study conducted by the Heritage Foundation suggests evidence of a relationship between early sexual intercourse and depressive symptoms. Sabia, a researcher using the National Longitudinal Study of Adolescent Health, presents evidence that says

otherwise. Sabia (2006) has found consistent evidence that suggests “that early entrance into sexual intercourse is not the cause of depression, but rather is an observable indicator of depression” (p.821). The findings of this study does not suggest that delaying sexual activity will improve adolescent mental health, nor does it prevent the continuation of other health or non-health benefits to abstinence. Also, recent work “that carefully addresses unobserved heterogeneity suggests that early teen sex might have negative educational spillovers” (Sabia, 2006, p. 822). Therefore, a complete understanding of the teen decisions would contribute to adolescent sex literature and the debate over sex education (Sabia, 2006).

Abstinence-Based Sex Education

Abstinence-based sex education is a program that encourages teens to abstain from sex until marriage. The program shows teenagers that they can achieve their goals and dreams without the worry of consequences that occur due to sexual activity (Focus on the Family, 2008). Abstinence-only approaches include discussions of values, character building and refusal skills, while avoiding specific discussions of contraception or safer sex (Collins & Stryker, 1997). According to the Center for AIDS Prevention Studies by the University of California, "93% of American men and 80% of American women between the ages of 18 and 59 were not virgins on their wedding night" (Collins & Stryker, 1997, paragraph 6). Researchers state that the best type of sex education is abstinence, encouraging it for young people who are not yet ready to have sex and others who choose to stay a virgin until marriage (Collins & Stryker, 1997; Toups & Holmes, 2002). The amount of adolescents taking part in premarital sex has become a concern for both educators and parents for reasons of both health and pregnancy risks; a school's adoption of an abstinence-based sex education curriculum could possible impact the reduction of these numbers.

To see if the abstinence-based curriculum was effective among adolescents, researchers from Florida State University and the University of Texas at Austin went to Florida schools to administer a questionnaire. The questionnaire was targeted to see the effects of Education Now and Babies Later (ENABL) programs that were being taught to students (Arnold, Smith, Harrison, & Springer, 1999). The study showed, along with many other researches that have been conducted, that students taking abstinence-based sex education were not as sexually active as those who had no education at all (Arnold, et al., 1999; Toups & Holmes, 2002).

However, results of the National Survey of Family Growth showed that adolescents who received abstinence-based sex education had a higher chance of teen pregnancy than those who received another form of education or no education at all (Kohler, et al., 2007; Hennessy, et al., 2006). Although it is controversial on what type of sex education is appropriate to teach adolescents, "77% of parents of junior high students and 72% of parents with high school students, believe that sexuality education is very effective in helping teens avoid HIV/AIDS." In the same survey, "73% of parents of junior high students and 66% of parents with high school students believe that [sex education] is very effective in helping teens avoid pregnancy" (SIECUS, 2004, p.39). The overall study showed that parents preferred comprehensive-based sex education rather than abstinence-based sex education.

Thanks to the Bush administration, New Jersey became the fourth state in 2006 to be rejected federal funding for sex education programs. Accepting federal money from the government "would have required the state to abandon its existing comprehensive based sex education, and instead rely exclusively on abstinence-only programs" (Bruggink, 2007, p.4). For abstinence-only education, the federal government has eight requirements that must be maintained in order to receive money to support the program (Hennessy, Fishbein, & Bleakley,

2006) (see Appendix A). Even though abstinence from sexual intercourse helps prevent HIV and STDs, abstinence programs are considered uncertain. A survey that was taken between the years 1980 and 2007 showed that programs that encouraged abstinence from sex do not seem to affect the risk of HIV infection in high income countries (Underhill, 2007). Researchers believe that "abstinence- only education programs, as defined by federal funding requirements, are morally problematic, by withholding information and promoting questionable and inaccurate opinions" (Santelli et al., 2006, p.10). In the abstinence-only curriculum in 2007, 80% of the information given to adolescents was considered false (Bruggink, 2007).

An abstinence-based sex education approach "ignores the developmental diversity in young people's sexuality and marginalizes, and possibly alienates, those who, for whatever reason, do not adopt the "no sex" option" (Gruseit, Kippax, Aggleton, Baldo, & Slutkin, 1997, p.444). This type of program misses out on the opportunity to educate the students who plan to become sexually active in the future.

Comprehensive-Based Sex Education

Comprehensive-based sex education uses the methods of both abstinence and alternative behaviors on sexual activity. Arguments show that sexuality education should encourage abstinence, but also provide teenagers with information on how to be protected if deciding to become sexually active (Collins, Alairi, & Summers, 2002). This can include proper ways to put on a condom, safe sex behavior, and other contraceptives to protect adolescents from the consequences sexual behavioral can lead to. According to a study done by Archives of Pediatrics and Adolescent Medicine, research shows that "by 15 years of age, 25.1 % of youth have had vaginal sex, and this figure increases to 37.5% at 16 years of age, and 46.9% by the age of 17" (Hennessy, et al., 2006, p.1152). Research concludes that comprehensive-based sex education is

the best way to control the substantial amount of pregnancies and reported cases of STDs among teenagers.

In a study conducted by Underhill (2007), she concluded that teaching abstinence-based sex education does not decrease the chances of teenagers becoming infected with sexually transmitted diseases; abstinence does not prove to be effective. When a teenager undergoes classes based on the comprehensive prospective, they are more prepared with ways to prevent pregnancy and STD's than just by simply being told not to have sex. Sex education advocates have acknowledged that many teenagers are having sexual intercourse, and that the population of teenage students needs to have the knowledge to protect themselves and their well-being (Collins, et al., 2002). A study that was conducted in 2005 reported that "half of 12-14 year-old-girls and two-thirds of 12-14 year-old-boys said they used contraception the last time they had sex" (Oligney & Klepacki, 2005, p.1). Three-fourths of the sample said they used condoms, and the one-fourth said they used ineffective methods such as withdrawal and rhythm. This study concludes that comprehensive-based sex education is the more effective type of sex education. Adolescents are going to have sexual intercourse no matter what education is being taught, so it is best to teach them the proper ways to stay protected. Another study conducted by the University of Washington reported that "sex education programs were significantly associated with reduced risk of teen pregnancy" (Kohler, et al., 2007, p.349).

According to the American Humanist Association, a study was conducted by researchers at the London School of Hygiene and Tropical Medicine to see the shift on premarital sex in ninety five countries worldwide. Researchers concluded that married couples are having sex the most. Even though people are starting to have sex before marriage, they are not starting out at increasing young ages (Bruggink, 2007). The study also showed that there was no connection

between multiple partners and the risk of obtaining a STD. Developed nations reported higher rates of multiple partners, but did not have increasing rates of HIV and AIDS (Bruggink, 2007). Researchers concluded that there was no general approach to promoting sexual education in all areas, and that no one intervention will work everywhere.

When conducting a study on the U.S. public opinion on sex education, Hennessy, Fishbein, and Bleakley (2006) found that abstinence only programs were not supported by the majority of the public nor the scientific community. Participants ranged from the ages of 18 to 83, all picked at random. Out of 1,096 respondents, 39% agreed to abstinence only programs while 80.4% believed that a combination of abstinence and other methods was more effective (Hennessy, et al., 2006). The majority of the population who responded to the survey said they disagreed with the "beliefs that abstinence only programs were effective in preventing unplanned pregnancies and that teaching condom instruction encourages teens to have sex" (Hennessy, et al., 2006, p.1154). The SIECUS report (2004) concluded that 82% of adolescents (15 to 17) and 75% of young adults (18-24) want to see more of a "how to" type of education; how to stay protected, how to protect from STDs and pregnancy, and what type of birth controls are available.

Preventing Sexual Activity

There are many other factors that can affect a teenager's choice to become sexually active such as educator's likability, parenting styles, parent/child communication, neighborhood characteristics, and peer relations. Researchers from universities across Scotland hypothesized that there was a connection between sexual behavior among teenagers and the person who delivered the sex education class. They believed that if the students received sexual education from a teacher who they well admired that students will be more than likely to abstain from sex

(Wight, et al., 2002). There were 7,616 pupils that completed the questionnaire, and 5,854 students did a follow up questionnaire two years later. There was no connection between the administrator giving the class and the reduced acts of sexual activity among adolescents.

Parenting styles can influence a child's choice on whether they become sexually active at a young age. Many studies indicate that teenagers are more likely to wait to have sex if their parents set down firm rules, involve in social activities, and discuss sex with their child (Roche, et al., 2005). Results concluded from a 1985 study of African American families in Chicago, Hogan, and Kitagawa that young girls were less likely to engage in sex if their parents were involved in their early dating behavior. A similar national sample of white youth show that females are less likely to become sexually active if their parents knew some, or all of their friends (Roche, et al., 2005).

Parent and child communication may also play a big role in delaying sexual intercourse at an early age. A survey conducted in 1983 by Alexander and Jorgensen was sent out to parents and adolescents in two communities asking their views about sexual education, focusing on their opinion on who should be the primary sex educators of their children. Even though both parents and students supported the teaching of sexual education within the school systems, parents (95%) and adolescents (76%) agreed collectively that parents should be the most responsible for teaching their children about sex, followed by the school systems next (Alexander & Jorgensen, 1983).

There is a small but significant connection between neighborhood characteristics and adolescent sexual activity. In a series of "analysis of adolescent girls sexual behavior using the National Survey of Family Growth, [researchers] found a lower rate of early intercourse for non-black girls living in census tracts with a lower rate of residential mobility and divorced

single-mother households and a higher proportion of college-educated adults and black, non-Hispanic residents" (Roche, et al., 2005). They also found that an effect for neighborhood socioeconomic status (SES) is that boys are more likely to engage in sexual intercourse while girls are less likely to participate in sexual activity when living in low SES neighborhoods (Roche, et al., 2005). Upchurch (1999) and colleagues concluded that there is an association between girls and boys becoming sexually active at an early age when they live in a neighborhood with crime, violence, and physical decay.

Peers may also help reduce teen pregnancy in some parts of the world. According to the United Nations Population Fund, "pregnancy has become the leading cause of death among adolescent girls in the Dominican Republic" (UNFPA, 1999, p.10). About one-fourth of young girls ages 15-19 are pregnant or have already had their first child, putting them at risk due to limited access of health care outside the major cities. UNFPA is working with nongovernmental organizations to develop programs of peer-educators to increase access to sexual education in thirty-six different neighborhoods. There are over 360 volunteer peer-counselors who work to pass out material on sex education, and with parental consent, they also pass out condoms and birth control pills as well. The program not only wants to lower the rates of pregnancy, but also wants to lower the rates of unwanted STD's. In the past two years that the program has been up and running, peer-counselors have counseled over 9,000 young people, 30% of them which are out of school. In many countries, "girls who become pregnant are not permitted to return to school-it they were in school in the first place" (UNFPA, 1999, p.10).

Role of the Church

The number of school systems engaged in developing sex education curriculum is increasing daily. Many schools are involved, from public schools in small towns and big urban

areas, to private day and boarding schools, and parochial schools as well (Calderone, n.d.). But many people feel like it is the role of the church to teach their adolescent about sex, more so than the school system. On the flip side, many also feel that “churches can no longer live with the idea of Eden; it just doesn’t exist” (Mallon, 2002, p.134). People are going to do with their sexualities what they want. Research shows though, that adolescents have become less religious; fewer adolescents attend weekly services, pray daily, or even respond that they believe in a personal God (Rostosky, Wilcox, Wright, & Randall, 2004). In recent surveys that were conducted throughout the United States, almost all adolescents said that believed in God, and a significant amount of these students said that religion was important to them; 90% roughly claimed to be affiliated with some sort of a denomination (Rostpsky, et al., 2004). In 1981, only 41% of adolescents attended weekly service, 31% in 1991%, and has remained constant through 1997 (Rostosky, et al., 2004). Specific beliefs and practices tend to vary according to age, gender, and race.

Forty-four percent of girls who report not having engaged in sexual intercourse also report having some affiliation with a religion or moral values as their motivation to not have sexual intercourse until marriage (Rostosky, et al., 2004). An additional 33% simply state it is because they want to abstain from catching an STD or become pregnant (Moore, Driscoll, & Lindberg, 1998). Although there is a clear line “between religious values and abstinence, a few studies have established a causal direction of this association, and studies have tested explanatory models” (Rostosky, et al., 2004, p.680). Religion may persuade socialization and behavior at any level such as the individual, familial, and macro level. For instance, participation in religious activities may or may not provide “adolescents with a broader array of social resources or social capital than might be available to other youth. The social integration

and support that is available through interaction with members of a religious community may serve to clarify and reinforce acceptable and unacceptable sexual behaviors” (Rostosky, et al., 2004, p.861).

In a study conducted by Rostosky et al. (2004), fifty empirical studies were collected and analyzed to examine to effectiveness of faith-based adolescent pregnancy prevention programs. White and Black Fundamentalist Protestants were more likely than anyone else to delay in sexual intercourse. Although both denominations discourage no sex until marriage, Black churches may be more communalistic and forgiving, and White churches may be more judging (Hertel & Hughes, 1987).

Across all studies found, white females who attend religious services more often are more likely to delay in sexual intercourse (Rostosky, et al., 2004). In a study by Jessor and Jessor (1975), 362 high school virgins were examined over a year’s time. During the year of data collection, 50 females and 27 males transferred from virgin to non-virgin status. Females who reported were no longer on virgin status reported lower church attendance than when first being measured earlier that year. The students that had not transitioned during the year had showed no change in attendance of weekly service.

Conclusion

No matter the amount of research conducted, there will never be a single factor that can settle the debate against abstinence-based versus comprehensive-based sex education. Even though most research concludes that the majority of the population would rather see comprehensive-based sex education in the classroom, there are still people who would like to see abstinence being taught to their teenagers due do some research that shows its effectiveness. Early studies help get a general idea on what to look for when conducting a

study on sex education in the classroom. The federal government fights more for abstinence-based sex education taught in the classroom, but the population tends to advocate more for comprehensive-based sex education. Many teenagers who become sexually active at an early age often result in health, education, economic, and psychological consequences. Even though abstinence teaches students to stay away from sexual activity until marriage, studies show that abstinence-based is more effective than no sex education at all (Kohler et al., 2007).

Abstinence-based sex education does not prepare teenagers "how to" stay protected when they decide to become sexually active. Unlike popular belief, abstinence is no longer a choice for most teenagers. Pre-marital sex is rising throughout the nation, and parents feel like their child needs to know ways to stay protected. Unprotected sexual activity is associated with various health risks such as unwanted pregnancies, sexually transmitted diseases, and abortions. Many believe comprehensive-based sex education teaches students ways to prevent consequences such as these.

Therefore, this study will explore how adolescents in high school perceive sex education, either abstinence-based or comprehensive-based. Based on recent studies the hypothesis for this study is that more students will want comprehensive-based sex education than those who want abstinence-based sex education, and data will be collected based on past methods used. This study will hopefully add to the collection of research that supports the effectiveness of comprehensive-based sex education programs. The study will enhance evidence-based practice in the prevention of social problems associated with adolescent pregnancy.

Methodology

The research questions for this study were: (1) Does comprehensive-based sex education prove to be more effective than abstinence-based sex education? And, (2) what type of sex education should be taught among high school and middle school students? To answer these questions, students in introductory courses at Concord University were selected to answer a short, twenty-question survey (see Appendix A). This is to allow for a more randomized sample of participants instead of choosing a particular group of students to survey. Several other variables were explored along with abstinence-based and comprehensive-based sex education, including gender, race, and age. Analysis was conducted to see if any correlations are made between such variables, sexually active teens and the type of sex education they received, if any was received at all. If students are able to receive the preferred type of sex in the classroom, then the rates of sexual activity are expected to decline.

Participants Section

Participants were selected from introductory courses at Concord University; Edu 210, P Ed 101, Art 101, Mus 101, Eng 101, Biol 101, Chem 101, Math 101, Geog 101, Hist 101, Posc 101, Soc 101, and Sowk 161. This is so the researcher could get a more randomized sample of participants. Professors that allowed their students to participate were selected for the study. No student was discriminated against due to sex, race, sexual orientation, or ethnicity. There were also no incentives offered to students taking the survey. Roughly 15-30 students in each introductory course were predicted to participate in the survey, which would allow for roughly 200 participants throughout the introductory courses. Students participating in the study were asked to sign a consent form before the survey was administered (see Appendix B). The survey was completely anonymous; no names were put on the surveys nor were anyone able to see

results other than the researchers. If a student was in more than one introductory course, they were to only participate in the survey one time.

Instrumentation Section

Past studies have concluded that the type of sex education class taught to students does increase/decrease sexual activity among teenagers. For the survey in this study, questions were asked that were specially based on the knowledge that was trying to be gained. Questions were designed to answer the research question on comprehensive- based versus abstinence-based sex education, and the effectiveness of the two outside the classroom. Survey questions included background information, and questions regarding the type of sex-education classes the student has received. Questions were also asked in relation to each variable being looked at: demographic location, socioeconomic statuses, parenting styles, parent and child communication, religious affiliation, age, gender, race, sex class educator, and neighborhood characteristics. The survey was neither measurable in terms of reliability nor validity.

Data Collection

The researchers and professors administered the surveys during the introductory course during normal class time. The surveys were collected and sealed in an envelope immediately after completion to insure the privacy of the students. The surveys were kept totally confidential. Educators were not permitted to glance over the survey. Once the participants had taken the survey, if administered by an educator, they were then sealed in an envelope, and then returned to the researcher or research mentor where they were kept until all surveys had been administered. No student was allowed to handle the surveys; only administrators and staff. This was to make sure the surveys are not tampered with, and that the answers were kept confidential. Once the researcher had the surveys, they were kept in a locked box where only the researcher

had a key. This way no one could access them without the researcher's knowledge, and to ensure the confidentiality of all students. After analysis of the surveys, they were destroyed.

Data Analysis

SPSS was used to sort and analyze the data that is collect. When doing so, comparisons were made to students who have and have not become sexually active to the type of sex education that they had received (if a sex education class was administered to them at all). Also, researchers compared sex and race to whether or not chances of having a sex education class would lower the chances of having sex; same goes for neighborhood characteristics, demographic locations, and socioeconomic statuses. Parenting styles and parent and child communication was also analyzed to see if there is a correlation with the age in which one starts having sex. Bar and pie graphs were designed to show the results that were found when doing the analysis.

Timeline

The study took about six to eight months to complete. Meeting with each professor was essential to make sure they allow their students to participate. After getting permission from the Human Subject Review Board at Concord University and the professors from each introductory course, the researchers went to each class and explained the reasoning of the survey. The students signed a consent form before doing the survey, but it was all obtained the same day. Data was collected throughout a one month span, giving researchers and educators time to administer the survey to all participating introductory courses that were on different days and at different times. There was roughly ten minutes given to students who took the survey. Once the collection of data was complete, the study took about one to two months to analyze. Results were given to those involved upon request. Researcher will give presentations with the McNair

Scholars Program regarding the results that were analyzed.

Results

There are several issues that have become a serious threat to our nation's youth; i.e. sexually transmitted diseases such as HIV and AIDS, and unplanned or unwanted pregnancy. To challenge these threats, it is important for adolescents between the ages of 12-19 years old to receive a form of sex education. This study was designed to see what appeared to be more effective in teaching high school and middle school students, abstinence-based or comprehensive-based sex education. Also, it looked at the opinions of college students on what they believed should be taught to adolescents in the classroom. Three hundred and twenty-eight respondents answered a short survey concerning their sexual activity, what type of sex education they received, demographic location, socioeconomic statuses, parenting styles, parent and child communication, religious affiliation, age, gender, race, and sex class educator.

Operational Definitions

1. **Race-** ethnic background. There was one question on the survey that pertained to race or ethnicity.
 6. Which of the following best describes your racial or ethnic background?
2. **Age-** a period of human life, measured by years from birth. There was one question on the survey in relation to age.
 1. What is your age?
3. **Gender-** the state of being male, female, or neither. There was one question on the survey about gender.
 3. What is your gender?
4. **Class-** a number of pupils in a college, ranked together, or graduating in the same year. There is one question concerning the class of the participants.
 2. What class are you in?
5. **Demographic Location-** the area in which one lives. There is one question on the survey that pertains to demographic location.
 4. Are you from West Virginia?

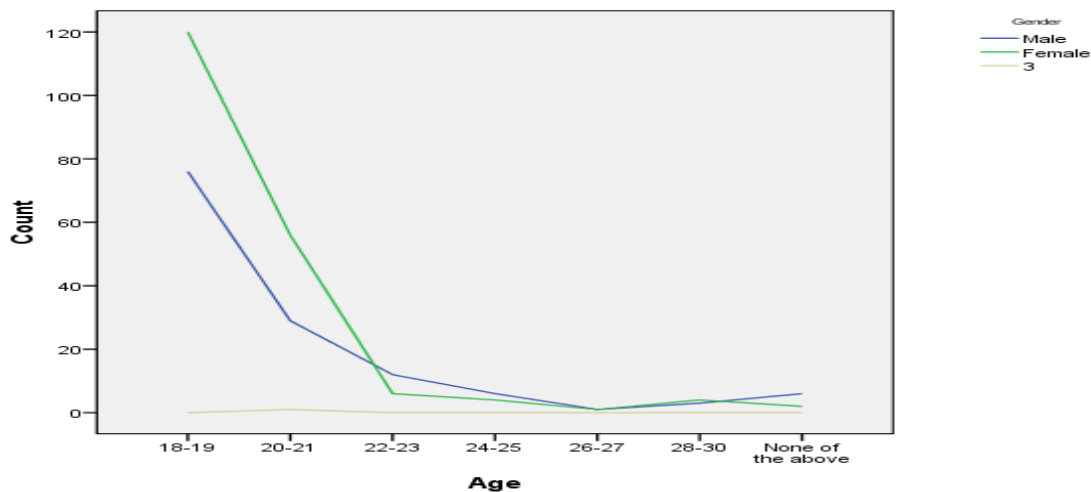
6. **Socioeconomic Status-** An individual's or group's position within a hierarchical social structure. There is one question in on the survey that is associated with socioeconomic status.
 5. What is your family's approximate household income a year?
7. **Religion-** the body of persons adhering to a particular set of beliefs and practices. There is one question on the survey that pertains to religion.
 14. Do you attend church?
8. **Parenting Styles-** a particular, distinctive, or characteristic mode or form of construction or execution in the way one parents. There are five questions on the survey that is associated with parenting styles.
 7. When you were in high school would you have considered your parents/guardians strict?
 8. When you were in high school, did your parents/guardians know who most of your friends were?
 9. Did you have a curfew?
 10. Did your parents/guardians know what you were doing at approximately all times?
 11. How many times a week did/do you eat dinner with your family?
9. **Parent/Child Communication-** the imparting or interchange of thoughts, opinions, or information by speech, writing, or signs between children and their parents. There are two questions on the survey that pertain to parent/child communication.
 12. Do/did you talk to your parents/guardian about things that happen in your life?
 13. Do/did you talk to your parents/guardians about sex or sexual activity?
10. **Sexual Activity-** activities associated with sexual intercourse. There is one question on the survey that concerns sexual activity.
 15. Are you sexually active?
11. **Sex Class Educator-** a person or thing that educates about sex. There is one question on the survey in relation to the sex class educator.
 19. Do you feel that the instructor of your sex education class influenced your decision about having sex?
12. **Sex Education-** a class that is taught to middle school and high school students about sexual intercourse and other related topics about sex. There are three questions on the survey that pertains to sex education.
 16. Have you ever had a sex education class or discussed sex education in health or any other class?

- 17. What type of sex education class was it?
- 18. Did you become sexually active before or after having a sex education class?

13. ***What type of sex education taught?***- this is in reference to the opinions of the respondents. There is one question on the survey in reference to the opinion on what type of sex education class is preferred.
20. What type of sex education do you feel should be taught to middle school and high school adolescents?

Race, age, gender, class, demographic location, socioeconomic status, and religion

Of the 328 respondents at Concord University that were included in the analysis, 40.5% were female and 58.8% were male. The majority of the respondents were between the ages of 18-19 at 60.1% (Chart One);



81.7% were of white ethnicity, 7.3% black, and 10.9% were other. Of the students in the study, 45.7% reported being a freshman at the university, followed by 32.9% reporting to be a sophomore. The majority of the respondents resided in West Virginia (68.0%), and 31.4% reported as being non-residents. In chart two, household incomes \$50,000 to less than \$75,000 were reported at 23.8%, and under \$10,000 at 5.5%. Thirty-nine percent of respondents reported attending church *sometimes*, while 22.9% reported *never* attending church.

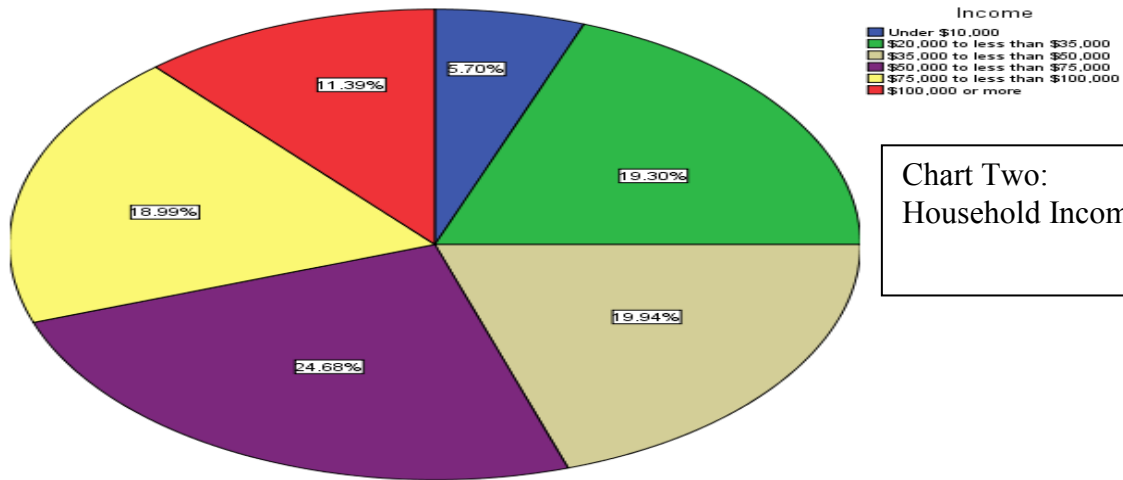


Chart Two:
Household Incomes

Expanding young people’s access to sexual education is important in increasing their awareness of what could happen when sexual activity occurs. When doing a comparison using Chi Square Crosstabs, it is shown that there is no significant difference in the age of the respondents and their sexual activity ($p=0.342$), along with sexual activity and what type of sex education the respondents preferred be taught among high school and middle school students ($p=0.102$). Of the respondents, 54.8% between the ages of 18-19 years of age preferred abstinence-based sex education, while 61.3% preferred comprehensive-based sex education. As age increases, the preferred type of sex education is abstinence based by 45.1% total, and 38.7% comprehensive-based.

Gender * Sex Cross tabulation

Count		Sex		
		Yes	No	Total
Gender	Male	97	35	132
	Female	124	68	192

Table one: Gender & Sex

3	0	1	1
Total	221	104	325

According to past research,

approximately one-third of all girls will become pregnant before they reach the age 20.8.

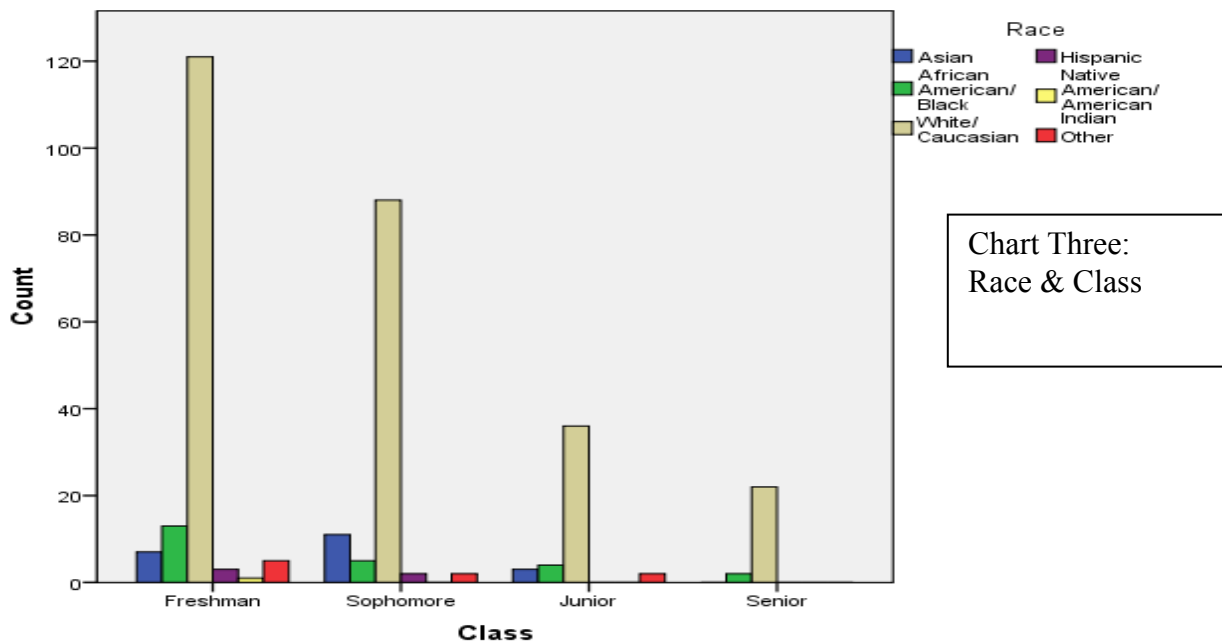
(Kjepacki & Oligney, 2005). More than 50% of these pregnancies will lead to the departure of the father once they have impregnated their partner. A marginal significant difference ($p=0.083$) was found among gender and sexual activity. In table one, females reported not having sex at 65.4%, while males at 33.7%. There was, however, a significant difference between gender and what type of sexual education should be taught in the classroom ($p<0.001$). More males reported that abstinence-based sex education should be taught (61.3%), and females reported that comprehensive-based sex education should be utilized (64.0%).

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.980 ^a	2	.083
Likelihood Ratio	5.178	2	.075
Linear-by-Linear Association	3.583	1	.058
N of Valid Cases	325		

Chi-Square
Crosstabs

According to analysis, comprehensive-based sex education is preferred among white, black, Asian, Hispanic, and Native American backgrounds. A significant difference is not shown between ethnicity and what type of sex education should be taught to middle and high school students ($p=0.610$). Chart three shows that of all respondents, 9.5% (8.3% of white race) wanted abstinence-based sex education, 85.6% wanted comprehensive-based (69.9% of white race), and

4.8% (3.4% of white race) said neither one was appropriate to teach to high school and middle school students. Among all classes, senior, junior, sophomore, and freshman, there was no significance in class and what type of sex education is preferred in the classrooms ($p=0.261$). Among the 46.2% freshman respondents, 37.8% prefer comprehensive-based sex education; 29.5% of the 32.9% of sophomore respondents, 11.4% of the 13.5% of junior respondents, and 6.8% of the 7.4% senior respondents prefer comprehensive-based sex education



According to past research, both young boys and girls are more likely to delay in sexual activity at an early age if they live in neighborhoods with low crime, violence, and physical decay. This study showed no significant difference between the location of the respondents and their sexual activity ($p=0.204$). Those who answered yes to being sexually active, 66.4% were West Virginia residents, and 33.6% said they lived outside of state lines. Of the respondents who answered no to being sexually active, 71.4% live with the state, and 27.6% live elsewhere. Also, no significant difference was shown between participants who are West Virginia residents versus

non-West Virginia residents and what type of sex education should be taught in the classroom.

Of the respondents who stated abstinence-based should be taught in the classroom, 71.0% were from West Virginia and 29.0% stated that they were from somewhere outside state lines.

Comprehensive-based preferred, 68.3% lived in WV and 31.3% stated they lived elsewhere, and those respondents who said neither was appropriate to teach, 62.5% live in WV and 37.5% live elsewhere.

Prior research has shown that household income is to be one contributing factor to young adolescents experiencing sexual intercourse. According to past research, teens that are below or around the poverty line are more likely to engage in sexual activity. This study showed to have no significant difference between household income and sexual activity ($p=0.579$). The majority of respondents who stated that they were sexually active made a household income of \$35,000 to less than \$75,000. Those who responded that they were not sexually active made a household income between \$50,000 to less than \$75,000. Both sexually active and non-sexually active respondents were in the same socioeconomic status. Also, there was no significance between the income and the location of the respondents; 24.1% of West Virginia residents said they made a household income between \$50,000 to less than \$75,000 while non-residents were in the same category at 25.5%. The next leading category for WV residents in \$35,000 to less than \$50,000 (20.0%), while for non-residents it is tie between two categories: \$35,000 to less than \$50,000 (20.2%) and \$75,000 to less than \$100,000 (20.2%).

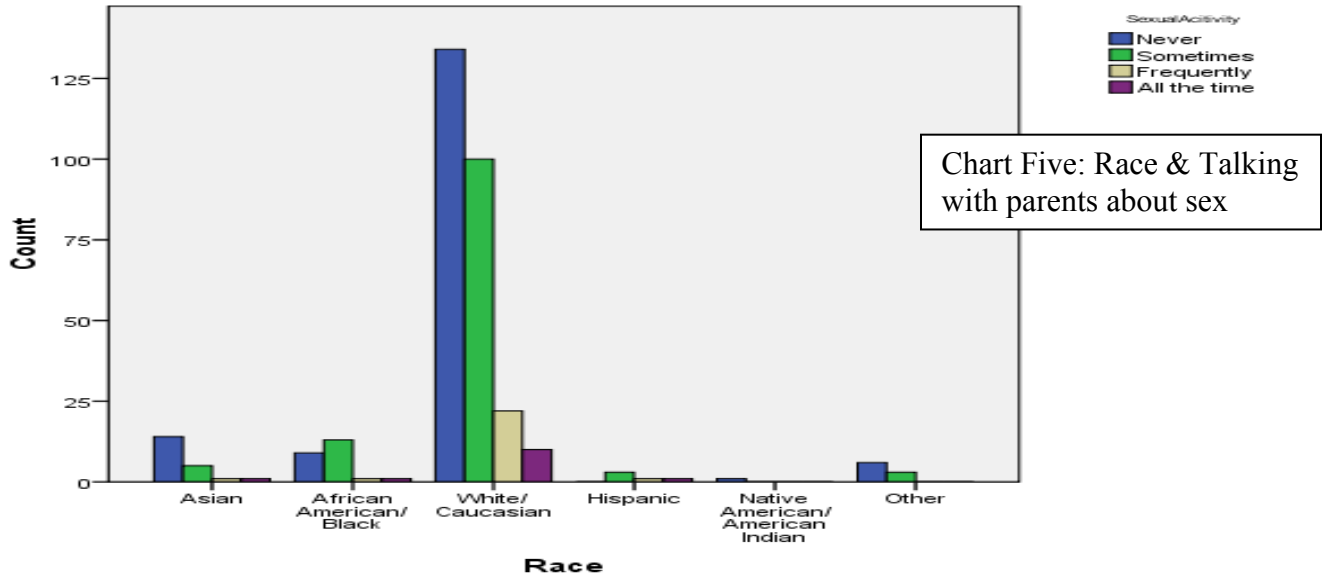
Religion may influence socialization and behavior at any or all levels: micro, mezzo, and macro. Participation in religious activities may provide adolescents access to a broader array of social resources, such as sexual education. In this study, there showed to be no significant difference between the type of sex education that is preferred in the classroom and the affiliation

with church ($p=0.132$). Of the 128 respondents that stated they never go to church, 68 of them said they preferred comprehensive-based sex education over abstinence-based. Of the 60 that said they went to church all the time, 46 stated they prefer comprehensive-based as well. Refer to Chart Four for details.

Parenting styles and parent/child communication

Communication between parents and early adolescents about sexual topics is often difficult or strained. Some parents think that they should wait until their children ask questions about their sexual activity to provide information, and adolescents take this as a message from parents to not ask such questions. There was no significant difference between sexual activity among teens and the communication between parent and child about sex ($p=0.379$). Of the 67.7% who reported that they were sexually active, 34.2% state that they *never* talk with their parents about sex; 26.2% said they so *sometimes*, 5.5% said *frequently*, and 1.8% said *all the time*. Of the 32.2% who reported as not being sexually active, 16.3% said they *never* talk with their parents about sex, 11.7% said they do *sometimes*, 2.2% said they did *frequently*, and 2.2% said they did *all the time*.

In this study, there showed to be no significant difference in ethnical background and parent and child communication about sexual activity ($p=0.423$). In chart five, it shows that out of 266 white respondents, 134 stated that they *never* talk to their parents about their sex life; 100 respondents *sometimes*, 22 *frequently*, and 10 *all the time*. African American respondents (24) reported that they speak with their parents *sometimes* about sexual activity (13); 9 stated that they *never* talk with their parents about that issue, 1 *frequently*, and 1 *all the time*.



Parental behavioral control, as defined by parents' efforts to set firm rules and monitor children's activities within and outside the home. In the study, there shown to be no significant difference in parenting knowing who their child's friends are and sexual activity ($p=0.296$). Ninety point five percent of the respondents that reported as being sexually active states that their parents know who their friends are; 86.7% of the respondents that states they were not sexually active said their parents also knew who they associated with.

Young adolescents are more likely to delay sexual activity when parents set firm rules, monitor social activities, and discuss sexual issues with their child. Surprisingly enough, there showed to be no significant difference between teens having a curfew and their sexual activity ($p=0.499$). Of the respondents that said they had a curfew when they were a teenager, 63.3% stated that they were sexually active; the respondents that were not sexually active, only 58.1% said they had a curfew.

An important role in protecting adolescents from involvement in sexual risk behaviors is for a parent to know what their children's activities are. In table two, there showed to be a marginal significant difference between sexual activity among teens and parents that know what their children are doing at all times (p=0.074). Of the respondents who said they were sexually active,

Table two: Sexual Activity & Talking with parents about sex

Sex *Parents talking with kids about sex Cross tabulation

Count						
		Parents talking with kids about sex				
		Never	Sometimes	Frequently	All the time	Total
Sex	Yes	111	85	18	6	220
	No	53	38	7	7	105
	Total	164	123	25	13	325

59.3% said that their parents knew what activities they were doing at all times. Of the respondents who said they were not sexually active, 69.5% said the same about their parent's knowledge of their whereabouts at all times.

Parenting styles and parent-adolescent communication plays an important role in delaying early sexual intercourse, especially in young girls. Although, the study showed to not have a significant difference between parenting styles and teenage sexual activity (p=0.958). Sixty-eight percent of respondents that said they were sexually active; 11.7% of them said

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.082 ^a	3	.379
Likelihood Ratio	2.886	3	.409
Linear-by-Linear Association	.459	1	.498
N of Valid Cases	325		

they ate dinner with their parents at least five times a week, 11.3% said at least six times a week,

and 9.8% said either three or four times a week. Thirty-two percent that said they were not sexually active; 6.1% of them said they ate dinner with their parents at least five times a week, 5.2% said at least seven times a week, and 4.9% said at least three times a week.

There also seems to be no significant difference in parenting styles and the age of the child ($p=0.205$). Of all 328 respondents, 58 stated they ate dinner with their parents at least five times a week, 49 said at least three times a week, 48 said at least six times a week, 47 said at least four times a week, and 46 said at least seven. Of the 58 respondents that said they ate dinner with their family at least five times a week, thirty-four were between the ages of 18-19 years old, sixteen between 20-21 years old, two between 22-23, one between 24-25, one between 26-27, and four between 28-30 years old. Analysis shows that there is a slight difference between having parents having dinner with their children and the age in which the children are; the youngest generation tends to eat dinner with their parents more than the older generations.

Sexual Activity, sex class educator and the type of sex education taught

Many adolescents place themselves at risk of an STD infection or an unplanned pregnancy no matter if abstinence-based or comprehensive-based sex education is preferred. There showed to be no significant difference between sexual activity among teens and what type of sex education that is preferred ($p=0.145$). In chart six, respondents that reported being sexually active, 55.7% stated that they preferred comprehensive-based sex education over abstinence-based. Those that reported that they were not sexually active, 25.8% reported that they also would like to see comprehensive-based among high school and middle school students.

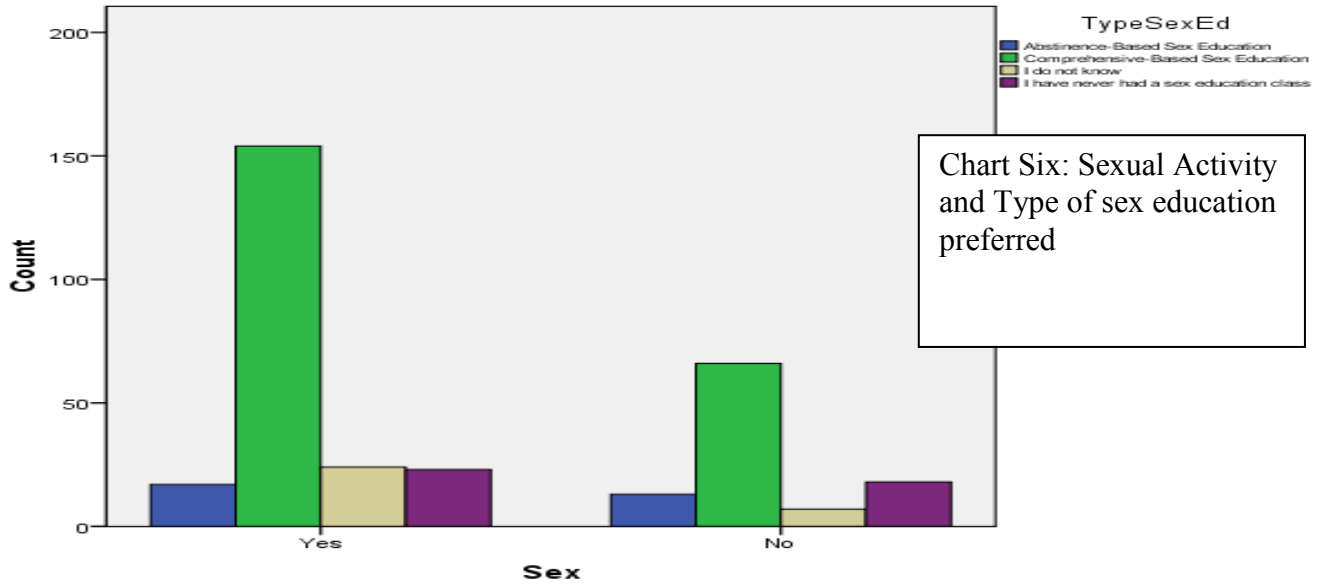
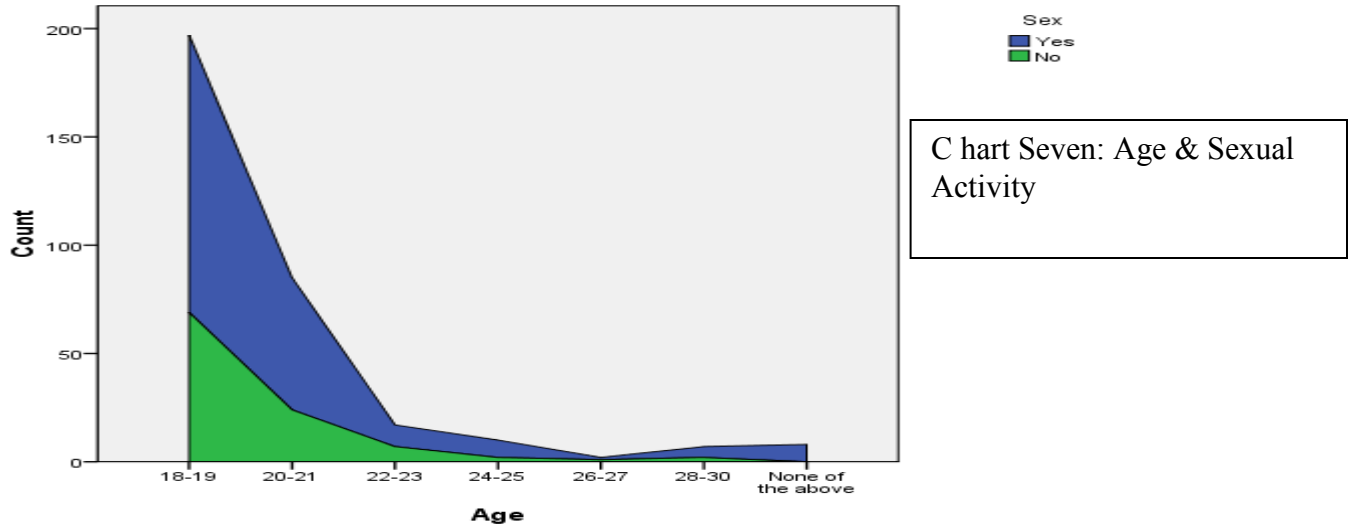


Chart Six: Sexual Activity and Type of sex education preferred

Becoming comfortable with one's sexuality, coping with pressure to have sex, and ultimately deciding if, when, and with who to become sexually active are important development transitions in adolescence. There showed to be a significant difference between teenage sexual activity and having sex education before or after one has sex ($p < 0.001$). Sixty-eight point three percent of the respondents stated that they received comprehensive-based sex education in the classroom; 40.4% states that they became sexually active after having sex education, 12.1% states that they were sexually active before and 15.2% that they were not sexually active. Those respondents who had abstinence-based sex education (9.3%), 1.6% said they had sex before the sex education class, 4.0% stated that they had sex after the class, and 3.4% said they are not sexually active. Refer to chart seven for details.



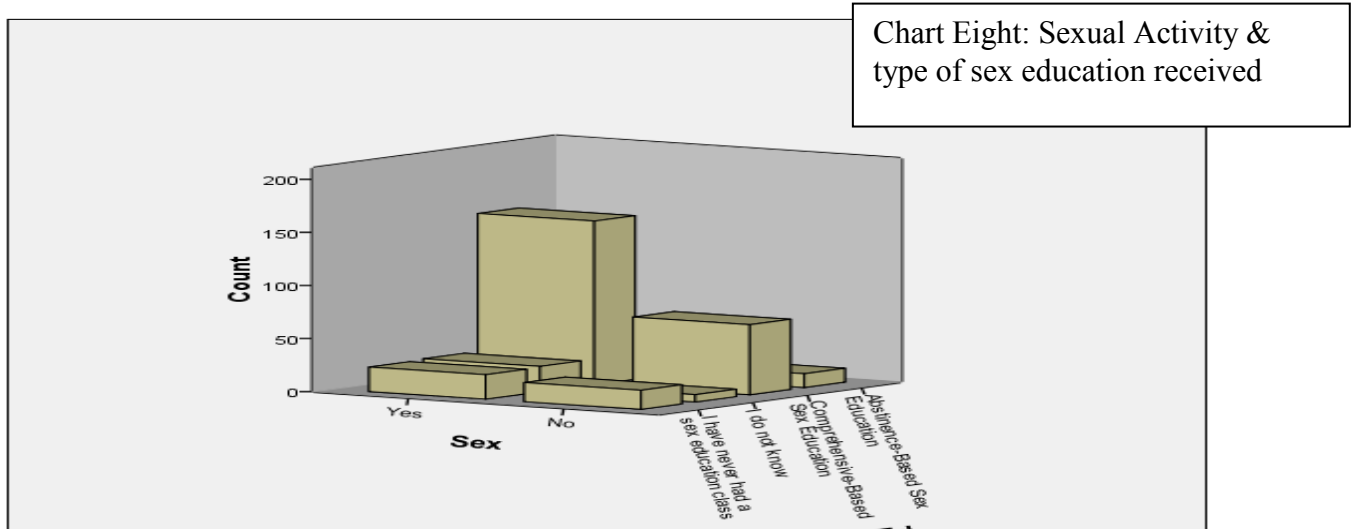
No significant difference was found between the sex education instructor's influence on teens and teenage sexual activity ($p=0.206$). Majority of the respondents who said that they were sexually active (67.5%) stated that the instructor of the sex education had no influence over their decision in becoming sexually active (52.0%). The majority of the respondents who were not sexually active (32.5%) also said the same thing; 22.3% of them said the instructor had no influence.

DISCUSSIONS

Does comprehensive-based sex education prove to be more effective than abstinence-based sex education?

Abstinence-based sex education when taught to adolescents strictly enforces no sex until marriage; no other type of contraceptives is taught with this type of sexual education. When teaching comprehensive-based sex education, educators teach students to abstain from sex until marriage, but also teach contraceptives such as condoms, birth control, and masturbation. By a slight margin, chart eight shows that there was not a significant difference in teens who become sexually active and the type of sex education that they received in school ($p=0.108$). Respondents

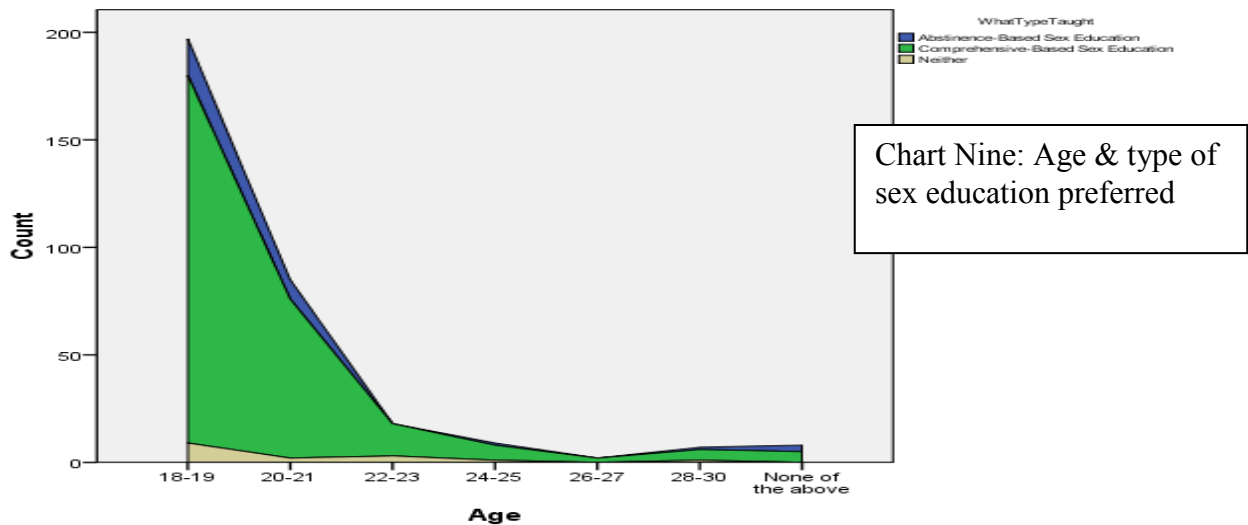
who said that they were sexually active (67.7%) said that when in middle or high school, the majority of them had comprehensive-based sex education (47.8%). Those that reported that they were not sexually active (32.3%) stated that they also received comprehensive-based sex education when in school (20.5%).



What type of sex education should be taught among high school and middle school students?

Sexuality education for children and young adults is one of the most debatable issues among policy makers and educators. Many feel that abstinence-based education allows teens to live out their hopes and dreams without worrying about the consequences of teen pregnancy and/or sexually transmitted diseases. Also, many feel that comprehensive-based education should be utilized due to the fact teenagers often become curious; if they do decide to become sexually active then they know the information needed to stay protected. This study showed that there were 328 respondents who answered the question: “what type of sex education do you feel should be taught to middle and high school adolescents?” Chart nine shows that over majority of the participants wanted comprehensive-based sex education (85.1%) while only 9.5% said they believed abstinence-based se education was the best to teach in the classroom; 4.9% said that

they felt neither one is appropriate to teach.



Overall, this study showed that comprehensive-based sex education was the preferred type of sex education among college students at Concord University. Also, comprehensive-based does not prove to be more effective in preventing sexual intercourse. Since there was no significant difference in the type of sex education that was used and sexual activity, both are either working in preventing sexual intercourse or neither one is working in preventing young teens from having sex.

Limitations/Recommendations

When conducting this study, there were several non-traditional students in the classroom. It was predicted that they would not be able to give the adequate amount of information needed in conducting an analysis of what students want in the classroom. Since this survey was voluntary, there were several students who did not want to participate in the study. Also, there were several students in multiple classes who had already taken the survey in another class; this caused the sample size to decrease. When the number of participants decreased, so did the chances of receiving reliable outcomes. Since the survey was intended to measure sex education and sexuality among teenagers, the survey asked a lot of personal questions to students. Some

students may have felt the need to lie about a question due to embarrassment or just to make themselves look good. The results may not always be accurate due to false answers given by some students. Since the study is directed towards high school students, and college students are the ones being surveyed, we cannot generalize that all high school students feel this way. As students mature, so may their opinion on sex education. Future research needs to be conducted on students who report they are sexually active whether protection is used during sexual activity. Since there seems to be no connection between sex and sex education, are students doing what needs to be done to stay protected from the dangers of teenage pregnancy and STD's? Further research will need to be conducted to analyze such answers.

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Appendix A
Sex Education Survey

Please Circle Only One Answer to Each Question Below:

1. What is your age?
A. 18-19 years B. 20-21 years C. 22-23 years D. 24-25 years E. 26-27years
F. 28-30years G. None of the above _____ (please specify)

2. What class are you in?
A. Freshman B. Sophomore C. Junior D. Senior

3. What is your gender?
A. Male B. Female

4. Are you from West Virginia?
A. Yes If so, what county? _____ B.No _____ (please specify)

5. What is your family's approximate household income a year?
A. Under \$10,000
B. \$20,000 to less than \$35,000
C. \$35,000 to less than \$50,000
D. \$50,000 to less than \$75,000
E. \$75,000 to less than \$100,000
F. \$100,000 or more

6. Which of the following best describes your racial or ethnic background?
A. Asian B. African American/Black C. White/Caucasian D. Hispanic
E. Native American/American Indian F. Other _____ (please specify)

7. When you were in high school would you have considered your parents/guardians strict?
A. Yes B. No

8. When you were in high school, did your parents/guardians know who most of your friends were?
A. Yes B. No

9. Did you have a curfew?
A. Yes B. No

10. Did your parents/guardians know what you were doing at approximately all times?
A. Yes B. No

11. How many times a week did/do you eat dinner with your family?
A. None B. One C. Two D. Three E. Four
F. Five G. Six H. Seven I. More than seven
12. Do/did you talk to your parents/guardian about things that happen in your life?
A. Never B. Sometimes C. Frequently D. All the time
13. Do/did you talk to your parents/guardians about sex or sexual activity?
A. Never B. Sometimes C. Frequently D. All the time
14. Do you attend church?
A. Never B. Sometimes C. Frequently D. All the time
15. Are you sexually active?
A. Yes B. No
16. Have you ever had a sex education class or discussed sex education in health or any other class?
A. Yes B. No
17. What type of sex education class was it?
A. Abstinence-based sex education (teaches “no sex until marriage”)
B. Comprehensive-based sex education (teaches “no sex until marriage” but also teaches safe sex and use of contraceptives such as birth control, condoms, and masturbation)
C. I do not know
D. I have never had a sex education class
18. Did you become sexually active before or after having a sex education class?
A. Before B. After C. I am not sexually active
D. I have not had a sex education class
19. Do you feel that the instructor of your sex education class influenced your decision about having sex?
A. Yes B. No C. I have not had a sex education class
20. What type of sex education do you feel should be taught to middle school and high school adolescents?
A. Abstinence-based sex education (teaches “no sex until marriage”)
B. Comprehensive-based sex education (teaches “no sex until marriage” but also teaches safe sex and use of contraceptives such as birth control, condoms, and masturbation)
C. Neither

Thank you for your time!

Appendix B

Dear students,

My name is Amanda Showalter, and I am senior McNair Scholar studying social work at Concord University. I am conducting a survey on what type of sex education is preferred among students, abstinence-based or comprehensive-based. I am asking for your voluntary participation in this study, with no harm or risks involved. The survey will take about five minutes, and all answers will be kept confidential; you will not have to put your names on the paper. If you would like to participate in the study, please sign your name below.

YES: I would like to participate _____ Date: _____

Assessment of Passive Treatment of a West Virginia Stream Impacted by Acid Mine Drainage

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Mentor: Dr. Thomas B. Ford

Biology Major

Abstract

We assessed the effectiveness of two passive acid mine drainage (AMD) treatments in Morris Creek near Montgomery, WV. Passive treatments often utilize carbonates (e.g. CaCO_3) to increase acid-neutralizing alkalinity and anaerobic wetlands to remove oxygen that could mediate metal oxide precipitation, possibly fouling the system. Water chemistry revealed sub-standard acidic waters (pH 3.6-5.79) between and downstream of treatments. Conductivity levels were found to range from 320.2 – 951.5 $\mu\text{S}/\text{cm}$ upstream, between, and downstream of treatments. These results suggest that sizing of treatments were assessed inaccurately and that further modifications will be necessary.

Introduction

Acid mine drainage (AMD) is an ongoing environmental challenge in West Virginia and throughout much of Appalachia. AMD is formed when pyritic rocks and ores (FeS_2) are exposed to the atmosphere during the extraction of metal ores (e.g. Fe, Pb, Zn, Cu), sulfur, or coal. In the presence of water and oxygen, oxidation of exposed rocks and mineral results in a highly acidic and metal-rich leachate that can severely impact the overall health of a stream (Zipper and Skousen 2010).

Much of the AMD occurring in WV is a result of pre-SMCRA (Surface Mining Control and Reclamation Act of 1977) underground mining. After mining operations were completed, many companies simply retrieved their equipment, including pumps used to prevent flooding, and moved on to the next site. Without pumps, water begins to collect within abandoned mines and results in AMD. Therefore many communities are now experiencing AMD from small inaccessible mines scattered throughout their watersheds.

The impact AMD exerts on a stream is dependent on its buffering capacity. The stream's ability to neutralize acidic waters most often results from the amount of calcium carbonate (CaCO_3) and other buffering compounds. Remediation of AMD is needed when the natural buffering capacity is not sufficient to restore a neutral pH. Passive treatments of AMD, such as instream treatment with limestone and constructed wetlands, are popular in Appalachia due to their lower maintenance costs. Passive treatment systems require detailed preconstruction planning, otherwise known as sizing. One disadvantage of passive treatment is if treatments are undersized, it is difficult to restore their remediation capabilities (Zipper and Skousen 2010).

In this study, we assessed the effectiveness of passive treatments in the remediation of an AMD impacted stream in West Virginia. We sampled the macroinvertebrate community and

measured the water chemistry of sites upstream and downstream of two constructed passive treatments. To determine the efficacy of this remediation, we compared the water quality of the AMD impacted stream sites to sites from a nearby non-AMD stream.

Methods

AMD Impacted Stream

The Morris Creek watershed (MCW) is located approximately 40 km (25 mi) south of Charleston, WV near the town of Montgomery on Morris Creek, a tributary of the upper Kanawha River. The watershed spans over 8 km (5 mi) from north to south, and covers approximately 19.5 km² (7.5 mi²).

Morris Creek is situated in the Upper Kanawha River Watershed, which is in Group A of the WV Watershed Management Framework (WMF) system, and has been listed on West Virginia's 303(d) list of impaired streams.

Six sample sites were established for Morris Creek starting before any treatments were administered and ending after treatments just before the stream empties into the Kanawha River. These sites were selected for their positioning before and after treatments. Both water chemistry and macroinvertebrate assessments were performed at sites 1, 2, 4, and 6.

Non-AMD Stream

The Davis Creek watershed (DCW) is found approximately 5 mi south of Charleston, WV in the Lower Kanawha River watershed. The watershed spans over 13 km (5 mi) covers approximately 127 km² (49 mi²). The headwaters of Davis Creek originate in Kanawha State Forest and join the major tributary, Trace Fork, as it continues southwestward.

This site was selected as a control for its geographic similarity and lack of environmental disturbance. The headwaters of Davis Creek within the park have been protected and therefore

should display the characteristics of a healthy, unimpaired stream of WV.

Three sample sites were established at Davis Creek to obtain a general assessment of the water chemistry and macroinvertebrate community. (MAP)

Water Chemistry

A YSI Professional Plus with YSI Quatro probe was used to take readings for the following parameters: temperature (°C), pH, dissolved oxygen (% saturation and mg/L), conductivity (uS/cm), and ORP (mV). These parameters were measured on at MC on 6 Sept. 2010, 24 Oct. 2010, and 13 Nov. 2010. Multiple readings (at least three) were recorded for each site on all sampling dates, and an average was obtained. Multiple readings of the same parameters were also measured at DC on 26 Nov. 2010. These readings were then averaged for each site.

A HACH Digital Titrator (Model 16900) was used to assess levels of the following parameters: alkalinity, calcium hardness, and total hardness. A HACH DR-820 Colorimeter was used to assess levels of the following parameters: ferrous iron (mg/L), total iron (mg/L), sulfate (mg/L), aluminum (mg/L), and manganese (mg/L). Water samples from MC were collected and analyzed on 13 Nov. 2010. All water samples from tests from DC were collected and analyzed on 26 Nov. 2010. Water chemistry results were then averaged for each Morris Creek site. A mean of the water chemistry from the three DC sites was calculated to obtain a general assessment of the water quality of a non-impacted stream.

Macroinvertebrate Sampling

Macroinvertebrate sampling was performed on 06 Sept. 2010 at MC and on 26 Nov. 2010 at DC. Samples were collected using a kicknet with a 500 µm mesh. Using a 0.25 m² frame, a total area of 1 m² was sampled at each site. Samples were only collected from riffles within

the stream. Each kicking session lasted no more than one minute, and specimens were immediately preserved in ethanol.

Several metrics and indices were reviewed to evaluate the macroinvertebrate communities. These included: %EPT, the Hilsenhoff biotic index (HBI), and the WV Stream Condition Index (WVSCI). The WVSCI is a multi-metric index developed to compare WV streams with unimpaired “reference” streams and is scored on a scale of 0-100, zero being very different (impaired) from reference streams and 100 being very similar (unimpaired) to reference streams (Table 1).

Results

Most notable from all results were those of pH and conductivity. MC sites 3-4 (after stream diversion) and 5-6 (after wetland) were all below the acceptable pH standards of above 6 and below 9 established by the WV DEP (Table 2). All MC sites (1-7) were above the EPA standards of 300 uS/cm for conductivity (Table 2). Levels of heavy metals (iron, aluminum, and manganese) were observed to be higher in MC sites downstream of the first treatment as compared to the reference stream. Sulfate levels were determined to be elevated in all MC sites (above 80 mg/L), especially when compared to the 0 mg/L found in DC. Finally, levels of Ca^{2+} and total hardness (CaCO_3) were also elevated when compared to the DC (Table 2).

Percent EPT (Figure 1) and HBI (Figure 2) both indicate MC as being within the same range as DC (reference stream). The WVSCI (Figure 3) did indicate that MC has some level of biological impairment with the closest score being 7.29 points below the reference stream.

Discussion

For several decades, the Morris Creek watershed has been heavily impacted by AMD resulting from poor mining practices. Although attempts to remediate the AMD within the

watershed have resulted in notable improvements, the aquatic life has yet to recover to levels comparable to non-AMD streams (DC). This can be contributed to the low pH, high conductivity, and the presence of heavy metals.

The efforts to remediate the stream (Upper and Lower Mainstem sites) have improved the quality of the water, but appear to be declining in effectiveness as iron and other heavy metals precipitate within the treatments and begin to negate their buffering capacity via armoring and reduced water flow.

Biological assessments of Morris Creek display somewhat misleading results (%EPT and HBI). This is the result of a pollution tolerant species of Hydropsychidae (Order: Trichoptera) that was found in high quantities.

In order to more accurately assess the effectiveness of the passive treatments being utilized at Morris Creek, higher quality chemical tests are needed, especially for Al, SO_4^{2-} , and iron.

In conclusion, the passive treatments being used on MC are improving water quality, but not to acceptable standards that would encourage the colonization and reproduction of desired species such as trout and other game fish. In order to accomplish this, active treatments should be implemented or methods of “recharging” existing passive treatments developed and utilized. However, all of these options may become increasingly difficult to perform thanks to the Keeley Decision. This federal court decision requires anyone (including Good Samaritan organizations) that owns or operates an AMD passive or active treatment to obtain a NPDES (National Pollution Discharge Elimination System) permit and must meet the high water quality standards for each non-point output that is created.

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Literature Cited

Zipper, C. and Skousen, J. 2010. Influent Water Quality Affect Performance of Passive Treatment Systems for Acid Mine Drainage. *Mine Water Environment* 29: 135-143.

Additional Materials

Table 1. Rating system for West Virginia Stream Condition Index.

SCI score	Rating
> 78 - 100	Highly comparable to reference sites (above 25th percentile)
> 68 - 78	Comparable to below-average reference sites (between 5th and 25th percentiles)
> 45 - 68	} Increasingly different from reference condition
> 22 - 45	
0 - 22	

Table 2. Water chemistry values for Morris Creek (MC) and Davis Creek (reference, DC).

Parameter	Site							DC Avg.
	MC#1	MC#2	MC#3	MC#4	MC#5	MC#6	MC#7	
pH	7.63	7.99	3.6	5.79	5.37	5.43	6.32	7.87
DO%	88.2	90.9	72.9	85.3	83.9	87.8	89.1	96.4
DO (mg/L)	9.75	9.48	7.49	8.78	8.88	9.06	8.61	8.61
C (uS/cm)	320.2	353.9	952.5	579.0	714.8	665.1	483.9	71.9
ORP (mV)	94.4	87.7	340.9	79.9	237.0	165.2	145.6	101.2
Ca Hardness (mg/L)	128	98	291	170	250	190	191	44
Total Hardness (mg/L)	177	190	550	334	502	348	321	51.6
P Alk (mg/L)	0	0	0	0	0	0	0	0
Total Alk (mg/L)	21.0	22.5	18.0	12.0	0.0	5.4	0.0	0.0
Fe+2 (mg/L)	0.03	0.04	>3.30*	>3.30	0.12	0.94	0.00	0.05
Total Fe (mg/L)	<10.0	<10.0	18.0	4.5	<10.0	<10.0	0.0	<10.0
Sulfate (mg/L)	> 80.0	> 80.0	> 80.0	> 80.0	> 80.0	> 80.0	> 80.0	0
Aluminum (mg/L)	0.000	0.000	>0.800	0.338	>0.800	0.155	0.006	0.000
Manganese (mg/L)	0.2	0.2	11.8	2.4	4.9	1.8	0.6	0.1

* Values containing greater than (>) or less than (<) symbols indicate that the test value fell outside the boundaries the HACH test employed.

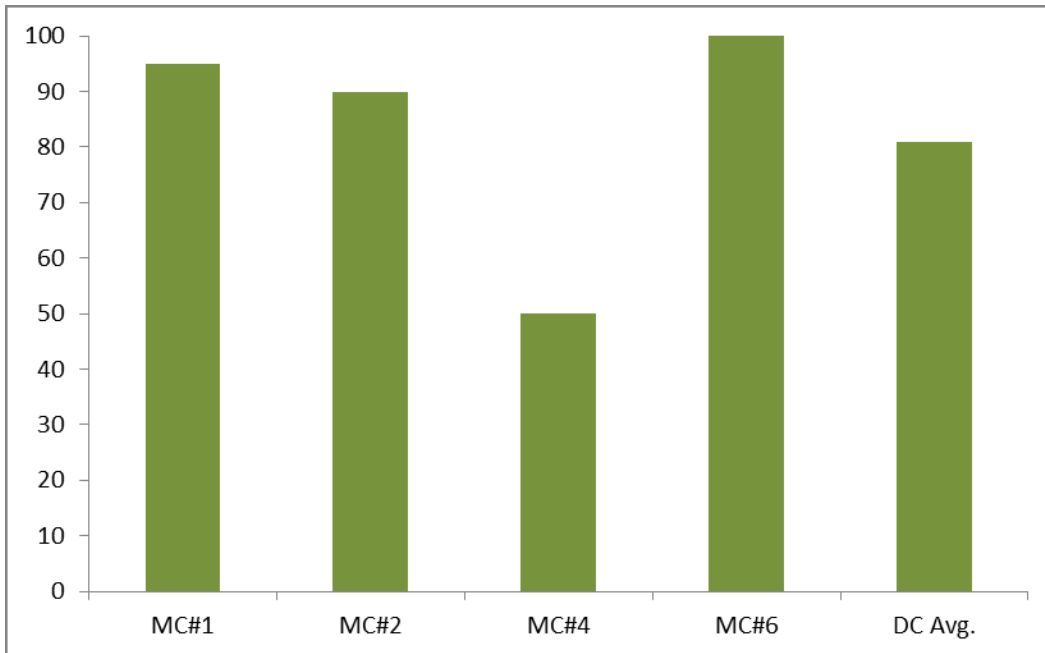


Figure 1. Percent EPT taxa observed at Morris Creek and Davis Creek (DC, reference).

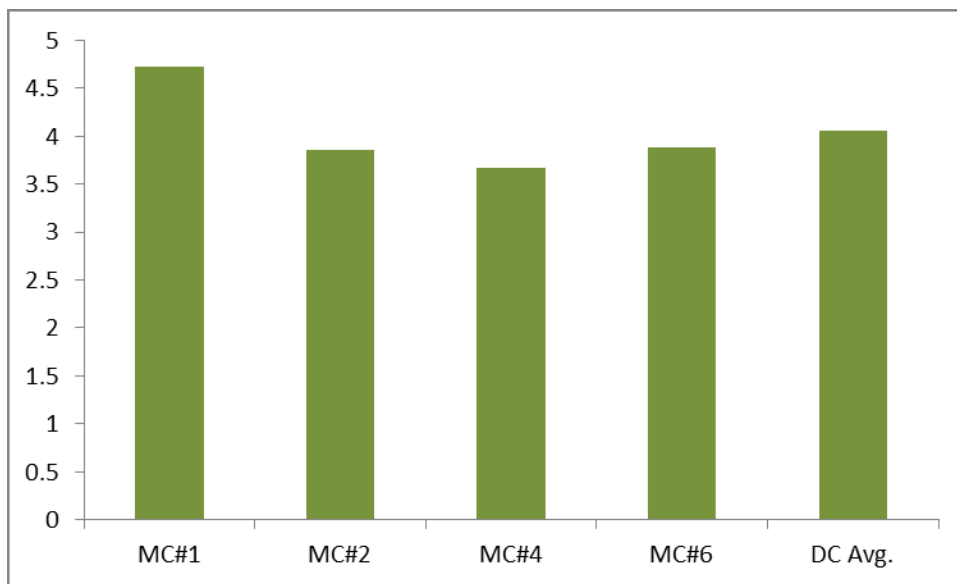


Figure 2: Hilsenhoff biotic index (HBI) scores for Morris Creek and Davis Creek (DC, reference).

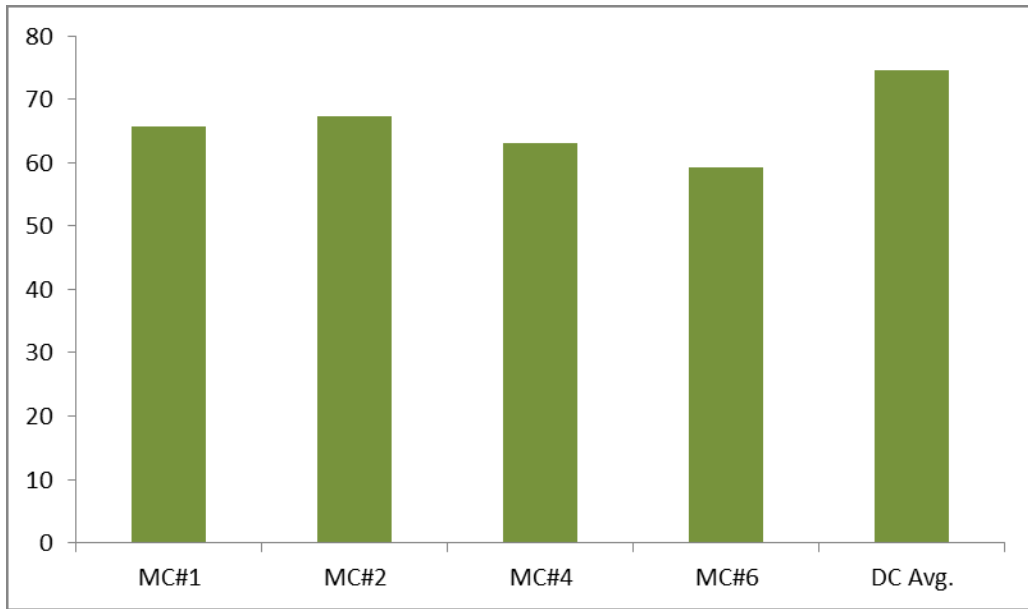


Figure 3. WV Stream Condition Index (WVSCI) scores for Morris Creek and Davis Creek (DC, reference).