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# A Study of the Implementation of the Free, Potable Water Subsection of the Federal Healthy, Hunger-Free Kids Act

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# A Study of the Implementation of the Free, Potable Water Subsection of the Federal Healthy, Hunger-Free Kids Act

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**Approval Page**

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**Abstract**

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The Association of School and Curriculum Development (ASCD), one of the world's largest education profession organizations and the Centers for Disease Control and Prevention called for a "greater alignment between education and health to improve each child's cognitive, physical, social and emotional development" (ASCD, 2014, p. 6). Lack of attention to the factors impacting learning can prevent students from reaching their full academic potential because education practitioners are failing to meet their students' non-instructional needs (ASCD, n.d.).

Nothing is more basic than water. Repeated studies have identified hydration as an important factor in learning (Bar-David, Urkin, & Kozminsky, 2005; Edmonds & Burford, 2009; Edmonds & Jeffes, 2009); yet according to Kenney, Gortmaker, and Cohen (2016), "access to clean, functioning free drinking water sources in schools may be limited, and compliance with state and federal policies to establish free drinking water access is low in many schools" (p. 28).

Despite the mandate stating the provisions of the federal Healthy, Hunger-Free Kids Act of 2010 (HHFKA; United States Government Publishing Office, 2010), student access to clean drinking water remains limited in schools (Cradock, Wilking, Olliges, & Gortmaker, 2012; Jones, 2016; Kenney et al., 2016). Lack of or poor access to water could result in students not consuming enough to meet their daily needs (Patel & Hampton, 2011). This could yield a negative impact on student achievement (Bar-David et al., 2005; Fuchs, Luhrmann, & Simpson, 2016).

The purpose of this cross-site case study was to examine the degree to which schools in a southeastern state school district are implementing the free, potable water subsection of HHFKA. Using a purposive sample, the researcher observed school food service practices in three middle schools and interviewed school and district food service managers. Constant-comparative analysis of interview transcripts and field notes (Glaser & Strauss, 1967) demonstrated wide variance of both knowledge and practice across sites and among interviewed participants. Implications for policymakers and practitioners include greater training of child nutrition professionals, school leaders, and classroom teachers.

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# Chapter 1: Introduction

Teachers and parents have long recognized the importance of teaching the whole child. According to the Association of School and Curriculum Development (ASCD, n.d.), emphasis on higher, more uniform standards alone is insufficient for improving student achievement. "Only when implemented within a more comprehensive, deliberate school improvement effort will they exert the influence on student success which past standards movements have failed to achieve" (ASCD, n.d., p. 2). The whole child approach to education has engaged educators, policymakers, and researchers in the exploration of "the broad array of factors influencing long-term success rather than short-term achievement" (ASCD, n.d., p. 1).

The whole child movement has fostered an approach to education that extends beyond the academic curriculum (Noddings, 2005). One of the major tenets of the whole child approach places emphasis on the health and well-being of each individual child (ASCD, 2007). In fact, ASCD and the Centers for Disease Control and Prevention called for a "greater alignment between education and health to improve each child's cognitive, physical, social and emotional development" (ASCD, 2014, p. 6). In the quest to address the needs of the whole child, researchers, policymakers, and practitioners are giving consideration to external and internal factors believed to impact student learning (Heschong Mahone Group, 2003; Li et al., 2013; PRN, 2012).

Efforts have been made to meet the health and nutritional needs of students (ASCD, n.d.). According to the United States Department of Agriculture (USDA, n.d.), with the passage of the Healthy, Hunger-Free Kids Act of 2010 (HHFKA), the USDA was allowed the "opportunity to make real reforms to school lunch and breakfast programs by improving the critical nutrition and hunger safety net for millions of children" (para. 1). HHFKA established nutritional requirements for school meals provided by an institution receiving federal meal reimbursement. Additionally, HHFKA required "schools participating in the school lunch program . . . shall make available, free of charge, as nutritionally appropriate, potable water for consumption in the place where meals are served during meal service" (U.S. Government Publishing Office, 2010).

Despite the mandate stating the provisions of HHFKA were to go into effect in the 2011-2012 school year, student access to clean drinking water is still limited in schools (Cradock, Wilking, Olliges, & Gortmaker, 2012; Jones, 2016; Kenney, Gortmaker, & Cohen, 2016). Failure to implement HHFKA may prevent students from receiving the health and cognitive benefits of proper hydration (Cradock et al., 2012). According to the United States Department of Education, National Center for Education Statistics (2016), school children in the United States spend an average of 6.64 hours a day for 180 days in school. Additionally, students typically receive one third of their daily nutrition requirements in school resulting in a need to consume 8-12 ounces of water during the school day (Cradock et al., 2012). Lack of or poor access to water could result in students not consuming enough to meet their daily needs (Patel & Hampton, 2011). This could yield a negative impact on student achievement (Bar-David, Urkin, & Kozminsky, 2005; Fuchs, Luhrmann, & Simpson, 2016). Recent research indicates poor hydration is associated with poorer cognitive function and overall well-being (Bar-David et al., 2005; Benton & Burgess, 2009; Edmonds & Burford, 2009; Fadda et al., 2012).

**Theoretical Base**

Given the potential benefits to students' cognitive and physical development, inconsistent implementation of the water subsection of HHFKA is surprising (Kenney et al., 2016); however, many schools fail to meet federal standards for providing minimum student drinking water access (Cradock et al., 2012; Jones, 2016; Kenney et al., 2016). Plumbing infrastructure, cost, and lack of necessary staff have been cited as barriers to implementation (Kenney et al., 2016). Lewin's model of change may also offer insight into the non-uniform compliance with HHFKA.

Prior to the 2010 reauthorization of HHFKA, only 12-13% of U.S. students were enrolled in districts with policy provisions for free drinking water access (Chriqui et al., 2010). The federal mandate required state and local districts to evaluate and possibly reform their water access policies (Chriqui et al., 2010). The researcher speculates failure to implement necessary modifications is likely due to a lack of effective planning for change.

According to Kurt Lewin, change occurs in three distinct phases (Schein, 1995). In the initial phase of effective change, leaders must "unfreeze" the current equilibrium (Kritsonis, 2005). This requires the creation of a sense of urgency among stakeholders (Schein, 1995). Employees must be shown how the current state of operation is hindering the work of schooling (Schein, 1995). The researcher speculates that a failure to provide school staff with valid research demonstrating the impact of student hydration on academic achievement and training in federal, state, and local policy affecting water access has resulted in a lack of motivation to move toward effective implementation of HHFKA. In order to ensure food service directors, cafeteria managers, school leaders and teachers move toward free access to water for students, they must be provided with information (Kritsonis, 2005). The more decision makers know, the more urgently change is sought and the more motivated employees are to accept it (Kritsonis, 2005).

Without increasing the driving forces of change through educating stakeholders, the second phase of Lewin's model is not possible (Schein, 1995). "Change" begins to take place when staff members believe and act in ways that support the new direction (Kritsonis, 2005). The second phase of Lewin's model of change involves the group beginning to take action and evaluate, on a trial and error basis, how to move to a more acceptable set of behaviors (Burnes, 2004). It is possible that no attempts have been made toward "change" in some schools because the group is still frozen (Kritsonis, 2005); therefore, there is no motivation to revise current practices because there has been no investment in changing stakeholder perspectives (Kritsonis, 2005).

The final phase of change involves "refreezing." Within this phase, new practices are adopted as a behavioral norm (Schein, 1995). In order to ensure the changes are used constantly, leaders must recognize early adopters and reinforce the new behaviors and practices (Schein, 1995). Those responsible for enacting HHFKA may be more consistent in providing student access to water when their efforts are recognized by upper level leadership (Schein, 1995).

**Statement of the Problem**

Improving student achievement through curriculum alone is not enough (ASCD, n.d.). The Council of Chief State School Officers (2010) stated, "Teaching begins with the learner. To ensure that each student learns new knowledge and skills, teachers must understand that learning and developmental patterns vary individually, that students bring unique individual differences to the learning process" (p. 9). Reform efforts must focus on meeting the individual needs of the whole child. Student learning hinges on a multitude of external and internal factors (Council of Chief State School Officers, 2010).

Lack of attention to the factors impacting learning can prevent students from reaching their full academic potential because education practitioners are failing to meet their students' non-instructional needs (ASCD, n.d.). Nothing is more basic than water. It has repeatedly been identified as an important factor in learning (Bar-David et al., 2005; Edmonds & Burford, 2009; Edmonds & Jeffes, 2009); yet according to Kenney et al. (2016), "access to clean, functioning free drinking water sources in schools may be limited, and compliance with state and federal policies to establish free drinking water access is low in many schools" (p. 28).

The researcher concludes Lewin's theory of change combined with research pertaining to student access to water in school indicates a lack of knowledge among school leadership and food service workers on the importance of student hydration and the current federal legislation.

**Significance of the problem.** Students need to consume 8-12 ounces of water during the school day (Cradock et al., 2012). School water access has been associated with increased water intake among adolescents (Patel, Bogart, Uyeda, Rabin, & Schuster, 2010). Failure to implement HHFKA may prevent students from meeting their daily hydration needs (Cradock et al., 2012). Recent research indicates inadequate hydration can lead to decreases in cognitive performance and have a negative impact on student achievement (Bar-David et al., 2005; Benton & Burgess, 2009; Edmonds & Burford, 2009; Fadda et al., 2012).

## Purpose of the Study

Despite emerging research suggesting poor hydration is associated with poor cognition, water access in schools is inconsistent (Kenney et al., 2016). Kenney et al. (2016) stated in addition to improving the availability of water, there is a need for objectively measured data about the adequacy of water access in schools. The researcher attempts to address the extant gaps in the relevant research on the subject of student access to water. The purpose of this study is to examine the degree to which schools are implementing the free, potable water subsection of HHFKA though a cross-site case study of schools of a southeastern state school district. The study examined the following research questions.

1. How are schools providing free access to water for students during meal service times?
2. To what extent are district policies aligned with daily practice at the school level?
3. What is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers?

**Definition of Terms**

**Potable water**. Water suitable for drinking.

**External factors to learning**. Influences on student achievement originating outside the learner.

**Internal factors to learning**. Influences on student achievement originating within the learner.

**Organization of the Study**

This document contains four subsequent chapters. Chapter 2 consists of a review of the relevant literature. Chapter 3 describes the methodology that was be used in the study, the instrumentation, and a summary of the steps and procedures that were used for data analysis. Chapter 4 presents the description and analysis of data. Finally, Chapter 5 includes conclusions, discussions, and recommendations.

## Chapter 2: Literature Review

Despite emerging research suggesting poor hydration is associated with poor cognition, water access in schools is inconsistent (Kenney et al., 2016). The purpose of this study is to examine the implementation of the free, potable water subsection of HHFKA through a cross-site case study of middle schools of in southeastern state school district. A review of the literature will begin by examining the major external factors impacting student learning: acoustics, background noise, light, air quality, and temperature. This is followed by an examination of selected research completed on the internal factors related to learning: shelter, sleep, food insecurity, and diet quality. This literature review concludes with studies related to hydration and cognition as well as research focused on student access to water in school.

### External Factors Affecting Learning

The Heschong Mahone Group (2003) completed a study investigating the relationship between various external aspects of the learning environment and student performance. The performance of 8,518 third- through sixth-grade students in Fresno Unified School District was compared using multivariate regression analysis (Heschong Mahone Group, 2003). Researchers controlled for traditional explanatory variables such as student and teacher demographic characteristics and examined other physical attributes of the classroom such as ventilation, indoor air quality, thermal comfort, acoustics, and quality of view out of classroom windows. The Heschong Mahone Group categorized variables impacting the physical conditions of the classrooms into seven thematic groups. They completed tests for collinearity among the physical characteristic variables using the singular value decomposition methodology (Heschong Mahone Group, 2003). In the study group, ventilation, thermal comfort, and acoustic conditions were all intertwined and had a negative impact on student performance (Heschong Mahone Group, 2003). The Heschong Mahone Group found a pleasant view out the window, which includes vegetation, supports better outcomes of student learning. Additional findings in this study point to the negative impact of sources of glare and direct sun penetration as well as the need for teachers to be able to control sources of visual distraction through blinds or curtains (Heschong Mahone Group, 2003). Overall, the Heschong Mahone Group found external variables in the physical learning environment to be as significant and of equal or greater magnitude as teacher characteristics in predicting student performance.

**Acoustics.** Research by Klatte, Hellbruck, Seidel, and Leistner (2010) delved into the impact of the constructed environment on student achievement by examining the effects of classroom acoustics on performance. Klatte et al. collected performance and questionnaire data from 487 German first and second graders from 21 different classrooms. Acoustical measurements were performed as students participated in a standardized lesson (Klatte et al., 2010). Speech materials for the lesson were prerecorded in a sound-attenuated laboratory prior to the administration of the lesson (Klatte et al., 2010). Each classroom task was explained to the students; the experimenter and two assistants were present in the room to ensure all children followed the instructions (Klatte et al., 2010). Participants were assessed on written language acquisition, nonverbal intelligence, and phonological processing (Klatte et al., 2010). Klatte et al. also included questionnaires to measure seven social and emotional school experiences: pleasure of learning, school attitude, achievement motivation, relation to the teachers, academic self-concept, class atmosphere, and social integration. Klatte et al. completed one-way ANOVAs on the effects of classroom reverberation times and the questionnaire ratings. Klatte et al. found in classrooms with long reverberation, there were significant effects of reverberation on achievement motivation, relation to teacher, class atmosphere, and social integration. Participants judged these to be less positive ($p < 0.01$) in all cases (Klatte et al., 2010).

**Background noise.** Shield and Dockrell (2008) originally explored the relationship between external and internal noise in the learning environment and student achievement. The researchers studied 142 primary schools situated in three separate boroughs in London (Shield & Dockrell, 2008). Shield and Dockrell measured noise levels of the primary schools in each of the boroughs. The external and internal levels were used along with standardized assessment test data to complete correlation and regression analysis (Shield & Dockrell, 2008). Data analysis showed "chronic exposure to both external and internal noise has a detrimental impact upon academic performance and attainments of primary school children" (Shield & Dockrell, 2008, p. 141). When the data were corrected for socioeconomic factors, English tested in Key Stage 2 at 11 years of age was the subject most strongly affected by internal noise (Shield & Dockrell, 2008). There was a significant negative relationship ($r = -0.59$, $p < 0.05$) between background noise in year six classrooms and test scores for English (Shield & Dockrell, 2008).

Similarly, Ronsse and Wang (2010) delved into the external factors impacting learning by examining the relationship of noise from building mechanical systems on student achievement. Ronsse and Wang utilized site visits, acoustical measurements of background noise level, and results from the Iowa Test of Basic Skills of an entire elementary school system. Fourteen elementary schools from Council Bluffs, Iowa, participated in the study (Ronsse & Wang, 2010). The unoccupied noise levels were measured in 58 second- and fourth-grade classrooms (Ronsse & Wang, 2010). Ronsse and Wang found none of the measurements to be less than the recommended noise level of 35 dBA specified for classrooms in the Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools. All classrooms measured within a range of 36-50 dBA (Ronsse & Wang, 2010). The researchers also gathered results from standardized student achievement tests from the Iowa Test of Basic Skills (Ronsse & Wang, 2010). Available scores from the reading comprehension and math subject areas were compiled (Ronsse & Wang, 2010). Statistical analysis was performed to determine the impact of background noise on student achievement scores (Ronsse & Wang, 2010). Upon completing a zero-order Pearson correlation relating background noise and standardized achievement scores, Ronsse and Wang found a significant relationship between background noise and reading comprehension scores ($r = 0.55$, $p < 0.01$). The results of their study left the researchers to conclude, "lower student reading comprehension scores were significantly related to high background noise levels from building mechanical systems" (Ronsse & Wang, 2010, p. 347).

**Light.** Sleegers et al. (2013) researched the impact of lighting conditions on the concentration of elementary school children. One study conducted by Sleegers et al. employed two schools in a pretest-posttest nonequivalent control group study. A total of 98 pupils participated in the pretest and two posttests (Sleegers et al., 2013). Researchers administered the d2-test to assess concentration in terms of speed and accuracy (Sleegers et al., 2013). The lighting during the administration of the pretest in the control and the experimental school were conventional recessed luminaires fitted with louvres (Sleegers et al., 2013). The experimental classrooms evaluated by Sleegers et al. were equipped with a dynamic lighting system which allowed teachers to select from four preset lighting settings: energy setting, focus setting, calm setting, or standard setting. The settings were created by color-mixing light output (Sleegers et al., 2013). For example, the energy setting was a cold blue, rich white light and the calm setting was a white light with a warm red color tone (Sleegers et al., 2013). The two posttests in the experimental school were administered using the focus setting of the dynamic lighting system (Sleegers et al., 2013). Sleegers et al. conducted a mixed ANOVA to compare student scores on the concentration posttests across schools and classrooms. Although Sleegers et al. found evidence of a potential learning effect, the focus lighting setting had a positive effect when comparing concentration performance scores across schools on the second posttest with the pretest ($F_{(1, 87)} = 8.57$, $p < 0.01$, $r = 0.30$) and with the first posttest ($F_{(1, 87)} = 6.29$, $p < 0.05$, $r = 0.26$). Findings of this study indicate a positive influence of the lighting system on pupil concentration (Sleegers et al., 2013).

Barkmann, Wessolowski, and Schulte-Markwort (2012) also focused their attention on variable lighting as an external factor impacting student learning. Barkmann et al. examined the effects of a lighting system which varied in luminance and color temperature using a quasi-experimental design with pre and postintervention measurements. Two classes each within two different schools were compared in the study (Barkmann et al., 2012). Each school contained a control group and an intervention group (Barkmann et al., 2012). The intervention group was equipped with a variable lighting system (Barkmann et al., 2012). The variable system allowed teachers to select lighting from standard, focus on board, board only, concentrate, activate, relax, or extreme relax light settings (Barkmann et al., 2012). The control groups and the intervention groups at each school completed a pretest, the Brickenkamp d2 Test of Attention (Barkmann et al., 2012). Standard lighting conditions were used for the pretest for both the intervention and the control groups (Barkmann et al., 2012). Following the pretest, the intervention groups were advised in using the variable lighting system

(Barkmann et al., 2012). After 4 weeks, Barkmann et al. administered a posttest using the concentrate setting for the intervention group participants and the standard light setting for the control groups. Barkmann et al. found that students in the intervention groups made 20.8% fewer errors of omission on the d2 Test of Attention under the concentrate light setting than participants in the control groups, indicating variable lighting represents an environmental factor impacting learning conditions (Barkmann et al., 2012).

**Air quality.** Continuing the focus on the external factors that impact learning, Shaughnessy, Haverinen-Shaughnessy, Nevalainen, and Moschandreas (2006) conducted a study of the ventilation rates in classrooms and student performance. Fifty-four elementary schools were monitored for carbon dioxide concentrations (Shaughnessy et al., 2006). Carbon dioxide concentrations were compared with fifth grade standardized test scores in reading and math (Shaughnessy et al., 2006). Results point to a significant association between classroom-level ventilation rate and test results in math (Shaughnessy et al., 2006).

Haverinen-Shaughnessy, Moschandreas, and Shaughnessy (2011) continued exploring the quality of classroom ventilation rates and student academic achievement. Haverinen-Shaughnessy et al. expanded their research to include 100 elementary schools. As in their previous study, Haverinen-Shaughnessy et al. monitored fifth-grade classrooms for carbon dioxide concentrations. Carbon dioxide concentration data were again compared with standardized test scores. Data analysis revealed a positive linear association between the ventilation rate and the proportions of students passing standardized tests (Haverinen-Shaughnessy et al., 2011).

**Temperature.** A study completed in 1979 by Wyon, Andersen, and Lundqvist investigated the effects of moderate heat stress on mental performance. The researchers subjected 72 healthy high school students to a climate chamber with rising air temperature (Wyon et al., 1979). The participants were randomly assigned to one of three temperature conditions (Wyon et al., 1979). The control condition had a temperature variation from 68-73.4˚F in the course of 50 minutes (Wyon et al., 1979). In condition two, the temperature ranged from 73.4-84.2˚F in the course of 50 minutes (Wyon et al., 1979). Climate chamber three also maintained a temperature range from 73.4-84.2˚F, in addition to a constant relative humidity of 50% (Wyon et al., 1979). Participants completed work in three successive 50-minute sessions in their assigned climate chamber, receiving a 10-minute break between exposures (Wyon et al., 1979). Participants completed a series of mental tasks aligned with the various aspects of school work. Sentence comprehension, multiplication, cue utilization, spelling, tests of creativity, a test of reading comprehension, and a test of manual dexterity and perseverance were included (Wyon et al., 1979). Data indicating the subjects' thermal comfort were also gathered using a dial-voting technique (Wyon et al., 1979).

Wyon et al. (1979) found "that moderate heat stress, only a few degrees centigrade above the optimum, has a marked effect on mental performance" (p. 360). The researchers completed an analysis of variance in a 3 X 3 X 2 independent measures design with temperature condition, hour, and sex as the independent variables (Wyon et al., 1979). Significant effects were seen in sentence comprehension, multiplication, and word memory (Wyon et al., 1979). Data collected from the sentence comprehension activity showed a significant interaction ($F = 2.77$, $p < 0.05$) between temperature condition and time (Wyon et al., 1979). The emerging trend was a tendency to work less hard at difficult or boring tasks in the middle period of an exposure (Wyon et al., 1979). Data indicate participants performed the sentence comprehension task over 20% more slowly at the intermediate temperature of 26˚C (Wyon et al., 1979). The researchers found it significant (F = 4.37, $p < 0.05$) that male participants in the elevated temperature condition worked more slowly on the multiplication test (Wyon et al., 1979). Although there was no significant effect on error frequency, male subject speed was most diminished at 28˚C (Wyon et al., 1979). Males also showed a decline in performance at temperatures above 26˚C in the word memory task (F = 4.98, $p < 0.05$; Wyon et al., 1979). Based on the data, Wyon et al. concluded tasks demanding concentration and clear thinking were adversely affected by heat stress due to reduced arousal and the distracting effect of thermal discomfort. Further, it was recommended that classroom activities requiring concentration should be carried out early in the day before temperatures rise (Wyon et al., 1979). Further discussion of thermal comfort by Wyon et al. leads to the conclusion that "thermal comfort is a byproduct of the interaction between task and environment effects on the behavior of the subjects" (p. 360).

Wargocki and Wyon (2007) examined the impact of classroom temperature on student performance. Wargocki and Wyon conducted two crossover studies in which temperature was manipulated in two classrooms of 10- to 12-year-old children in Denmark. In both experiments, split cooling units were used to manipulate classroom air temperature for 1 week (Wargocki & Wyon, 2007). In the first experiment, when cooling was provided, the average air temperature dropped to 20˚C (68˚F); and in the reference condition, the average temperature was 23.6˚C (74.5˚F; Wargocki & Wyon, 2007). In the second experiment, the temperatures were slightly higher due to increased outdoor temperatures with the average intervention temperature of 21.6˚C (70˚F) and a reference condition of 24.9˚C (76.8˚F; Wargocki & Wyon, 2007). In each condition, students completed tasks which included multiplication and subtraction, checking columns of numbers against each other, sentence comprehension, proofreading of text, acoustic proofreading of text, and reading of text with choice points inserted to determine whether the students understood the text (Wargocki & Wyon, 2007). Wargocki and Wyon found, “reducing moderately elevated classroom temperatures, can substantially improve the performance of a wide range of task characteristic of schoolwork, from rule-based logical and mathematical tasks requiring concentration and logical thinking to language-based tasks requiring concentration and comprehension” (p. 27). Wargocki and Wyon reported results that were statistically significant at the level of $p \leq 0.05$. When the temperature was reduced from 25˚C (77˚F) to 20˚C (68˚F), student performance increased in terms of speed on arithmetical and two language-based tests (Wargocki & Wyon, 2007). The temperature change resulted in a reduced percentage of errors on acoustic proofreading (Wargocki & Wyon, 2007). When classroom temperature was reduced by 1˚C (1.8˚F), student completion of schoolwork was improved in terms of speed by 2% (Wargocki & Wyon, 2007).

## Internal Factors Impacting Learning

In the quest to address the needs of the whole child, researchers, policymakers, and practitioners are giving consideration to both external and internal factors believed to impact student learning (Heschong Mahone Group, 2003; PRN, 2012; Li et al., 2013). The internal factors impacting learning include shelter, sleep, food insecurity, diet quality, and hydration.

**Shelter.** Rubin et al. (1996) conducted a cross-sectional controlled study design to determine the effect of homelessness on cognitive and academic performance. Rubin et al. gathered interview and standardized cognitive and academic performance data from homeless children (n = 102) and their mothers and housed children (n = 178) and their mothers. The group of homeless students and their mothers were living in shelters; the housed group of children and their mothers were selected from the homeless child's classroom (Rubin et al., 1996). Demographic, attendance, behavior, and residency information was obtained via interviews (Rubin et al., 1996). In order to assess cognitive function, Rubin et al. utilized Raven's Progressive Matrices to measure reasoning ability and the Peabody Picture Vocabulary Test to evaluate receptive knowledge of vocabulary and language comprehension. Academic functioning was determined using the Wide Range Achievement Test-Revised (WRAT-R; Rubin et al., 1996).

Rubin et al. (1996) completed a multivariate analysis that tested the relation between housing status and the standardized tests of cognitive function while controlling for gender, social class, age, and ethnic group. The data showed no significant differences in scores on Raven's Progressive Matrices and the Peabody Picture Vocabulary Test between the housed and homeless groups (Rubin et al., 1996); however, homeless students performed more poorly in comparison to their housed peers in academic achievement which was measured by the WRAT-R (reading $p = .003$, spelling $p = .001$, mathematics $p = .0001$; Rubin et al., 1996).

Hendricks and Barkley (2011) also examined the academic implications of homelessness. Hendricks and Barkley conducted a quasi-experimental study using the archival records of more than 57,000 sixth-grade students in 2006 and over 94,000 sixth-grade students in 2007. Data used for the students were provided by the North Carolina Department of Public Instruction and included reading comprehension and mathematics end-of-grade (EOG) test scores in addition to housing status (Hendricks & Barkley, 2011). Independent *t* tests were completed where the independent variable was housing status and the dependent variables were EOG scores in reading comprehension and mathematics (Hendricks & Barkley, 2011). Analysis revealed the EOG scores of normally housed students were significantly ($p \leq .05$) higher than the scores of homeless students (Hendricks & Barkley, 2011).

**Sleep.** Perkinson-Gloor, Lemola, and Grob (2013) examined the impact of sleep on academic performance. The researchers recruited 2,716 participants from eighth and ninth grade in Switzerland (Perkinson-Gloor et al., 2013). Students completed an online questionnaire assessing their sleep habits. Data obtained via the survey were compared with school grades in mathematics and German language (Perkinson-Gloor et al., 2013). Analysis of the data revealed that students receiving insufficient sleep had lower school grades in math and in German language when compared to participants who slept longer (Perkinson-Gloor et al., 2013).

A sleep series study completed by Li et al. (2013) further supported the assertion that meeting student basic needs results in an impact on academic outcomes. Li et al. conducted a sleep series study in China from November 2005 through December 2009. This included a 5-year longitudinal cohort study examining the association of sleep duration and school performance as well as a 2-year intervention study evaluating the effects of delaying school start times in 10 primary schools in Shanghi (Li et al., 2013). The cohort study revealed sleep duration played an important role in school performance (Li et al., 2013). Children receiving less than 9 hours of sleep had an increased risk for poor academic achievement (Li et al., 2013). In discussing the association of sleep duration, daytime sleepiness, and school performance, Li et al. stated, “impairment of academic achievement was especially severe” (p. 8).

**Food insecurity.** Food, a basic survival need, has also been examined by researchers as a factor in student achievement. Winicki and Jemison (2003) investigated the correlation between food insecurity and educational achievement. Researchers analyzed cognitive data and food security data from the fall 1998 Early Childhood Longitudinal Study (ECLS)-Kindergarten Class (Winicki & Jemison, 2003). The fall 1998 ECLS cohort was a nationally representative sample of 26,260 kindergarten children. Winicki and Jemison examined the data to determine the impact of food insecurity on a child's academic capacity at the beginning of the year and learning over the course of the year. Results showed food insecurity affects both initial capacity and learning over the year (Winicki & Jemison, 2003). "The children from less food secure homes not only score lower at the beginning of the year but also learn less over the course of the school year" (Winicki & Jemison, 2003, p. 151).

**Diet quality.** Florence, Asbridge, and Veugelers (2008) focused on the association between diet quality and academic performance in the 2003 Children's Lifestyle and School-Performance Study (CLASS). Researchers collected diet quality and school performance data from 4,589 fifth-grade students in Nova Scotia public schools (Florence et al., 2008). Data analysis revealed an association with academic performance and diet quality (Florence et al., 2008). "Students with decreased overall diet quality were significantly more likely to perform poorly on the assessment" (Florence et al., 2008, p. 209). Florence et al. further noted dietary adequacy as a specific aspect of diet quality important to academic performance. This gives support to the assertion that student learning is impacted by both external and internal factors.

The quest for finding ways to impact student achievement has led practitioners to examine a collection of external and internal factors. Not only have researchers concerned themselves with the air students breathe, how much they sleep, and what they eat, attention has also turned to the amount of fluids they drink.

Further study of the impact of meeting children's most basic need for water in school is especially important. Recent research indicates many school-aged children are dehydrated (Bonnet et al., 2012). In addition, emerging studies have noted a decline in cognitive performance when appropriate levels of hydration are not maintained (Grandjean & Grandjean, 2007; Ritz & Berrut, 2005; Tomporowski, Beasman, Ganio, & Cureton, 2007; Wilson & Morley, 2003).

Impaired cognitive performance can lead to a drop in academic achievement (Deary, Strand, Smith, & Fernandes, 2007. According to Kehley (2016), cognition is the manner in which the brain processes information. Cognitive performance is related to the comprehension of ideas and learning new skills (Kehley, 2016). Specific functions associated with cognition have been found to impact academic performance; these include the ability to keep information updated in working memory, the ability to inhibit irrelevant information from entering working memory, the ability to switch between tasks, and the temporary activation of long-term memory (Bull & Scerif, 2001).

The review of the literature further investigated the relationship between hydration and cognition along with the factors that place school-aged children at an increased risk of dehydration. Student access to fluids throughout the school day were examined. Finally, the implications of these findings on student hydration and cognitive performance are discussed.

**Impact of Hydration on Cognition**

Literature suggests that inadequate hydration can negatively impact more than an individual's physical performance (Patel, Mihalik, Notebaert, Guskiewicz, & Prentice, 2007; Pross, 2012; Shirreffs, Merson, Fraser, & Archer, 2004). Insufficient fluid intake also results in physiological changes within the human body (Kempton et al., 2009; Patel et al., 2007). Pross (2012) examined the impact of acute fluid deprivation on mood and physiological parameters. Pross employed a well-controlled dehydration protocol to evaluate the effects of 24-hour fluid deprivation of 20 healthy French women. Participants underwent randomized periods of dehydration and euhydration, which served as a control (Pross, 2012). During the fluid deprivation trial, participants were allowed final water intake between 6 and 7 p.m. and no beverages were permitted until 6 p.m. the following day (Pross, 2012). Water intake was permitted at fixed periods during the control condition (Pross, 2012).

Pross (2012) evaluated participant hydration levels by evaluating urine, blood, and saliva. Urine was collected from the beginning of each trial period up to the end of the assessments on day one (Pross, 2012). Urine was evaluated for gravity, color, and volume. In addition to this, venous blood samples were collected at the beginning of the trial and 24 hours later (Pross, 2012). Researchers collected saliva samples from subjects at the beginning of each trial, 24 hours later, 36 hours after the trial, and 48 hours after the trial period began (Pross, 2012).

Analysis of the data offered several relevant findings (Pross, 2012). Results showed fluid deprivation results in a negative impact on mood (Pross, 2012). Questionnaires completed by participants reported lower scores on calmness and happiness along with higher scores on confusion and sleepiness when in the fluid deprivation condition compared with the control condition (Pross, 2012). Participants were allowed ad libitum fluid intake following both trials (Pross, 2012). Pross (2012) found that most of the mood impairments were reversed by participant fluid intake, with the exception of fatigue, vigor, and calmness. This suggests dehydration has longer lasting effects which may not be directly reversed by voluntary consumption of liquids (Pross, 2012). Although the findings of Pross begin to bolster the assertion that hydration impacts cognitive processes, the results are limited due to the sample and methods used. Pross utilized only female participants between 22 and 28 years of age. In addition, the dehydration protocol imposed a 24-hour period of water deprivation which is unlikely to occur in everyday life (Pross, 2012).

The study conducted by Pross (2012) does add support to the findings of Shirreffs et al. (2004). Shirreffs et al. investigated the physiological response resulting from fluid restriction. The study group was comprised of nine males and six females (Shirreffs et al., 2004). Participants' mean age was 30 years. They participated in two experimental trials (Shirreffs et al., 2004). During a fluid restriction trial, participants were asked to abstain from the intake of all fluids and to consume only foods that had low water content (Shirreffs et al., 2004). Participants also completed a euhydrated trial (Shirreffs et al., 2004). Each individual was instructed to follow their normal pattern for fluid ingestion during the euhydrated trial (Shirreffs et al., 2004). The fluid restriction trial and the euhydrated trial were undertaken in randomized order and were completed 7 days apart (Shirreffs et al., 2004).

In each trial, the study group was required to fast 4 hours prior to arrival and was permitted no water for 2 hours prior to entering the laboratory (Shirreffs et al., 2004). Participants completed a food and activity log 24 hours prior to the trial (Shirreffs et al., 2004). Upon arrival, urine was collected (Shirreffs et al., 2004). A sample was retained after the total volume was recorded (Shirreffs et al., 2004). Body mass was recorded, and a baseline blood sample was collected (Shirreffs et al., 2004). All participants then completed a 100 mm verbally anchored questionnaire to measure subjective feelings (Shirreffs et al., 2004). Questions measured feelings of thirst, hunger, dry mouth, headache, fatigue, and alertness (Shirreffs et al., 2004). For each trial, participants visited the laboratory 24 hours and 37 hours after the start (Shirreffs et al., 2004). Upon each visit, participants' urine and blood were collected and body mass measured, and the subjective feelings survey was administered (Shirreffs et al., 2004). Participants were provided a drink of their choice following the final samples collection and were permitted to drink until satisfied (Shirreffs et al., 2004). Without their knowledge, the volume consumed after each trial was measured (Shirreffs et al., 2004).

The results reported by Shirreffs et al. (2004) implies mild dehydration may result in a negative effect on perceived ability to function mentally and on overall feelings of wellbeing. Although the participants began both the euhydrated and fluid restriction trials reporting the same subjective feelings during the fluid restriction trial, perceptions of thirst and mouth dryness were greater ($P < 0.05$); feelings of headache were higher at the 24-hour point ($P < 0.005$); and research participants had more difficulty concentrating ($P < 0.05$) and increased feelings of tiredness ($P = 0.01$; Shirreffs et al., 2004). The findings of Shirreffs et al. implied even mild dehydration has a physiological impact on individuals; however, the study does utilize a small sample size of 15 (Shirreffs et al., 2004). Additionally, Shirreffs et al. stated,

> there may be an influence of the reduced energy, carbohydrate or protein intake on the subjective feelings reported that cannot be distinguished by the present study design from any influence of hypohydration. However, it remains true that the FR protocol used did influence subjective feelings. (p. 957)

Further support for the nonphysical impact dehydration has on an individual can be seen in research conducted by Patel et al. (2007). Patel et al. (2007) aimed to determine the signs, symptoms, neuropsychological performance, and postural stability associated with dehydration. Although the goal of Patel et al. (2007) was to determine how dehydration affects the signs and symptoms commonly associated with concussion, the findings of their research provide support for a relationship between hydration and cognition.

Patel et al. (2007) studied 24 healthy male recreational athletes with a mean age of 21.92 years. Participants were subjected to multiple assessments under two conditions: euhydrated and dehydrated (Patel et al., 2007). The two conditions were imposed at least 7 days apart (Patel et al., 2007).

Patel et al. (2007) induced dehydration in research participants using fluid restriction. Prior to fluid restriction, participants provided a 2- to 4-ounce urine sample and weighed in order to obtain a pre-restriction measure of urine specific gravity (USG) to determine hydration level (Patel et al., 2007). They were instructed to refrain from consuming fluids and foods with high fluid content for 15 hours (Patel et al., 2007). Following the 15-hour food and fluid restriction, a 45-minute exercise task on an upright stationary bicycle was performed (Patel et al., 2007). A 25-minute rest period, during which the participants provided another 2- to 4-ounce urine sample and weighed, was followed by the completion of the Standardized Assessment of Concussion (SAC) to test mental status, Automated Neuropsychological Assessment Metrics (ANAM) to determine neuropsychological performance, the NeuroCom Sensory Organization Test (SOT) and Balance Error Scoring System (BESS) to test postural stability, and the Graded Symptom Checklist (GSC) to assess severity of symptoms (Patel et al., 2007).

Research participants completed the same battery of tests while in a state of euhydration (Patel et al., 2007). Fifteen hours before testing in the euhydrated condition, participants provided a 2- to 4-ounce urine sample and were weighed (Patel et al., 2007). The only restriction imposed during the euhydration trial was to avoid alcohol and caffeine consumption (Patel et al., 2007). Prior to testing, following 15 hours of normal hydration, participants provided their second urine sample and were weighed (Patel et al., 2007).

Patel et al. (2007) randomized the order of all tests. In completion of the GSC, participants self-reported the presence of 18 concussion-related symptoms along with the severity of the symptoms. The symptoms were categorized into four clusters: cognition, somatic, emotional, and sleep problems (Patel et al., 2007). The SAC was administered (Patel et al., 2007). The SAC tested the domains of orientation, immediate memory, concentration, and delayed recall (Patel et al., 2007). Researchers then assessed reaction time, mental processing speed, mental efficiency, visual memory, working memory, and subjective fatigue using a computerized neuropsychological assessment called ANAM (Patel et al., 2007). Following completion of the ANAM, subjects' postural stability was assessed using the BESS and the NeuroCom SOT (Patel et al., 2007).

Patel et al. (2007) analyzed the data using SPSS 12.0. Paired-samples *t* tests were carried out on the collected data (Patel et al., 2007). In order to determine any significant differences between the euhydrated and dehydrated conditions, individual symptoms, total symptoms score, and number of symptoms reported were analyzed (Patel et al., 2007).

Results of the GSC indicated a significantly higher total of symptom severity score in dehydration than euhydration (Patel et al., 2007). The total number of symptoms was also significantly higher in the dehydrated group than in the euhydrated group (Patel et al., 2007). The dehydration scores were worse, constituting a significant difference for the following symptoms: balance problems, dizziness, feeling slowed down, feeling like "you're in a fog," difficulty concentrating, difficulty remembering, fatigue/drowsiness, and headache (Patel et al., 2007). Comparison of the euhydration and dehydration conditions revealed no significant findings in the total ANAM composite scores, SAC score, SOT impairment, or significant impairment of the BESS total scores (Patel et al., 2007).

Discussion of the findings of Patel et al. (2007) offers evidence of hydration as an internal factor impacting cognitive function. Patel et al. (2007) stated, "the most commonly reported symptoms were those that could be categorized into the cognitive and somatic clusters" and "dehydration affects cognitive symptoms more than any other cluster" (p. 72).

Kempton et al. (2009) conducted research aimed at examining the physical changes that occur in the brain as a result of dehydration. Their findings offer evidence of a link between hydration and cognition (Kempton et al., 2009).

Kempton et al. (2009) utilized functional magnetic resonance imaging (fMRI) in order to assess the effects of dehydration on brain structure. Kempton et al. studied 10 fit and healthy adolescents recruited from schools and colleges in Chichester, UK. These participants had a mean age of 16.81 years (Kempton et al., 2009).

Individuals participating in the research study were instructed to consume 500 ml of water the night before reporting to the laboratory (Kempton et al., 2009). When the research participants arrived, they provided urine samples which were used to determine urine osmolality (Uosm; Kempton et al., 2009). Participants consumed an additional 500 ml of water 1 hour prior to engaging in a physical exercise protocol (Kempton et al., 2009). Study participants then practiced on the fMRI task in order to establish a baseline brain scan (Kempton et al., 2009). After establishing a baseline, they undertook an exercise protocol (Kempton et al., 2009).

The exercise protocol utilized by Kempton et al. (2009) consisted of four phases. Phase 1 involved 50 minutes of cycling on an ergometer; Phase 2 was a 10-minute seated recovery; Phase 3 was an additional 20 minutes of cycling, followed by Phase 4, which was a further 10-minute seated recovery. After the completion of the exercise protocol, participants completed a postdehydration fMRI scan (Kempton et al., 2009). During this scan, they were engaged in the Tower of London (ToL) task (Kempton et al., 2009). The ToL task was chosen in order to activate the functionally relevant cognitive demand network (Kempton et al., 2009). The task imposed a "planning" condition which researchers indicated tapped brain executive function (Kempton et al., 2009). "Planning" trials required participants to indicate the number of moves required to rearrange one array of circles so it matches another array (Kempton et al., 2009). The ToL also involved a "subtracting" condition (Kempton et al., 2009). "Subtracting" trials required those completing the task to calculate the difference in the number of objects between arrays (Kempton et al., 2009). The "subtracting" condition was used as a control. Both "planning" and "subtracting" were matched with visual-motor responses to questions (Kempton et al., 2009).

In each fMRI session, images of the whole head depicting the blood-oxygen-level-dependent (BOLD) response were acquired (Kempton et al., 2009). The fMRI BOLD response was measured at the onset and duration of "planning" and "subtracting" trials of the ToL task (Kempton et al., 2009). Researchers defined onset as stimulus appearance and duration was defined as the time from onset to response (button press)

(Kempton et al., 2009). Kempton et al. (2009) completed analysis of the fMRI BOLD data using SPM5. Analysis utilized a region-of-interest approach in order to determine how dehydration specifically affects task-related regions of activation (Kempton et al., 2009). Uosm values were compared across the conditions of dehydration and control using paired-samples *t*-test in SPSS 15.0 (Kempton et al., 2009). Correlations between measures within the study were assessed with Pearson's *r* conducted in SPSS 15.0 (Kempton et al., 2009).

Kempton et al., (2009) found BOLD response in the area of the brain mediating executive functions increased following dehydration; however, no effect of dehydration on cognitive performance was observed (Kempton et al., 2009). Discussion of this by the researchers indicates that participants exerted a higher level of neural activity during dehydration in order to match the performance level achieved during hydration (Kempton et al., 2009). Although dehydration did not significantly affect task performance, the findings of Kempton et al. indicated that dehydration negatively impacts brain functions linked to cognitive processes in adolescents.

Gopinathan, Pichan, and Sharma (1988) offered an example of early research aimed specifically at determining the relationship between dehydration and cognition. The focus of this study was a group of 11 healthy young soldiers aged 20-25 years from the tropical regions of India (Gopinathan et al., 1988). The soldiers were dehydrated using a climatic chamber while water restriction was imposed (Gopinathan et al., 1988). Frequent monitoring of subject body weight allowed Gopinathan et al. to target different degrees of body dehydration. Participants completed psychological tests prior to beginning the trial, after dehydration, and at the end of the rest/recovery period (Gopinathan et al., 1988). The tests administered were word recognition, serial addition, and trail-making (Gopinathan et al., 1988).

Results produced by the word recognition test showed short-term memory progressively deteriorated as the degree of dehydration increased (Gopinathan et al., 1988). When participants reached a dehydration level corresponding with a water loss of 2% body weight, results became highly significant (Gopinathan et al., 1988). Similar results were seen in the serial addition test and the trail-making test (Gopinathan et al., 1988). Both showed an inverse relationship between cognitive performance and dehydration (Gopinathan et al., 1988).

Bar-David et al. (2005) explored the effects of voluntary dehydration on cognitive functions of elementary school children. Findings of Bar-David et al. (2005) led researchers to conclude "voluntary dehydration is a common phenomenon in school-aged children and adversely affects cognitive functions" (p. 1667). This conclusion was reached via a group comparison of urine samples and cognitive test scores among 58 students (Bar-David et al., 2005). Bar-David et al. (2005) selected participants living in a desert region of southern Israel. They were in the sixth grade at two different elementary schools and aged 10.1 to 12.4 years. The final study group was comprised of 51 students, 19 boys and 32 girls (Bar-David et al., 2005).

Pretrained medical students collected urine samples from the participants at 8:00 a.m. and at 1:00 p.m. on the same day (Bar-David et al., 2005). Bar-David et al. (2005) employed a Fiske Osmometer to measure Uosm which was used to identify hydration levels. Following urine collection, pretrained psychology students administered five cognitive tests to the entire class (Bar-David et al., 2005). The test battery included Hidden Figures, Auditory Number Span, Making Groups, and Number Addition tests which were adapted from the Ekstrom et al. Kit of Factor-Referenced Cognitive Tests and a test of Verbal Analogies adapted from a Hebrew test battery (Bar-David et al., 2005). Bar-David et al. (2005) performed MANCOVA, ANOVA, contingency, and correlation analysis on the resulting data.

Bar-David et al. (2005) divided students into two distinct groups. Researchers applied the standard of Katz et al. which defines an Uosm level of 800 mosm/kg $H_2O$ or more as dehydrated (Bar-David et al., 2005). Nineteen participants had an Uosm of less than 800 mosm/kg $H_2O$ and were placed in the hydrated group (Bar-David et al., 2005). Thirty-two participants had an Uosm level that was greater than 800 mosm/kg $H_2O$ and were placed in the dehydrated group (Bar-David et al., 2005). Analysis indicated afternoon Uosm levels were highly related to morning Uosm levels ($r = 0.67$, $p = 0.000$), supporting Bar-David et al.'s (2005) assertion that many school-aged children are commonly in a state of voluntary dehydration.

The findings of Bar-David et al. (2005) were expanded to evaluate the relationship between voluntary dehydration and the cognitive function of the study group. Researchers found an overall positive performance trend in four of five of the tests in favor of the hydrated group (Bar-David et al., 2005). Data further indicate the largest discrepancy between the two groups could be seen in short-term memory tasks. Bar-David et al. (2005) stated,

> performance of mental tasks with a high cognitive load, such as continuous rehearsal of digits for an immediate recall, tends to deteriorate as a function of being in a voluntary dehydrated state during the school day. Mental tasks that are based on automated skills, perceptual or procedural, long-term memory retrieval, and controlled thinking have lower cognitive demands, and are therefore less affected by chronic dehydration. (p. 1672)

Edmonds and Burford (2009) found similar results in their attempt to examine the effect of drinking water on cognition in children. Specifically, Edmonds and Burford sought to determine if drinking water could aid cognition under normal conditions. Fifty-eight children participated in the research project (Edmonds & Burford, 2009). Among the 26 boys and 32 girls, the mean age was 8 years 7 months (Edmonds & Burford, 2009). Students were randomly assigned to two groups: the additional water group, which contained 28 children; or the no additional water group, which contained 30 children (Edmonds & Burford, 2009).

Children assigned to the additional water group were provided an individual drinking bottle with 250 ml of water and were encouraged to drink as much as they could (Edmonds & Burford, 2009). Twenty minutes after water consumption, students completed a battery of tests (Edmonds & Burford, 2009). The no additional water group and the additional water group were tested separately but both groups completed the same tasks in the same order (Edmonds & Burford, 2009). Edmonds and Burford (2009) sequenced the tasks as follows: thirst scale, story memory, letter cancellation, spot the difference, and visual-motor tracking.

Researchers also weighed student water bottles to determine the amount of water consumed by each participant (Edmonds & Burford, 2009). Data indicate the additional water group drank a mean amount of 211.7 ml (SD = 62.97 ml; Edmonds & Burford, 2009). This compared with results from student thirst ratings "revealed that children in the additional water group reported that they felt significantly less thirsty than children in the additional water group" (Edmonds & Burford, 2009, p. 778). Edmonds and Burford (2009) also found that children in the additional water group scored higher on the letter cancellation task and the spot the difference tasks. This led the researchers to conclude that even children in a state of mild dehydration can benefit from drinking more water to improve their cognitive performance (Edmonds & Burford, 2009).

Edmonds and Jeffes (2009) expanded upon the research of Edmonds and Burford (2009) by utilizing a pretest and posttest with a sample of 23 elementary students. Participants had a mean age of 7 years and 3 months (Edmonds & Jeffes, 2009). Students were randomly assigned to two separate groups (Edmonds & Jeffes, 2009). One group was given 500 ml of water and told to drink as much as they would like (Edmonds & Jeffes, 2009). The control group was not given any additional water (Edmonds & Jeffes, 2009).

Both groups participated in a pretest (Edmonds & Jeffes, 2009). The tasks included two rating scales (Edmonds & Jeffes, 2009). One scale measured subjective thirst. The second scale measured subjective ratings of mood (Edmonds & Jeffes, 2009). Following the rating scales, students completed several cognitive tasks (Edmonds & Jeffes, 2009). These tasks included a measure of visual attention, visual memory, visual search, and visuomotor performance (Edmonds & Jeffes, 2009).

Approximately 40 minutes after the pretest, Edmonds and Jeffes (2009) removed the no water group from the classroom. Children in the additional water group were given 500 ml of water and instructed to drink as much as they wanted (Edmonds & Jeffes, 2009). After a period of roughly 45 minutes, students engaged in the posttest (Edmonds & Jeffes, 2009).

Data indicate students in the additional water group had a greater decrease in feelings of thirst when compared to the no water group (Edmonds & Jeffes, 2009). Researchers found no significant difference in happiness, as measured by the mood scale, when the two groups were compared (Edmonds & Jeffes, 2009). Additionally, Edmonds and Jeffes (2009) found improvements in scores of visual attention were restricted to children in the water group, $t$ (10) = 4.22, $p$ = 0.002. Tests of visual memory were not affected by the consumption of water (Edmonds & Jeffes, 2009). Edmonds and Jeffes asserted this is due to the task being too easy due to pre and posttest scores being close to ceiling in both groups. Researchers did find a statistically significant improvement on visual search in the water group $t$ (10) = 2.81, $p$ = 0.019 (Edmonds & Jeffes, 2009); however, no improvement was seen in the control group, $t$ (11) = 1.90, $p$ = 0.085 (Edmonds & Jeffes, 2009). Finally, the study found no significant change in visuomotor performance in either group (Edmonds & Jeffes, 2009).

Edmonds and Jeffes (2009) asserted the data suggest that different aspects of attention may be selectively affected by water consumption. They further concluded that even under conditions of mild dehydration, having a drink of water can improve a child's cognitive performance (Edmonds & Jeffes, 2009).

Recently, Fadda et al. (2012) investigated the benefits of drinking supplementary water during the school day on students aged 9-11 years. Findings of this intervention study found dehydration had a negative impact on short-term memory and vigor (Fadda et al., 2012). Results also emphasized the importance of school policies in influencing student access to water (Fadda et al., 2012).

Fadda et al. (2012) studied 168 school children living in a hot Southern European climate. Participant ages ranged from 9.1 to 10.9 years (Fadda et al., 2012). Students were randomly placed into one of two groups (Fadda et al., 2012). One group received water supplementation (Fadda et al., 2012). The second group served as a control, receiving no additional water (Fadda et al., 2012). The children in the intervention group were given 0.5 L of water to consume prior to 12:00 p.m. and a second bottle of 0.5 L of water to consume prior to 3:00 p.m. (Fadda et al., 2012). Students were allowed to keep water at their desk, and teachers were given instructions to encourage students to drink throughout the day (Fadda et al., 2012). The water bottles were collected at 12:00 p.m. and 3:00 p.m., allowing researchers to document the amount of water consumed (Fadda et al., 2012).

In order to determine the hydration status of those participating in the study, participants submitted a urine sample at the beginning and the end of the school day (Fadda et al., 2012). Student hydration levels were determined via Uosm (Fadda et al., 2012).

Participant cognitive abilities were assessed using a pretest/posttest model (Fadda et al., 2012). Tests were administered in the morning and the afternoon, following urine sampling (Fadda et al., 2012). Cognitive testing involved Deux de Barrage to measure selective attention, number additions to measure perceptual speed and automaticity, auditory number span to measure short-term memory, verbal analogies to assess ability to determine relationship, and visual spatial abilities to measure the ability to mentally manipulate two dimensional figures (Fadda et al., 2012). Researchers adapted the test from Italian test batteries and from the Group Embedded Figure Test (Fadda et al., 2012).

Following cognitive testing, student transitory subjective states were measured (Fadda et al., 2012). Students completed three self-evaluation scales to evaluate vigor, fatigue, and confusion (Fadda et al., 2012). Data were also collected to evaluate participant nutrition habits (Fadda et al., 2012). This was done using a self-reporting survey completed at the beginning of the day and monitoring food consumption throughout the day (Fadda et al., 2012).

Fadda et al. (2012) analyzed data to determine whether the percentage of hydrated and dehydrated children changed from the morning as a result of the intervention. Morning urine samples indicated the majority of the children in the sample were in a condition of voluntary dehydration at the beginning of the school day (Fadda et al., 2012). Researchers defined a state of dehydration as having a Uosm above 800 mOsm/kg $H_2O$. With a mean Uosm level of 1287.3 (SD = 266.85), 84% of the participants were dehydrated at the beginning of the school day (Fadda et al., 2012). Data indicate a significant decrease in the percentage of dehydrated children in the intervention group (Fadda et al., 2012).

The relationship between hydration levels and cognitive performance was investigated by analyzing the change in cognitive pretest and posttest scores (Fadda et al., 2012). The changes in scores from the morning to the afternoon were correlated with each cognitive test (selective attention, perceptual speed of applying arithmetic operations, short-term memory, verbal analogies, and visual-spatial abilities; Fadda et al., 2012). This analysis produced results indicating a negative relationship between Uosm levels and short-term memory ($r = -0.56$; $p = 0.043$; Fadda et al., 2012). High Uosm levels signal a high level of dehydration which resulted in a decrease in short-term memory (Fadda et al., 2012).

Findings were also examined to evaluate the relationship between hydration levels and transitory subjective states (Fadda et al., 2012). A negative relationship was also found between Uosm levels and vigor ($r = -0.56$; $p = 0.043$) (Fadda et al., 2012). An increase in participant levels of dehydration, as measured by Uosm levels, correlated to a decrease in feelings of vigor (Fadda et al., 2012).

Fadda et al. (2012) found negative correlations between dehydration and cognitive performance and dehydration and feelings of vigor. Researchers also found the habitual water intake at school represented by the control group, in which the access to water was limited, was characterized by a tendency of children not to drink water during the school day (Fadda et al., 2012). This, combined with data pointing to the majority of children in their sample beginning the school day in a condition of voluntary dehydration, prompted Fadda to stress the importance of implementing drinking policies to increase student access to water.

**Why are School-Aged Children at Greater Risk of Dehydration?**

The Food and Nutrition Board of the Institute of Medicine (2005) provided dietary reference values for the intake of water. The general recommendation for women is approximately 2.7 liters of total water each day, and men are recommended to consume approximately 3.7 liters of total water (Institute of Medicine, 2005). Specifically, the Institute of Medicine (2005) indicates an adequate intake of 2.1 liters of total water in females aged 9-13 years and 2.3 liters in females aged 14-18 years. The adequate intake for adolescent males is 2.4 liters for ages 9-13 and 3.3 liters for males aged 14-18 years (Institute of Medicine, 2005).

The Dortmund Nutritional and Anthropometric Longitudinally Designed Study (DONALD) is a cross-sectional analysis of data using 24-hour urine samples to determine the hydration status and 3-day weighted food records to describe the dietary profiles of 717 German children (Stahl, Kroke, Bolzenius, & Manz, 2007). The DONALD study reports data indicating children between ages 4 and 10 do not consume the adequate intake recommended by the Institute of Medicine (2005; Stahl et al., 2007). Total water intake for boys aged 4.0-6.99 years in the DONALD study was 1.31 liters per day (Stahl et al., 2007). Boys aged 7.0-10.99 years only consumed 1.647 liters per day (Stahl et al., 2007). Similarly, girls did not achieve an adequate intake of water (Stahl et al., 2007). Girls aged 4.0-6.99 years consumed only 1.209 liters per day (Stahl et al., 2007). Girls aged 7.0-10.99 years consumed 1.483 liters per day (Stahl et al., 2007).

The National Youth Physical Activity and Nutrition Study completed in 2010 also found a prevalence of low water intake among adolescents (Park, Blanck, Sherry, Brener, & O'Toole, 2012). The survey results reported 54% of adolescents from a nationally representative sample of 11,049 high school students drank less than three glasses of water a day (Park et al., 2012).

An early study of Florida youth found corresponding results (Park et al., 2012). The Florida Youth Physical Activity and Nutrition Survey conducted in 2007 used a representative sample of 4,292 students in Grades 6-8 in Florida public middle schools (Park et al., 2012). Results of this survey indicated approximately 64% of respondents drank less than three glasses of water per day (Park et al., 2012).

Researchers have identified several reasons to account for an increased risk of childhood dehydration. D'Anci, Constant, and Rosenberg (2006) stated, "children may be more susceptible to fluid losses and are, therefore, at greater risk for dehydration than are adults" (p. 457). Several physical factors increase the potential of inadequate hydration in youth (D'Anci et al., 2006). Children have a high proportion of body surface area to body mass (Bar-David, Urkin, Dandau, Bar-David, & Pilpel, 2009; Benton, 2011; D'Anci et al., 2006). This greater surface area of skin allows for increased water loss through evaporation (Coe & Williams, 2011). The young also have a higher respiratory rate than adults, causing a larger amount of water loss through the lungs (Coe & Williams, 2011). Children tend to be more active than adults and less likely to limit activity in the hot hours of the day (Bar-David et al., 2005; Benton, 2011). This results in the need for the body to enable cooling mechanisms which result in loss of water (D'Anci et al., 2006). Individually and combined, these factors result in substantial fluid losses increase the likelihood of dehydration in children (Bar-David et al., 2009; Benton, 2011; D'Anci et al., 2006).

Social and developmental factors also heighten the potential for fluid deficits in the young (Coe & Williams, 2011). Children are often dependent upon others for the provision of fluid (Coe & Williams, 2011). Caregivers provide children with food and fluids (Coe & Williams, 2011); therefore, the child must rely on adults to recognize individual cues and behaviors and adjust food and beverage offerings to meet their dietary needs (Coe & Williams, 2011). If the signs of dehydration are overlooked, fluid intake may be inadequate (Coe & Williams, 2011).

Further heightening the susceptibility for dehydration in children is their underdeveloped thirst mechanism (Benton, 2011; Coe & Williams, 2011; D'Anci et al., 2006). The thirst signal is only triggered once a 1-2% loss of body mass of fluid loss has been reached (Kaushik, Mullee, Bryant, & Hill, 2007). A study conducted by Kaushik et al. (2007) sought to determine fluid intake and access to drinking water in elementary classrooms. The study involved 298 year-2 and year-5 students (Kaushik et al., 2007). Researchers recorded student fluid intake and toilet visits (Kaushik et al., 2007). The data indicate 46.5% of students who were given free access to water did not meet their expected fluid intake (Kaushik et al., 2007).

Numerous studies have also found that thirst is an unreliable guide for proper hydration (Bar-David et al., 2005; Shirreffs et al., 2004). Shirreffs et al. (2004) found that although subjects were dehydrated to a very high degree, when given opportunity to drink freely, they only replaced approximately 37% of their body-mass losses and remained in a state of moderate dehydration. Bar-David et al. (2005) found the spontaneous water consumption of elementary school children was not enough to achieve euhydration. The increased risk of dehydration in children heightens the need for student access to water in school.

**Student Access to Water**

Kaushik et al. (2007) examined the relationship between access to drinking water and fluid intake. Although the results of this study confirmed previous findings that most children had inadequate fluid intake, the data indicate free access to drinking water in class was associated with improved total fluid intake (Kaushik et al., 2007).

Kaushik et al. (2007) recorded the total fluid intake and toilet visits of 298 schoolchildren during one school day. Data were collected for students within three categories: free access, limited access, and prohibited access (Kaushik et al., 2007). Students in free access classrooms were permitted water at their desks; limited access students had water available within the classroom upon request; and prohibited access students were permitted no water in the classroom (Kaushik et al., 2007). The access groups were compared using a one-way analysis of variance. Results show a significant association between water access and total fluid consumption (Kaushik et al., 2007). The findings of Kaushik et al. strengthened the case for better access to drinking water for students.

HHFKA requires schools participating in the National School Lunch Program to make potable water available to children during the meal service without restriction (U.S. Government Publishing Office, 2010). A 2012 study conducted by Patel et al. sought to describe student access to water and student water intake in school food service areas. Patel et al. (2012) sampled 24 California Bay Area public schools. Data were collected regarding school drinking water quality, source, clarity, temperature, cleanliness, and flow strength (Patel et al., 2012). Observers also assessed student intake of water in food service areas by counting the number of students who drank free drinking water during all lunch periods during the observation day (Patel et al., 2012). Findings of the data collected indicate, at schools with free water in food service areas, of the 11,226 observed, only 4% consumed water at lunch (Patel et al., 2012). Patel et al. (2012) concluded it is necessary for schools to develop appealing water delivery systems to increase student water intake at mealtimes.

Kenney et al. (2016) conducted a study to objectively measure data and investigate the extent to which schools provided drinking water access that met state and federal policies. Kenney et al. observed 59 middle and high schools in Massachusetts. The type, location, and working condition of all water access points throughout each school was documented using a standard protocol (Kenney et al., 2016). Additionally, food service directors completed surveys reporting water access in the cafeteria. Kenney et al. found less than half of the participating schools met HHFKA requirements for water access during lunch. Kenney et al. concluded, “access to clean, functioning free drinking water sources in schools may be limited, and compliance with state and federal policies to establish free drinking water access is low in many schools” (p. 28). Kenny et al. further stated, “additional training and technical assistance for school personnel may be needed to improve access to drinking water and improve compliance with federal and state policy to prevent inadequate hydration and promote the consumption of healthy beverages” (p. 28).

**Summary**

In this review of the literature, the researcher examined external and internal factors that may impact student learning and cognition. The studies presented suggested the external factors of acoustics, background noise, lighting, ventilation, air quality, and temperature impact student learning. In addition, further literature was presented demonstrating the impact the internal factors of shelter, sleep, food insecurity, and diet quality have on cognition. Finally, detailed findings related to hydration and cognition and student access to water in school were provided.

The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA through a cross-site case study of middle schools of a southeastern state school district. The study examined the following research questions: How are schools providing free access to water for students during meal service times; to what extent are district policies aligned with daily practice at the school level; and what is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers?

Chapter 3 describes the methodology that was used in this study. The instrumentation and interview protocol and a summary of the steps and procedures used for data collection and analysis are discussed.

# Chapter 3: Methodology

The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA. The researcher used a cross-site case study of middle schools of a southeastern state school district. This chapter provides a summary of the methodology and outlines the steps of the research design. This is followed by a description of the methods that were used for data analysis and the steps that were taken to validate the findings.

## Qualitative Research

The goal of qualitative research is to investigate a phenomenon within its real-life context (McGloin, 2008; Range, 2016). Additionally, according to Corcoran, Walker, and Wals (2007), the purpose of case study research is, “a study of practice, with practitioners’ actions and the theories that underpin such actions being studied” (p. 47). The researcher used cross-site case study methodology to identify current practices and the level of knowledge related to the potable water subsection of HHFKA.

In order to draw a clear picture of an individual, program, or situation, case studies may rely on multiple sources of information (Range, 2016). Among these are observations, interviews, anecdotes, vignettes, direct quotes, documents, and reports (Range, 2016). The current study employed direct observations and interviews to outline the reality of practice within school food service areas. According to Pegram (2000), the use of multiple data collection tools provides a rich picture of the single unit.

Case study has been adopted as a valid methodology in a variety of professions, including education (McGloin, 2008). The intent of qualitative research is not to make generalizations outside those under study (Creswell, 2014); however, Corcoran et al. (2007) stated case study research can be used to transform and improve practice.

Therefore, a qualitative research design was best suited for the current study.

**Research Design**

The researcher examined the implementation of the potable water subsection of HHFKA through the lens of Lewin's Theory of Change. The following research questions were utilized: (1) How are schools providing free access to water for students during meal service times; (2) To what extent are district policies aligned with daily practice at the school level; and (3) What is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers? A multi-site case study design was used to help answer these questions.

Creswell (2014) defined case study as "a qualitative design in which the researcher explores, in depth, a program, event, activity, process, or one or more individuals . . . and [they] collect detailed information using a variety of data collection procedures over a sustained period of time" (p. 14). The study explored a single case, the implementation of HHFKA, across multiple sites. The study explored the practices related to providing students access to free, potable drinking water in three separate food service areas during meal service.

The researcher included multiple sources of qualitative information by employing observations and interviews. Data collected were thoroughly analyzed by the researcher and aggregated into a small number of themes. Creswell (2014) outlined a seven-step method for data analysis in qualitative research. These steps were applied by the researcher in the study.

**The Bounding of the Study**

Qualitative case study design requires the establishment of boundaries (Baxter &

Jack, 2008). Boundaries can serve to contextualize the study as well as limit the breadth and depth of the research (Baxter & Jack, 2008). According to Baxter and Jack (2008), binding a study prevents the researcher from exploring a question that is too broad or has too many objectives and allows the inquiry to remain reasonable in scope. The researcher bound the study by specifying the setting, participants, events, processes, ethical considerations, data collection strategies and data analysis procedures (Creswell, 2014).

**Setting.** Yin (2013) stated a case study is "an in-depth inquiry into a specific and complex phenomenon ('the case'), set within its real life context" (p. 321). Therefore, the proposed study was conducted in the school food service areas of three middle schools. The schools are all in a public school district located in in a southeastern state school district. Middle schools were selected because their student population falls into the adolescent age range. Research has found a prevalence of low water intake among adolescents (Park et al., 2012). The student population of each site ranged from 575 to 836 students. The schools had between 29-100% of their student population receiving free or reduced lunch. All three schools observed a traditional school calendar with traditional schedules.

**Participants.** Qualitative research typically relies on a small number of participants and sites (Creswell, 2014). No definitive rule specifies an exact number of participants; however, Creswell (2014) stated the sample size is largely determined by the qualitative design being used and recommended a sample size of four or five sites when using case study methodology. Participants or sites used in qualitative research are to be purposefully selected, which means they are chosen because they will best help the researcher understand the problem and the research questions (Creswell, 2014). The aim of the current study was to determine the level of implementation of the free, potable water subsection of HHFKA. The legislation states students are to be provided access to free, potable water during meal service times (HHFKA). Those primarily responsible for the execution of HHFKA are the district food service director and school food service managers; therefore, the district food service director and school food service managers were interviewed. School food service managers and students were also observed during meal service times to identify daily practice.

**Events.** Using case study methodology, the current study examined the manner and the extent to which students have access to free, potable water during meal service in school meal service areas. Additionally, the study examined the level of knowledge of food service managers regarding the policies impacting student access to water.

**Processes.** Determining the method through which food service managers were providing access to water was done through interview and direct observation. District policies were examined by interviewing the district food service director.

**Ethical considerations.** Ethical issues are inherent in any research design. Creswell (2014) provided an outline of major ethical concerns that should be considered and addressed in any study. This was used as a guide throughout the current study.

- Prior to conducting the study: Creswell (2014) provided a number of ethical issues that must be considered prior to conducting a study. Among these are examining professional association standards, seeking university approval on campus through an institutional review board (IRB), gaining local permission (Appendix A), and selecting a site without a vested interest in the outcome of the study (Creswell, 2014). Prior to beginning research, the current study was submitted to the IRB of Gardner Webb University for review. The researcher successfully completed required ethics training in human subject research through the Collaborative Institutional Training Initiative (CITI). Permission to conduct research was obtained from the local school district in which the study took place. The researcher served as an assistant principal in the selected school district; however, the researcher neither worked within any of the selected sites nor had any supervisory authority over those involved in the study.

- Beginning the study: Creswell (2014) identified disclosing the purpose of the study and obtaining consent forms without pressure as types of ethical issues to consider when beginning a study. The researcher addressed these by providing all participants with an informed consent (Appendix B). In addition to disclosing the purpose of the study, participants were informed of the procedures utilized to ensure anonymity, instrumentation, data reporting, and their right to discontinue participation. All participants signed an informed consent form as they chose to participate.
- Collecting data: When collecting data, Creswell (2014) stated the researcher should respect the site and disrupt as little as possible, make certain all participants receive the same treatment, avoid deceiving participants, and avoid collecting harmful information. These issues were managed through the use of an interview protocol (Appendix C). In order to respect participant time and limit disruptions, the researcher only completed observations and interviews on dates mutually agreed upon with the participants. Participants were informed of the purpose of the study through informed consent, prior to interviews, and at the conclusion of the interview. The researcher provided

food service managers with a copy of the observation protocol (Appendix D) prior to beginning the observations. A copy of the final research report was provided to the district food service director and school food service managers.

- Analyzing data: Ethical concerns when analyzing data include respect for the privacy and anonymity of participants and disclosure of the results (Creswell, 2014). To avoid compromising participant anonymity, interviewees and sites were only identified through their composite profiles. Furthermore, both positive and negative findings were reported.
- Reporting, sharing, and storing data: Creswell (2014) suggested researchers employ strategies of validation to ensure an accurate account of the information. The researcher used two strategies to ensure validity. The various data sources were triangulated to identify emerging patterns or trends. Additionally, a report of the major findings was provided to participants to review for accuracy and provide comment. The researcher has stored all raw data in a locked file cabinet. This will be kept for a minimum of 5 years. After this time, the raw data will be discarded.

**Data collection strategies.** According to Creswell (2014), "in many qualitative studies, inquirers collect multiple forms of data and spend considerable time in the natural setting gathering information" (p. 189). Two types of data collection were utilized in the current study (Creswell, 2014). The researcher conducted observations and interviews to examine the implementation of the free, potable water subsection of HHFKA.

- Observations: The researcher served as a complete observer without participating (Creswell, 2014). This allowed the researcher to record information as it occurred (Creswell, 2014). Observations were conducted in the month of March using a semi-structured format. See Appendix C for the outline used to gather field notes during observations of meal service practices relating to the provision of free access to potable water in food service areas.

- Interviews: Creswell (2014) indicated interviews are used in qualitative research in order "to elicit views and opinions of the participants" (p. 190). A further advantage is that interviews can provide historical information which may not be gleaned from observation (Creswell, 2014). The current study used interviews to determine the food service director's and food service managers' level of knowledge surrounding the potable water subsection of HHFKA. Interviews were conducted in the month of March using a face-to-face, one-on-one format. See Appendix B for the protocol that was used to guide the interviews.

**Data analysis procedures.** In qualitative research, the data collection and analysis occurs concurrently (Baxter & Jack, 2008). According to Creswell (2014), while interviews are occurring, the researcher may be analyzing an earlier interview, writing notes, and organizing the final report. It is important to return to the research questions during the data analysis phase in order to define the scope of the data to be reported and to build confidence in the findings (Baxter & Jack, 2008).

Creswell (2014) provided a number of steps that can be used to guide the data analysis process. These steps were followed in the proposed study.

- Organizing and preparing data for analysis: This phase of data analysis involves transcribing interviews, typing field notes, and sorting and arranging data (Creswell, 2014). In the current study, the researcher recorded all interviews and transcribed them following the interview. All handwritten field notes were typed.

- Read through all data: Reading through the data "provides a general sense of the information and an opportunity to reflect on its overall meaning" (Creswell, 2014, p. 197). The researcher reviewed all data collected and recorded general thoughts about the data during this stage.
- Start coding all the data: Coding is the process of chunking the data and creating a word or phrase to represent a category (Creswell, 2014). There are eight steps typically used in forming codes (Creswell, 2014). Tesch's (1990) Eight Steps in the Coding Process were used in this phase of data analysis. The researcher read all transcriptions carefully. One document was used to begin identifying underlying themes. A list of emerging topics was clustered. The topics were abbreviated as codes, and the codes were written next to the appropriate segments of text. Categories that related to each other were grouped. The data belonging to each category were assembled for preliminary analysis. A traditional approach was used during coding. The codes were allowed to emerge during the data analysis phase (Creswell, 2014). The data were aggregated in order to understand the overall case (Baxter & Jack, 2008).
- Generate a description of the setting, categories, and themes. The coding process is used to generate a description of the setting, people, places, or events (Creswell, 2014). In the current study, the researcher generated a small number of themes. Based on the model presented by Creswell (2014), the researcher examined the themes for each individual site and then analyzed

them across all three sites.

- Interpretation of the findings. Qualitative researchers interpret their data by identifying the lessons that can be learned from the results (Creswell, 2014). According to Baxter and Jack (2008), "addressing the propositions ensure that the report remains focused and deals with the research question" (p. 555). The researcher interpreted the findings by attempting to answer the research questions and comparing the findings to relevant published literature.

**Role of the researcher.** The researcher is the primary vehicle for data collection and analysis in qualitative research (Lichtman, 2013). "All information is filtered through the researcher's eyes and ears and is influenced by his or her experiences, knowledge, skill, and background" (Lichtman, 2013, p. 1139). It is necessary for the qualitative researcher to identify personal values, assumptions, and biases (Creswell, 2014).

**Subjectivity statement.** I have served as a teacher and assistant principal in the public school system for 15 years. During this time, I have worked with school sports teams as an athletic trainer and have spent a great deal of time in school cafeterias during meal service. In order to maintain transparency, I will explain how these experiences have impacted my personal beliefs and biases.

As a young teacher, I served as a high school athletic trainer in an at-risk school. I supervised many team practices and worked with coaches and parents to prevent and address student injury. Friday night football would bring numerous athletes suffering from fatigue and cramps. I began to notice the students most often side-lined were those from low-income homes. When questioned, often those students told of diets that were largely supplemented by the school breakfast and lunch program and very little else.

This demonstrated to me the importance of proper nutrition for young student athletes in addition to the major role hydration played in physical fitness.

I later became a middle school assistant principal in a Title 1 school. I continued to see the same pattern of poor diets and reliance on school nutrition services to meet student dietary needs. It was during this time that I began my doctoral studies. As I was researching the adolescent brain, I happened across an article which speculated office referrals in middle school often increase during the second part of the day because students are dehydrated. As an administrator in the trenches of the middle school mayhem, I was eager to seize upon anything that would help with student behavior and academic achievement. I began to dig deeper into the relationship between hydration and adolescent brain function. I paid more attention to what students consumed throughout the day. I asked questions about what they ate and what they drank. I began to notice the barriers adults often unknowingly create that prevent students from consuming fluids throughout the school day. I saw hundreds of cartons of milk and juice thrown into the trash unopened. I have read classroom policies that prohibit students from eating or drinking in class because teachers do not want students to be distracted. I have even seen students denied trips to the water fountain due to adult concern over misbehavior. I wondered if some negative student behavior was merely a symptom of poor policy planning and lack of understanding of what the brain needs for optimal function.

After I moved to elementary school, the discrepancies between what the brain needs and what educators provide still existed. Students would return to the school building from recess red-faced and dripping with sweat. It was common to hear “1-2-3 is enough for me” in order to limit the amount of time students took at the water fountain. While assisting students in the serving line, I have offered students water and been told by cafeteria workers, “we don’t do that.” Having researched the importance of brain hydration, I found these practices shocking.

When I have spoken to teachers and fellow administrators in the past, many are unaware of the positive impact on student achievement associated with good hydration. I personally believe that teachers, administrators, and policymakers are willing to provide better access to water when they are educated on the impact hydration has on student achievement and behavior. Although I have personal predispositions related to student access to water, I have taken steps to limit biases within my study. The section entitled Ethical Considerations in this chapter describes these steps in detail.

**Summary**

This chapter has outlined the methodology used in the current study. The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA. An outline of the methodology was followed by a description of the methods that were used for validating the findings and data analysis.

# Chapter 4: Data and Data Analysis

Nothing is more basic than water. It has repeatedly been identified as an important factor in learning (Bar-David et al., 2005; Edmonds & Burford, 2009; Edmonds & Jeffes, 2009); yet according to Kenney et al. (2016), "access to clean, functioning free drinking water sources in schools may be limited, and compliance with state and federal policies to establish free drinking water access is low in many schools" (p. 28).

The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA using a cross-site case study of middle schools in a southeastern state school district. This study utilized multiple sources of qualitative information by employing observations and interviews.

Data collected at each site will be depicted individually, followed by a cross-site analysis focused around the three research questions.

1. How are schools providing free access to water for students during meal service times?
2. To what extent are district policies aligned with daily practice at the school level?
3. What is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers?

## Participants

The aim of this study was to determine the level of implementation of the free, potable water subsection of HHFKA. The legislation states that students are to be provided access to free, potable water during meal service times (HHFKA). Those primarily responsible for the execution of HHFKA are the district food service director and school food service managers. Therefore, the district food service director and school food service managers of three middle schools were interviewed. School food service managers and students were also observed during meal service times to identify daily practice.

The district food service director was interviewed. Three middle school food service managers participated in interviews and allowed the researcher to observe food service practices during breakfast and lunch meal service. Board policy documents were obtained from the district website.

**Data Analysis**

All interviews with school food service managers were guided by the Interview Protocol (Appendix C), recorded, and transcribed following the interview. Recording equipment failed to work during the interview with the district food service director. The researcher used handwritten notes to create a transcript of the interview. This was provided to the district food service director to verify the accuracy of the transcript. Handwritten notes were taken using the Observation Protocol (Appendix D). All handwritten field notes were typed following the observations. School Board Policy 3530 subsection E governs school-based activities to promote wellness. A copy of this policy was downloaded from the district website and scanned to create a digital copy for reference.

Data analysis was guided by the general steps outlined by Creswell (2014). Tesch's (1990) Eight Steps in the Coding Process were used for coding the data. The researcher gathered all information from interviews, observations, and documents. All data were initially read through, and the researcher recorded general thoughts.

Underlying themes were developed during the second reading of the data. Additionally, segments of text were coded to indicate emerging topics. Similar topics were grouped together and analyzed.

**Interview with the District Food Service Director**

The district food service director was interviewed to determine the level of knowledge surrounding HHFKA and student hydration needs, determine local polices related to student access to water, and assess the level of training on the implementation of HHFKA and student hydration provided by the district to school food service managers. The district food service director and the researcher met at the district school nutrition office on a mutually agreed upon date. Throughout the interview, the researcher used the Interview Protocol (Appendix C) and took handwritten notes. The recording device failed to work during the interview. Following the interview, a transcript was created using recall and the notes taken. The transcript was provided to the district food service director for review. The district food service director reviewed the transcript and signed it verifying it was an accurate account of his interview responses.

The district food service director stated that HHFKA "empowered state agencies, in our case, NCDPI, to make potable water available to all students in dining rooms." He further commented, "There are additional guidelines that indicate this requirement can be met through water fountains in the vicinity of the dining room or through pitchers or portable coolers."

When asked how and where free, potable water was provided to students within the district during meal service, the district food service director indicated, "We make recommendations when schools are built that water fountains be in the area of the dining room. When that is not possible, we use pitchers or portable water coolers." It was also stated that the potable water subsection does not provide any funding to purchase items to dispense water such as coolers, pitchers, or cups.

The district food service director was asked, “If you wanted to provide more access to water for students, how would you initiate change?” He responded with, “It’s always about time and scheduling. Increasing opportunities for water may interrupt lunch and student schedules.”

The district food service director stated he had neither received any training on student hydration needs, nor is it provided to school food service managers; however, he did say, “We do review the requirements and the availability of water is looked for on inspections.”

In response to the question, “What are the local policies that impact your practice related to student access to water,” the district food service director stated that local policies were aligned with national policy; specifically stating, “Board policy 3530 on Student Wellness, subsection E, other school based acts to promote wellness, says drinking water will be available at all meal periods and throughout the school day.”

**Site 1**

**Interview with food service manager.** The food service manager of Site 1 was interviewed to determine the level of knowledge surrounding HHFKA and student hydration, determine local polices related to student access to water, and assess the level of training on the implementation of HHFKA provided by the district to school food service managers. Site 1 was a middle school with a student population of 575 (Table 1). All students at Site 1 receive free and reduced lunch through the Community Eligibility Program.

Table 1

*Relevant Study Site Data*

| Site | Student Population | Percentage of Students Receiving Free or Reduced Lunch |
|---|---|---|
| Site 1 | 575 | 100% |
| Site 2 | 714 | 65% |
| Site 3 | 836 | 29% |

The researcher arrived at Site 1 prior to the start of breakfast on a mutually agreed upon date. The food service manager greeted the researcher. It was decided the food service manager would participate in the interview at the conclusion of breakfast service. The researcher completed an observation of Site 1's food service practices. Following the observation, the food service manager and the researcher completed the interview. The interview was recorded and handwritten notes were taken using the Interview Protocol (Appendix C). The interview was transcribed later that same day.

In response to the first interview question, "Have you heard of the Healthy, Hunger-Free Kids Act," the school food service manager stated HHFKA ensures school cafeterias provide "the best nutritional meal that we can." She further stated,

> We try to make sure they get the right amount of vegetables and the right amount of fruit and the right amount of protein and make sure they're drinking so they can stay awake and . . . they can perform better in class.

When asked how Site 1 provided access to free, potable water, the school food service manager said, "We have the water cooler and we also have a fountain outside of here where the bathrooms are, a water fountain. They're allowed to get up and get it whenever they want." The school food service manager stated students had to ask a cafeteria worker for a cup in order to get water or bring their own water bottles to fill. It was also indicated that no additional funding was provided for cups.

The school food service manager was asked about the local policies that impact her daily practices related to student access to water. She said school food service managers

> have to make sure if there is not a water fountain outside the cafeteria that the kids can be accessible to, we have to make sure we have a water cooler inside the dining room so they can get water.

She also mentioned school cafeterias were held accountable for ensuring access to water through inspections conducted by their district coordinators.

The school food service manager stated they were provided training in student hydration needs. She cited the daily menu which indicates students can get both milk and juice with each meal but does not mention training specifically focused on student hydration.

When asked how to provide students more access to water, the school food service manager told the researcher there were no barriers to student access in the cafeteria; however, she did suggest teachers provide students water breaks during class.

**Observations.** Site 1 was observed in order to generate a picture of daily practice surrounding student access to water. The researcher arrived at Site 1 shortly before breakfast was served. After speaking briefly with the food service manager, the researcher found an unobtrusive location where student access to water could be observed. The same process was repeated during meal service at lunch. The researcher used the Observation Protocol (Appendix D) to take field notes during both meal service times. The handwritten field notes were typed following the observations.

A portable water cooler with water was situated on a cart near the end of the serving line in the cafeteria. There were no cups near the water cooler. Cashiers had Styrofoam cups at the registers. A water fountain was available for student use near the restrooms adjacent to the dining area. Several students brought their own water bottles into the cafeteria with them but did not use the portable water cooler to fill them. The researcher noted many students throwing away unopened milk or juice. During breakfast service, no students accessed the water cooler. At lunch, the water cooler was on a rolling cart that also held an urn of tea and cooler of ice for teachers. During lunch, one student requested a cup from a cafeteria worker and filled it with water from the cooler.

**Site 2**

**Interview food service manager.** The food service manager of Site 2 was interviewed to determine the level of knowledge surrounding HHFKA and student hydration, determine local polices related to student access to water, and assess the level of training on the implementation of HHFKA provided by the district to school food service managers. Site 2 (Table 1) has a student population of 714 with 65% receiving free or reduced lunch.

The researcher arrived at Site 2 prior to breakfast service. The food service manager and the researcher agreed to conduct the interview following breakfast. The interview was recorded, and handwritten notes were taken using the Interview Protocol (Appendix C). The interview was transcribed later that same day.

The first interview question asked the food service manager to tell the researcher what she knew about HHFKA. The food service manager of School B responded, "I don't really know anything about it." She also told the researcher no training had been provided on student hydration needs.

Site 2's food service manager indicated students were provided access to free, potable water via a water fountain in the cafeteria. She further stated cups were available for students, but they had to request them. The researcher added a follow-up question to determine if students were free to get up during mealtimes to get water. The food service manager replied, "I think so. It might depend on the teacher. They might have to ask."

The food service manager was asked, "What are the local policies that impact your practices related to student access to water?" She said, "We either have to have a water fountain in the cafeteria or we have to have a jug of water available daily with cups." In order to increase access to water, the food service manager suggested, "a jug of water with the cups in addition to maybe the water fountain."

**Observations.** Site 2 was observed in order to generate a picture of daily practice surrounding student access to water. The researcher arrived at Site 2 shortly before breakfast was served. After speaking with the food service manager, the researcher found a location allowing the view of the serving line and the water fountain in order to observe student access to water. The same process was repeated during meal service at lunch. The researcher used the Observation Protocol (Appendix D) to take field notes during breakfast and lunch. The handwritten field notes were typed following the observations.

A water fountain was stationed on one side of the cafeteria near the doors exiting into a corridor. During breakfast service, no students accessed the water fountain. It was observed that some students purchased only food items and did not get anything to drink. The researcher also noted some students throwing away unopened cartons of milk or juice.

During lunch, Styrofoam cups were placed at the registers. Bottled water was also available for purchase. Three students were observed taking sips out of the water fountain as their class passed by the water fountain. It was also noted that the water fountain was situated on a wall beside where students wait to enter the serving line. Students were observed leaning on the water fountain or playing in the water.

**Site 3**

**Interview with food service manager.** The food service manager of Site 3 was interviewed to determine the level of knowledge surrounding HHFKA and student hydration, determine local policies related to student access to water, and assess the level of training on the implementation of HHFKA provided by the district to food service managers. Site 3 (Table 1) has a student population of 836 with 29% receiving free or reduced lunch.

The researcher arrived at Site 3 prior to breakfast service on the agreed upon date. The food service manager greeted the researcher, and both agreed to complete the interview at the conclusion of breakfast. The interview was recorded, and handwritten notes were taken using the Interview Protocol (Appendix C). The interview was transcribed later that same day.

Site 3's food service manager was asked the first question on the Interview Protocol (Appendix C), "Have you heard of the Healthy, Hunger-Free Kids Act?" She stated, "I believe I've heard of it, but I don't know a lot about it."

The food service manager stated students were provided access to free, potable water during meal service through a portable water cooler with cups. She also said students could also use their own bottles or cups to get water from the cooler.

The food service manager could not name any local policies that impacted practices related to student access to water; however, she remarked, "We do have to make sure there's water available. Now if I had a water fountain in my cafeteria like a lot of them do, I would not have to have this [portable water cooler] out."

The researcher asked, "What type of training have you been provided on student hydration needs?" The food service manager simply said, "None." In order to increase student access to water, she suggested having bottled water out for student purchase during breakfast service in addition to lunch.

**Observations.** Site 3 was observed in order to generate a picture of daily practice surrounding student access to water. The researcher arrived at Site 3 shortly before breakfast was served. After speaking with the food service manager, the researcher found a location close to the portable water cooler. The same process was repeated during meal service at lunch. The researcher used the Observation Protocol (Appendix D) to take field notes during breakfast and lunch. The handwritten field notes were typed following the observations.

A water cooler was set up on a cart with cone cups. No students consumed water from the cooler during breakfast. At lunch, a cooler with ice and an urn of tea for the teachers were also on the cart with the water cooler. Three students accessed the water cooler during lunch. These students used the cooler to add water to their microwave food items. No students used the cooler for drinking water. Bottled water was available for purchase at lunch, and students were allowed to bring their own water bottles to school.

**Cross-Site Analysis of Data**

**Research Question 1. How are schools providing free access to water for students during meal service times?** The purpose of this research question was to determine the various ways schools were providing free access to water for students during meal service times. A memorandum from USDA provides guidance on the implementation of the potable water provision of HHFKA (Long, 2011). The memo stated there are a variety of ways for implementation (Long, 2011).

> Schools can offer water pitchers and cups on lunch tables, a water fountain, or a faucet that allows students to fill their own bottles or cups with drinking water. Whatever solution is chosen, the water must be available without restriction in the location where meals are served. (Long, 2011, p. 1)

Within the three study sites, several different methods were used to provide water to students. Ways in which students were provided access to water (Table 2) are as follows: a water fountain in the cafeteria, a portable water cooler (students must request a cup), a water fountain adjacent to the cafeteria, and a portable water cooler with cups.

Table 2

*Method for Providing Student Access to Water*

| Method | Site 1 | Site 2 | Site 3 |
|---|---|---|---|
| Water fountain in the cafeteria | | X | |
| Portable water cooler (student must request a cup) | X | | |
| Water fountain adjacent to the cafeteria | X | | |
| Portable water cooler with cups | | | X |

All study site food service managers stated that in addition to free access to water for students, they offered bottled water for purchase during meal service. According to Long (2011), water must be “available to children at no charge” (p. 1). Therefore, bottled water sold in the cafeteria did not qualify as free access for students.

**Barriers to water access.** Although, based on local and federal policy, all sites were meeting the requirement for providing students access to water, several potential barriers were observed in the participating sites. In all three cafeterias, the placement of the water source may have discouraged students from consuming supplemental water during meal service. Site 1 and Site 3 utilized portable water coolers. During mealtimes, the coolers were placed alongside an urn of tea and ice used by the teachers and staff. This may have given students the impression that the water cooler was meant for staff instead of students. At Site 2, the free water source was a drinking fountain situated on one side of the cafeteria. No students were observed crossing the cafeteria to get water. Additionally, students lined up beside the water fountain as they waited to enter the serving line, blocking access.

During meal service at all sites, students were not permitted to get up and move around the cafeteria at will. Although food service managers stated students could get up when they wanted to get water, this was contrary to observed behaviors. Students in all sites were required to ask permission to get up from their assigned tables. It was also noted that teachers would tell students to sit down if they were up without permission. Although procedures for student movement in the cafeteria are necessary to maintain order, this could have served as a possible deterrent to student access to water.

Site 1 and Site 2 offered cups for student use; however, students were required to request a cup from a cashier. This may have curbed student use of supplemental water, because students were afraid to ask for a cup or they did not know to ask at all. Additionally, lack of student knowledge of the policy allowing access to free, potable water may have prevented students from taking advantage of the water provided.

**Research Question 2. To what extent are district policies aligned with daily practice at the school level?** The purpose of this research question was to determine if district policies related to student access to water were upheld through daily practice. The district policy stated, "drinking water will be available at all meal periods and throughout the school day" (School Board Policy 3530 subsection E).

Practice in all three study sites supported district policy. The district food service director specified if there was not a water fountain in or adjacent to the cafeteria, the district utilized water pitchers or portable water coolers to provide student access to water. Each site had a water fountain within the cafeteria dining area or utilized portable water coolers. Site 1 exceeded district expectations by offering both a water fountain adjacent to the cafeteria and water from a portable water cooler.

When school food service managers were asked about the local or district policies that impacted their daily practice, all were familiar with the requirement. The food service manager at Site 1 indicated that district food service coordinators checked to see if water was available during their inspections.

**Research Question 3. What is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers?** The purpose of this research question was to determine how much the district food service director and school food service managers knew about the requirements of HHFKA. Additionally, the question attempted to assess how much the district food service director and school food service managers knew about the impact student hydration has on academic achievement.

Knowledge surrounding HHFKA was inconsistent among those interviewed in the study (Table 3). The district food service director had the greatest depth of knowledge of the legislation. He stated specific provisions contained within the law and additional guidelines that impact daily school food service practices. The food service manager of Site 1 stated the overall purpose of HHFKA: “We try to make sure they get the right amount of vegetables and the right amount of fruit and the right amount of protein and make sure they’re drinking so . . . they can perform better in class.” The school food service manager of Site 2 did not know anything about HHFKA. When asked about the law she said, “I don’t really know anything about it.” The school food service manager of Site 3 stated she had heard of HHFKA but stated she “did not know much about it.”

Table 3

*Knowledge of HHFKA*

| Knowledge of HHFKA | District Food Service Director | Site 1 | Site 2 | Site 3 |
|---|---|---|---|---|
| Has not heard of HHFKA | | | X | |
| Has heard of HHFKA but do not know much about it | | | | X |
| Has a general understanding of the purpose of HHFKA | | X | | |
| Has in-depth knowledge of HHFKA | X | | | |

Although knowledge of HHFKA was inconsistent among those interviewed in the study, this was not the case for the level of knowledge surrounding the impact of student hydration on student achievement. All participants indicated there was no training provided to school food service managers on the importance of student hydration and how it relates to school performance. When asked what type of training was provided on student hydration needs, the district food service director said, “None specifically on student hydration needs. We do review the requirements.”

**Summary**

This chapter presented the data collected as part of this research study. Interview and observation data for each participating site were presented individually, followed by a cross-site analysis of the data guided by the research questions of the study. Chapter 5 provides further discussion of the data and offer recommendations for educational practice and further research.

# Chapter 5: Discussion and Recommendations

Students need to consume 8-12 ounces of water during the school day (Cradock et al., 2012). School water access has been associated with increased water intake among adolescents (Patel & Hampton, 2011). Failure to implement HHFKA may prevent students from meeting their daily hydration needs (Cradock et al., 2012). Recent research indicates inadequate hydration can lead to decreases in cognitive performance and have a negative impact on student achievement (Bar-David et al., 2005; Benton & Burgess, 2009; Edmonds & Burford, 2009; Fadda et al., 2012); yet according to Kenney et al. (2016), "access to clean, functioning free drinking water sources in schools may be limited, and compliance with state and federal policies to establish free drinking water access is low in many schools" (p. 28).

The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA using a cross-site case study of middle schools in a southeastern state school district. This study utilized multiple sources of qualitative information by employing observations and interviews. The following research questions were used to guide the study.

1. How are schools providing free access to water for students during meal service times?
2. To what extent are district policies aligned with daily practice at the school level?
3. What is the current level of knowledge about HHFKA subsection 203 and the impact of student hydration on academic achievement among district leaders and site-based food service managers?

The various data sources used in this study were triangulated to increase the reliability and validity of the findings. Based on the data shown in Chapter 4, findings were reported for each research question addressed. There is evidence to suggest that the knowledge and implementation of HHFKA is inconsistent. It was revealed that a variety of methods are used to provide students access to free, potable drinking water; however, barriers to student use of supplemental water may still exist. Additionally, the data show food service workers are provided no training on the impact student hydration has on academic achievement.

**Discussion of Findings**

Interview responses indicated inconsistent knowledge of HHFKA among the participants. This is surprising given that HHFKA establishes requirements for all schools participating in federally funded meal programs. Additionally, no training on the importance of student hydration is provided to food service staff. It was repeatedly stated throughout participant interviews that food service managers were trained on the local requirements. Food service managers also mentioned meeting requirements for inspections; however, they were unaware of the reasoning behind the requirements.

Stephens and Shanks (2015) completed a review of K-12 school food service staff training interventions. They indicated those responsible for operating school nutrition programs are integral to the process of implementing the USDA guidelines (Stephens & Shanks, 2015). Stephens and Shanks stated, "appropriate and adequate training and education for school food service professionals may be one key to meeting USDA school meal guidelines and providing healthier meals overall" (p. 825). Additionally, the researchers remarked training of food service staff should not just address basic skills and job duties but also "empower school food service professionals with nutrition and policy knowledge to answer the 'why' questions regarding school meal requirements" (Stephens

& Shanks, 2015, p. 832).

In the current study, participants had no training on the importance of student hydration and the positive impact it has on student achievement. Participants were merely fulfilling a procedural requirement by providing access to water for students. It is speculated that if school food service managers were more knowledgeable of the benefits of promoting student hydration, they would be more likely to go beyond meeting the requirement and find ways to improve access to water and encourage student use of the supplemental water provided.

A lack of training in student hydration needs and HHFKA is further troubling because it may hinder a permanent change in school food service practices. According to Lewin's Change Theory, change should be planned (Stichler, 2011). The first step to initiating sustainable change involves creating a sense of urgency among stakeholders (Stichler, 2011). In building an awareness that the status quo must be altered, frustration must be generated by data that disprove our current beliefs (Schein, 1995. Stakeholders must have a "feeling that if we do not change, we will fail to meet the needs or fail to achieve some goals or ideals that we have set for ourselves" (Schein, 1995 p. 61). School food service staff members should know limiting or not providing free access to water fails to meet the needs of the students they serve and is contrary to the underlying premise of HHFKA. It is unclear how school food service workers could understand the importance of providing free access to water for students without being provided information on student hydration needs and the current legislation governing school food service practices.

Without a motivation to change leading to the unfreezing of current school food service perceptions and procedures, lasting and consistent change in practice will not occur. The current study revealed inconsistencies in implementation of the free, potable water subsection of HHFKA. It is possible this is the result of staff members merely fulfilling a minimum requirement instead of investing in a shared vision of how free access to water should look.

**Recommendations for Practice**

**Eliminate barriers to student access to water.** Several barriers to student access to water were noted in the current study. The sites that utilized portable water coolers, stationed their water alongside ice and tea used only by teachers. Situating drinking water near the refrigerated cooler holding other student beverage choices (milk, juice, etc.) may encourage students to consume more water by making them aware it is an option for them.

Site 2 of this research study had a single drinking fountain as its water source; however, research has shown students drinking water in food service areas is higher in schools with non-fountain sources of water (Patel et al., 2012). It is recommended that district and local food service managers consider this when planning how student access to water will be provided.

Site 1 and Site 2 provided cups for students only upon request. At both sites, the food service managers mentioned waste and the cups not being properly disposed of as reasons for not having the cups available at the water source. In order to increase student access to water, the Centers for Disease Control and Prevention (2014) recommended "that cups be made available at water access locations. Providing cups helps students drink more water" (p. 28).

It was observed at all three study sites that students were not permitted to move about the cafeteria dining areas at will. This could limit student access to water.

According to the Long (2011), having students raise their hand to get up and get water is not ideal, although it may be necessary to provide order. Principals and assistant principals should encourage procedures that allow students to get up to get water without requiring permission. Doing so could lead to increased use of supplemental water sources.

**Provide training to staff.** Not only is it recommended to provide training on student hydration needs and water access to food service workers, other staff members should be involved in education programs. The Centers for Disease Control and Prevention (2014) recommended training for school nutrition staff on how to provide and maintain drinking water access points. Additionally, principals, assistant principals, teachers, and support staff should be provided training in how to promote drinking water among students (Centers for Disease Control and Prevention, 2014).

It is suggested that more education in the importance of meeting the hydration needs of students will result in creating staff members that champion the cause. According to Patel et al. (2012), a "water champion" can be essential to developing and sustaining drinking water programs. Often "water champions" will go "beyond the letter of the law to provide students with water that [is] more appealing than water provided via a fountain" (Patel et al., 2012, p. 6).

**Promote student access to water.** Increased water intake by students has occurred when improved access is paired with student education programs (Patel & Hampton, 2011). It is suggested that after all staff have been educated on the advantages of student hydration, a schoolwide education program be implemented. As schools plan their schedules, consideration should be given to allowing time for water breaks. Additionally, teachers should be encouraged to promote drinking water in their classrooms as well as model good hydration habits. Promotional materials outlining the benefits of drinking water should be used to encourage student hydration.

School leaders should also attempt to promote student access to water by providing more appealing water sources throughout their facilities. Students may choose not to drink from fountains because they perceive them as unclean (Patel et al., 2012). Hydration stations, water coolers, and filtration systems could be used to provide water that students find palatable, increasing their likelihood to drink. Principals, assistant principals, and teachers should encourage students to bring refillable water bottles that can be used by students to drink water throughout the day. School leaders should also budget funds for the purpose of purchasing cups, coolers, or other necessary items to provide desirable water dispensation options to students.

**Recommendations for Future Research**

Research on the implementation of HHFKA and student access to water is lacking. Only a limited number of studies have examined how schools provide access to water to students. To get a true sense of the implementation of HHFKA, further research may include a larger number of schools across varying school districts.

One barrier to student access may be student lack of knowledge of water availability. It would be instructive to conduct surveys, interviews, or focus groups with students at various grade levels to determine their level of knowledge surrounding water access. This could be used to guide education programs as well as provide ideas for ways to promote student use of supplemental water.

Further study in the area of water dispensation methods and the placement of free water sources would be beneficial. Observing food service practices to determine which water sources and locations lead to higher rates of student consumption could provide practitioners and policymakers with valuable information to guide implementation.

Examining the impact of staff training on student hydration and HHFKA could also prove beneficial. A study that establishes a baseline level of knowledge of stakeholders before and after the implementation of a comprehensive education program could show the importance of providing training to those implementing HHFKA in daily practice.

**Summary**

The purpose of this study was to examine the implementation of the free, potable water subsection of HHFKA using a cross-site case study of middle schools in a southeastern state school district. It was found that implementation was inconsistent across sites and students rarely made use of the drinking water provided in the school food service areas.

Lack of or poor access to water could result in students not consuming enough to meet their daily needs (Patel & Hampton, 2011). Recent research indicates poor hydration is associated with poorer cognitive function and overall well-being (Bar-David et al., 2005; Benton & Burgess, 2009; Edmonds & Burford, 2009; Fadda et al., 2012). This could yield a negative impact on student achievement (Bar-David et al., 2005; Fuchs et al., 2016).

Building on previous research, the current study indicates a need for education practitioners to increase their efforts to ensure students are provided access to free drinking water and are encouraged to drink. Combined with comprehensive training and education programs, such efforts could lead to cognitive and health benefits for students as well as overall higher student achievement.

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# Appendix A

## Local Permission

**Jessica Mellon <jrmellon@[redacted]>**

## proposed research design and methodology

1 message

**Pamela G Miller** <pgmiller@[redacted]> Tue, Jan 3, 2017 at 4:06 PM
To: Jessica Mellon <jrmellon@[redacted]>

Please be advised that the four-page document detailing a study on free, potable water you provided for Dr. Mattox to present to CABINET has been approved.

*pam gann miller | administrative assistant*
*office of dr. kim mattox, leadership development |*[redacted]
*phone*[redacted] *or*[redacted]*| fax*[redacted]

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# Appendix B

## Informed Consent

Gardner-Webb University
Department of Education
110 South Main Street
Boiling Springs, NC 28017

Dear Participant,

My name is Jessica Mellon. I am an Assistant Principal in [redacted] and currently pursuing a doctoral degree in Education Leadership at Gardner-Webb University. As a requirement to complete my degree, I have chosen to explore the implementation of the potable water subsection of the Healthy Hunger-Free Kids Act. Simply put, I want to know how students are being provided free access to drinking water during meals.

I would like to invite you to be a part of this research study. You were selected to participate because you are a food service manager in a middle school. Participation in this study is completely voluntary. Please read all the information provided and ask any questions you may have before choosing to participate in this research study.

First, I am asking you to participate in a brief interview. This interview will take approximately 10 minutes and will focus on student access to water during meal service times in the school cafeteria. Additionally, I would like to conduct an observation of your practice throughout meal service in the school food service area for one school day.

The records of this study will be kept strictly confidential and all research records will be kept in a locked file. I will not include any information in any report I publish that would make it possible to identify you or your school. Deciding not to participate in this study will not result in any penalty or loss of benefits to you. If you decide to leave the study, you must simply notify me you no longer want to participate and you will be immediately removed from the study.

You have the right to ask questions about this research study and to have them answered by me before, during, and after the research. Feel free to contact me, Jessica Mellon, at jrmellon@[redacted] or by telephone at [redacted]. If you feel the need to discuss your experience in this research with someone unassociated with the study, please contact licensed therapist Amy Hunnicut at [redacted]. If you have other concerns about your rights that have not been answered by the researcher, you may contact Gardner-Webb University Graduate School Institutional Review Board, (704) 406-4724.

Thank you,

Jessica Mellon
XXXXXX
XXXXXX

Gardner Webb University Doctoral Student Education Leadership
110 South Main Street
Boiling Springs, NC 28017

**Participant Permission**

By signing this document you, ________________________________, are agreeing to be a part of a research study examining the implementation of the potable water subsection of the

Healthy, Hunger-Free Kids Act. Your participation in this study is voluntary. You may withdraw from the study at any time.

You will be provided a copy of this document. A copy will remain with the materials related to the research study.

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***I agree to participate in this study and am doing so voluntarily.***

____________________________________________ ____________
**Signature** **Date**

***I understand that if at any time I would like to withdraw from the study, I am allowed to do so without consequence or repercussion.***

____________________________________________ ____________
**Signature** **Date**

# Appendix C

## Interview Protocol

Date: ____________________ Interviewer: ____________________

Location: __________________ Interviewee: ___________________

**Implementation of the Free Potable Water Subsection of the Healthy Hunger-Free Kids Act Interview Protocol**

**Introduction**

*I am Jessica Mellon. I serve as an Assistant Principal in* [redacted]*. I am currently pursuing a doctoral degree in Education Leadership at Gardner-Webb University. In order to complete my degree I have chosen to examine the implementation of the free potable water subsection of the Healthy, Hunger-Free Kids Act. Simply put, I want to know how schools are providing for student access to water during meal service.*

*I would like to ask you a few brief questions. Please know all of your responses will be kept confidential. I will not include any information in any report that would make it possible to identify you or your school. You may choose not to participate in this study without any penalty or loss of benefit. If at any time you no longer choose to participate, please let me know and you will be not be interviewed further.*

**Interview Questions**

1. Have you heard of the Healthy, Hunger-Free Kids Act?

2. How and where is free potable water provided to students during meal service?

3. What are the local policies that impact your practices related to student access to water?

4. What type of training have you been provided on student hydration needs?

5. If you wanted to provide more access to water for students, how would you initiate change?

6. **District Food Service Manager Only**- What type of training has been provided by the district to cafeteria managers?

7. **District Food Service Manager Only**- Could you provide me with copies of state and local/district policies used to regulate/guide daily practice?

**Ending the Interview**

*Thank you for your participation in this interview. Please remember, I will not provide any information in my final report that can be used to identify you or your school. I will be glad to provide you with a copy of my final report if you would like one. I appreciate your time and willingness to participate in this interview.*

# Appendix D

## Observation Protocol

Date: _____________________ Time: _________________________

Location: __________________ Observer: ______________________

**Implementation of the Free Potable Water Subsection of the Healthy, Hunger-Free Kids Act**
**Observation Field Notes Recording Sheet**

**Availability of Water**

**Student Water Usage**

**Potential Barriers to Water Access**