THINK TO DRINK: THE EFFECTS OF ADEQUATE HYDRATION ON STUDENT PERFORMANCE

JANICE ELAINE OTTEWELL

B. Ed., University of Calgary, 1975

A Project Submitted to the Faculty of Education
Of the University of Lethbridge
In Partial Fulfillment of the
Requirements for the Degree of

MASTER OF EDUCATION

LETHBRIDGE, ALBERTA

August 2002

Dedication

For my father

Abstract

Research on the relationship between nutrition and neuroscience suggests water is a valuable educational tool. What students drink can have a marked effect on their mood, behaviour, and, in turn, their ability to learn. Poor hydration habits and the consumption of food additives, such as aspartame and caffeine, can have a negative effect on student performance. This study examines the effects of regular and adequate hydration on rural high school students in a grade twelve class. Eight students consumed and tracked their regular beverages and mood for two weeks, while the researcher interviewed the subjects regarding their awareness of the benefits of hydration. In the subsequent three-week period the students drank a minimum of eight glasses of water daily, while at the same time eliminating caffeine products from their diets. Tracking beverage consumption and mood continued. A post-study interview elicited the subjects' feelings of well being, and understanding of adequate hydration, as well as the students' intentions, if any, to alter their beverage intake as a result of their experience. The students also completed written feedback regarding their impressions about their participation in the study. Adequate and regular water seemed to have a positive effect on the students' well being and mood. Several reported feeling more alert and more focused, less tired and less stressed—more ready and able to learn. In addition to teaching and modeling the educational benefits of hydration, schools and educators must do their part to ensure the availability of water in the vending machines, the cafeterias, and the classroom.

Preface

"Come to the edge," he said.
They said "We are afraid."
"Come to the edge," he said.
They came.
He pushed them

And they flew.

Guy Apollinaire

Acknowledgements

Without all the Randys and that special day of all "special days," perhaps the idea for this project would never have come to be. Without "The Water Babies" this study would never have been.

Table of Contents

List of Tables

Table

List of Figures

Figure

"Honest water, which ne'er left man i' the mire."

William Shakespeare

Chapter 1: Background to the Study

Prologue

One fine spring afternoon in my English 13 class, it was Randy's "special day," an activity the students had proposed themselves, whereby their recreational interests would be the sole focus of the class. The moniker, of course, was laughingly derived from their kindergarten days. Nonetheless, they all looked forward to Tuesday afternoons when each, in turn, would talk about themselves and their hobbies, and—even better—provide tasty snacks for everyone. We had already seen dismantled carburetors, abandoned grey hound dogs, smelly hockey gear, and today it was to be Randy's turn.

He arrived looking a little worse for the wear, lugging his heavy golf bag, yet proceeded to give an animated discourse about the joys of golf. The obligatory question period followed. He patiently explained about handicaps, birdies, links, and other baffling golf jargon. Everyone then began to anticipate the food. Randy rather shamefacedly explained it had been a rough night, but he had managed to bring two 24 packs of Coca-Cola, a beverage dear to many of his classmates' hearts. A palpable air of excitement began to fill the room.

He rapidly torpedoed the pop at me and his delighted classmates, some of whom—especially the boys—guzzled at least four cans within the space of five minutes. Horrified and alarmed by the pelting distribution and rapid consumption, I tried to stop the behavior, but to no avail. What followed was even worse. One boy emitted a deep guttural burp, and then another. Another joined in. Then the girls swelled the chorus. It

quickly became a cacophonous symphony of belching and hysterics I was powerless to stop. Initially insulted and angry, I, too, eventually collapsed into paroxysms of helpless laughter at this outrageous Coke concerto. After several minutes, however, the din and chaos arrested and the class, now quite discomfited, apologized for their terrible behavior, suggesting juice, or even water might be preferable in the future.

That truly unforgettable incident, coupled with my observation of students' growing predilection for pop—and very little else—made me pause. I began to think about the implications of Randy's "special day." I began to wonder about caffeine, about its effects on behavior, and about the possible educational effects of water, that precious liquid that is necessary for our very existence.

"We thank you, almighty God,
for the gift of water."

The Book of Common Prayer

Introduction

A visit to the local middle school reveals five massive vending machines replete with cola, soda, iced tea, root beer, juice, and power drinks, but absolutely no bottled water. The situation at the local high school is not much better. Of five machines containing some 50 choices in total, only three buttons offer bottled water, and these are located at the very bottom of the row, almost impossible to see, almost as if water were an unthinkable option.

When I began my teaching career some 20 years ago, there were no mammoth pop machines dominating school corridors. Today, they are ubiquitous. When I began teaching there were only water fountains. Today, dwarfed by their caffeine competition, the hapless water fountains have become virtually abandoned. Today, many students, surrounded by tempting vending machines offering multitudinous options other than water, select beverages that seem less conducive to better classroom performance and more conducive to inattention, drowsiness, and boredom. In a school of 700 students with twelve water fountains and five pop machines, each containing some ten caffeine choices, the message is clear: drink pop, not water.

In my lengthy experience, not only have I observed the increased proliferation of these machines, but also in a parallel fashion, the increasing propensity of students to forsake the water fountain. Neither has it escaped my observation that those students in

the non-academic streams seem even more likely to arrive in class dangling a plastic soft drink bottle between thumb and forefinger. Coincidentally, their attitude is more apt to be inattentive, lethargic, and drowsy. It was not until Randy's infamous "special day," however, that I began consciously to consider the ramifications of student beverage consumption on learning. Of course, the potentially harmful effects of caffeine and aspartame have been debated for years, and for that reason I had always been slightly suspicious of carbonated beverages. Once they became available on a large-scale basis in our hallways and cafeterias, however, trying to stop their infiltration into the classroom setting was like trying to part the Red Sea. That day in English class marked an epiphany of sorts: I began to wonder if there was, in fact, a correlation between student performance and beverage choice.

Until the summer of 1999 my musings remained just that. However, a presentation at The University of Lethbridge by Les Omotani, Chief Superintendent of the West Des Moines Community School District, provided more food for thought. He alluded to recent discoveries in the field of cognitive science and biology that argue a strong case for the important role of water in the learning process. Adequate hydration is crucial for all chemical and electronic actions of the brain and central nervous system; students who are hydrated are more likely to be alert, interested, and unstressed. Mr. Omotani then went on to describe the Las Vegas school district's landmark decision to install water coolers in every classroom in every school at an astronomical expense. I was intrigued. Here was the first tangible evidence I had heard to suggest that the amount of water students consume could profoundly affect their school performance. Conversely, it seemed to me, here was a possible explanation for some students' less than satisfactory performance.

My interest piqued, I began to read some of the latest educational brain research, to discover that it is only recently that educators have begun to appreciate and advocate the power of water. I began to observe my students ever closer. I began to question their beverages of choice. I began to discover, too, that, while they seemed to understand the importance of water in a physical activity, many deprecated its value in a cognitive setting. Most of the time they considered it optional. It held little appeal. Tasteless and colourless, water was no match for the zing of iced tea or the electric jolt of cola. Despite my zealous efforts, the conversion rate remained abysmally low. Nonetheless, I did begin to spy a kind of hope in the small but growing number of trendy students sipping bottled water.

As I began my Master of Education degree at The University of Lethbridge, the question of an educational research topic was compellingly focused on water. For me there was no hesitation. The effect of hydration on students was the issue I wanted to explore. In fact, I had already begun to investigate it, albeit in an informal way. In observing a steady decrease in students' desire to consume adequate amounts of water, I wished to validate that humble liquid as one of the powerful building blocks of performance. As an experienced classroom teacher, I was also qualified to conduct practical, meaningful, and useful research that could prove beneficial to all educators. The central research question, whether students who regularly consume adequate amounts of water perform better, was the issue I wanted to explore. It became my goal to investigate the impact of water on learning.

"And in the water's soft caress,
Wash the mind of foolishness…"

Rupert Brooke

purpose and focus.

The question of whether students who drink enough water are more alert, more focused, and interested is an important one to education. Could the ingestion of a minimum of four eight-ounce glasses of water per day, with an ideal consumption of eight to fifteen glasses, result in an improved school performance? Whether those students, on the other hand, who consume regular amounts of soft drinks, tea, and/or coffee might be more inattentive, irritable, and disinterested is also worthy of consideration. If a change in consumption of liquids can, in fact, affect mood and concentration, then this correlation could provide a meaningful clue as to how students can learn better, one deserving of investigation. If water is so closely connected to learning, water consumption, in turn, needs to be encouraged much more seriously. Adolescents need to be convinced that water—and no other liquid—allows and facilitates optimum learning. At the very least, the results of this study might cause students to consider why they must drink to think and think to drink. Four research questions have focused and shaped this research project:

Do students who consume regular amounts of soft drinks, tea, and/or coffee exhibit inattention, disinterest, slower thinking, and/or drowsiness?

Does dehydration have a negative effect on student mood, behavior, and performance?

Does adequate hydration have a positive effect on student mood, behavior, and, in

turn, performance?

Do students who regularly consume sufficient water perform better on classroom learning tasks at school?

"Water is taught by thirst."

Emily Dickinson

Chapter 2: Review of the Literature

Introduction

The human brain, a mere three pounds of grey matter, is the most marvelously complex organ in the entire human body. It is responsible for the Sistine Chapel, the sonnets of Shakespeare, the Messiah, the Spanish Inquisition, the Wars of the Roses, the Leaning Tower of Pisa, and rhubarb custard pie. While the human brain has always been the *raison d'être* of the education profession, educators have not always really understood it. Nor has neuroscience (Sylwester, 1995). Recent dramatic developments in the scientific understanding of the brain and its processes have broad educational applications that can be introduced into the classroom. Knowing how the brain functions, and therefore how best to learn, can make a tremendous difference in how educators address the needs of their students (Sprenger, 1999). Unfortunately, there is no single answer as to why children learn and behave the way they do. Television, pop culture, the Internet, the media, lack of parental guidance, and even adolescence itself are frequently blamed for the legions of bored, listless, sluggish, tired, stressed, and hyperactive students teachers face every day (Givens, 1998).

Research regarding the connection between nutrition and neuroscience make underachieving students' hydration habits a serious educational issue. A dehydrated student may exhibit characteristics that interfere with the ability to learn: drowsiness, lethargy, decreased levels of energy or stamina, and poor attention span (Ault, Guy, Rues,

Noto & Guess, 1994). While we still do not know the ideal diet for optimum cognition, surveys show that certain patterns are associated with impaired mental function, such as apathy, and irritability. Those diets tend to be high in diet drinks and low in dairy products (Conners, 1998). In fact, some educational researchers are convinced that some of those listless and tired learners may be simply dehydrated (Dennison & Dennison, 1988; Hannaford, 1995; Jensen, 1995; Schiller, 1999; Ward & Daley, 1993)

Drinking plenty of water heightens energy, improves concentration, mental and physical coordination, and academic skills (Dennison & Dennison, 1988; Hannaford, 1995; Jensen, 1995; Schiller, 1999; Ward & Daley, 1993). Hospitals, athletes, performers, and nutritionists all report the benefits of boosting water consumption to achieve peak performance (Jensen, 1995). The health care field reports dramatic improvements in geriatric and psychiatric wards when patients are encouraged to drink water frequently. Memory function improves; degenerative diseases may reverse; and greater calmness prevails (Ward & Daly, 1993). Good coaches insist their athletes maintain vital levels of water during training and competition in order to boost success on the playing field (Ward & Daly, 1993).

Teachers, too, have found that in classrooms where students are encouraged to drink cool, fresh water as often as needed behavior improves, as does learning (Bourne, 2000; Fahey, 2000). Brains dehydrate rapidly, and before the learner is even aware of an insistent thirst, concentration wanes, boredom sets in, and drowsiness and confusion reign (Ward & Daly, 1993). If that is, indeed, the case, then adequate hydration should increase student mood and performance.

"But somewhere, beyond Space and Time
Is wetter water."

Rupert Brooke

The Literature

Water literally sustains our very existence. Some say life on Earth began in water. It is the world's most abundant chemical compound and the largest single component of the human body (Taratora & Grabowski, 1993). We gestate in water; we bathe, play, and baptize in it. We luxuriate and heal ourselves in it. We grow, transport, prepare, and heat our food in it. We marvel at its awesome majesty, and fear its mighty force. Wars have been fought over water, and great civilizations have flourished beside it. We consider it holy and hallowed. We cannot live without water. Simple, humble, and innocuous, it is, at the same time, powerful, remarkable, and paramount.

If we readily recognize water's essential role as the most abundant inorganic substance in the body (Hannaford, 1995), then it must be equally essential to learning. In fact, human beings may be regarded as nothing more than hairy bags of skin filled with water (Coyne, 2001). In normal adults water accounts for approximately 55 to 70 percent of body weight (Taratora & Grabowski, 1993). Lungs, heart, kidneys, and blood are made of 80 percent or more water. The skin, spleen, intestines, and muscle are 72 to 75 percent water. Even fat tissue is ten percent water and bones are 22 percent (Coyne, 2001). Normally, water loss equals water gain, so that the body retains a constant volume, and water is the main component of all body fluids (Taratora & Grabowski, 1993). It comprises an estimated 78 to 90 percent of the brain (Toratora & Grabowski, 1993; Jensen, 1995), more than any other part of the body. The control centre for learning, the

brain uses 20 percent of the body's energy needs. Its primary source for energy is the blood—eight gallons of it per hour—that carries nutrients like glucose, protein, trace elements, and oxygen.

For all that, remarkable water seems so unremarkable. Not just a drink, the miracle of water goes far beyond. A highly undervalued liquid is water. It is the single most important nutrient a human being ingests. We can live a month without food, but only a week without water. Adequate hydration is crucial to the maintenance of body temperature, expiration, proper lymphatic function, cushioning of the joints, conversion of food into energy, absorption of nutrients, and waste removal (Coyne, 2001; Toratora & Grabowski, 1993). Most importantly, all of the electrical and chemical actions of the brain and central nervous system dependent on the conductivity of electrical currents between the brain and the sensory organs are facilitated by water. Water provides the hydration necessary to conduct these impulses through the body, impulses that carry orders from the brain to the muscles and feedback to the brain. A combination of hydrogen and oxygen, water is essential for neurotransmission, those chemical impulses that carry information between neurons necessary for cellular communication. The brain runs on electrochemical reactions. These currents travel at speeds up to 400 kilometres per hour (Dennison & Dennison, 1994). In that sense, it is water that makes us moving, sensing, thinking beings (Hannaford, 1995).

Nerve cells have membranes that conduct electricity to send messages. Inadequate levels of water decrease the conductivity of these cells, causing electrolyte imbalance problems (Toratora & Grabowski, 1993). Electrolytes (primarily sodium, potassium, phosphorous, calcium chloride, and magnesium) control the osmosis of water between body compartments, carry electrical current, and help maintain essential minerals. The polarity (membrane electrical potential, ranging from –70mV to +70mV) across the membrane can rapidly decrease due to

inadequate hydration levels in the body (Taratora & Grabowski, 1993). Even a slight change in the amount of water in the body can affect the charge. A change of only 30 millivolts can cause death (Jensen, 1995). Anything that decreases membrane polarity damages the functions of the nervous system and, thus, cognition. Indeed, decreasing polarity causes one of the insidious debilitating long-term effects of malnutrition, impairment of brain development (Hannaford, 1995). Even mild dehydration (one percent of body weight or .75 to one litre of water) can create a reduction in performance. The signs of dehydration begin to show: headache, dry eyes, drowsiness, loss of concentration, and irritability (Coyne, 2001). Serious performance inhibition, both physical and mental, occurs at three to five percent of body weight, producing a noticeable impairment of exercise performance, reaction time, judgement, concentration, and decision-making. When athletes were dehydrated by four percent of their body mass, performance was reduced by between twenty to thirty percent. Collapse was likely at seven percent dehydration (Borowski, 1998). Of particular concern to boxers is that dehydration increases the risk of brain injury (Wright, 2000).

Water also moistens the air sacks of the lungs so that oxygen can dissolve and enter the bloodstream, and travel to the brain (Hannaford, 1995). One fiftieth of the body's weight, the brain gobbles up one fifth of the body's oxygen. Thus, adequate levels of oxygen (i.e. water) are required to decode, process, and store information. Insufficient oxygen levels result in impaired brain function. We must drink to think. All academic skills, concentration, and mental and physical coordination are improved by adequate hydration (Dennison & Dennison, 1994).

Choma, Sforzo, and Keller (1998) report the significant short-term effects of dehydration in wrestlers preparing for a tournament. Fourteen athletes practiced rapid weight loss (food restriction; fasting; and dehydration techniques including laxatives, diuretics, purging, and sweating), while 15 controls maintained normal body weight and dietary practice.

Blood glucose, hemoglobin, plasma volume, and body weights were measured at each test session. The subjects also completed mood and hypoglycemic profiles, in addition to five short cognitive tests. The results showed greater mood negativity and short term memory loss in those practicing rapid weight loss. Although these findings could be partially explained by pre-competition jitters, nonetheless, all base line measurements rapidly returned after rehydration. Weight cutting may also alter hormonal status, affect psychological state, impair academic performance, and result in more severe complications such as pulmonary emboli, pancreatitus, and reduced immune functions. The use of diuretics may result in even more profound effects on electrolyte balance and cardiovascular systems (Oppliger, Case, Horswill, Landry & Shelter, 1996).

Dehydration decreases physical strength and endurance. It decreases the ability to concentrate. It also increases irritability. In short, dehydration prevents peak performance. Not only has the American College of Sports Medicine recommended water as the optimal drink for endurance exercise (Wright, 2000), but it has also taken the strong position that rapid weight cutting has significant adverse effects that may affect performance, physical health, and normal growth and development (Oppliger et al., 1996).

Thirst is a sign, albeit too late, of dehydration, the progressive depletion of body fluids caused when fluid losses exceed fluid intake. It is the result of a drop in the water content of the blood; the concentration of salt is higher, which increases the release of fluids in the bloodstream, raising blood pressure and stress levels. Physical, psychological and environmental stresses deplete the body of water by dehydrating the cells (Dennison & Dennison, 1994). Within five minutes of drinking water, however, two hormones associated with elevated stress, corticotropin and ACT (adrenocorticotropin) decline markedly.

Surprisingly enough, when people are the most dehydrated, they are not even thirsty.

The body finally loses its alertness to dehydration, the result of ignoring the message for so long (Hannaford, 1995). Experts recommend from eight to fifteen glasses of water a day, depending on body size, weather, and activity level (Jensen, 1995). One ounce of water per day for every three pounds of body weight has been recommended (Dennison & Dennison, 1994). In times of stress, or vigorous physical activity, we require even more, perhaps even double or triple that amount (Hannaford, 1995). Working with electronic equipment, such as computers, is particularly dehydrating, as well (Dennison & Dennison, 1994). Water intake is vital before and during test taking or other possible times of stress (Dennison & Dennison, 1994). Students perform better in examinations when they drink water while studying. They do even better when they have had a glass of water before the test (Ward & Daley, 1993). A student bringing a bottle of water into an examination room makes as much sense as a cyclist taking water during a race does.

Unfortunately, however, many high school students turn, not to water, but to caffeine laden carbonated beverages, tea, and/or coffee to assuage their thirst. A natural chemical found in tea leaves, coffee beans, cacao, and cola nuts, caffeine is viewed by many as a relatively harmless substance that boosts energy. Feeling temporarily more alert and awake, the caffeine addict is sometimes unaware that it is, in fact, a drug. Those who drink caffeine every day will usually need to consume that amount in order to feel normal. And if they do not get their daily fix, headaches, sleepiness, grouchiness, and shakiness may be the result.

The average 12 to 19 year old American boy now drinks 868 cans of pop per year—more than two a day. The population as a whole quaffs 15 billion gallons of carbonated beverages every year. That arresting figure is the equivalent of 508 five cans of soda for every man, woman, and child. It represents a nine-fold increase in the consumption of fizz since the 1940s, and a doubling in the last twenty years (Millman, 2000). While shrewd advertising

would humbly attribute this giant leap to the taste sensation of their marvelous products, such figures are more than likely due to the mood altering and physical-dependence producing effects of caffeine, the most widely consumed psychoactive substance in the world (Millman, 2000).

It is interesting that the Philadelphia school board, supported by parental opposition, recently abandoned a 43 million-dollar contract, which would have placed Coca-Cola machines in all elementary schools, thereby doubling the number of city machines to more than three thousand. One vehement parent who spoke at the meeting maintained the proposed agreement undermined the children's health (www.rethinkingschools.org). " 'If your task was to make the American child as unhealthy as possible, could you do much better than...soft drinks in the cafeteria' " (Brownell, quoted in Brownlee, 2002, p. 62)?

Whatever the case, children are drinking less milk, less juice, and less water in favour of soft drinks. Children may not only be replacing healthy drinks with soda, but they may also be substituting nutritious food in general with a large volume of carbonated liquid. Three cola drinks for a 60 pound child is equivalent to eight cups of coffee for a 165 pound man. This amount of caffeine can cause insomnia. And when children drink more pop to combat the next day's sleepiness, they end up even more jittery and irritable. Small wonder they find it difficult to sit still in class and concentrate (Millman, 2000). Minnesota researchers tested eight to twelve year old boys to determine whether they would suffer from caffeine withdrawal symptoms. The subjects drank Coca-Cola (55 milligrams of caffeine per 12-ounce serving) or Mountain Dew (45 milligrams) for 13 consecutive days and then stopped. Afterwards, they performed poorly on tests requiring sustained attention; moreover, this deterioration lasted up to a week after the subjects quit the trial and quit the pop (Millman, 2000).

The soft drink industry maintains caffeine is added solely for its flavour. Seventy percent of pop contains caffeine, including six of the seven top sellers. Most clear soda like Sprite, 7-Up, or ginger ale do not have caffeine; other flavours like orange or root beer are usually caffeine free, depending on the brand. Twelve ounces of Jolt Cola boasts the highest amount of caffeine, at 71.2 milligrams, while Pepsi contains 37.2 milligrams. Iced tea contains a surprising 70 milligrams, while one ounce of dark chocolate has 20 milligrams of caffeine. Milk chocolate fares a little better, at six milligrams. Even chocolate milk contains five milligrams, while one tablet of Triaminicin cold medication has 30 milligrams. Although Aspirin and Tylenol contain no caffeine, one tablet of Excedrin pain reliever has 130 milligrams. The average American brand of tea has 40 milligrams; the average imported tea contains 60 milligrams. And, of course, five ounces of brewed coffee contains 115 milligrams of the stimulant. Two ounces of Espresso coffee contains a whopping 100 milligrams of caffeine.

Caffeine seems especially harmful to children. Stomach aches, headaches, sleeplessness, nervousness and a racing heartbeat may occur. More serious medical problems can result. Aside from the risk of allowing children a mood-altering substance in the first place, their bones may be endangered. Phosphorous, which is found in colas, interferes with the skeleton's ability to absorb calcium. A study in the American Journal of Disease in Children discovered that teenage girls who drink the most soft drinks are the most likely to end up with bone fractures (Millman, 2000). Physically active females are even more at risk: they are five times as likely to break bones as those who do not drink soda are. When soda replaces milk in their diets, it is robbing them of bone-building calcium during a critical time of bone formation. This same lack of bone density can further lead to a greater risk of osteoporosis in late adulthood (Millman, 2000).

Rising levels of obesity in North America may be partly attributed to an increase in soft drink consumption. Sugary drinks replace good nutrition. A can of cola has the equivalent of ten teaspoons of sugar. Soft drinks make up 10.3 percent of the calories in an overweight adolescent boy's diet, compared with 7.6 percent of the calories of a teenage male of normal weight (Millman, 2000).

Caffeine acts as a diuretic, reducing the hydration of the body and brain (Schiller, 1999), thereby decreasing learning potential (Hannaford, 1995). It dehydrates by decreasing the production of the cerebrospinal fluid, designed to bathe the brain, through vasoconstriction of the blood vessels. People also urinate more frequently when ingesting this stimulant. By inhibiting the re-absorption of water into the kidneys, caffeine causes even more water to be lost in the urine. Those who drink this soda need even more water to make up the deficit. Consequently, optimal nerve and muscle potential cannot be maintained in the nervous system (Hannaford, 1995). As students' bodies expel water, and their brain, in turn, sends signals of thirst, they are often apt to consume more Coke, more Pepsi, and expel more water, and so on. Moderate caffeine use will not cause problems for most people; however, those susceptible to its effects may want to avoid it (Work, 1991). Although it may make people initially feel more awake or alert, this boost is only temporary.

Johnson-Green, Fatis, Sonnek, and Shawchuck (1988) surveyed 270 college students regarding their caffeine consumption and identified several deleterious effects possibly related to its use. The excessive daily ingestion of caffeine in the form of tea, coffee, chocolate, soda pop, and various medications (headache remedies, analgesics, cold medication, artificial stimulants, and appetite suppressants) may lead to a disorder known as "caffeinism." Characteristics of this problem range from mild physiological responses like insomnia, irritability, tremulousness, and diuresis to more serious symptoms such as depression and

anxiety. Nonetheless, 75 percent of caffeine users rarely sought information on the caffeine content of the products or deliberately avoided them.

While aspartame, a sugar substitute in carbonated beverages affects children in different ways not yet clearly understood (Conners, 1989), it can result in lethargy, inattention, and/or depression (Givens, 1998). An artificial combination of two naturally occurring amino acids, its very chemistry is frightening: 40 percent Aspartic acid, and 50 percent phenylalinine, along with ten percent methanol. High levels of phenylalaline impair neurological function and argues for caution in using any amount in children (Conners, 1989). Conners (1989) documents the case study of a formerly successful, happy high school student, a self confessed popoholic, who consumed up to fifteen cans a day of diet soda. As a result, she suffered depression, headaches, blurred vision, and lethargy. In yet another study documented by Conners, nurses observed 37 patients with quite severe conduct problems and hyperactivity for several weeks. Aspartame was used for the placebo drink with the assumption that it would not have any effects, whether psychological or behavioral. The children's normal diets were compared to one that featured an orange drink at breakfast containing either sugar or a low dose of aspartame. A 60 item behavior checklist revealed that headaches, fatigue, lethargy, diarrhea, and aches and pains rated significantly higher on the days the children received the aspartame than either the sugar or normal baseline days (Conners, 1989). At the least, aspartame can build up in healthy people and cause temporal headaches (Givens, 1998).

If that were the case, then surely fruit juice would seem a healthy hydration alternative to chocolate bars and pop. On the contrary, regarded by the body as food because of its high sugar content, it binds up the water in the body, depleting the supply readily available for maintaining electrolyte levels. Juice is not a water substitute. Granted, it eventually supplies metabolic water, but water must first be taken from other parts of the body in the digestive

process to break down the juice (Hannaford, 1995; Schiller, 1999). All other liquids are processed as food, as well, and do not serve the body's hydration needs (Dennison & Dennison, 1994).

This scientific evidence builds a strong educational case for promoting water as the "...magic elixir for learning" (Hannaford, 1995, p. 138). A principal of a poor, rural high school of 715 students in Virginia, with a population of 50 percent Caucasian and 50 percent African-American students, John Fahey instilled the water perspective for two years, from 1997 to 1999. He reported that the school climate changed for the better (Fahey, 2000). Realizing that withholding drink privileges was not conducive to optimum learning, he was concerned that schools often neglected this fundamental learning tool. Understanding the compelling need for water awareness in schools, he immersed himself in research on the brain, health, diet, and learning. After a water-related workshop, the staff increased their own water consumption and made ready to transfer that philosophy to the student body. Despite some long-standing dissension on the issue of food and drink in the school, they agreed to allow the consumption of water in classrooms and in the hallways. Bottled water vending machines were installed and access to the washrooms, previously viewed as a distraction, no longer required the bathroom pass, a source of continual conflict between teachers and students. The restrooms experienced a continual flow of teacher traffic, too, with the result that bathroom mischief declined with little evidence of smoking, graffiti or vandalism. The staff maintained that consuming water was a good break strategy for ninety-minute classes filled with active learners. Water eased tension, and gave the students more freedom. For optimal learning, the body needs every advantage, and in this case, water had a subtle, yet significant impact on the students' social and emotional lives. Water is necessary for biological, neurological, environmental, psychological, and emotional wellness (Fahey, 2000).

John Wilson Elementary School in Innisfail, Alberta conducted an action research project incorporating "Brain Gym" techniques, a system of specialized exercises designed to increase mental prowess (Dennison & Dennison, 1994). The teachers happily reported an improvement in overall student behavior in a grade 2/3 class of 54 children, when students were encouraged to drink plenty of water as part of the programme (Bourne, Carr & Matt, 2000). A Coleman jug of water was made available; the students were directed to fill their water bottles and have a sip every twenty minutes. Unrestrained access to the washrooms was made available and initially the children urinated frequently, although the output decreased with time. Consumption of pop and Kool-Aid quickly diminished, and hydrated students even began to bring water in their lunches. Both staff and parents noted students were more energized, and not nearly as tired or cranky at the end of the day. Parents commented that their children were well aware of the benefits of water and continued drinking it at home. Subsequent to the project, a water cooler was installed in the staff room and more water bottles than coffee cups now litter the countertops. The classroom also has its own cooler and the parents gladly pay a yearly five dollar fee for the purified water their children enjoy.

While what children consume can profoundly affect how they think and feel (Conners, 1989; Givens, 1989; Jensen, 1995), attempting to control their diets is sometimes physically and ethically impossible. As a result, many studies examining nutrition as a cure or cause for mental dysfunction and misbehavior remain flawed, inconclusive, and difficult to replicate (Conners, 1989). Nonetheless, food and drink have profound effects on cognition, even in seemingly well nourished children (Conners, 1989). Educators can nurture and responsibly care for the brain and the thinking-learning process of their students by incorporating and adapting emerging knowledge into classroom practice (Sylwester, 1995).

Overall, the literature certainly justifies the positive effects of hydration. In view of that

literature, however, perhaps the notion of performance should be re-examined in the original hypothesis. That is to say, to measure the thinking process may be too formidable a task. Rather, one might look at the effects of hydration in terms of mood, behavior, and well being, for those factors have a definite effect on learning. Does a change in consumption of liquids, in fact, affect mood? Restlessness, irritability, concentration, energy, and alertness may be considered, to name a few (Johnson-Greene et al., 1988; Millman, 2000; Oppliger et al., 1996). Recent discoveries in the fields of cognitive science and biology can, indeed, provide meaningful clues as to how students can learn better (Fahey, 2000). Water, this humble liquid, one of the most important and powerful building blocks of high performance (Hannaford, 1995), is readily available to all. A requisite to life itself, it is all too often ignored and under rated. If water means life, it is also means learning.

"O! Water cold we may pour at need
down a thirsty throat and be glad indeed;"

J.R.R. Tolkien

the treatment.

If the primary mission of research is to advance human understanding, then data must be turned into results to make it helpful. Data analysis renders heaps of data into useful and credible statements, descriptions, and predictions about what the researcher has studied. Hence, interpretation becomes an act of imagination and logic, wherein the researcher seeks "believable, firm ground" (Peshkin, 2000, p. 5). It is invariably fact seeking, assumption laden, and judgement driven (Peshkin, 2000). Interpretation has to do with the convergence of questions, images, and ideas that begin an inquiry. Interpretation has to do with where the researcher chooses to look. Interpretation has to do with judging what to collect that provides documentation. Interpretation has to do with a perspectival accounting of what the researcher has learned (Peshkin, 2000).

It is therefore inconceivable that other interpretations, meanings, and understandings are not unimaginable. To substantiate the worthiness of an interpretation is not to prove it right or wrong. Rather, the real test of social research is whether the study is useful or interesting to an audience. What can be worthier than the utility of one's findings for the inspiration of others (Peshkin, 2000)?

Researchers make multitudinous decisions in creating their research studies; they reconstruct, interpolate, extrapolate, modify, judge, assume, affirm, and doubt. (Peshkin, 2000). Perhaps two studies are required, in fact, to present one qualitative research project. One comprises the research project itself and the other is the study about the

study (Chenail, 1995). Since increasingly scholars want to engender a sense of empathy in research (Eisner, 1997), one study might comprise the research project itself, and the other might encompass the study about the study. That is to say, in addition to seeing the actual results, the reader should enjoy the opportunity of understanding and seeing the choices made by the researcher, the steps in the process: forming the research questions, choosing the subjects, selecting the methodology, collecting the data, and analyzing it (Chenail, 1995). It is especially important, then, to present as much of that behind-the-scenes information as possible: the creation of the project, the choices that were made, and the ideas that were considered and retained or rejected (Chenail, 1995). In that way the reader can begin to have a perspective from which to judge the observations.

In contemplating this final analysis of the study, one can use the analogy of a jigsaw puzzle (LeCompte, 2000). In order to assemble the whole, people can group all the similar pieces (the waterfall, the rocks) in piles, then assemble those sections, and finally, identify the linking pieces so that the big chunks can be put together into a coherent facsimile of the original picture. Players can help themselves—or cheat—by glancing or scrutinizing the picture on the box, but the completed puzzle still reveals little about the real meaning of the original painting from which the puzzle is taken. The researcher works in a similar vein. He or she determines how to organize the data and uses it to construct an intact picture of the issue under study, but unlike the jigsaw, then attempts to explain what it is that the portrait means (LeCompte, 2000).

As phenomena are recorded and classified, they are compared against the categories. The researcher sifts through the data through repeated readings in order to recognize items relevant to the central research questions. Items can be identified because they are numerous. Items that *never* appear can also be recorded when the researcher

considers their absence significant. Items that are identified or deemed significant by the participants in the study can be noted, as well.

Items are then organized into groups or categories through comparison and contrast, or mixing and matching. Things that are exactly alike, that differ slightly, that differ a great deal, or negate each other are significant. Using meaningful criteria can make these comparisons easier. One such set of guidelines is semantic relationships (Spradley, quoted in LeCompte, 2000). Items in a data set can be substituted into the phrases in it in order to organize them into sets, such as the following:

X is a kind of Y
X is a place in Y
X is a part of Y
X is a result of Y
X is a cause of Y
X is a reason for Y
X is a place for doing Y
X is used for Y
X is a way to do Y
X is a stage or step in Y
X is a characteristic of Y

Substituting the names of the individual items for the "X" and the names of potential categories for the "Y" permits the researcher to identify and clarify descriptions of items more systematically. (E.g. Palatability is a cause of students' soft drink consumption.) The resultant lists constitute a taxonomy or classification scheme.

Table 1: A Taxonomy of Items for "X IS A REASON FOR Y [students drinking pop]."

Taxonomic Name (Y)	Items (Xs)
students drinking pop	Taste Availability at school Price Availability at work Availability at home Special occasion Palatability Popularity of pop Perceived "boost" effect

After stable taxonomies are created, the pervasive patterns need to be identified, that is, those taxonomies that fit together or seem related. This step is like linking all the waterfall pieces together with the rock pieces so that the whole jigsaw begins to emerge. Whereas collecting data is akin to disassembling something and identifying its constituent parts, locating patterns is like reassembling them in ways that begin to show a coherent explanation or description of the phenomenon under study. Identifying important patterns can further help to solve problems, to improve programs or practice, or to generate theory. Like the characteristics used to identify items (frequency, omission, and declaration), assembling patterns also involves contemplating relationships.

Similarities or analogies can be noted, that is, those sets of items that are identical or serve the same purposes. (Students who drink coffee often drink pop, as well, because of the perceived boost effect.) Sets of things that occur at the same time or phase, co-occurrences, can be recorded. (Students drink water when they play sports.) Hypothesized patterns researchers think should exist, based on prior research, experience, or educated guesswork, are also be important. (Students whose parents do not monitor their pop intake may drink more of it.) Finally, corroboration or triangulation, patterns

whose existence is confirmed by other pieces of data, are important, as well. (Observation of a frequently irritable and cantankerous student is confirmed by the student herself in an interview.)

Once patterns have been identified, groups of them can be assembled into structures, which help to explain the whole phenomenon Taken together, these linked and related patterns build an overall description of the problem being studied.

Table 2: Patterns Assembled to Create the Structure "Promoting Hydration in Students"

Installing water coolers in classrooms
Increasing the number of water fountains
Eliminating vending machines
Reducing caffeine choice in vending machines
Teachers modeling hydration
Beginning good habits in the early grades
Educating students about the necessity of adequate hydration
Encouraging students to drink water during class
Reminding students to drink more water during times of stress
Informing parents about the issue

Juxtaposition is another one of the keys to representing a quality paper or presentation. Data excerpts must be juxtaposed with the researcher's discussion about that data. The quintessence of presenting qualitative data research comes down to how well the researcher is able to juxtapose the data with description, analysis, explanation, and commentary highlighting exemplary "...pieces of talk" (Chenail, 1995, p. 3). The art of presenting qualitative research is to stay close to the data, yet be restrained by them. The researcher should look at the data and record what is seen—nothing more and nothing less. In juxtaposing the data and discussion there should be a recognizable pattern or rhythm throughout the analysis section of the work. This template to structure the text

will help the researcher to lay out the data and weave the commentary throughout the narrative. It will also serve to help the reader glide from section to section. Although the data will change, the pattern will remain constant, making the entire paper more coherent. In this way simplicity can be brought to the complexity of data representation (Chenail, 1995).

Rarely is research a simple record or summary. Rather, it seeks to make "…[w]hat is strange, mystifying, puzzling, contradictory…no longer so " (Taylor, quoted in Peshkin, 2000, p.5). Qualitative research is a halting journey with many crossroads. Its contents provide a framework for expanding awareness, deepening meaning, widening our conceptions, and enlarging understanding (Eisner, 1997). In that sense, it means exploring the edge (Eisner, 1997).

" 'Tis a little thing
To give a cup of water, yet its draught
Of cool refreshment, drained by fevered lips,
May give a shock of pleasure to the frame
More exquisite than nectarean juice
Renews the life of joy in happiest hours."

Sir Thomas Noon Talfourd

Chapter 3: Methodology

Human behavior is simply too complex to explain or predict based solely on theoretical considerations. That being the case, qualitative research would seek a greater complexity and relational understanding of why things are the way they are and what that means to education. The way research has been done traditionally is to reduce learning to text and number. Our culture's view of knowledge is linked to verification, and verification is related to truth. Truth is backed up by claims, made up by assertions, which are, in turn, supported by proposition. And propositions require text. "We prefer our knowledge solid and like our data hard" (Eisner, 1997, p.7). In addition to real performance outcomes, however, it is equally important to discover how the learners *feel*, and what they *believe* about the issue before and after the study has been completed, and, finally, what *meaning* they attach to the whole exercise. In fact, real understanding may require real feeling. Increasingly, scholars want to engender a sense of empathy in research. Literal facts are unlikely to possess that power. "...[W]e have begun to realize that human feeling does not pollute understanding" (Eisner, 1997, p. 8).

Thus, the sampling for this study is ethnographic and purposive, consisting of a small, easily trackable group of eight students (three males and five females) in a French 30 class, whom the researcher saw six times a week that semester. The researcher was

well acquainted with this small class, having taught them for the three previous years at a rural high school in southern Alberta. A sweet, open, and enthusiastic group, they could be trusted to be honest, vigilant, and committed. Nonetheless, this very familiarity could prove a double-edged sword due to the so-called "Hawthorne Effect."

Although the names and other identifying characteristics have been changed in order to protect the individuals involved, the researcher seeks to represent the whole story and invites the reader to step inside her shoes, to see what the researcher sees (Chenail, 1995). The audience need a sense of verisimilitude; it needs dimension; it needs round participants; the events must come alive in order to produce a sense of perspective from which to judge the observations (Eisner, 1997). To that end, the participants will be described briefly and given symbolic names, so as to record more faithfully their actions and reactions during the course of the study.

Two "key informants" (Bogdan & Biklen, 1992), subjects who are unusually perceptive or articulate, have been dubbed The Purist, and The Singer. Both are highly academic and musical, highly principled, highly involved, and highly motivated. The former is tall, willowy, and athletic, with a tangled riot of long, dark, curly hair. Her family grows organic vegetables for local restaurants and is well versed in a healthy diet and good nutrition. No stranger to the benefits of water is she. The latter is also tall, but more curvaceous, and dreams of an opera career. Having spent a summer in Belgium, The Singer has experienced a European culture and is adaptable and open to new ideas. Her lengthy musical training has made her quite cognizant of the necessity for hydration in order to lubricate the vocal chords.

Another pair has been called The Pop Queen and The Convert. Both are employees of local fast food restaurant chains and, consequently, enjoy the dubious

benefit of practically unlimited pop during breaks and dinner. They are similar in other ways, too: both are somewhat quiet, both athletic, and both diminutive. While The Pop Queen is a serious, sterling student, she can be a little irascible at times. The Convert, on the other hand, is more happy-go-lucky, rather droll, and less driven to succeed at school. He is soon to become a shift manager at his place of employment.

The Body Builder has a rather devil-may-care attitude. A year younger than the other grade twelve students, he thinks his French Immersion background gives him the freedom to be less serious. Rather small in stature, blond, blue-eyed, and striking, he teases the girls unmercifully, and works out regularly in order to sculpt his muscular build.

Very tall, and very thin, The Scholar is very intelligent. His work is stellar; his computer skills are amazing, and the class affectionately calls him "cynical" because of his sharp wit and sometimes caustic comments.

The Journalist, for that is her ambition, wields a pen with ease. Quiet, serious, and steady, she is a polite, diligent student with a rare, but beautifully shy smile. She also handles a hockey stick with expertise and is an enthusiastic member of a female hockey team.

The Volunteer smiles, jokes, and laughs often. She is the infamous creator of hilarious magazine collages lampooning the members of the class, including the teacher. A fellow employee of the one of the other hamburger flippers, she is also a deeply spiritual person who is concerned about the welfare of others. Her last two Easter vacations have been spent in Mexico helping the poor and homeless.

At the beginning of the pre-hydration phase of the research, the participants were given a brief explanation of the study and its purpose. They solemnly vowed to monitor

precisely their beverage intake—both in and out of class—during the initial two-week period in order to ascertain their normal drinking habits (Conners, 1989). They were quite scrupulous, in fact, about recording their consumption, faithfully keeping the yellow chart in their binders or posted on the 'fridge at home. They wondered about the colour—yellow for all the urine they excrete while drinking carbonated beverages! The Singer wondered whether I should add another column in addition to water, fruit juice, pop, coffee, and tea. She shyly suggested "other," which might include alcohol—"but only wine"—or hot chocolate, for example. A good idea.

The participants also filled out a yellow self-reporting scale, rating themselves on concentration, restlessness, self-control, mood, distractibility, and feelings. A pre-hydration recorded interview was conducted, as well, using questions designed to ascertain their attitude toward hydration, their knowledge of its effects, their normal beverage consumption, and their family's influence on their habits.

During the subsequent fortnight after Easter vacation ("You're not going to make us do it over the holidays, are you? What about all that chocolate?"), the participants agreed to eschew caffeine-related beverages, and to consume six to eight glasses of water per day. All the while, they continued faithfully to monitor their beverage intake on blue paper—blue for the beautiful, azure water on the French Riviera. Despite voluntary cooperation at school, tracking diet can be a slippery situation, for the researcher can not always be sure that the subjects have not sneaked more than a sip of the *verboten* beverages. Other than caffeine, factors such as other dietary influences, medication, alcohol consumption, lack of sleep, emotional upset, and/or stress can also affect mood and behaviour (Conners, 1989).

On the first day of the second stage, the hydration phase of the study, the subjects

were shown a "For Better or Worse" cartoon from the Sunday comics. *À propos* of the entire exercise, it served as a perfect springboard to launch this phase. Elly is listening to a fitness report on the radio which advocates drinking at least six to eight glasses of water daily. She dutifully downs the requisite number during the course of the day and, later, heads for home after work. *En route*, however, it becomes painfully and immediately clear that it is imperative she reach her bathroom posthaste. Intent on her frantic mission, she speeds through the city streets, only to hear the frightening whine of a police siren. Elly is pulled over and given a ticket, while she ironically reflects that this is the first time she has been stopped for "drinking and driving."

After reading the cartoon, the students were relieved to know that the staff had already been advised of the study and the probable need for frequent bathroom breaks at first. As an added perquisite, they were told they had exclusive and unrestricted access at any time to the staff washroom immediately adjacent to the classroom.

Then the students were given back their yellow pre-hydration beverage logs to tally. A Machiavellian measure, the totals served to remind some of them of how very little water they had been drinking before. For others, it was an admonition that some of the delicious beverages they loved to drink were now off limits for the next little while. Indeed, some of the totals shocked everyone. When The Pop Queen announced her staggering 91 Coca Colas, the group was truly appalled. "I'd pass out," exclaimed The Purist. "I'd be spinning around the room," remarked The Singer.

After a brief reminder of what *not* to consume, the participants were required to calculate their own weight in water so as to underscore its biological importance to their bodies. Suitably impressed by the hard figures, they were each given rather sleek, clear plastic water bottles with a pastel coloured lid. "Shotgun on green," was the first excited

comment from The Volunteer about the bottles, specially ordered from the local hardware store. After writing predictions about the upcoming exercise in hydration, they gleefully announced the group now looked like a little club. The Singer jokingly inquired whether t-shirts might not be a nice touch. They alluded to an infamous Social Studies video they had seen in grade ten, which explored the ease with which people could be brainwashed. The Purist laughingly suggested *they* were being indoctrinated into hydration. "Water Boy," an Adam Sandler film, was something they suggested we watch, too, since its title was perfect for our study. I replied that, actually, a more suitable appellation for them might be "The Water Babies," a pun in honour of that classic allegorical tale by Charles Kingsley. At first, a couple students seemed slightly miffed at being called infants until I explained the name and briefly outlined the plot. Henceforth, my daily salutation at the beginning of class became "Bonjour mes enfants d'eau," both as a cheery greeting and a gentle reminder of their commitment to the study.

As a symbol of their undertaking, a pristine, white water cooler stood like a silent sentinel in the corner of the room. They flocked around it and quickly filled one of the new water bottles. They speculated how many eight-ounce cups it might contain and quickly deduced the number as three. About three water bottles per day would easily fulfill the requirements. They were now ready to begin. "Oh, my goodness, I'm going to die!" moaned a doleful Pop Queen.

Finally, three weeks later—they wanted to continue for another seven days—the blue beverage logs having been tallied, the subjects briefly wrote about their own personal experience and feelings during the course of the study. A post-hydration recorded interview followed to ascertain any changes in their attitudes, mood, energy, habits, and beliefs. They also completed a second self-assessment exactly like the first, except for the

colour of the paper, of course. The two regimens would then be compared and contrasted.

In such a study, the researcher then becomes the de facto instrument, with the measurement being non-standardized, narrative, and ongoing. The words become the data. Greater insight can thus be gained regarding the hypothesis that students who consume adequate amounts of water perform better. *The ingestion of five to eight glasses per day, with as many as fifteen being considered sufficient* (Dennison & Dennison, 1994; Schiller, 1999), becomes the independent variable. The dependent variable, *better performance,* may be defined as more advantageous, effective, or favorable in terms of something accomplished, a behavior or deed.

Consent on more than one level had to be obtained, of course, before the study could proceed. Subsequent to the approval of the proposal and a review by the Faculty of Education Human Subjects Research Committee, the researcher contacted the school superintendent. Written documentation concerning the background to the study, its intent, procedures, and parental letters of letters of consent followed that conversation. Once the study was approved, that same information was made available to the administration of the school. After permission had been granted to begin, the sample group was advised, and the parental consent letter mailed. All interest groups willingly agreed to the project, embracing an exercise in self-exploration and self-help that just might increase the participants' learning potential.

"Water, when taken in moderation, cannot hurt anybody."

Mark Twain

Chapter 4: Results

Table 3: Pre-hydration Beverage Logs (two week period)

	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
Bodybuilder	53	39	7	1	5	0	14
Purist	43	21	1	0	18	0	4
Convert	18	6	57	0	7	0	25
Scholar	13	10	23	4	8	2	13
Journalist	12	25	20	1	8	0	0
Volunteer	29	27	17	0	3	0	3
Pop Queen	8	14	91	0	0	0	0
Singer	53	23	2	0	11	7	11

Table 4: Hydration Beverage Logs (two week period)

	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
Bodybuilder	127	32	0	0	0	0	1
Purist	119	14	0	0	8	7	1
Convert	118	7	1	0	4	0	14
Scholar	118	13	0	0	12	0	0
Journalist	103	23	0	0	7	0	0
Volunteer	71	21	4	0	7	0	3
Pop Queen	112	29	0	0	15	0	3
Singer	122	12	0	0	0	0	4

Table 5: Pre-hydration Beverage Log for *The Purist*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	4	1	0	0	1	0	0
March 31	1	3	0	0	2	0	0
April 1	2	4	0	0	5	0	0
April 2	1	3	0	0	2	0	0
April 3	2	2	0	0	1	0	0
April 4	2	2	0	0	3	0	1
April 5	3	1	0	0	1	0	0
April 6	5	0	0	0	0	0	1
April 7	2	3	0	0	0	0	0
April 8	5	0	0	0	0	0	1
April 9	8	0	0	0	0	0	1
April 10	4	0	0	0	1	0	0
April 11	1	1	0	0	1	0	0
April 12	3	1	0	0	1	0	0

Hydration Beverage Log for *The Purist*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	11	1	0	0	1	0	0
April 24	12	2	0	0	1	0	0
April 25	11	1	0	0	1	0	0
April 26	8	1	0	0	0	0	0
April 27	8	0	1	0	0	0	0
April 28	6	1	0	0	1	0	0
April 29	8	1	0	0	1	0	0
April 30	8	0	0	0	0	0	1
May 1	8	0	0	0	1	0	0
May 2	5	0	0	0	0	0	0
May 3	8	1	0	0	0	0	0
May 4	8	0	0	0	2	0	0
May 5	8	0	0	0	0	6	0
May 6	10	6	0	0	0	1	0

Table 6: Pre-hydration Beverage Log for *The Body Builder*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	0	2	3	0	0	0	0
March 31	1	3	2	1	0	0	0
April 1	1	3	1	0	0	0	1
April 2	5	4	0	0	0	0	0
April 3	4	2	0	0	1	0	0
April 4	8	3	0	0	2	0	0
April 5	8	0	0	0	0	0	0
April 6	5	2	0	0	0	0	0
April 7	2	7	0	0	0	0	0
April 8	4	4	0	0	0	0	0
April 9	2	6	0	0	0	0	0
April 10	4	2	0	0	0	0	0
April 11	3	1	0	0	0	0	0
April 12	6	0	1	0	2	0	13

Hydration Beverage Log for *The Body Builder*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	12	1	0	0	0	0	0
April 24	11	2	0	0	0	0	0
April 25	10	3	0	0	0	0	0
April 26	11	3	0	0	0	0	0
April 27	10	3	0	0	0	0	0
April 28	5	3	0	0	0	0	0
April 29	5	3	0	0	0	0	0
April 30	10	2	0	0	0	0	0
May 1	9	3	0	0	0	0	0
May 2	10	1	0	0	0	0	0
May 3	9	4	0	0	0	0	0
May 4	8	2	0	0	0	0	0
May 5	9	2	0	0	0	0	1
May 6	8	0	0	0	0	0	0

Table 7: Pre-hydration Beverage Log for *The Convert*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	1	0	5	0	1	0	1
March 31	1	0	6	0	1	0	1
April 1	1	0	4	0	1	0	1
April 2	1	1	6	0	0	0	1
April 3	1	1	6	0	1	0	1
April 4	3	0	2	0	1	0	3
April 5	1	1	5	0	1	0	1
April 6	4	0	2	0	0	0	1
April 7	1	0	3	0	1	0	1
April 8	0	0	4	0	0	0	1
April 9	1	0	2	0	0	0	1
April 10	1	0	4	0	0	0	1
April 11	1	1	3	0	0	0	1
April 12	1	2	5	0	0	0	10

Hydration Beverage Log for *The Convert*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	9	0	0	0	2	0	1
April 24	10	2	0	0	0	0	1
April 25	11	0	0	0	0	0	1
April 26	8	1	0	0	0	0	1
April 27	9	0	0	0	1	0	1
April 28	9	1	0	0	0	0	1
April 29	10	3	0	0	0	0	1
April 30	7	0	0	0	1	0	1
May 1	9	0	0	0	0	0	1
May 2	10	0	0	0	0	0	1
May 3	7	0	0	0	0	0	1
May 4	8	0	0	0	0	0	1
May 5	5	0	0	0	0	0	1
May 6	6	0	1	0	0	0	1

Table 8: Pre-hydration Beverage Log for *The Scholar*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	4	0	3	0	1	0	1
March 31	3	1	2	0	1	2	0
April 1	2	1	3	2	0	0	0
April 2	0	0	2	1	1	0	1
April 3	0	1	1	0	1	0	1
April 4	0	0	1	0	1	0	1
April 5	1	2	1	0	0	0	2
April 6	0	3	1	0	0	0	1
April 7	0	1	4	0	0	0	1
April 8	1	1	0	1	1	0	0
April 9	1	0	1	0	1	0	1
April 10	0	0	3	0	0	0	1
April 11	0	0	1	0	0	0	2
April 12	1	0	0	0	1	0	1

Hydration Beverage Log for *The Scholar*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	8	0	0	0	2	0	0
April 24	8	2	0	0	1	0	0
April 25	8	1	0	0	1	0	0
April 26	8	1	0	0	2	0	0
April 27	9	2	0	0	0	0	0
April 28	11	1	0	0	1	0	0
April 29	10	0	0	0	1	0	0
April 30	8	2	0	0	0	0	0
May 1	8	1	0	0	1	0	0
May 2	8	1	0	0	1	0	0
May 3	8	1	0	0	1	0	0
May 4	8	1	0	0	0	0	0
May 5	8	0	0	0	1	0	0
May 6	8	0	0	0	0	0	0

Table 9: Pre-hydration Beverage Log for *The Journalist*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	1	2	1	0	0	0	0
March 31	2	1	2	1	0	0	0
April 1	2	1	1	0	1	0	0
April 2	2	2	1	0	0	0	0
April 3	1	2	2	0	1	0	0
April 4	0	3	1	0	0	0	0
April 5	0	1	0	0	1	0	0
April 6	0	2	4	0	0	0	0
April 7	1	2	0	0	0	0	0
April 8	1	3	0	0	1	0	0
April 9	1	1	1	0	1	0	0
April 10	0	2	3	0	1	0	0
April 11	1	1	2	0	1	0	0
April 12	0	2	2	0	1	0	0

Hydration Beverage Log for *The Journalist*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	5	2	0	0	0	0	0
April 24	5	1	0	0	0	0	0
April 25	6	2	0	0	0	0	0
April 26	8	0	0	0	2	0	0
April 27	9	2	0	0	0	0	0
April 28	11	4	0	0	0	0	0
April 29	8	4	0	0	0	0	0
April 30	8	2	0	0	1	0	0
May 1	3	1	0	0	1	0	0
May 2	8	0	0	0	0	0	0
May 3	8	0	0	0	0	0	0
May 4	8	3	0	0	0	0	0
May 5	8	0	0	0	3	0	0
May 6	8	2	0	0	0	0	0

Table 10: Pre-hydration Beverage Log for *The Volunteer*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	2	2	1	0	0	0	0
March 31	0	2	2	0	0	0	0
April 1	1	0	1	0	0	0	0
April 2	2	0	2	0	0	0	1
April 3	5	2	0	0	0	0	1
April 4	2	3	3	0	0	0	0
April 5	3	2	1	0	0	0	0
April 6	2	3	0	0	0	0	1
April 7	2	2	0	0	2	0	0
April 8	0	1	4	0	0	0	0
April 9	3	4	0	0	1	0	0
April 10	3	3	0	0	0	0	0
April 11	4	2	0	0	0	0	0
April 12	0	1	3	0	0	0	0

Hydration Beverage Log for *The Volunteer*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	10	1	0	0	0	0	0
April 24	5	2	0	0	1	0	0
April 25	6	2	0	0	0	0	1
April 26	7	1	0	0	1	0	0
April 27	6	1	0	0	0	0	0
April 28	1	2	2	0	1	0	0
April 29	5	0	0	0	0	0	0
April 30	5	0	0	0	1	0	0
May 1	4	2	0	0	0	0	0
May 2	2	1	0	0	0	0	0
May 3	6	2	0	0	0	0	0
May 4	6	2	2	0	2	0	0
May 5	4	2	0	0	1	0	2
May 6	4	3	0	0	0	0	0

Table 11: Pre-hydration Beverage Log for *The Pop Queen*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	0	1	1	0	0	0	0
March 31	0	0	12	0	0	0	0
April 1	0	0	14	0	0	0	0
April 2	0	1	8	0	0	0	0
April 3	0	1	4	0	0	0	0
April 4	2	3	2	0	0	0	0
April 5	0	1	9	0	0	0	0
April 6	3	2	5	0	0	0	0
April 7	0	1	6	0	0	0	0
April 8	0	1	8	0	0	0	0
April 9	1	1	5	0	0	0	0
April 10	0	0	3	0	0	0	0
April 11	1	1	5	0	0	0	0
April 12	1	1	9	0	0	0	0

Hydration Beverage Log for *The Pop Queen*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	9	1	0	0	0	0	0
April 24	7	1	0	0	2	0	0
April 25	8	1	0	0	3	0	0
April 26	7	0	0	0	0	0	0
April 27	8	0	0	0	0	0	0
April 28	8	4	0	0	1	0	0
April 29	9	7	0	0	4	0	0
April 30	8	2	0	0	1	0	0
May 1	7	1	0	0	0	0	0
May 2	6	2	0	0	1	0	1
May 3	8	0	0	0	0	0	0
May 4	9	3	0	0	0	0	0
May 5	10	5	0	0	0	0	0
May 6	8	2	0	0	3	0	2

Table 12: Pre-hydration Beverage Log for *The Singer*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
March 30	3	2	0	0	1	0	0
March 31	6	3	0	0	1	0	2
April 1	4	5	0	0	0	0	0
April 2	4	1	0	0	0	0	0
April 3	3	1	1	0	3	0	0
April 4	4	0	0	0	0	0	0
April 5	4	0	0	0	2	0	0
April 6	4	1	0	0	0	0	4
April 7	3	1	1	0	2	0	0
April 8	4	1	0	0	0	2	0
April 9	3	1	0	0	1	3	0
April 10	4	2	0	0	0	2	0
April 11	4	4	0	0	0	0	0
April 12	3	1	0	0	1	0	5

Hydration Beverage Log for *The Singer*

DATE	WATER	FRUIT JUICE	POP	COFFEE	MILK	TEA	OTHER
April 23	9	1	0	0	0	0	0
April 24	12	1	0	0	0	0	0
April 25	12	0	0	0	0	0	0
April 26	8	0	0	0	0	0	0
April 27	8	0	0	0	0	0	4
April 28	8	0	0	0	0	0	0
April 29	8	2	0	0	0	0	0
April 30	8	1	0	0	0	0	0
May 1	8	1	0	0	0	0	0
May 2	9	1	0	0	0	0	0
May 3	8	2	0	0	0	0	0
May 4	8	1	0	0	0	0	0
May 5	8	0	0	0	0	0	0
May 6	8	2	0	0	0	0	0

In analyzing the pre-hydration logs, it became evident that the subjects drank a wide variety of beverages. Water, fruit juice, pop, coffee, milk, and tea headed the columns, while under the heading "other," the students listed specifically hot chocolate, protein drinks, chocolate milk, Kool-Aid, and alcohol (wine, coolers, daiquiris, beer, whiskey, and shooters) as alternate beverage choices.

It became apparent that on a daily average the group, as a whole, consumed negligible amounts of coffee and tea, .05 and .08 glasses respectively. Units of alcohol consumption showed .61 servings per day, while the subjects drank 1.49 glasses of juice. More interesting, however, is that the amount of water and pop consumed was virtually equal: 2.04 glasses of water per day versus 1.94 cans of pop. Individually, however, only The Body Builder drank the daily recommended eight glasses of water—on two occasions. As for the other individuals' daily average hydration rates, The Body Builder and The Singer both drank an average of 3.78 glasses of water per day, followed by the Purist and The Volunteer at 3.07 glasses. The Convert consumed 1.28 glasses of water, while The Scholar, The Journalist, and The Pop Queen trailed the group, with less than a full glass of water every day: .9, .85, and .57, respectively.

Conversely, The Pop Queen guzzled a daily average of 6.5 cans of carbonated beverages with The Convert drinking four cans. "I drink lots of pop because I get three free a shift, so that's why I drink so much." Twelve and fourteen cans marked her two highest daily consumption rates. The Pop Queen explained that, like The Convert, her beverage intake varies, dependent on whether she is working at the fast-food restaurant or playing sports. The fact that she works an inordinate number of hours helps to explain why she drinks an inordinate amount of pop. The others consumed much less. The Scholar's average daily intake was 1.6 cans, The Journalist 1.42 cans, and The Volunteer

1.2. The Body Builder drank the equivalent of half a can of pop per day, while The Singer and The Purist consumed inconsequential amounts of .14 and .07 cans each.

Overall, half the participants drank a daily average of more pop than water (The Scholar, The Convert, The Journalist, and The Pop Queen), while, on the other hand, the other 50 percent consumed more water than pop (The Body Builder, The Purist, The Volunteer, and The Singer).

Milk was another liquid sadly lacking in their diets. During a critical time in the formation of their bone mass, only one of these adolescents drank the daily equivalent of one full glass of milk. Canada's Food Guide recommends a daily minimum amount of 3-4 servings of dairy products for adolescents. This is not to say that yogurt, cheese, and the like cannot be substituted; nonetheless, it would seem unlikely that they are ingesting an adequate amount of calcium. Most alarming, perhaps, is that the group's consumption of *any* liquid was insufficient. They averaged only 6.2 servings per day, with only two individuals, The Body Builder and The Convert, drinking the requisite eight daily glasses. The others ranged from four to six servings of liquid per day. In fact, even the students themselves noticed this paucity. "It shocks me how little liquid I've been drinking," wrote The Singer at the bottom of her beverage log.

Clearly, these figures indicate a group of high school students who are more than likely chronically dehydrated. Rarely—hardly ever—do they drink the recommended eight glasses of water per day. Their milk consumption appears dangerously low, as well; instead, fruit juice and carbonated beverages seem to be the other mainstays of their beverage intake, drinking habits that contribute even more to dehydration.

When asked in their pre-hydration interviews, conducted before the end of the initial two-week tracking session, whether it was important, in fact, to drink water, all

participants unanimously agreed. Two subjects, The Singer and The Purist promptly mentioned that human beings are made up of 75 per cent water. "...[W]e're mostly made up of water so it's pretty much obvious it's important." Two others, The Scholar and The Convert reiterated, albeit somewhat dubiously, that "*they* say it's important," and cited the eight cup a day minimum. "I know it's healthy for you and you replenish, clean, and all that," stated The Pop Queen. "Generally it's a good thing for your body," affirmed The Volunteer. More specifically, they mentioned exercising, being in the sun, playing hockey, and being physically fit. But not thinking. "When I drink water is usually when I'm playing sports 'cause I need to keep hydrated," stated The Convert. "Drinking water makes you feel energetic. To be fit—it's just the best thing to drink. Like those sports drinks, they don't really work, I don't think; they're just full of sugar water," asserted The Journalist, avid hockey player that she is. The Body Builder alluded also to the purity of water. The Singer, The Volunteer and The Purist mentioned another benefit: clear, healthy skin and a good complexion.

Having said that, only one subject at the outset viewed water as relevant to school performance. The Purist commented, "[It's] brain food, I guess. I took a course once. How you have to maintain hydration for studying and stuff like that. So your brain can actually perform and do its functions." When pressed, The Singer eventually admitted the brain might be in better condition, too, if properly hydrated. "Well, I guess they use water for all, like, neural transmissions and stuff like that, so, of course you'll be able to transmit neural messages and stuff faster."

On days when he plays sports and, consequently, was careful to hydrate himself, The Convert allowed that, coincidentally, he might also be somewhat more attentive during class. The Pop Queen was very careful to drink plenty of water while playing

sports, too, and did note that she also tries to drink more water and less pop during exams. "I want to do well. I understand that pop won't let me do well." The Volunteer and The Journalist, however, did not see any connection whatsoever between hydration and cognition. "I don't think so." The Body Builder flatly denied any correlation. "Thinking is not physical." Water is essential, of course, when playing hockey or working out, but "[t]here's no other times. Positive."

Most subjects declared they drank only a glass, or two—or three—a day, which was borne out by the hydration logs. "It's hard to drink just *one* glass of water a day. I never do it," admitted The Convert. Only The Body Builder aimed at four to six daily glasses because of his exercise programme, augmented by commercial energy supplements. Said The Scholar, "I drink pop, which is mainly water; I count that as drinks of water." Six of the subjects admitted to drinking a modest two or three caffeine products on a daily basis. The Singer guessed she drank one or two cans a week, whether pop or coffee, while The Purist rarely drinks any soda. "You can't put junk and all that in and expect to perform academically, emotionally, or whatever. It's sort of like a car—you have to put in good gas."

As for most of the other subjects, caffeine products seem to be a part of daily life. Soda beverages are instantly and readily available at school. "You turn around and you can just buy it," noted The Convert. "It's the easiest thing to get," affirmed The Body Builder. "Possibly the huge Coke machines! That's not promoting [water]," scorned The Purist. The Volunteer agreed. "They encourage it at school. If there were only water available, you'd drink more water, but caffeine products are easily available."

Most of the families seem unconcerned about the caffeine intake of their children. The Scholar's mother packs him a Coke in his lunch every day. "My Dad always drinks

coffee; they don't care 'cause they drink coffee themselves." The Singer prefers tea, however, and says she grew up with it. "When we have family get-togethers we have Earl Grey. The kids would always have it with the milk and the sugar." It is not surprising that the Pop Queen, aside from her job, drinks copious amounts of pop, since it is readily available at home, too. "Normally we have this system where, like, my Mom'll buy a flat of Coke and then my brother will, and then I will, so it's usually always there." Nor is it surprising that for The Purist, pop is only served to the children in her family on special occasions. "We don't have it at my house. It's not an option." The Singer told a similar story. "It's not usually around my house and I don't bring cash to school, so I don't drink it often."

For the three who work at a fast-food restaurant, the availability of caffeine beverages is another contributing factor to their rates of consumption. "Who wants to drink water when there's unlimited pop there?" was the rhetorical question posed by The Pop Queen. She considers herself addicted and calmly described a disturbing scenario. "Even in the middle of the night I'll get up and I'll be thirsty and I'll, like, go into the kitchen and I'll grab, like, a Coke, and it's, like, four in the morning. Then I'll wake up and my throat'll be, like, raw." Later on in the course of the interview she acknowledged, "I just can't stop."

Those who do not consider themselves slaves to caffeine, nevertheless, appreciate the stimulant. The Scholar maintained it keeps him awake. "The caffeine kinda keeps me alert." The Convert agreed, while admitting the effect is fleeting. "If I'm tired sometimes and I need to stay up I'll drink a Coke 'cause that wakes me up pretty good. Temporarily it'll make you feel a bit [better]; then afterwards you bottom out." The Purist avoids Coke for that very reason. "I don't drink Coke if I have pop. It doesn't make me feel hyper, but

it shoots me up high and drops me down lower than before. My eyes water and I get a headache. Sprite or something else is just fine." She fears its addictive power, as well. "Why would you want to be dependent on something like that?"

The particular taste of caffeine products seems to be the most important factor in their beverage choice. Ordinary water tastes, simply, too ordinary. "Water is just tasteless," complained The Pop Queen." "When ya get the choice between pop compared to water, pop tastes better," rejoined The Convert. " 'Cause it's sweet and it tastes good," explained The Volunteer. Even The Purist considered water "bland."

The subjects also blamed the water fountains at school for part of their reluctance to hydrate themselves adequately. "[E]ither they don't have enough pressure, or they're not cold and I don't like warm water. They're usually gross, too," lamented The Pop Queen." As for the numerous vending machines, they considered bottled water rather expensive and the Slushies available at the cafeteria much cheaper.

According to the subjects, most everyone drinks pop. The Singer philosophized, "It's a culture thing—drinking pop. Like in Europe, they don't drink that much 'cause it's so expensive. But the coffee and the chocolate!"

Despite their predilection for caffeine, the students are aware of its side effects. "Caffeine is, like, addictive," stated The Body Builder. "It makes you feel crappy. It doesn't really hydrate you." "When you drink Coke it leaves that taste in your mouth," complained The Volunteer. The Body Builder concurred. "Pop gives you, like, cotton mouth. Then you're drinking more of it." As for concentration, The Convert noticed, "…[d]rinking Coke, sometimes I just wander off." " I've heard caffeine can kinda make you shaky. If you stop drinking caffeine you get headaches," mentioned The Scholar. "Caffeine dehydrates you; caffeine is a diuretic," he added. Paradoxically, however, he

still believes, "It's not bad for you."

The participants seemed to be well aware of the consequences of dehydration, citing fatigue, dry skin and headaches, as well as lethargy, and decreased energy. "Attention span sure goes down. You can't concentrate as well," remarked The Convert. In short, they felt that the body simply does not function as efficiently.

Ironically, it was The Pop Queen, mammoth caffeine consumer that she is, who deduced that water and academic performance just might be related. "You need energy to be in school to do the assignments in class, or to even just listen takes energy and pop doesn't help that, but water does." Initially, The Journalist did not think that hydration could help cognition, but upon further reflection decided, "Maybe water would improve the thinking processes and make [us] more physically fit and more energized." Even The Purist seemed slightly skeptical. "I'm not sure if it's directly related, but I think it might be important to drink water to maintain academics."

Following this initial two-week period of the study, the students girded themselves for the second stage, commencing after the Easter holidays. Naturally, they had a few concerns and comments about the upcoming hydration phase. Visiting the bathroom, drinking adequate amounts of water, and resisting temptation seemed to be important considerations. They were interested, as well, to see any changes that might result.

The Purist:

It won't be too difficult to drink 8 glasses because I'm being <u>expected</u> to drink the water. I have the smallest bladder! So that will be the challenge. I think the body cells will become accustomed to increased fluids, so hopefully I will make this a habit.

The Scholar:

It will be easy for me because I have strong willpower. I like green water bottles. I will get tired of drinking water because it has little flavour. Hopefully I will be less tired and have less headaches.

The Convert:

The period of time in which we will be doing this experiment will be tough. I never drink water unless I'm playing sports. The toughest part will be at work where I am allowed to have 3 free pops a shift and I usually work 5 days a week. It will be interesting to see the changes.

The Singer:

I'm going to have to go to the bathroom constantly!!! This won't be hard because I don't mind water, but I hope I don't forget. I like my "trendy" new water bottle. I hope I'll continue this after the two weeks.

The Pop Queen:

I think this project will be extremely hard, not only to stop drinking pop, but also to dramatically increase my water intake. I also think it will be hard to stop eating chocolate. I think I may be more alert and awake, although I will probably be very grumpy from lack of caffeine. I think it will be especially hard at work.

The Volunteer:

It's nice to have a water cooler in the room—very handy. I was happy to get a new water bottle.

The Journalist:

I am interested to see how I will react to the loss of caffeine in my diet, and how the excess of water will affect my body. I believe I will be okay with eliminating caffeine from my diet...but we'll see. So far I haven't noticed the absence but it is only day one.

The Body Builder:

It won't be too difficult to do it because I do it already. But ya know, um, I'm always tempted to eat chocolates. 'They so good!' Ya know I like drinking water. But yeah, I like juice, too, especially that Mango Tango stuff. According to me I'll probably be able to do it.

In looking at the participants' post-hydration logs, it is clear that they tried very hard to keep to the spirit of the study and maintain a healthy fluid intake. It was not always easy. The Convert's fellow employees "...had a fun time trying to make me drink pop." Hardly anyone drank any caffeine beverages, except for The Volunteer—and in a weak moment—The Convert. No one consumed any alcohol. Five students drank more than the minimum 112 glasses of water for the 14 days; The Pop Queen valiantly consumed exactly the required amount. One participant fell slightly short of the expected minimum, while The Volunteer drank significantly less water than the minimum. So enthusiastic were they, in fact, and so interested to see the results of adequate hydration, that they requested a second blue sheet on which to record a third week.

During this hydration phase they periodically offered general comments in class regarding the study. "I'm becoming an ocean," giggled The Singer. They were truly shocked at the caffeine content of coffee and iced tea when the figures were presented to them. Many noted they had more energy and felt thirstier during the course of the day if they had, inadvertently, left their water bottle at home. They remarked that on the weekends it was much harder to deal with peer pressure and remain "good." Conscientious to a fault, they were even reluctant to consume a piece of chocolate cheesecake that was part of a class presentation, for fear they would ingest some caffeine. The Convert and The Pop Queen, not surprisingly, both reported headaches during the

first few days, and the latter noted she slept much better and did not wake up as frequently during the night. They admitted, too, that water did not really taste that bad, after all. "It's all about adaptation," sagely explained The Singer. One day, the class enjoyed a hilarious water chugging competition between The Scholar and The Body Builder. The former was the victor, with a time of twelve seconds—six seconds faster than his competitor. At the end of the hydration phase, The Purist vowed to carry on charting her water intake so as to continue being conscientious about adequate hydration.

Individually, their beverage intakes, apart from the increased water, were significantly healthier than in the initial phase of the project. The Body Builder drank virtually the same amount of juice as before, two hot chocolates, and no alcohol whatsoever. The Purist drank much less hot chocolate, but not as much juice or milk, and was very careful to drink only herbal tea. The Convert succumbed to one iced tea, his nemesis, and drank a little less milk, with an equal amount of juice and protein drinks. He imbibed no alcohol. Previously, The Scholar had previously drunk a significant amount of chocolate milk, but during this phase managed to resist. He consumed more milk and virtually the same amount of juice. The Singer drank half the juice and no milk whatsoever during this period. She did manage to eliminate the alcohol, however. The Journalist's régime remained basically the same, but for the water, of course. The Volunteer's beverage intake differed slightly, as she maintained her milk and juice intake, while continuing to have a few Slurpees and only 71 glasses of water. The Pop Queen got by with a little help from her friends. Two of her co-workers kindly followed the programme with her, so as to make her battle somewhat easier. She consumed no pop whatsoever, a personal triumph. She did drink almost double the juice, and more importantly, consumed 15 glasses of milk, a liquid conspicuously absent from her diet in

the pre-hydration phase.

Presumably, beverage intakes such as these, which are significantly more healthy, should have some kind of effect on the participants. During the course of the post-hydration interviews, conducted immediately after the hydration phase, they all reported feeling more physical energy and stamina than before. The Convert reported he felt less tired playing sports and had more energy for a longer period of time. Previously, he'd guzzle a pop. "I'd bottom out." He even advised a teammate to start drinking water when playing hockey. "He noticed a difference, too, when we played; we went and bought bottles of water." That purchase was significant—buying water was something he had vowed he would never do; hence his ironic sobriquet, The Convert. The Pop Queen told a similar story. "Badminton Provincials fell in the middle of the study. Normally I get tireder [sic], weaker, sort of, midway through the tournament. I didn't find that and was able to move around a lot better and I didn't get so tired." The Volunteer felt the same. "I think this has helped me for tiredness."

The Singer specifically noticed a moister throat at the Music Festival. She even speculated that water might have an effect on life expectancy. "There was that Oprah show about living longer, about people who had really long lives and every single woman that they interviewed drank at least eight glasses of water a day." She found it difficult to describe how she felt in general. "It's like, I don't know how to explain it; it's sort of a different feeling, It's more awake, I guess." The Purist felt likewise. "You do notice once you're doing something *good*. How can you drink 16 cans of Coke a day? Good grief!" She also noticed her skin felt drier before, while the Body Builder mentioned "[p]op and chocolate give you zits." "I feel a little better about myself, knowing I'm drinking more healthy," concluded The Journalist. The Pop Queen ruefully admitted before she was

drinking "...an insane amount of pop." Her mother encouraged her during the study. "She found me happier, not so tired and crabby," adding, "I'd like to consciously drink more water because of the effects it's had on me."

Some reported other effects directly transferable to the classroom setting. "I believe the water helped me in being a little more alert in class, helped me to focus a little more. My mind didn't wander as much," asserted The Journalist. "I noticed when I was studying, when I had water continually, I would stay more alert. Not losing my attention span so fast helps me to learn better, I guess," agreed The Pop Queen. The Singer and The Purist concurred. The Volunteer saw the connection, too. "Mentally, since it gives you more energy it keeps you more alert." The Body Builder, despite his assertion that dehydration slows you down, disagreed. "I don't know if water does anything mentally." The Scholar saw no change in himself and remained unconvinced, as well. The Convert, in spite of his enthusiasm for water while doing physical activity, hedged on the issue, declaring the study too short to form any definite conclusions.

Nonetheless, most participants did mention situations where they would be especially careful to drink water. Six immediately mentioned physical activity. "If I was gonna work out or do running or something," said The Body Builder. "When exercising, I guess, and plus, even when it's summertime and it's hotter," remarked The Singer. The Purist also specifically mentioned physical activity. "Sports and stuff like that." "Especially during sporting events, yes," agreed The Pop Queen.

Disappointingly, however, only two participants mentioned academics. "When I study now, I'm gonna start drinking water," announced the Journalist. Only when pressed to see a possible connection between water and school performance, did The Singer reluctantly allow, "I guess before a test?"

All vowed to make some permanent changes in their beverage habits, with the exception of the cynical Scholar. "I won't think about what I drink—ever." "I'll continue to drink water," stated The Volunteer. "I'll make a conscious effort," resolved the Purist. She reported her family applauded "...the conversion of students 'to the good side.' " Some wished to reduce their caffeine intake, as well. "I couldn't believe some days how much I drank," exclaimed The Convert. His partner in pop was also aghast when tallying her considerable soft drink consumption. "When it came up as 91 I was, like, whoa! Just kind of, what is this?" She decided to omit Coke entirely from her diet, since she experienced a post-study headache after trying one, hitherto her favorite brand. The Body Builder asserted he intends not to drink pop anymore, either. The Convert wanted to try to drink four or five cups of water a day with the occasional can of his beloved iced tea. "I changed my views because I swore I would never buy a bottle of water. I didn't see the point."

In an effort to encourage other students to drink water, the participants had several suggestions. Installing water coolers in every classroom would help, but that option would likely be too expensive. Perhaps the number of vending machines could be reduced. More bottled water should be sold in them. The schools should not allow the sponsorship of soft drink manufacturers. "Coke shouldn't be a sponsor, but, you know, they get their way," commented The Purist. The benefits of hydration might be taught in health classes. "I don't think a water assembly would be very popular," joked The Singer.

They did feel students should be informed about the issue, but were not sure if anything would come of it. "Everyone should be aware of what they're drinking and what kind of effects it has on them, because it does have an effect," declared The Pop Queen. Adolescents being what they are, such information may have little or no results. "Most

kids, they'll just shrug it off," decided The Convert. "Well, I think that teenagers, for the most part, don't take care of themselves very well," concluded The Volunteer. The Singer philosophized that most people already know about drinking eight glasses of water a day, but ignore it. "Sometimes what you're *supposed* to do seems too much."

Whether these participants will continue to do what they are supposed to do is unknown. It was heartening to learn that four months after the study The Convert was still assiduously avoiding caffeine beverages. And The Pop Queen, still true 12 months later—now back at the fast food restaurant for the summer after her first year of University—steadfastly affirms, "The study changed my life." She has since lost weight, and still feels healthier, has a clearer complexion, concentrates better, and is less tired, and more energetic. In fact, part of the pact that she and her study buddy devised for final exams included plenty of exercise and eight glasses of water a day.

The self-reporting scales they completed corroborated the participants' remarks during the post-hydration interviews. Concentration, restlessness, self-control, mood, distractibility, and feelings were surveyed prior to, and at the end of, the hydration period. Post-hydration, The Journalist reported feeling more focused, more patient, more alert, and less worried about things. The Purist felt less fidgety, less tired, less worried, and less sad. The Body Builder found himself able to sit still longer, feeling more patient, less frustrated, and less impatient. The Volunteer noted she was more alert and more focused; she also felt less frustrated, less stressed, less tired, less nervous, and less liable to talk to others in class. As might be expected, The Scholar documented no changes, other than less fatigue. In contrast, The Singer reported various changes for the better: less restlessness, less stress, less fatigue, less distractibility, and less moodiness. As might be expected, The Convert and The Pop Queen documented the most improvement. The

former felt less restless, much less fidgety, less frustrated, less tired, less distracted, less nervous, less worried, and more patient. The latter reported feeling more alert, less restless and fidgety, much less frustrated, more patient, less impulsive, much less stressed and tired, more able to work in class and less worried.

Finally, after tracking their beverage intake for five weeks, undergoing two interviews and completing two self-reporting scales, the subjects wrote some final comments and thoughts about the whole experience.

The Purist:

It was interesting to be in this study and to track what I actually consume! I think I have become more conscious of what I'm putting into my body and how I'm affected by it as well. I really became aware of what everyone else drinks too—the amount of people who have cola as a staple food product almost is sad! I think they drink pop because water isn't promoted as much. The benefits, however, will most likely be long term. One time on "Oprah" there were "women who were 50+ but looked 30," crediting H_2O as their primary beauty product. I didn't have trouble drinking 8 glasses a day...when I made a habit of it I actually found myself having more than 8. I had and ate more food when I wasn't adequately hydrated, too, so it was more that I noticed the effects of <u>not</u> drinking water than <u>drinking</u> water. I'm going to make H_2O a habit...because when I'm tired and it's late I found when I was hydrated I was more alert.

The Scholar:

I am going to go back to my old habits. I didn't really feel any different drinking [more] water than normal. I didn't like being called a water baby. I would prefer water adult because I am over 18 years old. I found it annoying having to keep track of everything I drank. Otherwise, I don't think about what I drink. When my hypothalamus

says I'm thirsty I drink. I don't think 8 glasses a day is necessary. The body is built to retain water through the use of hormones such as aldosterone and antidiuretic hormone and drinking more than you need just makes you get rid of it all. I enjoyed the opportunity to participate in this study.

The Convert:

This project was very rewarding, not only physically but mentally. I learned that water was actually good for my body. While I was playing hockey, volleyball, or football I found I was a lot more energetic and that energy lasted for a greater span of time. Before the project I greatly detested water and its taste. Now, after I got used to drinking water I sometimes turn to water instead of pop. It was interesting to see the effects on my body. I also found I wasn't really tired near the end of the day. It was cool to be part of an experiment that ended up helping me from my habits that I had previously.

The Singer:

I found the "hydration project" very interesting because I learned how little water I was drinking. Overall, I did not feel that much different, but I think that was because I don't drink that much caffeine. I felt as though I was a member of a cult, the Water Babies cult! This project was during Music Festival, and I noticed I didn't have to drink as much water to keep my throat saturated, probably because I <u>was</u> already was saturated. Lately I've noticed more teenagers carrying a water bottle around with them. Although the majority of the population does not drink enough water, I think the importance of drinking water in every day life is increasing in awareness. The long-term benefits of drinking sufficient water are enormous. I think the major problem with society and water is that there is no huge advertising company behind the water, pushing the product. Plus, caffeinated products usually taste good, and you can immediately feel the effects. The

effects of water are more long term. This was a unique opportunity, which caused a lot of thought and realization to occur.

The Pop Queen:

I think I will probably be more aware of the amount of water I drink, and try to consume less caffeinated drinks. However, I don't believe I will continue to drink 64 oz. of water a day, just because I had to force myself to drink that much during the study. I found it interesting to discover exactly what I do drink, and what effects it is having on me. I also was interested to see how much pop I drink compared to the others. I do think this study helped me to realize why I am often "tired and crabby," or, at least, provide perspective into one of the reasons why people drink water during sports because they know it is healthier. People drink water more often during sports because it replenishes the body after losing so much sweat and also because other beverages just make you more thirsty. Water quenches thirst better, and when you cannot continually drink something (like when playing sports) water is better.

The Volunteer:

I enjoyed doing the water study, however I missed the freedom of being able to eat and drink what I want. One definitely feels more hydrated when more water is consumed. I didn't find that there were a ton of noticeable effects on me personally. Mostly due to a lack of sufficient amount of water—in other words, I did not drink as much water as I was supposed to. Also, are women now supposed to drink more water since they do menstruate? (Just a thought.) Anyways, it was fun, I definitely enjoyed the water bottle and being able to use the staff washroom adjacent to our classroom.

The Journalist:

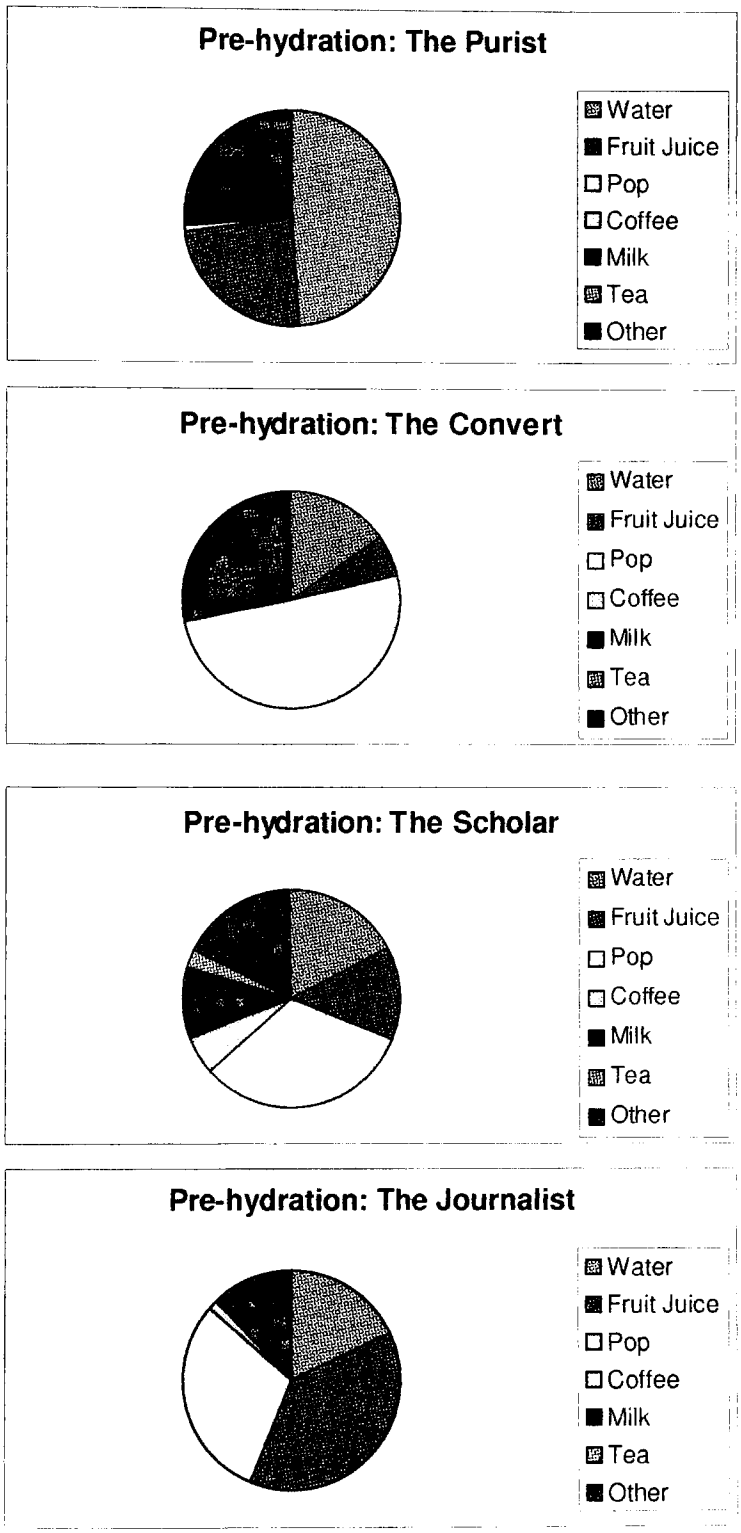
I enjoyed the study, because I've always wanted to start drinking more water and

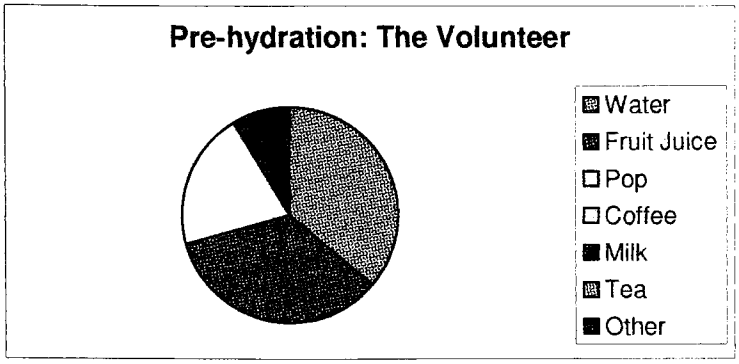
cutting down on my caffeine intake. With the study I HAD to stick to the "diet." Although a few other factors may have been involved I have been feeling better about myself, knowing that I'm drinking a little more healthy. My younger brother, Alex, also began to drink more water at home, he said he was "inspired" by me…although I don't know how true that is…he's 12.

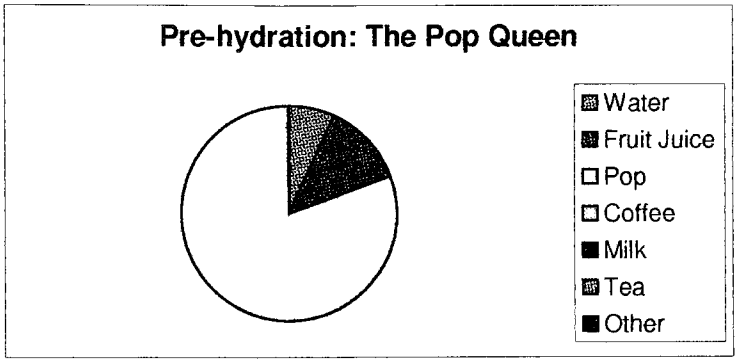
The Body Builder:

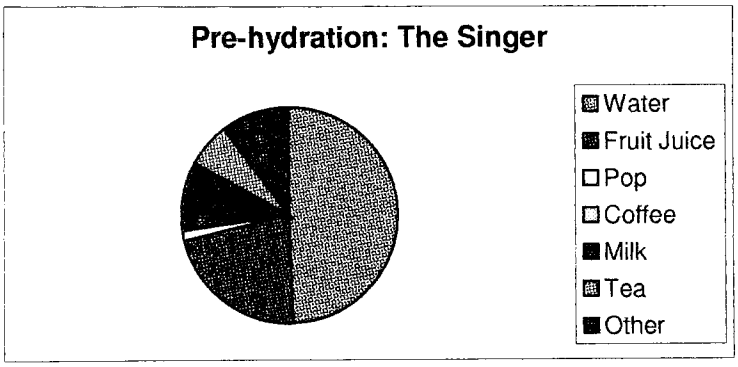
Being in the hydration study was fun. It was kinda like you couldn't drink bad stuff. This study made me think more about what I drank and made me realize I like water. Now instead of drinking pop or Iced Tea I usually choose water to drink. And I try not to drink booze so much anymore, actually barely ever. But water makes me feel cleaner and I'm a waterholic now, it's terrible.

Figure1: Pre-hydration Pie Graphs




Pre-hydration: The Volunteer
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other


Pre-hydration: The Pop Queen
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other


Pre-hydration: The Singer
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other

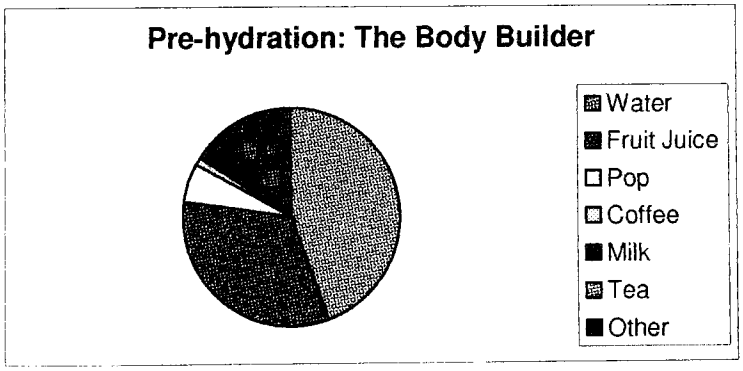
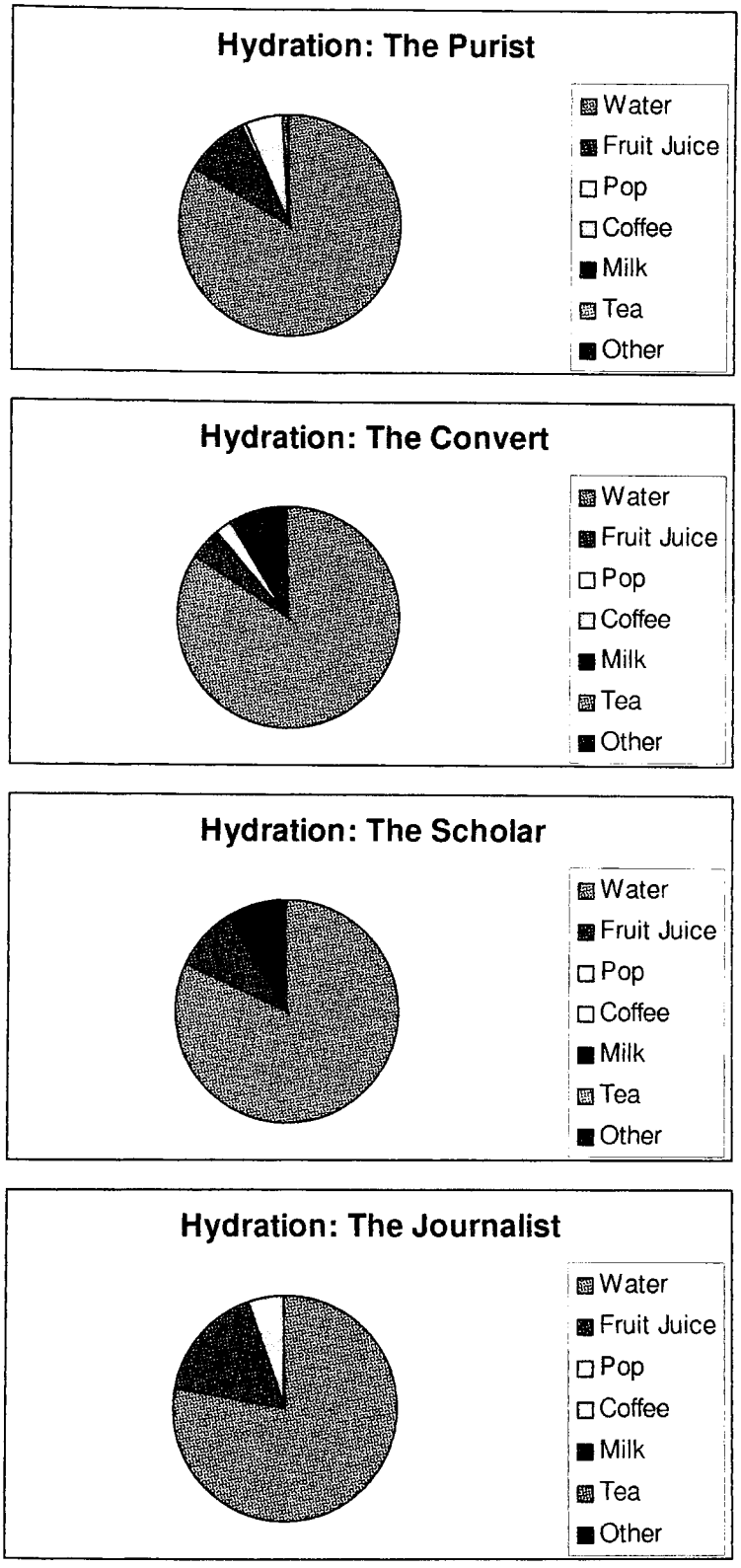
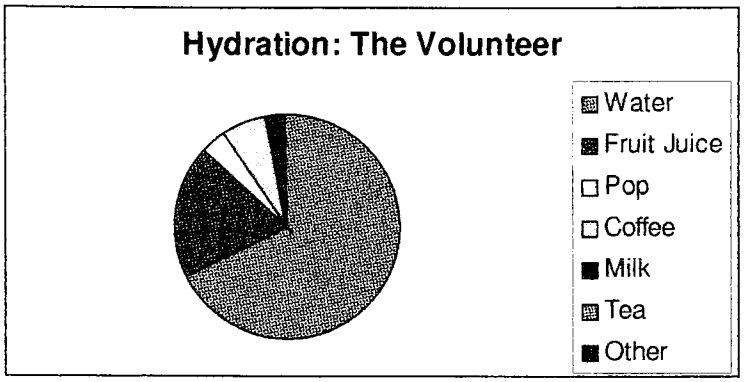
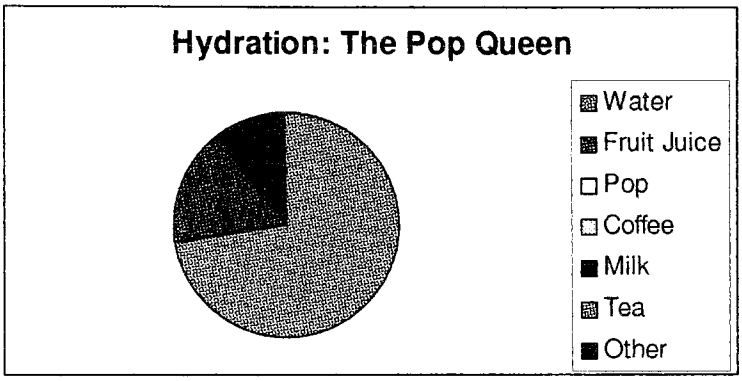
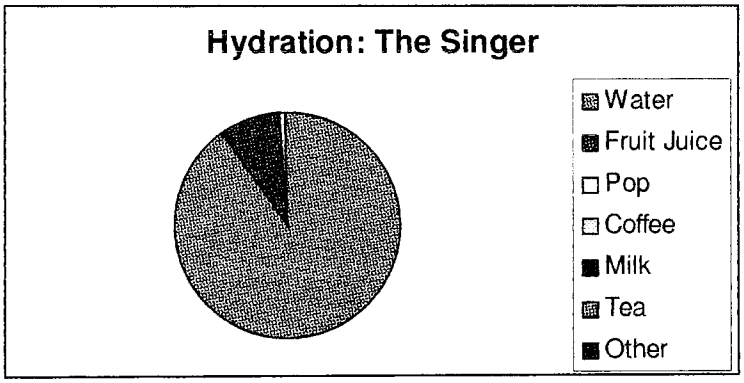

Pre-hydration: The Body Builder
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other

Figure 2: Hydration Pie Graphs




Hydration: The Volunteer
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other


Hydration: The Pop Queen
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other


Hydration: The Singer
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other

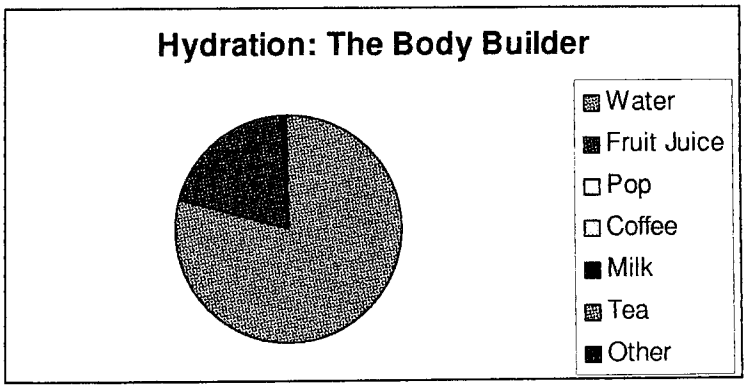

Hydration: The Body Builder
Water
Fruit Juice
Pop
Coffee
Milk
Tea
Other

Figure 3: Pre-hydration Beverage Logs

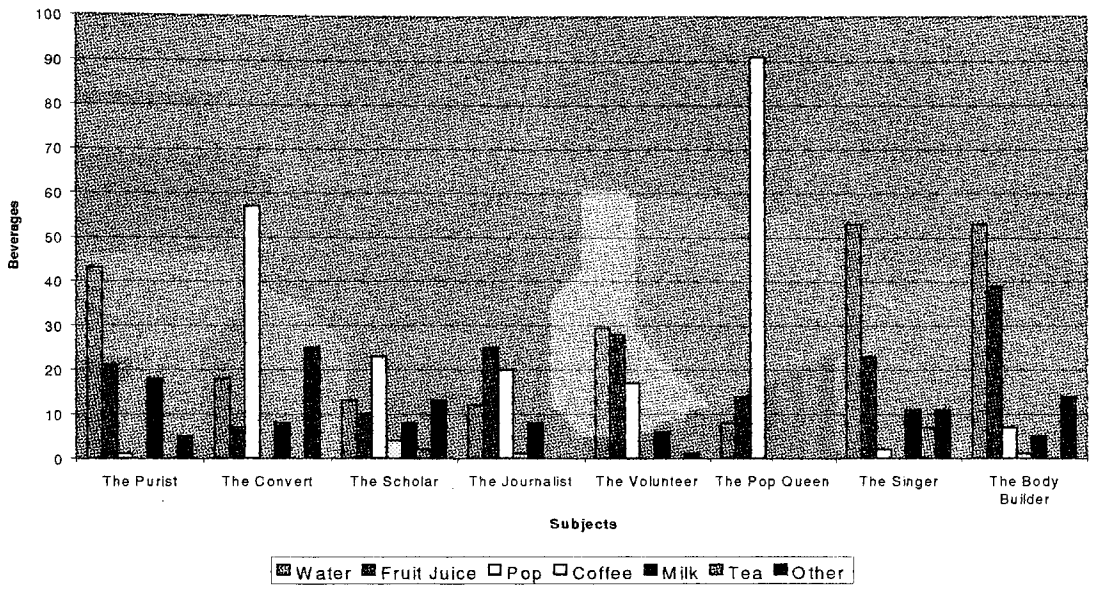
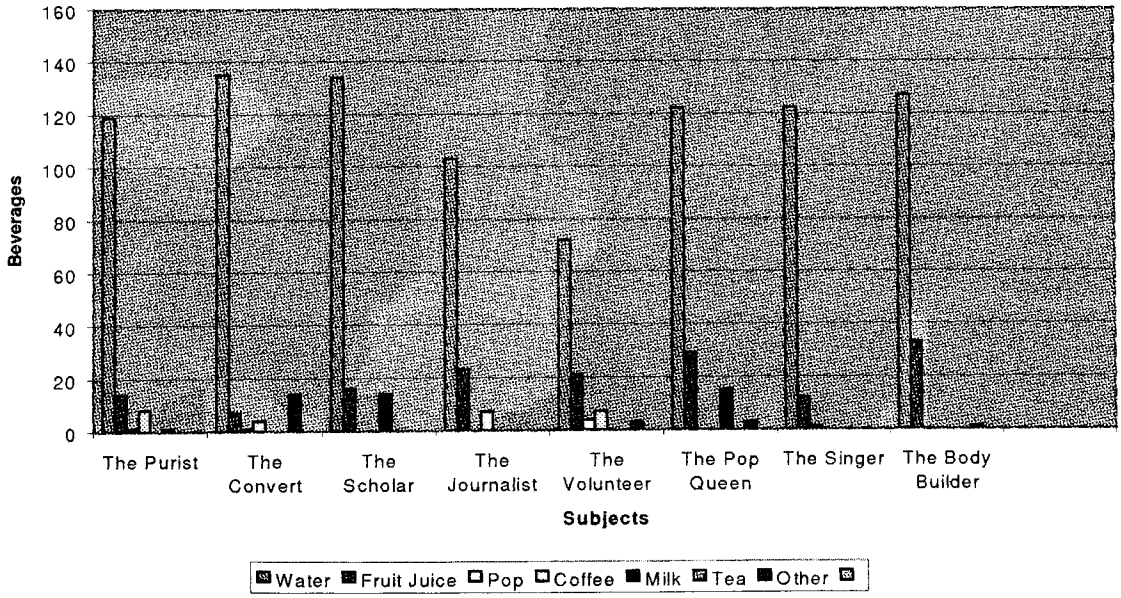


Figure 4: Hydration Beverage Logs



"...where with loud voice the power of water shakes..."

William Wordsworth

Chapter 5: Conclusions and Implications

Conclusions

There is an obvious biological necessity for water, but research has underscored the additional fact that adequate hydration has a subtle yet powerful effect on the learning process. The neurological transfer of information through water signifies that more water can mean more learning. It is as simple as that, as simple as turning on the tap, as simple as buying a bottle.

Clearly these students know the biological facts. Albeit a small survey sample, it nevertheless personifies the entire spectrum of beverage habits. But like teenagers themselves, the participants' attitudes toward water are contradictory. They clearly understand the benefits of hydration. They agree water is essential for general good health and fitness. They think it especially important to be hydrated during physical activities, but are not so convinced that it has an impact on mental processes.

They are more than likely chronically dehydrated. For too many of the participants, this dehydration is exacerbated by the ingestion of regular amounts of caffeine. Yet, at the same time, the group comprehends the effects of dehydration, as well as some of the deleterious side effects of this stimulant. Nonetheless, it has become an unconscious part of the daily routine. Caffeine is readily available at home, at school, and at work. For some, it is the addiction; for others it is the stimulating effect, for most it is the taste that fuels their caffeine craving and precludes water. Taste is paramount and

water prosaic. While these students appear all knowing, they do not know all. They simply do not perceive water as an intrinsic part of learning. In their opinion it is intrinsic to physical activity, but for thinking? Unlikely.

The students did notice a marked physical and mental difference in themselves during the five week period. More specifically, they noticed a positive change during the three weeks of adequate hydration. They felt more alert, more energized, more focused, and, conversely, less tired, less irritable less moody, and less stressed—especially those who normally drank the least amount of water and the most caffeine beverages. This improvement in well being was duly noted in the self-reporting scales, as well as in the post-interviews and impressions feedback. The participants remarked that they realized now more than ever the benefits of hydration, and indicated a desire to continue such a régime in the future.

Properly hydrated students who are, as a result, more attentive, more focused, less lethargic, and less distractible are more apt to perform better at school. Unfortunately, however, that is the simple deduction they simply failed to understand. Only a few really understood the implicit learning advantage of water; hopefully, they will be the ones more inclined to endorse it as another effective tool in their learning repertoire. As for the others, in the future they may think to drink, but it seems unlikely they will drink to think.

Steak 73% water
Egg 74% water
Watermelon 92% water
Human body 75% water
Human brain 80% water

Encyclopedia International

Implications

The philosophy and implications of water consumption from theory to practice needs to be encouraged as an important school issue. Since teaching is often a more intuitive, experiential, and behaviorist profession, teacher education students rarely do much academic work in biology, chemistry and cognitive psychology (Sylwester, 1995). Indeed, this information needs to be disseminated to every classroom teacher. Informed educators need to explain to sometimes dubious and unconvinced adolescents how water—and nothing but—helps the brain to function better by preventing dehydration (Fahey, 2000; Jensen, 1998). This increasing knowledge of the consequences of drinking water put into practice should allow enhancement of some abilities, change some behaviors, and improve mental efficiency. The practical consequences of these findings are vital, yet, at the same time, so sensible and so easy. As a learning-to-learn-better tool, hydration is universally applicable. Its long-term effects include not only better scholarship, but also improved well-being, general health, and fitness.

While this relationship between beverages and learning has enjoyed some general attention, little specific educational research has been done (Givens, 1998). The challenge is to investigate further the benefits of hydration and any other nutritional factors that influence the thinking and learning process, and to incorporate this nascent knowledge into teaching

education and practice (Sylwester, 1995).

Educators can remind learners to drink water regularly and promote the use of water bottles in their classrooms, while at the same time discouraging less brain-friendly beverages (Dennison & Dennison, 1994). These good habits, if instilled at the elementary level and reinforced throughout the years, would eventually become second nature, as much a fundamental part of learning as a pen and paper. Students also need to understand the effects of caffeine and know the products that contain this potentially dangerous stimulant. Teachers can actively promote and create a hydrated environment conducive to learning (Schiller, 1999). Instead of arriving to class carrying cracked, caffeine stained mugs, they, themselves, can model drinking water (Schiller, 1999). And what can boost student performance can do the same for teachers. Custodians and cleaning budgets would also reap the benefits, as water is innocuous compared to other liquids spilled on carpets and floors (Fahey, 2000).

An educational system that understands the benefits of hydration, but at the same time surrounds students and teachers with soft drink machines, is sending a mixed message, a dangerous message. As much as their total environment heavily influences people, they are also powerfully affected by the peripheral, which is rich in signals and subliminal messages (Caine, Caine & Crowell, 1999). Schools serious about increasing students' learning potential might consider installing water coolers in the classrooms, or increasing the number of water fountains in the hallways. Ideally, they would completely eliminate the sale of caffeine beverages and products, but, alternately, might consider replacing some of the soft drink machines with bottled water vendors. At the very least, juice could replace the caffeine beverages that these machines offer. A disquieting statement made by Gatorade chief Susan Wellington only shows the dogged determination that aggressive industry and advertising bring to bear on unsuspecting students: " 'When we're done, tap water will be relegated to showers

and washing dishes' " (Eisenberg, 2000, p. 38). Some of the products sold in the school cafeteria could be also scrutinized (Givens, 1998). These moves might not prove popular, however, since product sales generate healthy revenues and the companies donate a percentage to the schools. Soft drink companies vie for exclusive "pouring" contracts to place their machines in the school hallways, offering appealing incentives and thousands of dollars to cash starved school districts (Brownlee, 2002).

Administrators must do their part to enlighten their staff and the general public. Parents need to be informed about hydration's role in learning via the school newsletter or information displays set up during parent-teacher-student conferences. If parents were educated not to offer their children soft drinks, except for special occasions, the youngsters might grow up to appreciate more nutritious beverages. The patterns built up in childhood can have a profound effect in later years. Parents might scrutinize their own intake, as well, for children of heavy caffeine consumers may prove more reluctant hydration converts.

Administrators must also ensure the availability of water in their schools—in the cafeteria, in the vending machines, in the staff room, and in the classrooms. Nonetheless, genuine school reform comes from within; it is the teachers, as the *agents provocateurs*, who make a difference in the lives of their students.

It is my hope that this study will contribute to the work already done in the area of hydration and learning. If water is such a simple tool that can do so much to boost well-being and, in turn, performance, perhaps this work will validate the need for more educators to look at water in a different light and promote its use. Indeed, it is of momentous importance to students and educators all over the planet. More importantly, perhaps this study may prompt my colleagues and other teachers to encourage their students to think to drink.

References

Ault, M., Guy, B., Rues, J., Noto, L. & Guess, D. (1994). Some Educational Implications for Students with Profound Disabilities at Risk for Inadequate Nutrition and the Nontherapeutic Effects of Medication. *Mental Retardation*. 32(3), 200-205.

Bogdan, R. & Biklen, S. (1992). *Qualitative research for education: An introduction to theory and methods*. Boston: Allyn and Bacon.

Borowski, L. (1998). Sweating. *The Science Teacher*. 65(7), 20-24.

Bourne, J., Carr, T. & Matt, D. "Brain Gym in Multi-aged Classrooms." Retrieved December 14, 2000 from www.edu.uleth.ca/arnia/.

Brooke, R. (1916). "South Seas." *Collected Poems*. Retrieved January 2, 2001 from www.bartleby.com.

Brownlee, S. (2002). Too heavy, too young. *Time*. 159(3), 60-62.

Caine, G. Caine, R. & Crowell, C. (1999). *Mindshifts*. Tucson: Zephyr Press.

Chenail, R. (1995). Presenting Qualitative Data. *The Qualitative Report*. Retrieved on July 17, 2001 from www.nova.edu/ssss/QR/QR2-3/presenting.html.

Choma, C.W., Sforzo, G. & Keller, B. (1988). Impact of Rapid Weight Loss on Cognitive Function in Collegiate Wrestlers. *Medicine and Science in Sports and Exercise*. 30(50), 746-749.

Conners, C.K. (1989). *Feeding the brain: How foods affect children*. New York: Plenum Press.

Coyne, L. (2001). "Water for Health and Performance." Retrieved on September 4, 2001 from www.centralhome.com/ballroomcountry/hydration.htm.

Dennison, Paul, E. & Dennison, G. (1994). *Brain Gym,Teacher's Edition*. Ventura: Edu-Kinesthetics Inc.

Dickinson, E. (1924). "Part Four: Time and Eternity." *Complete Poems*. Retrieved on

January 2, 2001 from www.bartleby.com.

Eisenberg, D. (2000). A New-Age Drink War Starts as Soda Flops. *Time*. 156(25), 38-39.

Eisner, E. (1997). The Promise and Perils of Alternative Forms of Data Representation. *Educational Researcher*. 26(2), 4-9.

Fahey, J. (2000). Water, Water Everywhere. *Educational Leadership*. 57(6), 60-61.

Givens, B.K. (1998). Food for Thought. *Educational Leadership*. 56(3), 68-71.

Hannaford, C. (1995). *Smart moves: Why learning is all in your head*. Arlington: Great Ocean Publishers, Inc.

Jensen, E. (1995). *The learning brain*. San Diego: Turning Point Publishing.

Jensen, E. (1995). *Teaching with the brain in mind*. Alexandria: Association for Curriculum and Development.

LeCompte, M. (2000). The Nature of Interpretation in Qualitative Research. *Educational* Researcher. 29(9), 5-9.

Meyer, C. (1980). *Water and water supply*. Encyclopedia International. 19, 248.

Millman, C. (2000). "The Buzz on Soft Drinks and Caffeine." Retrieved on November 26, 2000 from www.discoveryhealth.com.

Oppliger, A., Case, S., Horswill, C., Landry, G. & Shelter, A. (1996). Weight Loss in Wrestlers. *Medical Science Sports Exercise*. 28(2), 9-12.

Peshkin, A. (2000). Analyzing Qualitative Data. *Theory into Practice*. 39(3), 146-154.

"Philly Coke Contract Falls Through." (2000). Retrieved on November 16, 2000 from www.rethinkingschools.org.

Schiller, P. (1999). *Start smart! building brain power in the early years*. Beltsville: Gryphon House Inc.

Shakespeare,W. *Timon of Athens*. I.2.61.

Shakespeare, W. *Titus Andronicus*. II.4.7.

Sprenger, M. (1999). *Learning and memory: The brain in action*. Alexandria: Association for Supervision and Curriculum Development.

Sylwester, R. (1995). "A celebration of neurons: An educator's guide to the human brain." Retrieved on December 13, 2000 from www.ascd.org/readingroom/books/sylwester95book.html.

Talfourd, T. "Ion." I.i.2. Retrieved on January 2, 2001 from www.bartleby.com.

Tolkien, J. R. R. (1966). *The fellowship of the ring*. London: George Allen and Unwin Ltd.

Toratora, G. & Grabowski, S. (1993). *Principals of anatomy and physiology*. New York: Harper Collins.

Ward, C. & Daly, J. (1993). *Learning to learn*. Christchurch, New Zealand: A and H Print Consultants.

Work, J. (1991). Are Java Junkies Poor Sports? *Physician and Sportsmedicine*. 19(1), 82-88.

Wordsworth,W. (1888). "Taken during a pedestrian tour among the Alps." *Complete Poetical Works*. Retrieved on January 5, 2001 from www.bartleby.com.

Wright, C. (2000). Why Do Athletes Become Hydrated? *Peak Performance*. 130, 5-7. Retrieved on February 14, 2002 from http://www.quotationspage.com

Appendix A

Track Your Fluid Tank

Track Your Fluid Tank

Amazing Facts

- ***A cup of spit weighs ½ pound.***
- It takes at least 3 hours to re-hydrate your body.
- Cold water enters the body the fastest.
- Muscles are 70% water.
- The brain, at 3 pounds, is 80% water, or 2.4 pounds of water.
- Your water weight is 60-75% of your body weight.

Example 150 pound man 150 x. 60 = 90 pounds 150 x 75 =113 pounds
90-113 pounds of his weight is water

My water weight ranges from:

.60 x _____ body weight = _____ pounds

.75 x _____ body weight = _____ pounds

I am _____ pounds of water.

Appendix B

Student Self-reporting Scale

"My birthday began with water." Dylan Thomas

Self Reporting Scale ***Name_____ Date_____***

Concentration	My mind wanders.	0 1 2 3
	I have trouble concentrating.	0 1 2 3
	I feel alert.	0 1 2 3
Restlessness	I can't sit still for very long.	0 1 2 3
	I feel restless inside even when I am sitting still.	0 1 2 3
	I fidget.	0 1 2 3
Self Control	When I want something I have trouble being patient.	0 1 2 3
	I feel easily frustrated.	0 1 2 3
	I think before I act.	0 1 2 3
Mood	Things stress me.	0 1 2 3
	I am frequently tired.	0 1 2 3
	My moods change.	0 1 2 3
Distractibility	I find it hard not to talk to others in class.	0 1 2 3
	I find it difficult to work in class.	0 1 2 3
	I find myself distracted by others.	0 1 2 3
Feelings	I get nervous.	0 1 2 3
	I feel sad and gloomy.	0 1 2 3
	I worry about things.	0 1 2 3
Beverage Intake	Normally I drink ____ glasses of water per day.	
	Normally I drink ____ cans/cups of pop/coffee/tea per day.	

0=never 1=sometimes 2=quite often 3=always

Appendix C

Pre-hydration Beverage Log

Pre-Hydration Beverage Log for _____

DATE	*WATER*	*FRUIT JUICE*	*POP*	*COFFEE*	*MILK*	*TEA*	*OTHER*
March 30							
March 31							
April 1							
April 2							
April 3							
April 4							
April 5							
April 6							
April 7							
April 8							
April 9							
April 10							
April 11							
April 12							

Please place checkmark(s) beside any beverage(s) you have consumed for a particular date. Thank you.

Comments?

Appendix D

Pre-hydration Interview Blueprint

GUIDING QUESTION	THEORETICAL ISSUE	RELEVANCE	INTERVIEW QUESTION
Introduction		To establish a level of comfort	1. Describe your interests outside of school.
Outcomes	Benefits of adequate hydration	To determine if students understand the positive effect of hydration	1. Is it important to drink water? 2. How much water do you normally consume per day? 3. How many caffeine products do you normally consume per day? 4. Do you like to drink pop? If so, why? 5. Are there some situations where it is important to drink water? 6. What happens to people when they do not drink enough water?
Parental attitudes	Reluctance to hydrate	To determine if parents promote adequate hydration	1. Do your parents ever *discourage* you from drinking pop or caffeine products? 2. Does your family *encourage* you to drink water?
Nutrition	Other issues affecting performance	To determine if students' habits erode their well being	1. Do you consider carefully what you drink? 2. Is there anything in the school environment that makes it difficult for you to practice good nutritional habits? 3. Should students be concerned about the consumption of caffeine products?
Solutions	Effective actions	To establish the need for students to hydrate themselves.	1. Is the issue of hydration an important one for students to consider?
Conclusion		To close the interview	1. Is there anything else you would like to say about this issue?

Appendix E

Pre-hydration Interview Guide

1. Describe your interests outside of school.
2. Is it important to drink water?
3. How much water do you normally consume per day?
4. How many caffeine products do you normally consume per day?
5. Do you like to drink pop? If so, why?
6. Are there some situations where it is important to drink water?
7. What happens to people when they do not drink enough water?
8. Does your family ever *discourage* you from drinking caffeine products?
9. Does your family *encourage* you to drink water?
10. Do you consider carefully what you drink?
11. Is there anything in the school environment that makes it difficult for you to practice good nutritional habits?
12. Should students be concerned about the consumption of caffeine products?
13. Is the issue of hydration an important one for students to consider?
14. Is there anything else you would like to say about this issue?

Appendix F

Hydration Beverage Log

Hydration Beverage Log for _____

DATE	*WATER*	*FRUIT JUICE*	*POP*	*COFFEE*	*MILK*	*TEA*	*OTHER*
April 23							
April 24							
April 25							
April 26							
April 27							
April 28							
April 29							
April 30							
May 1							
May 2							
May 3							
May 4							
May 5							
May 6							

Please place checkmark(s) beside any beverage(s) you have consumed for a particular date. Thank you.

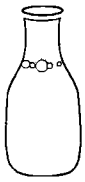
Comments?

Appendix G

Post-hydration Interview Blueprint

GUIDING QUESTION	THEORETICAL ISSUE	RELEVANCE	INTERVIEW QUESTION
Introduction		To establish a level of comfort	1. Describe your post-graduation plans.
Outcomes	Benefits of adequate hydration	To determine if students have understood the positive effect of hydration	1. Is it important physically and mentally to drink water? 2. How much water are you now consuming per day? 3. Are you now consuming fewer caffeine products? 4. Are there situations now where you would be more careful to drink water? 5. Have you consciously considered cutting down on caffeine consumption and increasing water intake? Will you now make permanent changes in your beverage habits?
Reactions	Internalization of the need for water	To ascertain if students will change their habits	1. Have you seen a change in your well being? 2. Have you cheated at all in this programme?
Nutrition	Other issues affecting performance	To determine if students' habits erode their well being	1. Should students be concerned about their consumption of caffeine products?
Solutions	Effective actions	To establish the need for students to hydrate themselves.	1. Is the issue of hydration an important one for students? 2. At school should we encourage students to drink more water?
Conclusion		To close the interview	1. Is there anything else you would like to say about your participation in this study?

Appendix H



Post-hydration Interview Guide

1. Describe your post graduation plans.
2. Is it important physically and mentally to drink water?
3. How much water are you now consuming per day?
4. Are you now consuming fewer caffeine products?
5. Are there situations now where you would be more careful to drink water?
6. Have you consciously considered cutting down on caffeine consumption and increasing water intake? Will you now make any permanent changes in your beverage habits?
7. Have you seen a change in your well being?
8. Have you cheated at all in this programme?
9. Should students be concerned about the consumption of caffeine products?
10. Is the issue of hydration an important one for students?
11. At school should we be encouraging students to drink more water?
12. Is there anything else you would like to say about your participation in this study?

Appendix I

Post Study Impressions

"Go home, call for sweet water."

William Shakespeare

POST-STUDY IMPRESSIONS, OBSERVATIONS, AND THOUGHTS

Having participated in this research study, would you be so kind as to write some thoughts about your hydration experience and the effect that it has had on you?

Thank you very much.
Mrs. Ottewell