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Student Perceptions of Environmental Quality While Attending Accelerated Medical Technology College Courses

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2018

Abstract

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MA, The University of Texas, San Antonio, 2001

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Project Study Submitted in Partial Fulfillment

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Abstract

Regional weather patterns in the southwestern United States frequently test the engineering involved in indoor air handling equipment in college facilities. Although an adequate indoor thermal environment has been found to affect student learning, little is known about students' perceptions of classroom heating and ventilation and impacts on learning. The purpose of this phenomenological study was to explore how students in accelerated medical technology courses perceived the environmental quality in their classrooms and discern whether these conditions affected overall gains in knowledge, persistence, and retention in their learning. Fourteen participants from 2 local community colleges were interviewed using purposeful sampling. Guided by Nicol and Humphrey's adaptive heat model along with the theories of Maslow, Bandura, and Bronfenbrenner, the research questions centered on how students perceived the classroom environmental quality and its effects on their learning and well-being. Thematic analysis was used to reveal concerns about the operational state of the heating, ventilation, and air conditioning systems, their effect on classroom environmental quality and the student's ability to attend class. Interview responses indicated that positive indoor environmental conditions are essential to students' learning. Project study results led to the development of a white paper for collaborative use at each development forum. Positive implications for social change include increasing staff members' knowledge about improving and maintaining adequate indoor environmental quality to support overall student achievement.

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Dedication

I dedicate this work to my parents, Clarence John, and Ruby Mae Westbrook. These two people, children of New World Generation parents who endured the challenges exclusive to immigrants in this country during the19th century, instilled in me the belief that humility, perseverance, and hard work has its rewards. My mother would say, "work hard at anything you do, because getting the best things in life ain't easy, if it were, everybody'd be doing it!" I know they are looking down on me and smiling…

To my son and daughter, Franklin Bernard and Vanessa Rene Westbrook. They are and will always be the driving force which compels me to continue building and expanding the legacy that my father started – leaving the farmlands of South Georgia to establish a name for our family by performing his craft in an upwardly-mobile urban community. It is with gratitude that I pay homage to my family in instilling me with the intestinal fortitude to complete this long and arduous scholarly quest.

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Finally, to my friends and colleagues, thank you for patience and understanding during this journey – a journey that at times made me feel like I was shipwrecked on an island. But just like a castaway, I believed that one day I would make it home.

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Section 1: The Problem

Introduction

The need for skilled technicians in the medical field is increasing worldwide. Students are enrolling at rates higher than in previous years at U.S. schools offering associate degrees and vocational certifications (U.S. Department of Labor, National Bureau of Labor Statistics, 2014). Community and proprietary colleges are the nation's fastest-growing postsecondary institutions, enrolling a high percentage of minority and older students who are either not prepared for college or who seek to obtain accelerated advanced training (Bailey, Badway, & Gumport, 2001; Chung, 2012; D. Deming, Goldin, & Katz, 2013; Iloh & Toldson, 2013).

The environmental quality at schools influences students' performance during classroom instruction. Student achievement is a goal of administrators who must achieve and maintain institutional accreditation while preparing professionals for a knowledge-based workforce (Kena et al., 2016). Learning institution owners and leaders seek to maximize college students' academic achievement by providing functional and comfortable learning environments (Choi, Guerin, Kim, Brigham, & Bauer, 2013/2014).

Leaders of community and proprietary colleges in the United States report these college's success rates to the National Center for Educational Statistics (NCES) as a part of a national operational certification program (Kena et al., 2016; NCES, 2015a, 2015b, 2015c; 2015d). In this certification program, students attend classes under an accelerated format for a minimum of 4 hours per day with the promise they will complete most

programs within 1 year (American Association of Community Colleges, 2014; Levin, Garcia, & Morgan, 2012).

Classes are held in 8-week segments, or semesters, to facilitate rapid course completion. To succeed in the accelerated instructional sessions of the certification program during shortened semesters, students must be present in the classroom. Ancillary environmental conditions both inside and outside the classroom become a distraction, particularly when heating, ventilation, and air-conditioning (HVAC) systems providing classroom air conditioning fail, requiring maintenance from school facility management personnel or HVAC contract services. A cross-sectional study of schools in New York state revealed that poorly maintained HVAC systems significantly affected learning and contributed to absenteeism (Simons, Hwang, Fitzgerald, Kielb, & Lin, 2010).

Accelerated training programs have strict completion guidelines; students must attend regardless of air-quality conditions in class or risk missing vital instruction (Johnson, 2009). Absences affect the transfer of learning, attendance, and eventual graduation (Caffarella, 2010; Johnson, 2009). Curriculum organizers at older traditional colleges are aware that students must complete these accelerated courses in usually half the time allotted regular classes. For this reason, facility maintenance becomes vital to students seeking to complete these courses without environmental quality issues.

For example, in a study involving evaluation of students who completed 6 and 12-week course curriculums, Len and Horsfall (2010) concluded that proper facilities management is essential to ensure students can focus on achieving learning. Hence,

thermal conditions in excess of 75 ˚F in accelerated classes can put added pressure on students attempting to complete their chosen courses on time (Corgnati, Filippi, & Viazzo, 2004). Outside temperatures such as those in the southwestern regions of the United States affect classroom instruction and task accomplishment if allowed to invade inside parameters due to lack of climate control (Haverinen-Shaughnessy & Shaughnessy, 2015).

Additionally, studies on global climate change have indicated current global temperatures are higher than in previous decades, and the average ambient outside temperature is increasing annually with no signs of decreasing (Nordhaus, 2012; Tol, 2009). Despite the emphasis in educational research on learning and achievement in the classroom (see Shamaki, 2015), few studies exist on how other factors, particularly temperature, can affect one's persistence and success in accomplishing accelerated programs, based on my review of the literature. In this project study, I explored the issue of indoor environmental quality (IEQ) in these classrooms as perceived by students to understand their experiences while pursuing advance knowledge.

Background

Schools located in warm climates have always had to compete with outdoor weather conditions during the academic year. Outside temperature and humidity add to the challenge of controlling thermal conditions indoors. From a weather perspective, the South Texas region periodically resembles climate conditions like those affecting landmasses at longitudes closer to the equator, such as tropical rainforests (Halpert,

2014). The need to control IEQ in the context of these weather patterns is a concern because of IEQ's connection with student learning (see Haverinen-Shaughnessy & Shaughnessy, 2015).

Haverinen-Shaughnessy and Shaughnessy (2015) studied 70 schools in the southwestern United States to determine if outdoor conditions influenced indoor environmental quality and interfered with student learning and attendance. Results of the study indicated outdoor temperatures might create environmental quality problems indoors that affect student learning attendance and health if not controlled (Haverinen-Shaughnessy, 2015). However, the data from this and other studies have failed to indicate how students made sense of their experiences during IEQ challenges.

Research has shown that former students attending school within the south Texas region have expressed concerns after leaving school about physiological affects triggered by inadequate IEQ that were linked to faulty HVAC systems (Choi et al., 2013/2014; Haverinen-Shaughnessy & Shaughnessy, 2015). Conditions such as chronic respiratory ailments stemming from exposure to byproducts generated and dispersed by faulty HVAC systems have displaced the focus on student learning in class (Bayer, Crow, & Fischer, 2000). In addition, elevated indoor temperatures and faulty HVAC systems have created environments for potential inhalation of mold and friable asbestos (Burdett, Dewberry, & Staff, 2016; Granito & Santana, 2016; Mendell et al., 2013; Redd, 2002). These conditions further exacerbate students concerns regarding class attendance, learning, and eventual graduation.

For instance, Newman (2009) wrote that approximately one half of the learning institutions in the United States have certain building defects such as mold and releases of friable asbestos caused by elevated indoor air temperatures and its effect on aging buildings. Exposures to asbestos by both students and instructors are well documented, and the risk of being exposed to airborne contaminants while attending classes exists daily (Thompson & Shukla, 2013). These rarefied air conditions and their effect on and within older buildings serve as contributors to indoor air quality problems (Gibson, 2012; Granito & Santana, 2016). These phenomena heighten students' concerns regarding exposure to airborne contaminants while attending classes.

The factors that create physiological responses in students present a unique challenge as students attempt to reach their educational goals. After determining that more research was necessary on similar cases, I conducted an extensive review of the literature. An exhaustive literature search helped me develop an understanding of the IEQ conditions experienced by students. The overall goals of this study were to explore how students made sense of their IEQ conditions and to help school leaders ensure that students succeed in accelerated medical technology courses despite these classroom IEQ conditions. I used study findings to develop a white paper for school leaders to implement into their staff training on IEQ in their organizational training forums.

Definition of the Problem

Ensuring that students receive more advanced education is the main concern of post secondary school educators, administrators, and leaders. However, researchers have

found that poor IEQ in classrooms affects these efforts (Lee et al., 2012). In addition, research on students' perceptions of IEQ is lacking, based on my review of the literature. Such knowledge is necessary to inform educational leaders' and policy makers' decisions. In this study, I explored how students at two community colleges in south Texas interpreted the IEQ of classrooms in which they received accelerated medical technology training. To meet the requirements for graduation, students must demonstrate proficiency in their training during class and while performing operations in clinical laboratories.

When indoor ambient conditions affect or contribute to certain behavior, the mechanics of this type of learning can be viewed from an environmental psychology perspective (Mehrabian, & Russell, 1974; Pati & Barach, 2010). The pressure of task performance in a compromised learning environment can cause students to rationalize the outcome of their learning based on these conditions and display actions geared toward dealing with the immediate surroundings (Wechsler, 1958). These surroundings could be the motivating mechanism that aids students in focusing on acquiring knowledge and being successful in class. Inadequate IEQ only adds more stress to the rigors of learning while attending medical technology courses (Schneider, 2002.)

Medical technology courses must be completed satisfactorily to ensure students succeed in their chosen professions as they enter the workforce (Wlodkowski, 2003). In studies conducted similar to the project location, Lee et al. (2012) found that concerns with IEQ directly correlated to classroom performance. Several studies on elevated

temperatures and other environmental factors in classrooms have shown that students accomplish tasks better in environmentally sound classrooms (Bakó-Biró, Clements-Croome, Kochhar, Awbi, & Williams, 2012; Wargocki & Wyon, 2007a). Further, studies in northern Europe and central South America regarding total student comfort and academic achievement show that adequately controlling the IEQ results in successful student persistence and learning (Vecchi, Cândido, & Lamberts, 2016; Wargocki & Wyon, 2007a).

School leaders and administrators play a vital role in providing classrooms that are well maintained and ready to support their schools' educational missions (Frontczak & Wargocki, 2011). These leaders are also responsible for ensuring that students achieve academic success (Burke & Burke-Samine, 2004; Corgnati et al., 2004; Puteh, Ibrahim, Adnan, Che'Ahmad, & Noh, 2012; Toftum, Kjeldsen, Wargocki, Menå, Hansen, & Clausen, 2015). However, classroom IEQ conditions involving thermal deviations can adversely affect students and distract them from focusing on the coursework needed to secure future employment (Baker & Bernstein, 2012; Wyon & Wargocki, 2007a).

Students in the south Texas area have chosen to attend accelerated courses at a higher rate compared to rates seen in traditional college classes (Lee & Horsfall, 2010; Quinton, 2014). However, consistent failure of HVAC systems to maintain comfortable classroom temperatures can lead to physiological effects that may hinder or interfere with class attendance (Earthman & Lemasters, 2011). High classroom temperatures and subsequent environmental factors can prevent students from completing their courses on

time (Corgnati et al., 2004; Haverinen-Shaughnessy et al., 2011). This can also have a psychological effect on students by interfering with their ability to maximize their personal qualities in classroom learning (Couture, Desrosiers, & Leclerc, 2007).

In this project study, I focused on student perceptions of how the IEQ in their classrooms affected their learning. The results of this study may help school leaders at each of the two project locations understand how students make sense of the IEQ they experienced during classes and how this may affect persistence, student retention, and graduation. Students will be more willing to attend class if the focus on instructions and accomplishing classwork is their only concern. Furthermore, the findings from this study may increase school leaders' knowledge of IEQ and provide a tool for use in periodic professional training forums.

Rationale

Evidence of the Problem at the Local Level

The outside temperature in the south Texas region from May to December averages 89.5°F (National Oceanic and Atmospheric Administration [NOAA] Regional Update, 2013; U.S. State Regulation of Private Schools, 2009). When HVAC systems fail in buildings and schools, the indoor air temperature can exceed 105°F (Hwang, 2006). Elevated indoor temperatures trigger the same physiological effects seen with any exposure to these conditions, regardless of the location. Students attending the schools in this project study have mentioned that classroom temperature, air quality, and other indoor environmental concerns have caused them to make choices regarding school

attendance, persistence, and retention. According to a student at one study location, she said that she did not want to say anything to the dean about the conditions inside the classroom for fear of expulsion.

Many venues in this region have regular HVAC failures which have a consequent effect on people. For example, during a National Basketball Association (NBA) championship game held in San Antonio, Texas, in May 2014, the air conditioning system failed before the start of the contest (Golliver, 2014; McDonald, 2014). The stadium air temperature, usually controlled at 77°F, reached 104°F during the event (Golliver, 2014). Players and fans were affected by the elevated temperatures before and during the game, displaying signs and symptoms consistent with heat exhaustion and heat stress (Golliver, 2014; McDonald, 2014; Taylor, Kondo, & Kenny, 2008). These individuals were either treated at the arena or taken to local medical facilities (Golliver, 2014; McDonald, 2014). The HVAC systems in this region are frequently challenged by high outdoor temperature and fail on a consistent basis.

In addition, elevated outdoor temperatures, humidity, and wind speed can affect temperatures inside buildings (Lin, de Dear, & Hwang, 2011). Lin et al (2011) quantitative study consisted of measuring elevated outdoor temperatures in Taiwan to determine thermal comfort indices for individuals who will occupy semi outdoor structures for outdoor recreational activities that require hardened structures. Results indicated that elevated temperatures more than 88˚F can cause physical discomfort for patrons in these facilities based on the outside temperature. Consequently, students

display characteristics like those shown by patrons exposed to elevated heat and environmental quality issues at venues with high indoor temperatures.

If the experience of patrons at the NBA game is compared to the experiences of students in classrooms where elevated heat and poor IEQ are the norm, Lin et al.'s (2011) findings would be similar in scope. Patrons at sports venues spend most of their time sitting with limited bodily movements, like students' posture as they attend class (Owen, Healy, Matthews, & Dunstan, 2010). In a learning environment, classroom instruction is typically performed in senarios where students are sedentary while receiving instruction – sometimes for extended periods. Thus, students at the two schools in this project study faced challenging IEQ conditions in their classrooms daily.

Similar to research on sports venues and environmental quality problems, studies have shown that elevated thermal conditions in school facilities can cause sedentary students to have difficulties in acquiring learning (Schneider, 2002; Yang, Becerik-Gerber, & Mino, 2013). Further, research has indicated that these thermal conditions can significantly affect student learning, potentially causing students to make decisions involving persistence and attendance that could affect their future as medical technicians (Earthman, 2002; Jung, Song, Ahn, Oh, & Im, 2011; Teli, James, & Jentsch, 2014).
In this project study, I explored student experiences with attending classes in an effort to discover how they made sense of the environmental quality in their classrooms.

Evidence of the Problem in the Professional Literature

Studies on academic performance in schools have indicated that students are more academically successful when the IEQ of their classrooms is conducive to learning (Haverinen-Shaughnessy, Shaughnessy, Cole, Toyinbo, & Moschandreas, 2015; Norbäck & Nordström, 2008). Maintaining school buildings requires regular facility maintenance. Facility maintenance personnel are essential in maintaining the operational integrity of these classrooms, particularly in regions in which average outside temperatures exceed 80°F (U.S. Climate Data, 2017).

Other researchers have employed a mixed-methods approach to relate local weather measurements to assessments of past individuals' collective attitudes toward experiencing changes in climate conditions (Egan & Mullin, 2012). Participants indicated that for each 3°F increase in local temperatures, they were 1% more certain of the existence of global warming (Egan & Miller, 2012). Thus, participants perceived they were living in a society in which global warming was a reality (Egan & Miller, 2012). Research has shown that students who are pleased with the IEQ in their classrooms are seldom absent (Earthman, 2004; Choi et al., 2013/2014). This satisfaction has a carry-over effect about better grades, student morale, and community confidence in school leadership.

In addition, similar studies have shown that neglect in maintaining an adequate indoor thermal environment can lead to higher absenteeism among students, thereby reducing instructional time, learning opportunities, and classroom effectiveness (El

Asmar, Chokor, & Srour, 2014; Issa, Rankin, Atallah, & Christian, 2011). These findings further emphasize that facility managers are an essential component in ensuring that school condition contributes to the success of students, particularly those in accelerated courses. Further, most students have personal and family responsibilities that influence them to complete their courses. If they are unable to complete segments of class because of structural and climate conditions, they may opt to pursue employment unrelated to their programs to support immediate needs (Abel, Deitz, & Su, 2014).

Communication gaps may exist between institutional leaders and students regarding the seriousness of the IEQ problem. This study focused on student perceptions of their experiences in IEQ-challenged classrooms to show how they made sense of these episodes. The information these students provided can be useful for leaders by increasing their awareness of how school aesthetics affect student success.

Definitions

Several terms were relevant to this study. These terms help readers understand the study's nuances.

Building coding system guidelines: Design standards and criteria for new buildings, alterations, and upgrades and repairs in historic structures; the criteria are consistent with the U.S. General Services Administration (GSA) Public Building Service standards (GSA Facilities Standard, 2003).

Environmental concerns: The types of conditions experienced by individuals as they attend classes under temperature and indoor air quality extremes (U.S. EPA, 2000).

Environmental quality: In this study refers to the conditions of the built environmental and how this environment serves its occupants (U.S. EPA, 2015).

Friable asbestos: Talc-size fibers containing asbestos released from aging materials found in older educational institutions. Inhalation of these fibers could lead to mesothelioma, a type of lung cancer (Bartrip, 2004; Flinn, 2014; Mendell & Heath, 2005).

Green schools: Educational institutions whose leaders seek Leadership in Energy and Environmental Design (LEED) certification, which is a part of the current environmental upgrade of educational facilities (Chen, Kleinman, & Dial, 2015; Kensler, 2012; Veronese & Kensler, 2013).

Indoor air quality (IAQ): Indoor environmental conditions that are acceptable or unacceptable to building and room occupants; IAQ is a viable part of the overall IEQ concerns of indoor structures (U.S. EPA, 2000).

Indoor environmental quality (IEQ): Indoor pollutants consisting of biological, chemical, or particulate pollutants, and thermal conditions such as temperature and humidity; in addition, noise, lighting and odor are all part of IEQ (U.S. EPA, 2000).

Leadership in energy and environmental design (LEED): A trend in building design in which environmental soundness and cost savings are ensured through careful design of HVAC and other supporting systems (Cooperman & Dieckmann, 2012; Hopkins, 2015).

Persistence: A student's willingness to complete a course of study by working diligently toward its culmination (Fike & Fike, 2008; Krivoshey, 2014). Persistence and retention are related.

Proximal process: Human biopsychological development through the constant active interactions and processes between other humans, the images, and entities outside their empirical environment. The longevity of these interactions is key to this process's effectiveness (Bronfenbrenner & Morris, 1998).

Retention: An institution's effort to ensure students have the equipment, tools, and support they need to continue to pursue their educational goal (Fike & Fike, 2008; Krivoshey, 2014). Retention is related to persistence.

Significance

The purpose of this project study was to explore student perceptions about the environmental quality of their classrooms as they attended accelerated medical technology courses. I sought to discover how they made sense of their IEQ experiences. Wlodkowski (2003) mentioned that accelerated education programs help the United States labor force compete globally with other nations on a micro level. Students enroll in accelerated training programs to gain employment in technically oriented professions in which shortages of trained personnel exist (Fike & Fike, 2008).

The United States education infrastructure is aging; the type and age of educational facilities could affect students' morale and attitudes (Earthman & Lemasters; 2011; Thapa, Cohen, Guffey, and Higgins-D'Alessandro, 2013). Studies on the

relationship between building age and student achievement and behavior have shown the need to upgrade school buildings (Jago & Tanner, 1999; Wargocki & Wyon, 2013). Older traditional colleges have the funding and maintenance crews on site to maintain facility operations (Thapa et al. 2013). With the introduction of accelerated curricula, older traditional schools have made staff and structural adjustments to accommodate students around the clock (Choitz & Prince, 2008; D. Deming et al., 2013).

Educational organizations have a mission to establish and maintain a productive and encouraging learning environment, enabling all students to succeed (Earthman & Lemasters, 2013; Epstein & Associates, 2008) According to Schneider (2002), no maintenance procedure is fail-proof, and system failures may take days to correct. Course schedules and students may be transferred to other locations, or students are asked not to attend school while the system is repaired. This situation may cause despair in students who may have other challenges in completing their training programs.

It is important that the findings from this study reach community stakeholders, so they can use their influence to ensure classrooms at all levels of academia are adequately maintained and ready for use (Gallucci, 2003). According to Coleman and Vedder (2010), new owners and managers of these institutions must ensure facility maintenance is a significant part of institutional budgets. Funding should be earmarked to help schools meet the minimum requirements for operation of HVAC systems. In addition, new learning institutions should meet minimum building code requirements prior to occupancy (ANSI/ASHRAE/IES Standard 90.1, 2013).

At the time of this study, no building upgrades or maintenance were scheduled or occurring at the two facilities. In this study, I sought to gather perceptions of the IEQ issues students experienced during class. Whether they are local community schools like the two in this phenomenological study or learning institutions at the state or national level that provide medical technology training students should have confidence in school leaders that they can learn in environmentally sound classrooms. Students believe school leaders will create a classroom environment that helps them focus on training, thus allowing the successful transfer of learning (Parsons, 2003; Taylor, 2000).

Guiding Research Questions

I designed this study to gather student classroom experiences of specific IEQ conditions at two local community colleges. The goal was to show how these students made sense of and assigned meaning to their IEQ situations as they attended medical technology courses. Because of the lack of qualitative information on how students respond to IEQ conditions (see Scammell, 2010), I sought to clarify how students responded to learning at institutions with poor IEQ.

This study was intended to assess how periodic problems with HVAC systems might contribute to student attendance, learning, and persistence problems. I sought to answer two research questions (RQs) as part of my phenomenological study:

RQ1. How do students make sense of the environmental conditions in their college classrooms?

RQ2. How do students perceive their learning and overall well-being is affected by these indoor environmental conditions?

Review of the Literature

The purpose of the literature review is to present findings from current studies to illuminate the research topic (Lodico, Spaulding, & Voegtle, 2010). I reviewed over 50 articles to determine if previous researchers had studied the lived experiences of students regarding teaching and learning in buildings with environmental quality challenges attributable to malfunctioning HVAC systems. The literature search involved electronically accessing databases such as ERIC, EBSCO, SAGE Journals, and ProQuest; in addition, I reviewed OSHA regulations and EPA studies, documents, and peer-reviewed articles on learning institution upgrades and operations. Search terms for germane literature queries included *postsecondary accelerated training*, *college classroom activities*, *environmental quality*, *school building conditions*, *student morale and motivation*, and *student learning*.

This literature review is categorized into subsections about environmental science, structural engineering, and environmental psychology. The first subsection is a discussion of global warming effects on the environment and includes reasons for considering global warming effects in the design, building, and upkeep of schools and the relation of global warming to student learning. In the second subsection, I discuss previous studies on building structures; thermal effects on learning, physiological, and psychological effects

of IEQ emotional responses to excessive heat; and physiological effects on occupants to illustrate how building conditions and subsequent IEQ affect student learning.

Reviewing existing literature supported the implementation of a study of college students' perceptions of the IEQ at their schools to show how their perceptions of IEQ affected instruction and learning. Although some IEQ studies have been performed in primary schools, the literature review indicated that reactions to these conditions are far-reaching, giving credence to this study showing how students' perceptions of IEQ at their local colleges affected their learning. This literature review is to show how paralleled exposures were experienced by students who were attempting to learn in classrooms with IEQ problems. I sought to explore how these conditions affected learning.

Conceptual Orientation

This study focused on adult college students' perceptions of environmental quality experienced as they attended accelerated medical technology courses. Indoor environmental quality categories are not similar; at any given time, any IEQ problem could either improve or hamper students' learning (Khalil et al., 2011). Therefore, the important facets of this study were (a) poor IEQ classroom conditions and their subsequent effects on students, and (b) students' perceptions of experiencing poor IEQ while they attempted to learn. Conceptually, the framing of this study related to Fanger's (1972) heat-balance theory, the adaptive model of Nicol and Humphreys (2002), Bandura's social cognitive theory (1977, 1989), Maslow's (1940) hierarchy of needs theory, and Bronfenbrenner's (1979) proximal process model.

In the southwestern United States, indoor temperatures in college classrooms fluctuate because of indigenous weather patterns. Classroom IEQ is usually a result of poor building maintenance and inadequate HVAC systems. In the literature review, I provide a methodological rationalization for how the attitudes and perceptions of stakeholders influence the organizational culture related to students. Students are important stakeholders at any educational institution and the success or failure of these institution rely on how well the student receive and use their newly gained knowledge.

The physical responses to temperature extremes, how these students adapt to these conditions, and their need to gain confidence in themselves and display this confidence to the communities they serve is centered on how well these institutions provide adequate learning areas. Whether schools are new or renovated, the research indicates that the adequacy of the facility and its upkeep aids in promoting learning and overall academic success (Goetz, Frenzel, Hall, & Pekrun, 2008; Roberts, Edgerton, & Peter, 2008). Thus, perusing data from the conceptual framework theories opened additional information avenues to support this study.

Global Warming Awareness

In recent years, global warming has received heightened attention (Van der Linden, Leiserowitz, Rosenthal, & Maibach, 2017). It is predicted that an increase of the global mean surface temperatures for 2081-2100 relative to 1986-2005 is projected to likely be in the ranges derived from the concentration-driven climate model intercomparison project (CMIP5) model simulations which approximates an increase of

32˚F to 35˚F (Intergovernmental Panel on Climate Change [IPCC], 2013; Stocker et al., 2013; Taylor, Stouffer, & Meehl, 2012). Because of this rise in global temperature, researchers anticipate an increase in heat-related health problems (Kovats & Hajat, 2008; McMichael, Woodruff, & Hales, 2006; Waldinger, 2015).

International organizations such as the United Nations Educational Scientific and Cultural Organization (UNESCO) have launched initiatives to educate countries on the global concerns of ecological changes and to encourage environmental education to inform the global public on the growing problem (Haugen, 2010). Similarly, the Partnership for Sustainable Development has noted that the unusual changes in the earth's climate along with subsequent degradation and depletion of natural resources are critical indicators of global warming that will affect global societies (Ashford, 2004).

However, critics in the United States who question global warming have indicated that this phenomenon is not a high priority. Henry (2000) noted that any environmental problems associated with global warming could be controlled or alleviated through engineering designs and procedures, thereby lessening public concerns. In addition, some politicians have portrayed global warming as a low public priority; the issue is thus weighted along partisan lines (Egan & Mullin, 2012; MacInnis et al., 2013; Wiest, Raymond, & Clawson, 2015).

The assessment of public perceptions is consistent with the findings of a study by MacInnis et al. (2015) evaluating how communities prepare for climate changes and how the information is framed and disclosed to the public. Eighty-two percent of the

participants felt that individuals and organizations who released pollutants into the atmosphere could make changes in their operational procedures thus reducing future risks to people and property (Jamieson, 2012; MacInnis et al., 2015). Debates about global warming may sway leaders to make HVAC upkeep and maintenance a low priority in school leaders' overall management scheme.

Community and similar colleges depend on student enrollment to operate the schools. I emphasized global warming in this study because all learners, regardless of political affiliations or socioeconomic status depend on the quality of the natural environment to sustain life (Hill, 2003; Krosnic, 2013). If students cannot focus or perform tasks during lessons, learning falters and motivation to learn diminishes. Next, I discuss the findings from studies showing how IEQ can affect classroom activities.

Building Conditions

Most of the information pertaining to the status of indoor IEQ consists of extensive prior research on building types, ages, and structural conditions (Shendell, Winer, Weker, & Colome, 2004; Wargocki & Wyon, 2017). As of this writing, the classrooms dedicated to the accelerated technical instruction at both colleges were in sections of buildings without windows, thus making them reliant on HVAC systems.

Studies of similar locations indicate that when such systems fail, remaining in these classrooms becomes unbearable. For example, Lee et al. (2012) noted the temperature and ventilation inside classrooms are essential elements affecting learning environments. Several researchers have indicated students and teachers cannot

successfully improve academic achievement from instruction delivered in antiquated facilities (Bowers & Burkett, 1987; Cash, 1993; Lumpkin, 2013). In fact, students cannot learn when the physical attributes of their classrooms are inadequate, even in newly designed or modernized facilities that are poorly maintained (Bowers & Burkett, 1987; Ketchum, 2015).

The condition of the building and classrooms are important for student achievement but are often taken for granted or ignored (Fisk & Seppanen, 2007). A model known as the commonwealth assessment of physical environment (CAPE) depicts seven key components crucial to successful learning in buildings designated for educational purposes (Cash, 1993). The CAPE model is a breakdown of specific conditions related to the physical makeup of structures and the effects of the conditions on the educational process (Cash, 1993).

The CAPE model and other studies have indicated that indoor climate control is a crucial contributor to the influence of IEQ on learning. Cash (1993) evaluated student measurement scores in English and mathematics and found significant differences in student grade achievement among students who learned in buildings with excellent IEQ (including temperature control), compared to students who learned in buildings in which IEQ was poor because of building age and poor upkeep.

Routine maintenance of air-handling systems to maintain indoor temperatures conducive to student comfort could prevent physical responses to elevated temperatures from occurring while individuals focus on completing assigned tasks (Lan et al., 2011;

Wyon & Wargocki, 2013). In a study regarding the impact on learning of the interior design of educational facilities, Ketchum (2015) assessed the core IEQ requirements for a sustainable educational institution. An essential part of the evaluation was to investigate the indoor air quality (IAQ) of two buildings—one newer, one older—to measure the indoor thermal quality in each area and determine whether the air quality was conducive to learning. Ketchum concluded the age of school buildings played a vital role in the efficient dissemination of education. School buildings older than 30 years affected advancement of student knowledge; achievement lagged because of the costs involved in upgrading older facilities (Ketchum, 2015).

In warmer months, students, instructors, and building occupants grow accustomed to stable indoor classroom temperatures and expect consistency in daily indoor temperatures. Vecchi et al. (2016) studied two architecture and planning department classrooms at a Brazilian university to compare occupants who used air conditioning to occupants who experienced limited air conditioning or received alternate means of body cooling. Results of the study showed that the longer occupants used air-conditioned environments, the more they preferred locations with similar cooling mechanisms in place, indicating an acclimation to air-conditioned environments (Vecchi et al., 2016).

Further, certain building conditions caused by elevated classroom temperatures can produce other adverse IAQ situations consistent with the institutionalized conditions indicated by Vecchi et al. (2016). Link, Edelman, Flores-Huerta, and Beauregard (2016) found that student complaints of discomfort and poor performance in class were

indicators that their classrooms contained components consistent with sick building syndrome (SBS) attributable to problematic HVAC systems. Students may miss classes during HVAC system repairs (Amin, Akasah, & Razzaly, 2015; Link et al., 2016). However, Link et al. concluded that maintaining a classroom temperature range of 70°F to 74°F ensured students' optimal classroom performance.

The preceding findings support the initial research problem referring to the lack of upgrading certain schools. Research has indicated that lack of vital upgrades can contribute to the deterioration of school buildings (Ketchum, 2015, U.S. General Accounting Office, 1996). Studies have shown that lack of repairs, building age, and lack of attention to subsequent IEQ problems can affect learning. For example, in a study involving how school buildings affected efficient learning transfer, Earthman (2004) found that older buildings did not have modern mechanical upgrades that could facilitate the physical ability to control temperatures; in addition, older buildings lacked the electronic and physical components necessary to provide adequate instruction.

Poor air quality and IEQ conditions in older structures have prompted new educational facility designers to install modern HVAC systems (U.S. EPA, 2017). The goal in introducing these new systems is to help control or eliminate the discomfort students experience while attending class, thus enhancing learning transfer through student persistence (Azhar, Carlton, Olsen, & Ahmad, 2011; Gibson, 2012; Granito & Santana, 2016). Leigh (2012) conducted a mixed-methods study on a new school and an old school in a southeastern Virginia school division to determine how the condition and

the age of a school affected instructor attitudes. Leigh concluded that negative teacher satisfaction at the old school stemmed from the lack of facility upgrades, thus affecting teachers' morale and ability to teach. Teacher dissatisfaction was attributable in part to the lack of thermal control in the older facility (Leigh, 2012).

Further, Uline and Tschannen-Moran (2008) performed a correlational study involving middle school teachers to explore how the quality of structural conditions, school resources, and climate related in the overall scheme of educational achievement. Results showed that teachers in dilapidated buildings were not motivated to apply any extra effort to support and influence student learning (Uline & Tschannen-Moran, 2008).

Additionally, Choi et al. (2013/2014) found school facilities typically have a history of poor design, and design flaws lead to meager funding. These studies have shown the age of school structures makes it difficult to maintain a consistent temperature in class. In addition, Cheryan, Ziegler, Plaut, and Meltzoff (2014) reported inadequate support mechanisms—for example, faulty or damaged HVAC systems and lack of physical temperature control in these buildings—hamper student achievement and instruction. These factors may hinder activities in medical technology classrooms in which students must prove technical proficiency to graduate.

Classroom Operations and IEQ

Students have various motivations for attending accelerated classes. Lewinski (2015) described motivation aimed at achieving a goal as *telic* motivation, in which classroom conditions are designed to accommodate students' needs and help them focus

on accomplishing their goals (p. 2). Instructors impart knowledge to students under controlled, equitable conditions such as adequate maintenance and temperature control.

However, a *para-telic* state or conditions develop that interfere with motivation develops when less accommodating conditions change students' focus from pursuing their goals of seeking physical satisfaction (Lewinski, 2015, p. 2). Research has shown that students react to these para-telic circumstances by either performing poorly in school or by being absent – physical responses consistent with inadequate IEQ and the physical condition of the classrooms (Durán-Narucki, 2008; Lewinski, 2015; Lucas, Epstein, & Kjellstrom, 2014; U.S. Environmental Protection Agency, 2008/2010).

Several studies have shown that maintaining the physical condition of learning institutions affects classroom achievement. In a quantitative study, Lan, Wargocki, Wyon & Lian (2011) asked adult college students employed as office workers to complete work-related neurobehavioral tests and office tasks during fluctuations in room temperature; the objective was to document students' physiological and psychological responses. Lan et al. found participants performing tasks in high indoor temperatures showed increased blood levels of carbon dioxide, which created acidosis, a condition that diminished the amount of oxygen saturation in the blood and interfered with routine mental processing.

Lan et al.'s (2011) study provided scientific support showing elevated indoor temperatures can affect mental performance; further, Lan et al. found similar physiological and psychological effects among students at educational facilities. Wong

and Khoo (2003) conducted an earlier quantitative study wherein individuals encountered conditions like those in the Lan et al. study. Wong and Khoo studied temperature fluctuations and class comfort to examine indoor thermal effects occurring during student classroom activities in Thailand. Students were more receptive to learning in cooler temperatures than in warmer temperatures (Wong & Khoo, 2003).

Shamaki (2015) conducted a mixed-methods study in which secondary school math students answered questions about the climate conditions of their classrooms. The students' responses were used to complete a statistical analysis of classroom IEQ. Findings from this study indicated that classroom temperatures between 68°F to 74°F provided comfort and did not impede academic activities (Shamaki, 2015). Although data from these studies were informative, no qualitative information was provided to show how students perceived IEQ conditions.

Classroom surroundings and heat retention help maintain comfortable temperatures in classrooms. Granito and Santana (2016) performed a qualitative study using exploratory methods at a Midwestern university to examine student and instructor thoughts regarding how classroom space and environment affected instruction and learning. In a qualitative segment of the study, the researchers collected information from participants, comparing students' experiences in newer studio-style classrooms to students' experiences in older traditional-style classrooms. Participants said they became ill while attending classes during extremely high temperatures (Granito & Santana, 2016).

Indoor classroom temperatures affect routine class procedures and performance. For example, Haverinen-Shaughnessy and Shaughnessy (2015) performed a quantitative study involving student reading and mathematics performance in classrooms with many IAQ and environmental conditions. A portion of their research showed that temperature control was a critical environmental factor that directly affected student performance. In sum, Haverinen-Shaughnessy and Shaughnessy (2015) and Granito and Santana (2016) showed that student and faculty believed adverse environmental conditions in classrooms negatively affected instruction and subsequent learning.

The conclusion of both the studies mentioned above indicated that controlling the adverse effects of air temperatures in classrooms can be reversed through gaining control of the classroom's environmental conditions; this control will improve the overall educational experience for students. The previous literature indicates that when classroom IEQ influences class occupancy, classroom attendance, and course duration are relevant factors in exploring students' perceptions of classroom ambient environmental conditions and their effects on student learning.

Course Duration and Attendance

The accelerated format at community colleges can have positive outcomes. The duration of accelerated courses is shorter than the duration of traditional courses. Students must adhere to the time elements in their class schedules to learn critical medical technology procedures. Studies have shown that if students are allowed to attend

class without classroom distractions, they can complete their training and graduate per school preliminary guidelines.

Lee and Horsfall (2010) studied accelerated learning and found students received multiple benefits from accelerated course formats, including receiving consistent feedback from instructors and peers and elevating the personal initiative students needed to focus on their subject. The study focused on how students responded to shifting from 12 weeks to 6-week course durations. Students reported they benefited from the shortened courses regarding camaraderie and responsibility to their peers, constant and immediate instructor feedback and being able to focus entirely on a single topic.

When students attempt to complete their training programs, they often respond to ancillary conditions such as elevated classroom temperatures. Institutional leaders are aware accelerated courses must be completed in about half the time allotted regular classes; hence, minor curriculum adjustments are made to accommodate these students to maintain overall persistence and minimize absenteeism (Edgecombe, 2011). The implementation of traditional 16-week college courses versus 8-week accelerated courses requires leaders to design the accelerated format consistent with rigorous developmental teaching and content to ensure student success under the accelerated pace (Edgecombe, 2011; Kasworm, 2001).

Another example of the benefits of accelerated training was introduced by Anderson and Anderson (2012) who conducted a study on an accelerated course in statistics implemented during a summer session. The researchers confirmed that students

who learned materials at a faster rate adjusted to the speed of the course and performed well on examinations. Further, students attended class daily and therefore had to increase their study rates.

The students completed the course in approximately 80% of the traditional course time, showing that students can perform better and achieve their goals under an accelerated format (Anderson & Anderson, 2012). However, Anderson and Anderson did not specify the physical parameters of their research or indicate how time was an essential element of course completion. Hence, absenteeism based on elevated indoor temperatures may interfere with completion of accelerated-format courses.

Regardless of the stage or level of education, a school's structural condition and subsequent IEQ problems may cause students' frequent absenteeism. School leaders at all levels must ensure the instructional environment is conducive to learning because these ambient conditions directly affect instructors' ability to teach, students' ability to learn, and the attendance of both instructors and students—all vital for course completion (The Wallace Foundation, 2013). The potential effects of IEQ on students who attend accelerated courses prompted my interest in clarifying how students at two colleges interpreted IEQ and discerning whether IEQ influenced their attendance and pursuit of knowledge.

Temperature, Persistence, and Absenteeism

Absenteeism is not exclusively unique to thermal exposure. It would be presumptuous to assume elevated classroom temperature is the sole reason students take a

hiatus from school. Primary and secondary schools experience the same IEQ situations as do colleges and universities (Jurado, Bankoff, & Sanchez, 2014).

For example, in a study in which inadequate HVAC contributed to student absenteeism, researchers evaluated the condition of 95 schools in upstate New York (Simons et al., 2010). In this cross-sectional study, Simons et al. studied operations at institutions in which faulty HVAC systems contributed to uncomfortable thermal conditions. Results showed that byproducts of HVAC failure can include moisture buildup, airborne mold spores, and media suitable for various vectors and vermin species (Simons et al., 2010).

In regard to IEQ and classroom performance, a quantitative study involving school absenteeism and air quality conditions in school buildings was conducted by Fike and Fike (2008). The researchers found an association between classroom heat and humidity and student absenteeism. Fike and Fike (2009) further indicated students' class performance prospered at an optimal temperature of 73°F.

Wargocki and Wyon (2007a) conducted a similar quantitative study in which classroom temperatures fluctuated from 25C (77°F) to 23C (73°F) to observe and measure educational attainment. Compared to warmer classroom temperatures, cooler classroom temperatures improved student speed and performance on classroom tasks (Wargocki & Wyon, 2007a). Therefore, a reasonable and constant temperature can positively influence students' health, learning, and willingness to attend class (Ariani & Mirdad, 2015; Earthman & Lemasters, 2011).

A further review of literature showed a relationship among the physiological effects of humidity, elevated temperatures, and depleted building conditions and indicated how these conditions could lead to increased student absenteeism (Simons et al., 2010). Jones et al. (2007) found elevated indoor temperatures created conditions wherein students sometimes chose to miss school rather than face poor IEQ in uncomfortable classrooms, thus interfering with course completion in accelerated courses.

Funding for school operations plays a role in developing mechanisms to control classroom temperatures, mainly if building age influences the allocation of these funds (Fisk & Seppanen, 2007; Hopkins, 2015). Currently, preliminary building design involving controlling the costs of maintaining IEQ is required for owners and developers to obtain leadership in energy and environmental design (LEED) certification (Chen et al., 2015). The LEED is world recognized building certification program created in March 2000 by the U.S. Green Building Council (USGBC). The individuals using the LEED rating system focus on building design, indoor environmental quality, use of building resources, conservation of energy, and how these concepts can be applied and maintained throughout a building's lifecycle (Kats, 2006; Matisoff, Noonan, & Mazzolini, 2014).

The guidelines for LEED certification incorporate technical requirements for HVAC systems developed by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE). LEED certification is an integral part of the

planning or upgrading of new primary, secondary, and postsecondary educational facilities. Issa et al. (2011) compared IEQ conditions in current buildings to retro-fitted energy-efficient buildings. Issa et al. compared these results to the results seen with newer "green" school buildings for which owners and developers sought LEED certification. Issa et al. found thermal conditions in current schools, retrofitted structures, and the green school buildings concept were similar; however, applying the green school buildings concept showed a decrease in absenteeism among students and faculty.

Although implementing the green building concept could help curtail problems with IEQ, the initial economic viability of the greening of buildings may not be financially feasible (Issa et al., 2011; Kats, 2006; Lumpkin, Goodwin, Hope, & Lutfi, 2014). A study by El Asmar et al. (2014) focused on IEQ metrics in the southwestern United States and the Middle East to determine if occupants were satisfied with the overall quality of their workplaces. A participant pool of 320 students, faculty, staff, and visitors at both locations responded to survey questions designed to pinpoint concerns about building and classroom occupancy and overall IEQ. Results showed thermal comfort was a problem in both locations – primarily attributable to the age and lack of modernization at these learning institutions.

Future School Funding and IEQ

As a part of the green concept (Baker & Bernstein, 2012), building enhancements are made to ensure IAQ longevity and future savings from minimized maintenance or repair (Cooperman & Dieckmann, 2012; Hopkins, 2015; Issa et al., 2011). Although the

green building concept could help improve overall IEQ, as mentioned, the initial economic viability of greening buildings may not be financially feasible (Issa et al., 2011). Moreover, obtaining LEED certification—the trend for the future—is a lengthy process (Cooperman & Dieckmann, 2012). Little regard is given to LEED when institutional leaders seek long-term savings (Indraganti, Ooka, Rijal, & Brager, 2014; Issa, Atallah, Rankin, & Christian, 2009); more concern is placed on capital expenditures, and leaders do not consider how individuals experience IEQ before upgrading and retrofitting of institutions (Fisk & Seppanen, 2007; Harik & Fattouh, 2010).

While evaluating the condition of school systems in the United States, Alexander, Lewis, and Ralph (2014) concluded leaders at approximately half of U.S. schools should consider allocating funds to bring their facilities to an acceptable occupant quality. Further, older buildings often lack a means of temperature control (Alexander et al., 2014), leading to student discomfort and subsequent air quality problems that hinder instruction and learning. These learning difficulties directly related to the physical conditions at the educational institutions in the study (Alexander et a. 2014).

According to Cheng, English, and Filardo (2011), economics and politics involving misappropriations of funds affect the successful pursuit of learning, especially in low-income areas such as inner-city education centers, including for adults seeking advanced education. Cheng et al. (2011) claimed misappropriations of funds directly violate student rights. Kozol (2005) mentioned further that exclusion of educational resources from a macro level has affected how and where students learn, regardless of

their previously acquired education levels. Accordingly, in this study, I gathered information to show how students perceived learning in classrooms with thermal quality challenges. Further, I sought to collect their experiences regarding contributing situation that may have interfered with learning.

The federal government regulates physical and ergonomic conditions in educational facilities. The National Institute for Occupational Safety and Health (NIOSH) is a federal entity that sets standards for building occupancy. State and local manufacturers refer to NIOSH regarding HVAC systems and air exchange rates during construction and operation (Code of Federal Regulations, 10 CFR PART 434, n.d.).

The preceding discussion of existing literature indicates the need for school leaders to understand how students manage the added pressure of poor IEQ conditions while maintaining the mandatory attendance needed to satisfy accelerated course requirements. Far more research is needed if leaders at these institutions are to know more about IEQ and its far-reaching impacts.

Physical Reactions to Thermal Conditions

Extremes in heat, in conjunction with related physical and mental duress associated with classwork, can hinder instruction (Jaakola, 2006; Lei, 2010; NASUWT, 2012). Students and instructors may display physical traits consistent with exposures to elevated air temperatures, such as profuse sweating, decreased motor skills, and difficulties with attentiveness and instructional delivery (Earthman & Lemasters, 2011; Stewart & Evans, 1997). Similarly, to determine task accomplishment rates and task

accuracy, Wargocki and Wyon (2007a) studied thermal conditions and student performance as students performed tasks involving mathematics and language arts.

Specifically, Wargocki and Wyon (2007a) assessed middle school students' performance on tasks involving multiplication, addition, reading comprehension, word identification, and word association under elevated thermal conditions. The children performed poorly on each task during which classroom temperatures ranged between 81°F to 86°F; children exposed to these temperatures displayed decreased completion rates in mathematic functions as well as decreased reading comprehension and speed (Wargocki & Wyon, 2007a). Wargocki and Wyon concluded that the children performed at optimal levels in both mathematics and language arts schoolwork when the classroom temperature was maintained between 68°F and 77°F.

Earthman and Lemasters (2011) and Wargocki and Wyon (2007a) conducted facility intervention projects requiring installation of wall-mounted air conditioning systems. The findings showed how students perceived the attention school leaders gave to HVAC systems and how the resultant IAQ affected learning, persistence, and retention. Instructors face the same challenges and concerns that students face when working in school facilities with poor IAQ (Earthman & Lemasters, 2011).

It is important to note limited data on adult exposures and reactions to classroom conditions with IAQ problems. Most studies have focused on IAQ effects on children, mainly because children breathe higher volumes of air to support rapidly growing organs and tissues (Faustman, Silbernagel, Fenske, Burbacher, & Ponce, 2000). Because poor

IEQ conditions exist and students react to the physical responses generated by excessive heat exposure, it is essential to clarify students' psychological and emotional experiences that may contribute to a lack of learning transfer and subsequent despair that develops from failing to reach their educational goals (LePine, 2004).

Morale and Course Completion

Students come to many conclusions about their schools. Lumpkin (2013) sought to understand how primary and secondary school students felt about structural conditions and morale and found students believed the condition of the educational facility reflected the extent to which school leaders cared about students' academic success. Lumpkin conducted a quantitative survey to measure how students in grades 4 through 10 performed while taking mathematics and English examinations at older deteriorating schools with failing HVAC systems.

Lumpkin's (2013) study was a causal-comparative research design where the condition of the old school or the independent variable or the condition of the schools (old or new) affected the dependent variable or the student's academic achievement by evaluating the percentages of passing mathematics and reading scores. Lumpkin compared student test scores to scores from students attending new schools with modern facilities that provided a more comfortable classroom experience. Results indicated that learning was improved as students transitioned from the old school to the newer educational facilities, thus students in the new schools performed better on the exams and

displayed better morale than did students testing in the older, dilapidated facilities (Lumpkin, 2013).

Lumpkin (2013) noted that high morale is necessary for positive learning in educational institutions. In addition, leaders have often distributed funding for school upkeep unequally based on politics and personal group affiliations, showing that poorly maintained educational facilities may reflect a lack of understanding regarding how education affects morale in schools and communities (Baker & Bernstein, 2012; Hudley, 2013; Karjalainen, 2012).

Social Pressure and Financial Commitments

Students commit to follow a course of study they hope will pay dividends in the future. Students may believe they can complete school with little or no strife because they are using federal funds to complete school or are financially able to meet scheduled payments. Schneider (2002) found attitudes and morale issues develop when students must decide whether they should attend classes under certain adverse conditions or leave school. Researchers have indicated students feel IEQ extremes might diminish their focus on instruction (Lee, Mui, Wong, Chan, Lee, & Cheung, 2012). These students may believe their future social status and ability to secure employment depend on finishing school (Agolla & Ongori, 2009; U.S. Environmental Protection Agency, 2006).

Student motivation to persist during challenging conditions is another concern related to poor IEQ and ancillary conditions. Choi et al. (2013/2014) studied indoor air temperature in an IEQ study at a Midwestern university: IEQ affected student motivation

and overall course satisfaction. Choi et al. (2013/2014) indicated controlled thermal conditions were among the decisive motivating factors influencing student achievement and mental retention in the classroom—factors that motivated students to persist and maintain academic progress.

Additionally, elevated temperatures may affect the mood and subsequent morale of all parties and activities associated with classroom learning. Earthman and Lemasters (2011) studied how indoor temperatures and mood affected learning ability. They concluded that students in classrooms with elevated temperatures had lower productivity and more occurrences of inability to perform routine classroom lessons, compared to students in temperature-regulated classrooms; in addition, instructor presentation quality declined. Further, the added pressure of acquiring substantial financial obligations while in these schools could have motivated some students to develop poor persistence habits (Schneider & Yin, 2011). In fact, students who faced environmental problems caused by inactive HVAC systems acquired additional burdens unforeseen during school recruiting processes and enrollment (Schneider & Yin, 2011).

The literature reviewed for this study illustrated how failure to maintain moderate temperatures between 68°F and 74°F can affect productivity, student achievement, health, and morale (Ariani & Mirdad, 2015; Filardo, 2008). Positive IEQ in class helps school leaders avoid adverse learning conditions, limit student absenteeism, improve instructional performance and efficiency, and avoid negative student perceptions of their schools. In the next section, I provide information on the disciplinary orientations

underlying the conceptual framework. Further, I discuss theories supporting how indoor environmental exposures to heat and potential ancillary situations developing from these exposures may interfere with the transfer of learning in college classes.

Conceptual Framework

The conceptual framework for this study centered on exploring how exposure to IEQ conditions influence students' pursuit of learning – especially where students enroll in medical technology training courses under an accelerated format. There are qualitative studies regarding the relationship certain indoor environmental conditions have with overall building conditions to understand how these areas influence of learning and academic achievement (Graetz, 2006). Recognizing occurrences of overexposure to heat from extreme outdoor climate conditions, failure of HVAC systems, and inconsistent maintenance and upgrade of educational institutions prompted me to formulate this study.

An attempt to devise a theory of how the human body reacts to elevated thermal conditions led me to review several models portraying the physiological response to high indoor temperatures. Also, I explored how these conditions can spark physical and vocal reactions to poor IEQ conditions at these schools. Milner (2010) found in a study on teaching in diverse communities that specific life challenges – be it social or financial – might incite aggressive mannerisms and vivid verbal responses. The following theories aid in developing a prism where the physiological and psychological actions and reaction to thermal exposures peculiar to poor IEQ will help in understanding the participant's perceptions of the environmental quality of their schools.

Human Body Heat Balance Theory

Fanger (1972) developed a theory regarding variations in temperature and whole-body reactions or sensation. Fanger's method involved a quantitative assessment of human functions known as the predictive mean vote (PMV). The PMV is an index of human physical movements involving motor activity, clothing, and physical or environmental parameters (Fanger, 1972).

Use of the PVM shows numerically how the human body balances heat using such variables as radiant temperature, air temperature, and relative humidity (Fanger, 1972). Responses from room occupants are measured based on the reaction to stimuli from each category (Fanger, 1972). These variables affect mental and physical functions as room occupants perform routine tasks and their bodies adapt to thermal loads (Balaras, 1996). Other researchers have claimed Fanger's theory was a simplistic approach to determining the real-world human perception of indoor thermal exposures.

Humphreys (1994) used the PMV model in a study involving the thermal assessment of participants in an office setting where elevated temperatures were present; air conditioning was used to curtail these temperatures. Humphreys (1994) concluded the PMV worked best under ideal conditions and that temperatures below 77°F were best for sedentary individuals to accomplish routine tasks.

However, further studies involving the PMV in British office areas that rarely used air conditioning revealed a bias when the thickness of clothing was factored into the model (Humphreys & Nicol, 2002). Humphrey and Nicol (2002) concluded the

conditions found inside North American offices and similar spaces would be outside the range of bias indicated in the PMV model. The researchers encouraged the use of the PMV model considering the users were aware of the clothing bias associated with this model (Charles, 2003; Humphreys & Nicol, 2002).

Further, Cash (1993) expanded on Fanger's (1972, 1973) work by considering other categories related to student comfort. Cash developed a facility conditions assessment tool known as the commonwealth assessment of physical environment, or CAPE. The CAPE is a theoretical model comprised of several common factors designed to measure the students' acceptance and usability perceptions of learning institutions.

Cash incorporated building conditions, age, weather, and occupant attitudes to provide a blueprint for effective approaches in fully functioning schools. A significant factor was the climate or thermal condition of the selected schools and its effect on students' ability to complete the Test of Academic Proficiency (TAC) for the Virginia region (Cash, 1993). Of these factors, Cash indicated that student achievement on tests was higher in classrooms with air conditioning.

Adaptation to Thermal Exposures

Researchers have studied human adaptation to environments with elevated indoor temperatures. For example, Nicol and Humphreys (2002) developed a human body adaptive model based on how individuals responded to a given thermal environment as they attempted to restore their thermal comfort. Participants in the Nicol and Humphreys study realized they may rationalize or attempt to make sense of their situation by

adjusting to the environment, initially ignoring any physiological and or psychological challenges until conditions become pervasive or unbearable. Humphreys (1978) theorized through his adaptive model that individual participation or activity in a temperate environment is more important than not participating at all; thus, the responsibility for obtaining physical comfort during the pursuit of advanced education rests solely on the student.

The adaptive model includes factors such as building design, clothing, and outdoor temperature variants in determining an individual's level of comfort (Nicol & Humphreys, 2002). However, in college classrooms, students have no control over HVAC system operations or controls. In regions where HVAC systems are the sole method of IAQ control, in the absence of air conditioning, physical adjustment may be limited to disrobing or seeking natural ventilation outside the classroom. Ogoli (2014) indicated the adaptive model works well when building occupants have active control of their environment.

Others have studied how physical environmental factors influence behavioral adaptation and development (Kaplan & Kaplan, 2005; Parsons, 2003). Kaplan and Kaplan posited that people are usually cooperative and reasonable if they work or learn in environments in which leaders show concern about individuals reaching their growth potential and goals. Hence, students and instructors may value course completion enough to endure classroom temperature extremes. De Young (1999) theorized these types of adjustments are consistent with individuals acting reasonably under trying environmental

conditions (p. 223). This need to achieve motivates learners to work against obstacles and forms the basis for essential satisfaction (Almy & Tooley, 2012).

Some researchers have studied thermal comfort and adaptation to evaluate how individuals make physical adjustments during classroom activities. For example, Brager and de Dear (1998) expanded Fanger's (1977) theory by further investigating why people make changes to stimuli in their environment. Brager and de Dear used a quantitative model of measurements taken inside classrooms during work activities as students were exposed to various thermal settings. The findings showed a numerical consistency in a thermally comfortable settings which provided comfort in class and helped to promote a positive classroom work environment (Brager & de Dear, 1998, p. 92).

In a training situation, students need thermal environments that help them concentrate and do not distract them from learning new tasks or operations. Bishop (2009) noted poorly functioning or inoperative HVAC systems can create a distraction for students who should be concentrating on learning, rather than experiencing physical reactions to elevated classroom temperatures.

Social Cognition and Needs Satisfaction

The social cognitive theory centers on how individuals embark on tasks based on their confidence in completing tasks, thus defining their levels of self-efficacy (Bandura, 1989; Schunk, 2012). Students attend courses with the belief they will receive instruction without ancillary distractions that may interfere with their learning (Almy & Tooley, 2012). This perceived comfort in the learning environment resembles Maslow's (1940)

theory that people's primary surroundings must provide satisfaction and safety before they can attain self-actualization – an all- encompassing state of completeness and well-being.

Additionally, Bandura (1977) indicated empathetic experiences, emotional arousal, and social persuasions are all expectations of active self-efficacy. When students must decide whether to endure or remove themselves from situations in which completing tasks are hindered, their emotional and persuasive responses, coupled with the testimonies of others who faced similar conditions, may present challenges detrimental to their self-efficacy. When students perceive the environmental quality of their classrooms are like what they experienced growing up where they failed to gain knowledge, these situations according to Bandura (1997) can influence an individual's self-efficacy and reflect what Bandura deems as a vicarious experience. Students must be in a position where their self-efficacy is heightened so they can handle stressful situations adequately (Cudre-Mauroux, 2011).

Further, the self-efficacy sought by these students is harmonious with the views of Maslow (1943) about how one achieves self-actualization. To that extent, Maslow (1943) indicated that to achieve self-actualization, people begin at the lowest level of human activity. Maslow (1943) claimed lower-order human functions or phases must be satisfied before they ascend to the next functional stage, eventually achieving self-actualization. Maslow proposed five goals or needs; meeting each need allows people to proceed to the

next level of need. Maslow's hierarchy shows that an unfulfilled goal might dominate an individual's consciousness until he or she reaches the goal (Maslow, 1943; Sze, 2015).

Based on Maslow's model, the perception of self-actualization may be acquiring a good job, a new car, or better living conditions. For these goals to be actualized, the need to complete their course of training becomes paramount. Maslow (1943) believed the pursuit of self-actualization was naturally driven within everyone and that accomplishing a goal provided complete satisfaction or achieving one's dreams. These students will ultimately attain employment in the medical field – thus satisfying their perception of economic relevance in a property acquisitions-based society (Kraus & Tan, 2015).

Proximal Development and Social Environment

There are theories where actions perpetrated by individuals in specific habitats. According to Bronfenbrenner (1979) theory of proximal development, an individual's environment and cultural origin are critical indicators of how they function in specific social settings. Bronfenbrenner illustrates this assertion of human activity in his process-person context-time (PPCT) model (Bronfenbrenner & Morris, 2006). The PPCT model depicts Bronfenbrenner (1979, 1999) key theory-styled human development as a senses-driven proximal process – where successions of development activities are all-encompassing and continuously develop. From Bronfenbrenner's observations, he established the PPCT model to illustrate critical factors in the proximal process:

- Process – Bronfenbrenner and Morris (1998) concluded that the process of human development depends on reciprocal actions amongst humans and

their environment; this interaction must occur regularly throughout time. These interactions help the individual understand and make sense of the world around them and how they fit in.

- Person – Bronfenbrenner and Morris (1998) further indicated that the human's role at this stage relies on specific characteristics such as:
    - Demand or individual stimulus – where characteristics such as age, gender, and physical appearance trigger first reactions that drive expectations or stereotypes
    - Resources – when one recognizes the mental and emotional primary needs such as food, housing, decent parents, and the knowledge to meet societal requirements and needs.
    - Force – the need to develop and display personal differences in motivation, attitude, and persistence in acquiring goals.
- Context – An individual's context depends on the microsystem where humans spend most of their time such as at home, with their peers, and how their belief systems develop. Values in the macrosystem must be experienced by one or more of the microsystems to influence a person's development (Bronfenbrenner, 1993; Bronfenbrenner & Morris (1998).
- Time – Individuals are affected by micro-time, or the consistency in interactions during certain activities and the chronological occurrence of

> events or macro-time. Developmental processes at the macro stage may vary based on history, world events, and the individuals age. For example, two individuals may have experienced the effects of a catastrophic natural event such as a hurricane during the same time but due to age differences and stages of their life cycle they view the outcome differently (Bronfenbrenner & Morris, 1998; Elder, 1996).

However, other studies regard Bronfenbrenner's PPCT model as regimented and only centers on the proximal process to shape the whole person. Hossain (2001) mentioned that the family has a significant impact on developing what role individuals play in their culture – what is acceptable in the family unit is okay even when displaying these mores outside the family realm.

Further, in a study on sustaining individual identity in a specific culture, Paris (2012) mentioned that there are differences in the way students communicate and learn based on cultural differences (p. 94). Bronfenbrenner's model shows that the proximal process is necessary for developing an individual's personality and that culture has a vital role in how an individual function in a macro society.

However, Bronfenbrenner's PPCT model is limited to how it can be used to assess how culture affects student behavior, mannerisms, and language. Irvine (2002) indicated that cultural disagreements in learning institutions could have hostile overtones and may lead to students failing to reach their goals. Others such as Elder (1995) concluded that Bronfenbrenner's PPCT model was unable to consider societal changes

and that the proximal process derailed as time elapses. Further, students who come from financially-challenged communities may perceive poor school conditions as an extension of what they have experienced and are hoping that graduating will alleviate their oppressed feelings (Bandura, 1997;Machado, Vaughan, Coppola, & Woodard, 2017).

Kraus and Tan (2015) indicated that social and economic events have a role in defining and categorizing class-structures based on the social and economic mores of macro society members. Others believe acquired character traits are the result of ethnic or cultural traditions and believe that members outside these ethnic groups reject their behaviors and influence their assimilation to what they deem as normal behavior (Gorski, 2015; Milner, 2010).

In contrast, the perception that students who attend inner-city colleges may bring mores peculiar to their communities into college classrooms such as hyperactivity or explicit language; this may reflect certain aspects of Bronfenbrenner's model where an individual's culture combined with continuous personal development may present unacceptable behavior. This generalization of human activity should be viewed as an opinion derived from societal observations and community trend analysis (Bronfenbrenner, 2005; Bronfenbrenner & Morris, 1998, 2006; Nocon & Cole, 2009).

In sum, the theories discussed comprised the conceptual framework and theoretical lens to gain a better understanding of students' experiences with indoor environmental quality conditions and their effect on learning.

Implications

In this study, the physiological and psychological effects of conditions peculiar to IEQ situations guided the data collection and analysis process. Because few data exist regarding how students perceive challenging thermal and associated environmental conditions in their classrooms, the findings from this study could be used to fill this knowledge gap and prompt future studies. After conducting this study, I developed a white paper (Gordon & Gordon, 2003; Graham, 2013, 2016; Kantor, 2009; Steizner, 2007, 2010) of the findings and made it available for dissemination among concerned parties (see Appendix A).

White Paper Uses

The white paper includes information on the current situation at each institution as well as applicable guidelines on acceptable operations at similar educational establishments. In addition, in the paper, I summarize how the interviews conducted in this study showed students' perceptions of their classroom environments. The information from the white paper was designed to help school leaders develop a workshop for future entrepreneurs planning to establish technical schools and colleges; such entrepreneurs could benefit from information about issues to consider when selecting locations and developing facility maintenance budgets. Also, the information in the white paper could help future owners and leaders who are considering renovations and upgrades of their facilities ensure learning, persistence, and retention of students.

Further, human resources personnel could use the white paper information to generate a checklist to help qualify prospective facility managers regarding their knowledge of HVAC operations and maintenance. This process could ensure the best facility maintenance personnel are hired to maintain HVAC systems, thus helping to minimize the amount of class time lost because of mechanical problems with air-handling systems.

In addition, the white paper could provide information for the development of awareness and sensitivity training for educational leaders, faculty, and staff. Students want leaders at their schools to understand students' feelings about elevated classroom temperatures, associated IAQ, and overall environmental quality problems. The contents of this white paper could stimulate additional discussions regarding attendance, persistence, and retention. I provided a snapshot of conditions occurring during class in the hope that this information will motivate interested parties to review the findings of this project study and include this information in their staff training regimens.

Summary

In Section 1, I introduced the topic that led me to study how students at two local community colleges perceived IEQ conditions while they attended medical technology courses under an accelerated format. Further, in this first section, I explained my intention to learn how these students made sense of IEQ conditions. I described my plan to convey this depiction to school leaders in hopes that they will recognize and correct IEQ problems. The literature review in this section indicated a link between building

conditions, adequate IEQ, and student learning and achievement (Earthman & Lemasters, 2011; Simons et al., 2010). In addition, in Section 1, I presented the nature of the study, the guiding research questions, a list of definitions, the conceptual framework, and the study implications.

In Section 2 of this study, I introduce the study's design and methodology and describe the sample parameters, and data collection and analysis. I discuss the study's relevance, assumptions, limitations, and scope and how they relate to the study's conceptual framework.

In Section 3, I describe the goals of this project study and present the timelines, evaluation, rationale, strengths, and weaknesses of the study. Section 4 provides a reflection of the study, including information to help community college leaders become more cognizant of student experiences and concerns. Leaders should understand how students make sense of adverse IEQ situations. Finally, I provide implications for future use of this study and its contents. The paper closes with conclusions of the overall study.

Section 2: The Methodology

Introduction

In this project study, I focused on exploring student experiences with IEQ as they attended accelerated college courses in medical technology. The accelerated course format helps students complete programs quickly, thus allowing them to pursue immediate employment; therefore, daily class attendance is paramount if students plan to graduate and enter the workforce promptly. However, any outside interference could affect learning, student persistence, and retention (Caffarella, 2010). Areas such as elevated indoor air temperatures due to faulty HVAC systems and conditions caused by the lack of temperature control such as dust, mold, and odors can all contribute to frustrating students thus effecting focus, concentration, and learning (Bishop, 2009).

This section includes information on areas necessary to conduct this study using qualitative methodology, including descriptions of the participants, data collection instrumentation, treatment of the collected data, and data analysis procedures. In addition, I present the findings. This study involved making inquiries into participants' experiences by performing in-depth interviews. The interview questions for this study were designed to provide data for answering the primary research questions:

RQ1. How do students make sense of the environmental conditions in their college classrooms?

RQ2. How do students perceive their learning and overall well-being is affected by these indoor environmental conditions?

The primary research questions helped me identify gaps stemming from the student participants' points of view regarding IEQ in their classrooms. The mode of interview questions followed best practice recommendations for implementing interviews to obtain qualitative information (Bogdan & Biklen, 2007; Creswell, 2007). This approached deemed necessary since the goal is to explore student perceptions about the IEQ conditions in their classroom and how they made sense of those conditions.

I applied a phenomenological approach to collect information through participant interviews. I transcribed the interviews, coded the interview data, and triangulated the findings with other peer-reviewed literature regarding environmental quality and the ancillary conditions involving IEQ. My goal was to evaluate the consistency of concerns involving HVAC and IEQ problems at both study institutions and discern how elevated temperature affected students' learning. In the following section, I discuss the rationale for selecting a phenomenological research design to describe college students' perceptions of IEQ as they attended accelerated medical technology courses.

Qualitative Research Design and Approach

Phenomenological Design

I selected a phenomenological research design to explore the experiences of local college students as they encountered poor IEQ classroom conditions. The heightened temperatures in classrooms at these two locations created IAQ conditions such as high indoors temperatures, airborne particulates, and odors that are a part of the larger IEQ spectrum. Use of the phenomenological research design can help researchers show how

people make sense of issues directly affecting their lives (Fisher & Stenner, 2011; Merriam, 2009; Mitchell & Jolley, 2010). Phenomenology originated from philosophers questioning the positivist approach prevalent during the 19th century—positivists believed that reality could be studied rationally and objectively (Reiners, 2012). However, critics asserted that positivism generated knowledge devoid of human interaction (Reiners, 2012). Positivists further believed that the senses held the definition of knowledge – obtaining this knowledge through spontaneous natural phenomena derived from direct observations and experiments (Reiners, 2012).

The 20th-century origins of phenomenology emerged from the efforts of German philosopher Edmund Husserl (1859–1938). According to Husserl (2002), phenomenology related to people's subjective consciousness, realities, and experiences. Husserl philosophized that memory, thoughts, and emotions were part of people's awareness and descriptive of their interactions with events. Qualitative researchers used Husserl's subjective mode of phenomenology to identify the meaning of specific actions; exploring these actions could help clarify the meaning of certain phenomena experienced by people (Giorgi, 1997).

Fellow philosopher Martin Heidegger (1889–1976), Husserl's student and assistant, had differing views on the philosophy of phenomenology. Heidegger (1962) indicated that, from an ontological perspective, knowledge was not the focal point in phenomenological research—a person's state of being was more important than the acquisition of knowledge. Heidegger and Krell (1993) claimed that ontology, or the study

of human self-being, was the basis for extending the concept of interpretation, known as *hermeneutics*, into what is now interpretive phenomenology.

Furthermore, Heidegger and Krell (1993) indicated that researchers had difficulties removing themselves from the experiences they studied. Proponents of hermeneutics hold that researchers must explore their prior understanding and interpretation of a phenomenon and let this knowledge become a part of the research (Smith, 2006). However, the undertaking of bracketing where the researcher avoids injecting personal thoughts or feelings into the research data helped to prevent preventing corrupted data into the study (Dahlberg, Drew, & Nystrom, 2008; Heidegger & Krell, 1993). I sought to separate my personal experiences from those of the participants and, therefore, engaged in the process known as bracketing (Ahern, 1999; Tufford & Newman, 2012). Thus, I relied on participants' information to provide a vivid depiction of the phenomenon, which was the potential for inconsistent classroom temperatures and ancillary IEQ problems to hinder learning transfer.

Use of the phenomenological design allowed me to answer the research questions by interpreting the interview data. These data not only reflected students' experiences when they received instruction in classrooms with poor IEQ but also revealed other related phenomena that may affect leaders responsible for students' academic achievement. Leaders must be cognizant to the needs of modern students since they have significant impact on the motivation, morale, and safety while they pursue medical training (Wood & Bandura, 1989). How leaders interact with these students also aids in

gaining trust from these students – ensuring that these students are successful in acquiring additional learning (Louden, 2012).

Reflection and Phenomenology

Reflection is an essential facet of phenomenological studies. Participants consistently reflected on what they were experiencing during their tenure in IEQ – challenged classrooms. Boud, Keogh, and Walker (1985) viewed reflection as a way to express intellectual and affective activities individuals orchestrate while exploring their experiences to help establish a new understanding and appreciation of what has occurred.

Van Manen (1990) claimed that a reflective nature stems from an effort to grasp the meaning of something. Van Manen noted further that the phenomenological method is the art of being sensitive to subliminal indicators, such as language, and retrieving messages from the language. Language is important because not only does it verbally reveal what participants see, feel, and understand but it also indicates other variables peculiar to an individual's background, environment, and cultural origin (Bronfenbrenner, 1979).

According to Polit and Becker (2005), reflection is the revealing part of phenomenology, displaying the subjective reality of people's experiences. Burgess (2013) called this personal experience in phenomenology *qualia*. Phenomenologists attempt to tap into qualia, allowing people to express how a phenomenon appears to them (Burgess, 2013, p. 27). In this study, related events or qualia included lost school days and negative morale resulting in despair among students.

People often theorize about why certain situations occur in their lives. Usually, people default to negative beliefs and stereotypes involving race, gender, culture, and socioeconomic status (Torres, Howard-Hamilton, & Cooper, 2003). Phenomenological researchers allow people to describe their experiences without applying any assumptions or perceptions outside of participants' conditions (Converse, 2012; Lester, 1999; Moustakas, 1994). Thus, the use of phenomenology differs from performing routine case studies (Flood, 2010). For example, Groenewald (2004) used a phenomenological approach to discover through participant interviews the significant role of mentors in work-based learning scenarios. Burgess (2013) used phenomenology to depict how missionary students made sense of instructional conditions that they believed to be biased during their stint in seminary.

Similarly, I chose a phenomenological research design to elicit participants' perspectives about their experiences (Lester, 1999; Moustakas, 1994). Thus, using phenomenology helped me in acquiring from students what Mouton and Marais (1992) defined as the "insider perspective" (p.157) or the ability to enter the research situation to directly observe, discuss, note perceptions, and interpret the phenomena qualitatively.

Research Setting and Sample

The study occurred at two local community colleges in south Texas that offered accelerated medical training programs. I selected two institutions at different locations based on student concerns regarding faulty HVAC and the resultant exposures to indoor temperature extremes. One building was 28 years old; the other was 53 years old. For

identification purposes, in this report, I labeled the locations for this study as "Location HH" and "Location BT." Hence, participants are listed as HH1 to HH7 and BT1 to BT7 to depict their respective locations while providing anonymity.

At the time of this study, the selected organizations provided day and evening accelerated training programs in the medical field. The student body at the selected schools varied from 2,000 to 2,500 students annually. The two chosen institutions served approximately 150 medical technology students attending day and evening courses. Staff assigned to the selected medical section consisted of eight to 10 instructors per school. Instructors had backgrounds in medical technology and taught day and evening courses.

Location HH had two buildings dedicated solely to medical instruction occupying approximately 40,000 square feet in a one-story structure previously used as an upscale furniture store. Location BT was in a single strip mall and consisted of about 25,000 square feet. I did not know how often the HVAC systems at both schools were upgraded to meet the minimum air-exchange rates recommended for student occupancy (OSHA Indoor Air Quality Manual, 2015). Classes were held at both locations in three 4-hour sessions throughout the day from 8 a.m. to 10 p.m., Monday through Friday. Weekend classes were held periodically for make-up work and administrative workshops.

Participants

Eligibility Criteria of Participants

This phenomenological study comprised student volunteers from each college who attended daytime classes. Most students primarily attended school during morning

hours between 8:30 a.m. to 12 noon. I obtained information from students attending class during the day to take advantage of optimal learning hours. Researchers have found students learn best during the day—in a study of medical student training, students who attended classes during daylight hours achieved maximum educational levels with regard to cognitive speed, learning, recognition of tasks, and ability to recall (Dinges, 2003).

According to Korf & Von Gall (2013), an individual's circadian system is operating at optimal levels during daylight hours. Circadian physiology is biological processes rhythmic with the time scale of a day (p. 1815). Korf & Von Gall (2013) further indicated during daylight hours maximized both alertness and wakefulness while challenges with sleep are overtly experienced and displayed at night.

The information for this study was obtained from participants attending class during hours where they should achieve optimum learning. This concept is supported by a study involving medical student training where it was revealed students who attend classes during daylight hours achieved maximum educational levels with regards to cognitive speed, learning, recognition of tasks, and ability to recall (Buysse et al., 2003; Dinges, 2003).

All participants in this study were over 18 years of age. I provided a consent form explaining all study procedures. I did not interview children during this study. One reason is that individuals under 18 years of age in the United States seldom attend community colleges and proprietary institutions (Bedard & Dhuey, 2006; Matta, Ribas, Sampaio, & Sampaio, 2016). Furthermore, over 22% of students begin their postsecondary education

after they turn 25 (Hussar & Bailey, 2009; Ma & Baum, 2016). The participants of this study included men and women (see Table 1) to avoid potential bias in research.

Table 1

Student Participant Identifiers and Gender Breakdown by Location

Location HH 1		Location 2 BT	
Student	Gender	Student	Gender
HH 1	M	BT 1	F
HH 2	M	BT 2	M
HH 3	F	BT 3	F
HH 4	F	BT 4	M
HH 5	M	BT 5	F
HH 6	F	BT 6	M
HH 7	M	BT 7	F

Note. M = male; F = female.

Justifying the Number of Participants

The combined population of students attending accelerated courses in which poor IAQ conditions existed consisted of fewer than 200 students. I selected seven participants from each school to participate in the interviews. Lincoln and Guba (1985) suggested that researchers should choose sample sizes to maximize the collection of available information. Smith and Osborn (2003) claimed sample size depends on the uniqueness of the phenomenon under investigation—a sample size of five or six participants was a reasonable sample size.

For this study, a total sample size of 14 participants was a workable number sufficient to achieve data saturation. Data saturation is when information from the data

becomes redundant or consistently displays similarities that can become counterproductive to the overall research (Fusch & Ness, 2015; Saunders et al., 2017).

To achieve data saturation, the sample size should be small so the researcher can recognize information redundancy, implying no new information will emerge (Creswell, 2012). In this study, all participants communicated their concerns about the IEQ (in terms of classroom temperature) and described how IEQ affected their focus during instruction. After interviewing all 14 participants from each site, I found that five of the seven participants from each site provided similar responses. I determined no new information was forthcoming. I recognized data saturation based on participants' repeated, similar responses to the interview questions.

I traveled to each school and met with college leaders to select participants who currently attend accelerated medical technology courses. The consideration for choosing the number of sample participants was consistent with Patton's (2002) discussion of choosing an adequate sample size based on "expected reasonable coverage of the phenomenon given the purpose of the study" (p.246). This mindset helped me recognize the point of data saturation.

Under the purposeful sampling technique, I initially used homogeneous sampling by selecting a small group of participants from each location. I then secured these participants attending the two institutions who experienced the buildings' physical conditions firsthand (Burgess, 2013). Purposeful sampling is used in qualitative research when sources of information are limited but the researcher seeks to obtain the most

information-rich data. This technique involves seeking and selecting individuals who have experience and are uniquely knowledgeable about the phenomenon being studied (Creswell & Plano Clark, 2011; Patton, 2002).

I also employed extreme-case sampling (Lodico et al., 2010) to recruit students who had periodically missed class because of physical ailments attributed to classroom environmental quality. I sought to capture the feelings and thoughts of students who experienced environmental extremes in class to learn how they adjusted to the challenges in class and in school.

Protection of Participants

Walden University Institutional Review Board (IRB) approved the proposal for this study before the start of data collection (IRB approval #06-15-17-0333881). No IRBs existed at either of the locations where the study took place. I conducted this research in accordance with the guidance found in Title 45, section 46 of the United States Code of Federal Regulations (CFR). Additionally, I provided and obtained informed consent as required under this code.

The informed consent forms included the following: (a) a written statement of the purpose of the research; (b) a written list of potential risks; (c) a list of discomforts the participants may have experienced during the study; (d) a statement regarding the confidentiality of information obtained during the research; (e) a statement informing participants they could cease participation in the study at any time; and (f) contact information to report concerns during the research. Further, to protect the identities of the

participants involved in this research, I removed their names, physical and electronic addresses, current and prior school affiliations, and any personal or health information from interview transcriptions and electronic information.

Finally, I followed Walden University requirements by completing an online ethics training course entitled "Protecting Human Research Participants" sponsored by the National Institutes of Health Office of Extramural Research. In addition, I completed a tutorial on conducting ethical research studies provided by Walden University.

Data Collection

Instrumentation

In this phenomenological study, I served as the data collection instrument. I used a set of interview questions to collect data on the lived experiences of 14 participants who had encountered poor classroom IEQ. The development of this tool stemmed from the initial research questions regarding how students made sense of the environmental conditions in their college environments and how IEQ affected their learning.

I did not interject any of my own thoughts and ideas during the data collection and analysis process. I understood that expressing my personal experiences with IEQ situations could have affected the research; therefore, I avoided conveying any preconceived notions and interpretations to the participants.

Setting aside my personal beliefs helped me maintain objectivity and avoid contaminating the data collection process. As suggested by Ahern (1999), I evaluated the areas in this research in which potential bias could have occurred and carefully

formulated the interview questions. I designed the interview questions to prompt participants to describe their perceptions and daily experiences while operating under IAQ extremes (Bjerregaard, 2011; Arksey & Knight, 1999). According to Giorgi (2009), the interview questions must meet specific criteria to provide the interviewer with a clear description of the phenomenon. I was cognizant of the participants' prior experiences involving IAQ in these institutions and used this mindset while seeking to obtain their vivid descriptions.

From the collected data, I developed a sense of students' actual classroom experiences, students' beliefs on learning in the classrooms, and school leaders' actions regarding IEQ in the medical technology classes. This "whatness" (Willis, 2004, p.4) was revealed in participants' perceptions of their experiences during adverse IEQ conditions. The manner and degree of posing these questions were integral in connecting meaning to the phenomenon, particularly regarding IEQ effects on learning.

Preliminary Coordination for Data Collection

After I received Walden University IRB approval, I e-mailed invitations to prospective students to participate in this study. I sent informed consent forms to each participant. In the e-mail, I explained the specifics of the interview process as well as start times and dates.

As suggested by the leaders at each study locations, I interviewed the participants in medical observation rooms equipped with two-way mirrors, allowing me to interview the participants without being in the room with them. Using the two-way mirror aided me in

enhancing the audio information about their experiences as well as allowing me to observe the participants as I collected data. I completed the data collection process within 5 days.

First, I electronically transcribed the data to ensure validity. The transcribing process ensures accuracy in documentation and supporting information and helps the researcher assign meaning to the data (Oliver, Serovich, & Mason, 2005). To validate data analysis, I telephoned members from each location to carry out member checks (Burgess, 2013; Creswell, 2007; Harper & Cole, 2012).

Member checks consist of having the participants of a study review the research interpretations for credibility; this aids the researcher in attaching reliability to the narrative accounts of the study (Creswell & Miller, 2000; Lincoln & Guba, 1985). Employing member checks facilitated the process of reviewing and identifying similarities in the data to validate information as well as to protect against interjecting my personal feelings. Misunderstandings can happen in this type of research; Maxwell (2005) indicated member checks are useful in helping the researcher identify personal biases and assumptions.

I did not offer any rewards or compensation for participation in this study. The main benefit of this research was its potential to help future decision makers improve structural and maintenance conditions at learning institutions.

Participant Selection

I held only one round of interviews. For the interviews I selected 14 participants in total, seven each from two institutions. I conducted interviews at locations convenient to the participants. I asked open-ended questions to guide and focus the interview. Appendix B contains a list of questions I asked the participants based on the primary research questions and previous literature.

Creswell (2007) indicated an open-ended interview approach helps interviewees reveal their lived experiences; thus, this approach was suitable for encouraging students to describe their experiences when encountering poor IEQ at their schools. In addition, the open-ended questions were intended to assess the effectiveness of the transfer of learning and reveal how leaders were involved in addressing IEQ.

I employed a semi structured interview approach to give me the ability to formulate guided follow-up questions (Bjerregaard, 2011; Creswell, 2007). College leaders at both schools assisted me in the data collection process. School administrators helped by reminding students to respond promptly to the electronic messages regarding the study. I therefore had ample time to gather the information I needed, to collect all data, and to prepare the data for rigorous assessment and review.

I was the only interviewer for this phenomenological study. This type of interview procedure was consistent with the descriptive approach recommended by Patton (2002) to obtain information on participants' perceptions of the phenomenon. This method

helped me obtain the many perceptions expressed by the participants (Burgess, 2013; Creswell, 2007).

The participants gave answers to each open-ended question and provided additional information that required my consideration during the interviews. The participants attended two different campuses; however, they experienced similar environmental quality issues in their respective schools. I devised an alphanumeric code design as an identifying device for reporting the findings.

Data Collection Process

I held interviews at both colleges. For documentation purposes, I labeled these schools as Location HH and Location BT. Each location had observation rooms that instructors used to view and verbally assist students while not being physically in the room. The observation rooms allowed me to ask interview questions without revealing my identity. Conducting the interviews in this manner gave me an unobstructed view of participants' nonverbal gestures as they answered the open-ended questions. All participants actively participated in this phase of data collection.

On the first day, I interviewed the first four participants at Location HH and three participants from Location BT. On the second day, I visited Location HH, interviewed four participants, and returned to Location BT to interview the final three participants. Bonaccio, O'Reilly, O'Sullivan, and Chiocchio (2016) noted that nonverbal movements could add important elements to the data and help reveal participants' true meanings. As I observed the participants' mannerisms from the other side of the two-way mirror, I did

not observe any overt gestures that did not match the feelings expressed from participants at both locations.

The participants appeared comfortable with the interview questions and responded willingly. They also provided clear emotion-filled information about their experiences in class under IEQ conditions. I used a multidata cell phone recorder to collect verbal responses for later use. Each interview averaged approximately 40 minutes.

Data Analysis

Development of Interview Data

Once I had completed the interviews at both sites, I compiled the transcribed data using HyperRESEARCH (ResearchWare, n.d.) to help me code the text. This software allowed me to input textual data to compare the consistency of the data collected from both sites to identify similarities. I then proceeded to triangulate the data to establish a clearer understanding of participants' perceptions (Creswell, 2007; Ortlipp, 2008, Creswell, 2007).

I transcribed and developed the data to show participants' experiences and perceptions regarding IEQ and ancillary IAQ conditions. I found my field notes consistently matched the comments from the participants in the study. For example, some participants displayed gestures and body movements synonymous with their psychological responses when discussing IEQ (Bonaccio et al., 2016). Lewis, Hitchcock, and Sullivan (2004) found that psychological reactions to poor IEQ represent human character traits that reflect consistent negative responses to IEQ.

Data Coding

To ensure I had a clear understanding of the data, I uploaded the transcript data into HyperRESEARCH (ResearchWare, n.d.) software to organize the transcripts and began coding the interview data. I used alphanumeric symbols to place certain limits on the data for clarity. For example, inputting data into the Hyper RESEARCH (ResearchWare, n.d.) software produced over 70 identification instances in which participants used specific terms. I later gave these codes thematic headings to highlight significant responses from the interviewees.

Identifying themes in the data begins with sequential coding (Creswell, 2007). Coding consists of reviewing the collected data to reveal a pattern of emerging themes (Babbie, 2001; Richards, 2009). Because indoor environmental quality (IEQ) was the driver for this research, I initially used a predesigned open coding system centered on what I anticipated the participants had experienced while attending class (Bogdan & Biklen, 2007; Gibbs, 2007; Sutton & Austin, 2015). I applied codes to text elements such as the description of each school, participants' ideas of a perfect indoor classroom environment, participants' perceptions of distractions in this context, and participants' beliefs that they could learn under these circumstances.

The next step was to use axial coding, whereby the relationships with sub-categories can be coded amongst primary coded categories (Creswell, 2007; Strauss & Corbin, 1998). According to Strauss and Corbin (1998), axial coding allows the development of a coding paradigm where I could view the overall phenomenon of my

study, the relative conditions of my research – either intervening, casual, or constructional, the methods or strategies needed to deal with the phenomenon, and the outcome or consequences peculiar to the phenomenon. Axial coding further aided in matching the interview responses to the interview questions.

After reviewing field notes and redocumenting interview data using HyperRESEARCH software for my transcript coding sequence, I found over 50 initial categories which showed a pattern; this narrowed the initial analysis to five essential categories:

- Location and setting – noting comments about building conditions, HVAC operations, and school facilities;
- Specific IEQ issues – comments about elevated temperatures, airborne particles, and odors associated with stagnant air movement;
- Emotional responses – verbal outbursts because of classroom conditions
- Participant perspectives – how participants felt about the leadership at their schools regarding classroom conditions; and
- Relationships associated with IEQ conditions – how participants perceived these conditions affected positive learning

After reviewing approximately 50 different categories, I narrowed the codes to disclose repetitive comments regarding four elements:

1. Correct choice of school for training
2. Uncomfortable temperature inside classrooms

3. Poor building condition and maintenance
4. School leaders don't know about the conditions.

Thematic Assessment of Data

Using a thematic analysis (Braun & Clark, 2006; Clarke & Braun, 2013; Creswell, 2009; Guest, MacQueen, & Namey, 2012; Ryan & Bernard, 2003) facilitated the identification of themes that recurred during analysis of the coded data. Comparing this information to the research questions helped me locate and establish categories depicting students' environmental concerns. Coding is a system used in qualitative research where regularities in data are sought out and identified as short phrases that represents patterns in the collected data; using this information is vital to the development of themes. (Babbie, 2001; Bogdan & Biklen, 2007; Rowley, 2012).

These analytical processes aided me in understanding how the participants' lived experiences emerge from the interview data and helped to discern their perceptions of the IEQ in their classrooms. Next, I categorized the responses according to the interview questions and summarized the findings. Burgess (2013) used a similar thematic analysis model to explore how students made sense of academic freedom in a seminary that used confessions as a means of religious control over students. Burgess (2013) recommended first-time phenomenology researchers apply thematic analysis using the process suggested by Smith, Flowers, and Larkin (2009).

The steps in the thematic analysis are both iterative and inductive, in which each level directs the researcher to pinpoint and thoroughly peruse the data for themes. Smith

et al. (2009) provided a strategy in theme identification as a part of interpretive phenomenological analysis. Therefore, to identify how participants made sense of their experiences with high indoor thermal exposures occurring while they attended accelerated training courses, I incorporated Smith et al.'s recommended six-step strategy:

1. *Analyze participants' comments, revelations, concerns, and perceptions. I read each transcript verbatim to understand the meanings enclosed in each passage fully.* Participants perceived that learning was challenged by them having to adjust to variations in air quality to remain in class and receive instruction.

Aspects of the heat-balance theory revealed that certain variables such as indoor ambient heat and overall air quality could affect physical and mental functions while the body adjusts to the physical burden (Fanger, 1977; Balaras, 1996). Hence the comment about learning was a challenge and how leaving class or not returning to school became options. This process allowed me to view the interview process through the participant's eyes.

2. *Identify consistencies in patterns of information in participants' comments as a path toward pinpointing both relative as well as ancillary situations related to their experiences, regardless of simplicity or complexity.* This process consisted of reading and re-reading my notes and recordings and archiving my thoughts about the participants' perceptions of their classroom environment. Although this was a very lengthy process, it was beneficial due to way participants responded to the interview questions through their mannerisms and emotions. The participants

from both schools perceived that the schools made environmental quality a low priority at their institutions. This process allowed me to conceptualize what the participants were feeling while aiding me in refining the interview data. Identifying consistencies in the data proved instrumental once the transcripts were coded and compared with the data generated by the HyperRESEARCH program. I took this information and further fine-tuned the responses to capture and gain an interpretive level of understanding of how participants made sense of classroom experiences.

3. *Developing a relationship with the data and my knowledge of IEQ, noting emerging themes.* The participants' responses aligned with my prior experience of the physiological and psychological effects of occupying rooms where the air temperature interferes with normal functions. Nicol and Humphreys (2005) mentioned that individuals adapt to indoor temperature extremes and stay focused on tasks. Most participants indicated how they must complete their training for both personal and financial reason and how they adjusted to conditions in their classrooms. My experience in being exposed to similar conditions helped me to identify with their perceptions and how their perceptions aligned with the comments they provided during the interviews.

4. *Organize the data so that the transcript entries show an information pattern from coding to the consistency in thematic development, allowing the creation of final themes.* I was careful to compare the coded transcripts to identify similar

patterns in responses. I then proceeded to combine like terms to responses from each participant. I rank the responses from general to specific concerns regarding in-class ambient conditions, effectiveness of learning during class, and whether school authorities are concerned about these conditions. This helped me to identify and confirm what Van Manen (1990) indicated as the truthfulness needed to fully illustrate phenomenological depictions.

5. *Use the extracted transcribed data to develop a descriptive narrative of responses from the interview.* To help me fully understand the participants experiences in class, I took all the transcribed data and created a narrative depicting what the participants experienced living through each day as they attempted to learn in these classrooms. By reviewing my open-ended interview questions, I was able to probe deeper into the participants' concerns to ensure I understood all the data form my point of view. This also helped during the member check process of this study.

6. *Finally, reflect on the understanding of the conceptual views revealed through the entire thematic development process.* Reflecting on was the participants conveyed during the interview process was crucial in helping understand what positive and negative perceptions the participants revealed during their tenure in class. It also helped in looking for potential solutions to their concerns about the adequacy for their learning environment (Smith et al., 2009, p. 241).

After completing and analyzing the coding of the transcript data, 50 categories were coded based on information produced by the HyperRESEARCH software and my comparison to hand-transcribed data. These themes emerged revealing the participants' classroom experiences with classroom environmental quality, how they viewed the quality of learning and instruction, how the IEQ was responsible for secondary concerns, and how they felt about the school and school leadership during these experiences.

The repetitive nature of participants' comments was instrumental in identifying themes. The identification of emerging common themes during the thematic analysis process was based on the number of times certain phrases appeared in the data. After revisiting the transcribed information, I narrowed the codes for similarities and identified the following themes:

1. Did I make the right decision coming here?
2. Hot, dusty, and muggy classrooms; can't think.
3. Maintenance crew can't fix anything.
4. Leaders are always in meetings while we suffer.

Appendix C includes the frequency of these themes in participants' responses.

Further, the themes aligned with the primary research questions and interview questions to provide a richer view of the collected data. Themes and subthemes emerge from repetition of concepts in text (Ryan & Bernard, 2003; . Smith et al., 2009). The bundled themes also yielded subthemes such as "The correct school choice"; "The temperature inside classrooms"; "Building conditions and maintenance"; and "Leaders'

awareness of classroom conditions. A depiction of these themes and subthemes is found in Appendix D.

The emergent themes helped me summarize students' views of facility operation, facility management, and instructors. Most important, the coding system helped me identify participants' concerns and feelings regarding learning in high thermal classroom conditions; thus, the themes were an integral part of the data analysis process and are the goal to answering the research questions (Creswell, 2007; Pitney & Parker, 2009). I conducted a thorough review process, as recommended by Smith et al. (2009) These procedures assured me that the data collected in the interviews were credible and fulfilled the goal of this research.

After completing the final tabulation of the data, I summarized and printed information related to the study. I further encrypted the data and assigned personal passwords to my security storage system for safekeeping. I scanned and stored the field notes, interviews, and any data associated with the study on hard drives and flash drives dedicated to this research. As of this writing, the computer dedicated to this research and the printed copies generated during the study are stored in my locked office, accessible only by me.

Research Findings

The following discussion contains the findings from semi structured interviews during which I asked 14 participants questions based on the primary research questions that guided the study:

1. How do students make sense of the environmental conditions in their college classrooms?
2. How do students perceive their learning and overall well-being is affected by these indoor environmental conditions?

Note: This section has interviewees using expletives to express how they felt about the IEQ and aesthetics in their classrooms; these comments are provided verbatim. Expletives in this study are used (a) to provide additional understanding to readers, (b) to indicate the speakers' emotional intensity, and (c) as a technique to aid in presenting a message and aid in providing overall credibility (Corden & Sainsbury, 2006; Millwood-Hargrave, 2000).

Many researchers have used specific narrative language to depict the feelings of participants in phenomenological studies. The participants in this project study were products of the local inner-city school system who chose the two colleges to pursue advance education. According to McInerney (2009), students from urban communities were previously categorized as "at-risk" during early school days and possibly would not finish primary or secondary schools. Their choice to attend community college may be either economic or social, and the profanity they used in response to my interview questions is their sole expressive power of language; this verbiage reflects as lamented by Sobre-Denton & Simonis (2012) as indigenous to the familiar surrounding peculiar to their living environment.

It is important to use the participants' words as given in the interviews to provide a rich description of how they perceive the environmental quality of their classrooms. Angier (2012) indicated that profanity in writing is necessary when it influences or enhance the nature of the literature (p.7). Further, the use of "real" language helps the reader to understand as Freire (1998) indicated in his depiction of critical consciousness – thus allowing the participants to express their lived experiences as they occur and how they handle situations based on their social and environmental surroundings.

Interpretation of Themes and Subthemes

In the following discussion, I summarize how participants responded to the open-ended interview questions derived from the primary research questions. The questions helped me understand how students perceived their experiences with the indoor classroom environment as they received instruction. From these responses, themes emerged from the data, which I used in the interpretation phase of this study.

The 14 participants alluded to concerns about the thermal and air quality conditions associated with the overall quality of their classrooms and how these conditions affect learning. The patterns or themes obtained from interview data showed how participants perceived the overall school experience at each location. The subthemes revealed during the thematic process helped to further illustrate the participants' experience as established through the expressiveness of their stories.

Theme 1 – Did I Make the Right Decision Coming Here? The participants in this study indicated that the most important reasons for attending these schools are how

fast they can complete their training and the convenience of having a medical technology training school close to their homes. All the participants perceived that attending these schools was the direct path to acquiring advance education and was the driver in them choosing these schools for their advance training.

However, the environmental quality of their classrooms prompted some participants to wonder if they made the right choice in selecting these schools. In discussing IEQ, several participants mentioned not attending class or quitting school. Participant HH 2 said

> I'm going through too many changes here ... hot and stuffy classrooms and shitty instruction. Why did I come here? This place in a freaking nightmare and I'm not learning shit. But they always tell you about what's going to happen if you fail. I just want to get through this quick, fast, and in a hurry!

Similarly, Participant BT 5 noted

> Every day when I come here I prepare myself for the heat. I sometimes take breaks in my car with the ac on. I shouldn't have to do this! My friends warned me about how broke down this place is...This was a mistake! If I could do this all over again I would go to a different school. This place is the only thing left between me and a better job!

In addition, participants expressed how they believed an ideal learning environment should look and feel.

For example, participant HH 6 mentioned that the air quality in class was identical to the air quality in classes attended in Mexico.

HH 6 stated

> Just like Mexico, it hardly rains here – always hot! And when it does rain, it's so humid after the rain your clothes stick to you! On most days in class it was cooler outside than it was inside—if you call an outside temperature of 90 degrees cool! You think somebody would put money in making this place better, yeah right! I don't know where the money is going, but it ain't here!

Participant HH 6 had anticipated experiencing better classroom environmental conditions at a school where students made financial investments for their education.

At both locations, participants stated they enjoyed attending their respective schools. For instance. BT 3 indicated that coming to school "was a relief! I get to talk to people who think like me. It hard to talk to my 12-year-old at home about anything!" However, the IEQ with subsequent conditions was the catalyst for distracting students as they received instruction, causing them to have difficulty concentrating in a less than pristine classroom environment.

Most participants from both locations made comments to instructors about the situation and mentioned IEQ on their course critiques. Both Participant HH 3 and Participant HH 7 said their instructors told them to "tell the boss about it," indicating instructors had no control over the environmental quality of the school; this further made them question the choice of enrolling at this school.

HH 3 added, “Some instructors really care, but others are stuck-up pieces of crap that are more concerned about their looks than our classrooms. Someone should tell them they are sweating just as much as me!”

Students from both schools were frustrated, believing school leaders either did not consider their comfort in class a priority or were not receiving information on classroom conditions and thus were unaware of the environmental quality of their classrooms. Participants stated the physiological responses to the air quality in class interfered with motivation.

Participant HH 1 said

> The hot, uncomfortable classrooms ruin the will and motivation to attend class, receive my lessons, and stay focused. This microwave oven makes you want to leave class. When I get home, it hard to study labs since most of the time I am distracted by trying to stay cool! My notes are everywhere!

Most participants indicated that the heat and other air quality conditions made being in class unbearable and learning difficult.

Participant HH 2 said

> The instructors and my classmates reacted to horrible conditions by adjusting like walking out of class or not coming to class at all. Staying in this smelly class should show someone you are more concerned about your future and are willing to put up with anything. But why should we? We pay to be here!

Participants also mentioned ancillary conditions related to the failing HVAC system. Participant BT 3 and Participant BT 5 said the hot, muggy air and odors in the stuffy classrooms made it hard for them to concentrate.

Participant HH 3 stated

> The air in these damn classrooms is stinky and hot, and no one seems to care! I go home, and my children ask me why do I smell so funny? I feel sick when I know I got to go back the next day. Sometimes I ask myself, should I leave this freaking school?

Students' concerns over classroom environmental quality create a situation in which learning is difficult because of constant distractions. Participants described their experiences but anticipated that the environmental quality of their classrooms would remain the same throughout their school term. Most of the participants indicated that they remain steadfast in their efforts to reach their dream of ultimate achievement. This is an example of self-actualization as postulated by Maslow (1943) through continuing to pursue advance education regardless of the obstacles. However, the participants said they felt uncertainties about controlling the indoor air quality and comfort within their classrooms.

The subtheme of the correct school choice evolved from the transcribed data depicting how the participants felt about their schools and why selecting these school was the best choice. HH 2 stated

> I have two small children and it is hard sometimes to get somebody to watch them. Since the school is close by, I can get my aunt or my sister to watch them. They watch them when I go to work also; I guess they are ok with it. So going to this school is the best choice for me.

BT 3 gave a different reason for choosing the neighborhood school. BT 3 said:

> I waited until my child turned 12 years old, so I could leave him at home with the neighbor, so I could go to school in the evening. Being close to home helps me to get there quick if I need to. It beats having to drive to the other side of town, I don't have to worry much.

HH 6 chose this school based on the recommendation of a former student. HH 6 stated:

> I have a friend who completed his training at this school and now works at a hospital making good money. He told me the school was well kept, the instructors are cool, and you can finish fast. That sold me right there!

The participants in this study believe they made the right choice in attending these schools and trust that all accommodations therein will result in successful learning. They further expressed how that their choice to attend school to improve their lives is a part of their correcting past poor choices, or as BT 1 said, "I've made mistakes in the past, but I feel going to this school is the best decision I've made in recent years."

Most students indicated that they enrolled in these schools with an open mind – believing that they will achieve their educational goals.

Theme 2 – Hot, Dusty, and Muggy Classrooms; Can't Think. The second theme obtained from the interview transcripts defined elevated temperatures in class as an important area of concern. These exposures spawned physical responses from participants that was impacting learning. The control of indoor air temperature in class during spring and summer months is vital to students are to acquire knowledge via classroom instruction without distractions. Participants consistently said that indoor air quality and room temperature influenced how they functioned in class. Participants at both locations mentioned inconsistencies in air quality, ventilation, comfort, and how these variables contribute to the effectiveness of classroom learning.

The participants were verbalizing how the room temperature affected their education, requiring them to either adjust to the conditions or not attend school. The need to control indoor temperatures was mentioned frequently, describing IAQ conditions as hot, muggy, and stuffy.

For example, Participant HH 2, Participant HH 3, and Participant HH 7 said classroom environmental conditions were unpredictable. They said temperature control was a big problem, particularly after facility maintenance workers had repaired the system.

Participant HH 7 said

> The janitor comes in here, touches the temperature control, and leaves. He knows something's wrong. Damn thing ain't made a sound in days! I see him later

> outside standing under a tree, smoking and talking on the phone. I guess they just don't care!

Some participants referred to prior learning experiences when comparing their current classroom environmental experiences. For instance, Participant HH 5 mentioned

> When I was in high school here the air conditioning stopped working all the time. Our classroom was hot and stuffy. Nobody could learn anything. We made fans out of our notebook paper. How could you concentrate? And now, here we go again!

HH 5 also stated about a fellow college student:

> One of my classmates fainted due to the heat. I never saw so much sweat! It was like he ran from home to be here. I was worried because he is overweight and told me he was taking blood pressure medication. He didn't come back to class for a few days after that.

Participant BT 1 referred to temperatures elevated because of absent or inadequate air conditioning: "You think more about the heat! It's so hot and muggy in here – I can't think!"

The participants said the faulty HVAC system triggered physical responses such as coughing and sneezing from inhaling airborne particulates, making it difficult to breathe. These conditions made attendance a challenge because sporadic HVAC and the poor IAQ spread germs to other classmates, causing them to become ill. In addition, participants said vocalized noise due to the students' physical reactions to the

environmental conditions coupled with the mechanical sounds coming from poorly repaired HVAC units increased a lack of concentration and overall discomfort. They said they could not receive instruction because of these conditions.

Participant HH 2 stated that in a phlebotomy class, the elevated temperatures made it hard to concentrate and induced headaches and sleepiness.

HH 2 also said

> When I go home from class, I'm drained from the heat and the energy it takes to fan myself. I even have to take a shower when I get home just to cool down. Hey, maybe I should be on the fuckin' beach!

Participant BT 2 indicated that trying to stay awake in class under temperate conditions created tiredness, "I can't learn nothing in this sweatbox!"

Further, participant BT 5 and participant HH 3 stated that instructors sometimes had problems conveying information because of classroom air quality, causing students anxiety and thus affecting learning. Participant HH 3 overheard two instructors speaking; one instructor said that if they did not improve these "shitty" working conditions he would find another job.

Participant HH 3 also stated: "It's funny, the instructors and us feel the same! No wonder they talk so fast! One of them even carries a sweat rag in his pocket! These school owners have to know what's up!"

Participant BT 5 described being in stuffy, hot classrooms in which the air was stagnant, identical to the air in the student restrooms in the building, in which elevated air temperatures produce a variety of odors.

Participant BT 5 mentioned

> Sometimes I hold my breath because the classroom smells like the funky restroom and the smell sticks to you. All I can think about is getting out of there. When I get home, I run to the shower to wash the funk off of me! I know what I signed up for. I must finish what I started. They really need to fix the ac so we can learn our lessons.

Participant BT 5 also indicated that accepting these conditions under the circumstances was essential, in restrooms and class, because both areas are needed and necessary to complete academic training.

The participants conveyed that students' experiences in and outside the classroom contributed to the physiological and psychological episodes students displayed while attempting to attend and remain in class. Additionally, these experiences reflect on the research questions regarding how students perceive that these conditions are affecting their overall learning.

A further review of the transcripts revealed the subtheme of the temperature inside classrooms and its effect – particularly when temperatures interfered with instruction and physical comfort.

The subtheme of temperatures in class during instruction due to failing or inoperative HVAC systems is frequently indicated from the transcribed data. The participants were enthusiastic when discussing how the elevated temperatures affected how they attended class. The temperatures extremes also made certain students recall past instances where the air temperature was a hindrance to academic training and health.

For instance, HH 6 was reminded of conditions while attending high school in Mexico – where the indoor air temperature in the summer was at times 20 degrees higher due to a faulty system HVAC. HH 6 indicated that it was impossible to learn during those times or as he stated, " I just walked out!" The concern about how the indoor heat was causing them to not focus on lessons and become sleepy during instruction was indicated throughout the study.

The participants also indicated that this heat may be a combination of faulty HVAC systems coupled with the condition of their school buildings. Some classes were held in sections where there were no windows, adding to the elevated temperatures caused by inoperative HVAC systems.

HH 5 said

One day they opened up all the doors when the ac stopped working. Not only did more heat come in, but car exhaust and noise from the outside came in. My lab is near the parking lot, so this didn't help at all!

Most participants indicated the heat in class due to the inoperative HVAC systems interfered with their concentration and caused them to make mistakes while receiving hands-on instruction in training labs.

BT 3 stated

> In one class I was trying to insert an IV on a mock unit. I was hot and sweating, and I missed the damn mark four times! I can't concentrate! I really want to get this shit right, I don't want to kill someone!

At both locations, participants indicated that they seldom see anyone consistently maintain the HVAC system on perform routine building maintenance. The participants perceived that if the maintenance was done on a consistent basis there would be no IEQ problem. The participants also believed that maintenance crews at both locations lack the skills to adequately maintain their schools.

Theme 3 – Maintenance Crew Can't Fix Anything. Participants in this study felt the condition of their school buildings and the maintenance of the HVAC systems are the most important areas requiring attention from school leaders. Most of the participants said the schools placed a low priority on general school maintenance. They said school custodians were to blame for the problems with the IEQ because the custodians were not specialized in maintaining HVAC systems. The participants claimed that the air-handling systems were the reason for distractions and pauses in learning.

Participant BT 2 strongly believed

> The only thing I see our custodian do is maybe sweep the floor and drink coffee even though he is sweating. He spends more time outside walking around than taking care of the building, he doesn't seem to know how to do anything! He can fix coffee but when it comes to the air conditioning, he can't fix crap!

Participants further said that leaders showed little interest in how their classrooms affected students' education. Participant HH 2, Participant BT 4, and Participant BT 7 shared similar stories; Participant BT 7 said these distractions could be limited if facility maintenance performed periodic spot-checks of the system. Participant BT 7 said, "I told the maintenance man it was too hot, dust was in the air, and it's hard to breathe, and he said, 'I' know it,' and walked away. I didn't see him anymore that day!"

Participant BT 4 similarly indicated that it was necessary to leave the classroom when temperatures were elevated, resulting in missed class time and essential course materials. Participant BT 4 said, "I must stay in a hot, muggy class. I can't get promoted if I don't finish, but I have to get out of here!"

At each school, the students attempted to make sense of their situations by interpreting school leaders' level of concern. General operations at these institutions seemed to take precedence over what Participant BT 3 identified as "little concern for the smell and the heat from school heads." This statement showed how participants made sense of the environmental conditions in their classrooms.

Participant BT 3, Participant BT 4, Participant HH 5, and Participant HH 7 said they accepted the situation for what it was and that their goal was to complete their

training regardless of any obstacles they encountered. They said it made sense to them that school leaders placed little concern on air quality and that students should adjust and deal with air-quality conditions.

Further, participants mentioned that because it was costly to attend these schools, leaders should hire competent facility managers and adjust school budgets to pay for their services. Participant BT 4 indicated that as a facility manager, he would gladly acquire the additional training to become a certified HVAC technician, especially if the schools would pay for his training. Participant HH 3, Participant HH 5, and Participant HH 6 said they would acquire training in HVAC maintenance and would work part-time for the school during warmer months.

Participant BT 4 said

> Working for the school would help pay my student loan—there will always be lots of repair work at this crappy place. They won't fix the AC or clean the damn lab benches. I can do it all and make this a better place to go to school!

This response gives credence to how often these HVAC systems failed and how students perceive operations in their schools. Participants viewed the condition of their schools are proportional to the local community – which explains why leaders are reluctant to make HVAC maintenance a high priority.

Comments from the participants give the perception that their school attendance is not important enough for leaders to ensure they have adequate classrooms to acquire

learning. Most participants said this could be attributed to the conditions of their school buildings and the little to no maintenance done to correct these conditions.

Building conditions and maintenance appeared as a subtheme frequently throughout the transcribed data. Most participants mentioned that the state of their school buildings could be better if leaders made upgrades and preventive maintenance a priority. Due to the heat in these buildings, ancillary IEQ problems develop contributing to the distractions students encounter during class sessions.

For example, participants BT 3 and BT 6 mentioned they observed white, dusty-looking particles at times when facility maintenance attempted to fix the air conditioning. BT 6 said, “white stuff fell from the ceiling, it looked like dusty snowflakes”. Researcher have described this as the same scenario where due to the building’s age and ceiling tile conditions that friable asbestos is being released into the air and being inhaled by room occupants (Flinn, 2014; Mendell & Heath, 2005)

Participants also mentioned during the interviews that poor maintenance on HVAC systems created loud noises in class which cause difficulties in receiving instruction and gaining knowledge. HH 3 said, “the janitor told me the noise will go away soon… It’ll be alright. I thought that squirrels were trapped in the ductwork. Damn, this place is a trip!” HH 6 felt the lack of attention to basic building maintenance problems gave students no confidence in the leaders at the school. HH 6 said, “it took them two months to fix the toilets in the stalls in the first-floor restrooms. Who knows how long its gonna take them to fix the AC!”

Most participants indicated that the leaders were not concerned with their comfort in class, but they appeared highly concerned about class attendance and making sure that students pay for their classes. BT 4 said, "You'd think they would care and be more aware of our concerns if you look at how often they are in meetings!"

Theme 4 – Leaders are Always in Meetings While we Suffer. The participants in this study it was important that leaders show concern about student well-being while attending school. Some participants perceived that leaders at their schools focused more on the fiscal operations of the school and less on student concerns. Most participants felt that this lack of awareness sent a message that their leaders had little to no concern about the conditions within their classrooms.

Participant HH 2, Participant HH 5, Participant BT 1, and Participant BT 3 mentioned that leaders at their schools did not respond to class and course reviews; students observed these leaders spending time attending numerous meetings; they even remove instructors from class at times to attend these meetings. Further, most participants said prior students had warned them about the environmental conditions in their schools and said these prior students were not surprised to hear about the current classroom conditions.

BT 1 said, "leaders made promises to fix the air conditioning and make sure the classrooms will be in better condition. I think because of the length of time we will be taking classes fixing the ac won't be necessary!"

Most participants mentioned that envisioning their future after they finished their present training courses motivated them to attend class. Participant BT 2 stated that the idea was to "do work in the medical field the rest of my career—it beats working outside!"

Participant BT 3 said

> Pursuing a better life through obtaining an education is a great motivator—I look at some of my friends I went to high school with and they ain't doing nothing. I just wish the classrooms were better; I don't think anyone fucking cares, especially the people in charge—they are always in meetings while we suffer. All they want is your damn money!

Participant BT 6 remembered attending a medical technology class in another state and quit the course because of poor environmental quality, which prompted his fellow students to talk and argue during class because of their discomfort. Participant BT 6 left that school because he thought the motivation for instructors to teach and learning from students was absent.

Students at both colleges indicated the instructors were prime sources of motivation during class, particularly when the students were confronting adverse environmental conditions. The instructors seemed to care but were powerless against school leaders. Participant BT 1 recalled a situation in which the air temperature was stuffy and uncomfortable because of a broken HVAC system. However, the instructor

made the experience tolerable by presenting the information differently, focusing less on the IAQ conditions and providing outstanding instruction.

Participant BT 7 indicated the emphasis in these classes was on obtaining knowledge under any circumstance, graduating, and getting a great job. Participant BT 7 said, "I never had a good job. I'm not going to let these people stop me—I'm going to make it! They'll never fix anything!"

Some participants mentioned the instructors help make the situation bearable. Participant HH 6 said the instructors were "super motivators." Participant HH 5 expressed discouragement at being around fellow students who had lost focus and used poor environmental conditions as an excuse for poor classroom performance.

Participant HH 6 further stated

> I just wish the school leaders here cared more about us—we're just numbers to them! We would be more motivated and feel better about the school if leaders showed an honest interest in fixing our classrooms and not be money hounds!

Overall, participants felt that the instructors at both locations were encouraging and wanted them to graduate from their respective schools. The participants recommended leaders at their schools "take a tip" from instructors and become better motivators. The participants said one way these leaders could show students they cared about how student comfort contributes to learning is by improving and maintaining the environmental quality in their schools. A reoccurring subtheme evolved from the transcript data that indicated leaders were unaware of what the students were experiencing daily.

The emerging subtheme that leaders do not care about improving the environmental quality in school classrooms may be the key to making sure these students receive the training they need to be successful in the medical field. Overall, the participants shared a concern about their future after they graduated; they wondered whether the environmental quality in their schools an impact on their education and physical well-being would have.

Further, the participants appeared to recognize the possibility that the air quality in their classrooms and associated environmental quality conditions were catalysts for the upper respiratory reactions displayed by fellow students. They believed that school leaders were unaware of student concerns; however, students noted that leaders had a role in maintaining overall school operations. Most participants indicated that they would be willing to meet with leaders during the semester to discuss IEQ concerns; however, the participants felt school leaders either didn't have the time or were reluctant to meet with them. BT 4 stated:

I tried to talk with the dean about how uncomfortable my class is. He told me to take it up with your sponsor and they will pass it on to me. If you aren't satisfied, then come see me. Then he just walked away and met up with another dean, laughing and joking as they went in his office. That sucks!

Other participants like BT 5 indicated that leaders at their school might not be aware of the indoor classroom air and associated environmental conditions in class.

Participant HH 3 also mentioned

> School bosses don't give a rat's ass about us! They should understand that a comfortable, clean, and cool classroom make me want to come to school and learn! What is it going to take for them to get it? Should I quit?

HH 1 had a different experience with the dean at his school. HH 1 said that the dean "was upset about how the heat and the smell in my class was affecting me!" The dean said, "I promise you I'm gonna get to the bottom of this!" As of this date, as HH 1 lamented, "I wonder if he found the bottom yet?"

Participants in this study indicated that at both locations leaders lacked awareness and concern about the condition of their classroom. The perception that leaders have no concern about the conditions is problematic because students enter these schools believing that they can trust leadership to provide a comfortable and safe place to learn.

Theme 1 Interpretation of results. This project study explored how students who chose to attend two colleges that use an accelerated training format made sense of the IEQ within their classrooms. The conceptual framework for this study centered on theories that reflect what students face each day when being exposed to conditions that trigger certain physiological and psychological responses.

The participants indicated that they chose to attend these schools to acquire additional knowledge to serve as medical technicians. They mentioned that pursuing this knowledge and graduating would help them to obtain better employment opportunities and bolster their self-esteem in the community (Maslow, 1970a). However, after

experiencing the problems associated with HVAC failure, they were asking themselves, "Did I make the right decision coming here?

Participants in this study displayed an attitude to achieve regardless of poor IEQ conditions. The theory of planned behavior shows (a) how specific behaviors are predictable based on available stimuli and (b) how the attitudes of others exposed to the same incentives are similar (Ajzen, 2002; Armitage & Christian, 2004). Most students indicated that nothing going to interfere with them pursing their education and expressed financial and personal reasons for attending these schools.

Participants being successful is a part of self-efficacy or the willingness to overcome all obstacles to reach personal self-actualization (Bandura, 1977; Maslow, 1943). Reaching educational goals in this forum is what Maslow (1962) described as a person's attempt in finding a meaning in life by pursuing and achieving a goal in which they have placed a high level of importance. In contrast, any obstacle that may hinder cognition or meeting aesthetic needs – such as the perceived problems involving heat exposures in the classroom – can interfere with becoming self-actualized (Maslow, 1970a) – particularly when pursuing employment and lifestyle changes.

Further, the correct school choice subtheme aligns with Bandura's triadic reciprocal causation model (Bandura, 1997, p. 6). This model focuses on how personal factors such as cognitive and biological events, the environment, and certain behaviors are determinants that have an effect each other and ultimately influence reaching a goal. Bandura (1986, 1997) through his social cognitive theory indicated that people are

primarily goal-oriented and are motivated by the anticipation of the result of their decisions.

This study also revealed the participants feelings about how completing this training at their chosen institution will be instrumental in helping to improve their current living conditions. Maslow (1943) indicated that this is key in reaching self-actualization based on task accomplishment. The participants in this study perceived that pursuing additional learning will aid in what Krems, Kendrick and Neel (2017) found as providing a motive for achieving status and gaining self-esteem for themselves and within their communities.

Kendrick, Neuberg, Griskevicius, Becker, and Schaller (2010) in their study of goal-centered cognition and subsequent behavior indicated that many esteem-centered behaviors are linked to improving one's status; most individuals attempt to align with successful people who have achieved status in their professions and want to mimic their methods to attain what Maslow described as being able to reach one's personal potential.

Theme 2 Interpretation of results. The participants in this project study were very informative when discussing the heat and other IEQ concerns they were experiencing in class. Many theories account for why the participants reacted to the heat in class and ancillary environmental quality issues. The human body heat balance theory (Fanger, 1972; Humphreys, 1994; Nicol & Humphreys, 2002) indicated that individuals react to the elevated temperatures based on indoor air temperatures in office and

classroom settings and that task accomplishment and routine thought processes are challenged.

Participants in this study also indicated the air temperature and aesthetics in their classrooms interfered with concentration. As in Cash's (1993) theoretical model, the participants mentioned how outside weather conditions, the type and age of the school building, and the failure to maintain adequate air conditioning added to their perception of why they had trouble learning in class or why they chose to miss class. Indoor temperatures over 90°F can cause the same psychological awareness and potential physiological responses both indoors and outdoors (Turunen et al., 2014).

Additionally, participants said during the interviews that the smells emanating from lavatories and classrooms were a direct environmental response to elevated temperatures in their classes. Odors occurring during events can remain in memory, possibly for decades (Köster, Møller, & Mojet, 2014; Proust, 1928). This psychological condition, known as the Proust phenomenon (Proust, 1928; Willander & Larsson, 2006), means that odor-evoked memory can trigger memorable episodes in a person's past.

Moreover, the participants in this study often commented on how the air temperature in the classroom was a distraction causing them to seek physical comfort by finding ways to cool themselves in class or leaving class altogether. Participants mentioned that adjusting to the classroom conditions was necessary to complete their course. The adaptive model theory (Nicol & Humphreys, 2002; Kaplan & Kaplan, 2005) indicates that individuals are responsible for their own self comfort.

Nicol and Humphreys (2002) showed in their adaptive model that individuals in their study adjusted to the indoor environment by ignoring the physical signs of excessive heat exposure. As displayed in the model, adjustment to temperature extremes is how the participant's made psychological sense of physiological stress they were experiencing. In this instance, participating in classroom activities was more important than not participating at all (Humphreys, 1978). These adjustments coincide with theories that indicate how individuals make physical adjustments to achieve goals while under duress (Humphreys, 1978; Nicol & Humphreys, 2002). Adjusting to conditions by seeking ventilation, disrobing, or not attending school at these times is consistent with the adapting to IEQ conditions even when other distractions such as noise, odors, or poor IAQ exist (Bishop, 2009).

Studies have shown that odors emanating from enclosed compartments such as classroom or restrooms can occupy places in one's memory that can last a lifetime. These odor-induced memories are more vivid and provocative than are memories triggered by any other stimuli (Arshamian et al., 2013; Herz, 1998/2004). It is possible that participants will have memories of experiences – good or bad - while attempting to make sense of IEQ conditions in their classrooms long after graduation. Some participants felt the odors they experienced in class was a distractor which had a lingering effect – especially when they at home trying to complete home-study assignments.

Theme 3 Interpretation of results. A segment of this study's conceptual framework discusses the correlation between facility conditions and student performance (Cash, 1993; Earthman & Lemasters, 2013). The participant's testimonies reflected how temperature within classes were uncomfortable due to failing or inoperative air condition systems. Participants also expressed their lack of confidence in each school's facility management personnel to correct the HVAC and subsequent IEQ problems. Although Cash (1993) found quantitatively that adequate maintenance was key in helping students achieve in class, facility maintenance continues to be a low priority in planning school budgets (Alexander et al., 2014).

Participants indicated that they felt the facility maintenance crews lacked the training needed to address HVAC systems and associated IEQ problems. This perception aligns with what Bishop (2009) lamented about how HVAC systems require consistent monitoring and maintenance to ensure they operate at peak capacity to prevent unwarranted distractions in class.

Participants further mentioned that since they had no control over how the HVAC systems work, they felt helpless and had to adapt to the indoor air quality conditions or risk missing vital class time. Some participants indicated that they are willing to acquire HVAC training to aid in maintaining air-handling systems at their schools. This willingness shows how the participants make sense of the IEQ in their classrooms and how they are wanting to assist in correcting these situations.

Additionally, heat-related air quality problems were noticeable due to failed or inoperative HVAC systems. Some participants mentioned that they had class interrupted due to dust accumulations on lab benches and desktops as well as noise coming from failing or somewhat repaired HVAC systems, By- products of humid air such as deteriorating ceiling tile, filter dust, and mold were observed daily. Participants felt leaders were not willing to repair already aged buildings and expect students to adjust to the situation.

Also, most of the participants mentioned that simply repairing and maintaining the HVAC system would solve the IEQ problems in the classroom and help in relieving undue stress. Cash (1993) theory and subsequent study showed how air conditioning improved student achievement on tests. The theory proved to be trustworthy based how participants in this study felt about the IEQ in their classrooms.

Theme 4 Interpretation of results. Participants said that they notice school leaders were always having meetings and felt these meetings had nothing to do with making any corrections or changes to in-class environmental conditions. Participants also sense that at these meetings leaders were more focused on recruitment and advertising aimed at increasing enrollment and raising faculty salaries. The data analysis results further indicate there is a misunderstanding among students and school leaders concerning the environmental quality of their classrooms. Participants perceive that this overall lack of concern interferes with their pursuit of learning.

The participants believed that school leaders are the first line of support for them as students and expect these leaders to be empathetic and show concern. The participants also believed leaders must insure the building conditions with subsequent IEQ suitable for student occupancy, instruction, and learning. The participants demonstrated through their testimonies that they had to adjust to what they were experiencing in class to make sense of the situation and that they needed to conduct themselves appropriately under these conditions.

Some participants felt leaders were never alerted to what students were experiencing and these leaders failed to visit during instruction periods. Participants wanted to become a part of the school's operational team by having student representatives on the building improvement committee. Participants also felt that if students attend these meetings, they can not only be more vocal about what IEQ conditions they are facing in class but also could obtain confirmation on when facility maintenance will make repairs.

Most participants felt that leaders were purposely separating themselves from mainstream to maintain the invisible student-faculty line. They felt that leaders were unaware of the conditions in class since leaders never attempted to contact students via various school and social media avenues regarding IEQ with any plans of addressing student concerns. This perceived lack of concern for student wellbeing serves as another distractor that students feel will affect their learning, graduation, and future employment.

Relevance of the Study

In this phenomenological study, I depicted the lived experiences of medical technology students as they received instruction in accelerated courses in classrooms in which poor IEQ sometimes interfered with successful learning. Some students may stay in class and attempt to adjust to the environmental conditions until the distractions become insurmountable (Choi et al., 2013/2014; Earthman, 2004; Hannah, 2013). Students may seek to find physical comfort, thus curtailing or forfeiting learning (Hannah, 2013).

The findings of this study may encourage community colleges planners who use accelerated teaching formats to consider making IEQ a priority in their classrooms. Although quantitative data exist, to date, few if any researchers have studied individual student perceptions of these conditions. The results of this study may motivate leaders to create procedures for establishing and maintaining classroom comfort and relief during IEQ extremes induced by changing climate conditions.

Using a phenomenological approach allowed me to collect qualitative information depicting how students made sense of their daily IEQ experiences. Additionally, by recording the students' actual responses to the interview questions, I depicted students' experiences with reduced environmental quality within their classrooms. Future educational leaders may empathize with the challenges students face daily, recognizing and respecting how and why students perceive their classroom environments.

Conclusion

The purpose of this phenomenological study was to explore students' experiences as they attended accelerated courses at two community colleges at which they encountered IEQ problems in their classrooms. In this chapter I performed data analysis on the testimonies obtained by interviewing study participants. By using a phenomenological approach, I focused on the total experience as revealed by those who experienced it (Willis, 2004). My purpose was to illustrate student reactions, thoughts, and opinions needed to gain attention and effect change to these circumstances.

The data I collected to accomplish this project study centered on two research questions (RQ):

1. How do students make sense of the environmental conditions in their college classrooms?
2. How do students perceive their learning and overall well-being is affected by these indoor environmental conditions?

From these research questions four themes emerged that answered the research questions. The themes represent higher-order thoughts and beliefs shared by most participants. Further, these themes are from a culmination of the richness of data obtained during the interviews and not based on how often similar comments occurred in data transcripts:

1. Did I make the right decision coming here?
2. Hot, dusty, and muggy classrooms; can't think.
3. Maintenance crew can't fix anything!

4. Leaders are always in meetings while we suffer.

These four themes represent the most salient experiences for participants while pursuing advance education in two colleges offering an accelerated training format to complete medical technology courses. I addressed each research question by developing interview questions aimed at reaching deep into the thoughts of the participants. The interview questions helped to paint a picture of what students think about classroom operational conditions and how these conditions can either help or interfere with their success and wellbeing.

Participants in this study indicated that they made the choice to attend these schools. They described how they felt about their choice once they were exposed to IEQ conditions such as elevated classroom temperature due to failing or inoperative HVAC systems. Participants further indicated that the conditions in their classrooms were understandable due to the condition of the school facilities but also felt being exposed to these conditions not only interferes with learning but also may cause future physiological illnesses.

To make sense out of what was occurring in the classroom, participants indicated that they made changes in how they approached and attended class sessions during periods of elevated temperatures and other environmental problems. Participants in this study were constantly adjusting to their classroom environment to make sense of what was occurring. Participants indicated that they made choices whether to attend class,

adjust to the environmental conditions in class so they can receive vital instruction, or simply not come to class and return when classrooms conditions improve.

Further, the participants perceived that the IEQ of their classrooms interfered with how they learned and whether they should attend or remain enrolled in these schools. The findings showed students consistently preferred to leave or not attend school rather than endure classrooms with poor IEQ. This was due mainly to the hot, dusty, and muggy conditions of the classrooms – making too hot for instruction, concentration, and learning. The data shows that leaders and facility managers at these schools are aware of the IEQ problems; however, in the students' minds this situation appear to be a low priority when compared to each school's operational and budgetary needs.

The participants also felt that conditions created from inadequate HVAC systems interfered learning and receiving instruction. The students made sense of their situation by understanding the benefits of completing their training and how to negotiate obstacles that may hinder their goal. The participants also indicated that future job opportunities be possible but can also be limited by not completing this training. Thus, as in the research question, the conditions in class can cause long-term effects.

The participants at both locations said leaders should take a more active role in making classrooms more accommodating for learning. Participant BT 3 suggested that leaders should "stop attending so many meetings and pay more attention to student critiques." Students noted that building conditions and lack of attention given to

correcting inadequate conditions was a catalyst for poor learning, sporadic class attendance, and eventual course failure.

The findings in this section provide a snapshot of student perceptions and attitudes about the IEQ at each school. The findings led me to conclude that school leaders should meet with students to assure them that academic success was the top priority. Using phenomenology as a research approach helped me conceptualize how students perceived the classroom challenges they experienced as they pursued advance education.

Based on the participants' perceptions of how IEQ affected their learning, psychological health, physical health, and overall morale, I developed a white paper to help leaders gain more awareness of the signs and symptoms of poor classroom IEQ conditions. Organizations such as the Association for Experiential Education (2011) have published white papers to help practitioners develop training programs to address certain training gaps and delinquencies.

White papers have been instrumental in influencing operational and policy decisions (U.S. Department of Commerce, 2010). When used as a collaborative tool in conjunction with faculty training programs, white papers can help persuade people to concur with policies, look for and address problems in their work and learning environments, and enforce current standards (Kalargyrou & Woods, 2009; Malone & Wright, 2018; Rivers, Tan, & Calic, 2002). Encouraging such behavioral changes could

be important when physiological condition and psychological responses trigger actions that may be detrimental to learning transfer at community colleges.

A description of the white paper appears in the following section. The white paper appears in Appendix A. I recommend the white paper be included in each college's professional development forum.

Section 3: The Project

Introduction

In this section, I describe the development of a white paper I designed to help school leaders at both study sites disseminate information about the different facets of IEQ as a part of each school's current professional development plan. The project description includes the rationale for selecting this mode to provide information on the need to maintain environmental quality in schools. In the review of literature, I forecast the development and implementation of the white paper and discuss barriers that may limit or prevent the white paper's inclusion into school professional development plans. A process evaluation is included to evaluate the effectiveness of the white paper. In addition, I discuss how the white paper can help address social change in local college communities.

At the outset of this study, I identified problems with the transfer of learning among students attending accelerated medical technology courses. Students receiving instruction in classrooms were encountering inadequate IEQ. Elevated temperatures in these classrooms occurred because of challenges involving HVAC system operations, which exacerbated subsequent IEQ problems. As I investigated this phenomenon, my goal was to show how students perceived the classroom IEQ challenges and the ancillary conditions that emerged. I sought to understand the adjustments students made to cope with this situation.

At the time of this writing, leaders at each school have held quarterly professional development training. It is important that leaders support administrative staff in ensuring that training documents such as white papers are used as a part of the facility awareness training in their staff development agenda (Bouchamma, 2012). Because school leaders set the agendas for professional development sessions, they can emphasize the importance of environmental quality at their respective schools and ensure that all parties supporting their teaching efforts are disseminating information to staff and faculty in a collaborative setting.

The participants in this study perceived that classroom air quality and associated environmental quality conditions contributed not only to physical discomfort but also to acute upper respiratory reactions. In addition, they believed that school leaders might not have been aware of student concerns; however, they believed that leaders had a role in maintaining overall school operations. The participants demonstrated through their testimonies that they had to adjust to their classroom experiences, make sense of the situation, and conduct themselves appropriately under trying conditions. They believed further that these conditions served as a catalyst encouraging them to stay in school to complete their training.

Rationale

The rationale for this project study stemmed from the growth of accelerated educational programs for students attending medical technology programs, and the condition of buildings used to teach these programs. An analysis of the responses

revealed themes directly related to how the participants made sense of the IEQ phenomenon. After reviewing the data, I found that students were concerned that the environmental conditions in class could be harmful and have long-term effects. In addition, they wondered if leaders at their schools cared about the IEQ problems they faced daily and if leaders would address these concerns.

I determined that the best way to ensure everyone in a leadership capacity would be knowledgeable about all aspects of environmental quality was to develop a white paper to help them recognize and address IEQ concerns. I used two research questions to guide the study. Analysis of participants' responses to seven interview questions revealed four themes. The participants' responses indicated concerns with the environmental quality of their classroom, elevated temperatures, failing HVAC systems, poor air quality and airborne particulates, and noise from fellow students and air-handling systems.

This qualitative study involved obtaining information from interviewing 14 students attending two separate colleges in south Texas. The semi structured interviews devised for this study provided experiential depictions of the participants' quality of learning conditions as they received instruction during challenging IEQ conditions. The revelations of students' physiological and psychological actions expressed during these interviews manifested, thus providing me with a better understanding of how individuals react under certain environmental extremes.

I used the data analysis of the participants' to identify themes depicting the thoughts expressed through responses to the interview questions. Participants' responses were instrumental in providing credible insight into their lived experiences. From those responses I was able to discover the measures they took to make sense of the environmental issues they encountered during class. I incorporated the responses into the white paper to present to the educational leaders at both sites.

Review of the Literature

Initially, this study centered on how elevated temperatures in community college classrooms affected learning transfer. Students attending accelerated-format medical technology courses at the two sites experienced elevated air temperatures in their classrooms. I collected substantial information during the interviews on what the participants were experiencing while attending class.

I found through reviewing the interview data that distractions associated with the by products emanating from elevated classroom temperatures were related to poor IEQ conditions. I developed a white paper which contains excerpts of the information found in the literature review and interview data as well as explaining the causes of high indoor thermal conditions. I further illustrate the various physiological and psychological effects from subsequent exposures to these conditions and offer suggestions on how to minimize or alleviate their impact.

Search engines such as Google Scholar, professional journals, federal guidelines, and the Walden University Library provided information to support the literature review.

I researched key terms such as *environmental quality in schools*, *thermal exposures within schools*, *indoor air quality*, *facility maintenance in schools*, and *school leadership responsibilities*. This literature review provides information needed for the schools' professional development programs about maintaining environmental quality in college classrooms.

Environmental Quality in Schools

The results of this phenomenological study showed how the environmental conditions in accelerated courses affected learning at two colleges. Leaders at new and existing learning institutions should add sections and concepts included in the white paper to their standard operating procedures regarding the maintenance of consistent environmental quality in classrooms (ASHRAE Standard 62-1999, 1999). Many studies have provided information about how future schools should look and operate (Earthman & Lemasters, 2004).

For example, today's trend for new educational facilities is the "green schools" design concept where school can be both ergonomically and economically efficient (Dall'O, Bruni, & Panza; 2013; Earthman & Lemasters, 2011; McGraw-Hill Construction 2012). This design concept incorporates the use of naturally-occurring energy mechanisms such as solar and wind energies and environmental controls to make the operations and budgetary requirements more focused on overall school operations (Earthman and Lemasters, 2011).

Leaders and managers of older traditional schools and buildings converted into schools must consider the potential environmental problems associated with global warming (Graff Zivin, Hsiang, & Neidell, 2018; Nordhaus, 2012) and the naturally occurring aging of structures. In both instances, circumstances created by the effects of global warming have the potential to interfere with regular classroom instruction and activities, particularly in accelerated courses in which student focus and attendance are paramount. Elevated classroom temperatures caused by faulty or inoperative HVAC systems can interfere with several classroom activities and will ultimately lead to decreased learning and absenteeism (Lan et al., 2011; Wyon & Wargocki, 2013). A general understanding of the definition of environmental quality should be a topic in faculty and staff training modules (Hill, 2009; Toyinbo et al., 2016).

In the initial literature review in Section 1, I discussed how elevated temperatures can cause specific, predictable effects on students as they attempt to achieve learning transfer. Many researchers have concluded that moderate temperatures averaging between 68°F and 74°F are optimal for accomplishing classroom tasks (Cheryan et al., 2014). School leaders and instructors should, therefore, be informed that optimal temperatures can promote positive performance levels during instruction. Young and MacPhail (2016) noted that failure to address environmental challenges consistently can have a negative impact on establishing productive learning communities.

Furthermore, students react when they are exposed to potential IEQ health threats in college classrooms. Faulty HVAC systems foster unstable classroom atmospheres

associated with molds, airborne fibers, and particulate matter, leading to upper respiratory ailments (Haverinen-Shaughnessy et al., 2012; Toyinbo et al., 2016). Participants conveyed their experiences of having to receive instruction in hot, stuffy classrooms and displayed similar physiological reactions peculiar to the exposures. Hence, leaders and staff should receive periodic training on identifying warning signs such as sweating, coughing, and wheezing associated with the unstable IEQ. Becoming familiar with students' extreme health reactions could help prepare leaders to respond to students effectively in these situations (Evans, 2014).

In any learning environment, students are the most important participants in the classroom; in addition, students are valuable community resources. Students not only try to secure future financial comfort by obtaining employment but also seek to improve their socioeconomic status through education, thus becoming an example to others in their communities (Akareem & Hossain, 2016). As technologically driven instruction increases, it is crucial that modern educational institutions provide quality in all aspects of education. As a result, students will not only attend school and graduate but also stimulate the interest of others in their community to mimic their efforts (Briukhanov, Kiselev, Timchenko, & Vdovin, 2010). These concepts indicate that leaders must have a better understanding of how thermal exposures affect learning.

Understanding Thermal Exposures in Schools

Current literature showed leaders at each school likely suffered a gap in knowledge about the effects of thermal exposures. Students should not have to make

decisions about attending college based on controllable indoor environmental quality conditions. Previous researchers have found poor thermal conditions affect school operations (Barrett, Davies, Zhang, & Barrett, 2015; Cheryan et al., 2014; Mäkelä, Kankaanranta, & Helfenstein, 2014). Students who attend school often assume an ambient indoor environment will always be present. Locations such as Africa, the Middle East, and the southwestern United States usually have outside temperatures that dictate how indoor temperatures are controlled (Amos-Abanyie, Akuffo, & Kutin-Sanwu, 2013; Makaka, 2015).

Based on the pressures involved in completing college courses, today's college students may take for granted or know little about the physiological effects of prolonged elevated heat exposure and other thermal reactionary responses and rely on school leaders to monitor and control this potential hazard. The availability of air-conditioned facilities, for example, can be the determining factor on whether heat-related injuries occur to occupants (LaKind et al., 2016; Allen et al., 2012). Many researchers have studied thermal exposures and discussed why training is necessary for identifying and controlling these environments and rendering aid when necessary (Lam et al., 2014; Gubernot, Anderson, & Hunting, 2014; Xiang, Bi, Pisaniello, & Hansen, 2014).

The white paper provides information for school leaders about how IEQ and other ancillary conditions affect students. Entities such as the National Institute for Occupational Safety and Health (NIOSH) and the CDC have recommended periodic occupational health and awareness training. Training on the identification of the signs

and symptoms of heat-related illnesses (HRI) is necessary to prevent injury or death regardless of the locations in which exposures occur (NIOSH, 2001). The CDC and NIOSH training should provide enough information to lay individuals to respond to HRI incidents until first responders arrive to render aid (CDC, 2015; Occupational Safety and Health Administration, 2015).

Training leaders to promote acceptable indoor and outdoor environmental quality can be instrumental in maintaining employee and student safety. Findings from a study in South Georgia involving migrant farm workers showed that training employers on the signs, symptoms, and prevention of HRI was a useful intervention that prevented injuries (Fleischer et al., 2013). Whether individuals experience thermal conditions indoors or outdoors, the signs and symptoms of overexposure are the same. These findings indicate that controlling thermal extremes should be prioritized as a part of community college faculty training and continuing education programs.

Additionally, thermal conditions can also be the catalyst for unwanted exposures to hazardous particulates and mold emanating from failed HVAC systems (Haverinen-Shaughnessy, Moschandreas, & Shaughnessy, 2011; Mendell et al., 2013.). These exposures can lead to upper respiratory ailments that hinder students' focus on classroom materials and eventually cause students to miss class. During an investigation on why students at a Georgia college were experiencing physiological ailments from building occupancy, researchers found inadequate air-handling systems were not providing the indoor air temperatures needed for classroom occupancy. As a result, students acquired

upper respiratory conditions related to poor air quality byproducts such as mold and airborne particulate matter (ANSI/ASHRAE Standard 55, 2013). Training on identifying visible signs of these materials appears in the white paper and can be an ongoing part of schools' professional development programs.

Leaders should understand how HVAC systems contribute to the overall daily school operations and what may happen to student populations and infrastructure if adverse conditions continue. Making the contents of the white paper a part of regular professional development training may help leaders maintain comfortable classrooms while increasing staff and faculty knowledge on appropriate indoor environmental quality.

Indoor Air Quality

As a part of the IEQ spectrum, indoor air quality (IAQ) consists of atmospheric conditions in an enclosed area in which occupants can function normally. The conceptual framework of this study centered on depicting how students made sense of the environmental quality in their classroom. According to information obtained during the interviews, participants felt classroom conditions triggered reactions and responses that rarely occurred in classes under normal operational conditions.

Specifically, participants in this study mentioned IEQ related to HVAC systems and control of indoor air temperatures. In addition, participants recommended facility maintenance personnel prevent HVAC systems from dispersing potential airborne particulates and creating mechanical noise. Participants faced three choices: to stay in

class and tolerate the heat, to remove themselves from class, or drop out of school. Nicol and Humphreys (2002) described these actions as part of adaptive theory: Students weighed the situation and adapted to their environment until they needed to make further alterations.

Further, airborne particulates of 10 microns or smaller are not captured through normal breathing function (Aliabad, Rogak, Bartlett, & Green, 2011; Kesavachandran, Kamal, Bihari, Pathak, & Singh, 2015; Kumar, Singh, & Banerjee, 2015); HVAC systems release contaminants through faulty or old air filters. Participants described the resulting coughing and sneezing from inhaling these particulates as highly distracting—students could not hear instruction because of constant interruptions. Brager and de Dear (1998) theorized individuals react to environmental stimuli and display actions commensurate with the stimuli. The airborne particulate matter caused coughing and sneezing, and the noise generated from these activities prompted some students to not attend class. All these conditions resulted from faulty or inoperative HVAC systems (Bartlett, Kennedy, Brauer, van Netten, & Dill, 2004; Mendell et al., 2013; Turunen et al., 2014).

Facility Maintenance in Schools

Based on participants' comments, I concluded that facility maintenance was poor at their respective colleges, which led to physiological and psychological episodes displayed during class. Participants further said that this behavior led to morale problems that eventually induced classmates to leave class.

Facility maintenance personnel should understand the basic operations of HVAC systems and recognize why proactive maintenance is essential to classroom occupants. In a mixed-methods study of the relationship between the learning environment and the upkeep of school facilities, Limon (2016) found improper maintenance was detrimental to student academic performance. A systematic approach by school leaders, stakeholders, and executives should be instituted as part of consistent facility monitoring, including regular maintenance and repair (Limon, 2016).

Further, the literature has indicated facility maintenance personnel should take into consideration regional climate conditions that warrant giving extra attention to air-handling systems. Mechanical problems with the HVAC systems, particularly during months in which elevated outdoor temperature is the norm, make it necessary for facility maintenance personnel and instructors to know how to set the HVAC systems to control classroom air temperature. When instruction cannot occur in classrooms, instructors should consult facility managers and other leaders to expedite repairs on the system; students perform better in classrooms that are maintained at a constant indoor air temperature (Link et al., 2016; Wargocki & Wyon, 2007b).

At times, students may react when faced with situations in class that hinder learning. Some students may move to a more comfortable area and hope to return later to a comfortable classroom; other students may choose not to return to class (Paulson & Barnett, 2016). Such reactions from students should prompt school leaders to take an active role in maintaining the overall environmental quality conditions in their schools.

College Leadership Responsibilities

School leaders have the primary responsibility of ensuring students complete classes and graduate. Leaders must provide periodic professional development sessions to personnel to ensure their schools are providing current and accurate information. The information can be presented in workshops or as continuous ongoing training regimens focusing on staff interactions and collaboration (Mangope & Mukhopadhyay, 2015).

The literature has shown that leaders are responsible for implementing improvements in their facilities and accomplishing proper maintenance on a regular basis (Earthman & Lemasters, 2013; Lavy, Nixon, & Samant, 2016). Educators should be allowed to teach in classrooms in which students are receptive to instruction without having to make decisions concerning class attendance based on environmental quality and aesthetics (Earthman & Lemasters, 2013). School leaders must take an active approach in addressing inadequate HVAC systems as well as thermal and air quality conditions in their classrooms. Leaders must be cognizant of student needs while identifying and controlling potential environmental quality issues if they interfere with normal school operations.

Colleges with environmental quality problems can potentially put students, faculty, and staff in adverse conditions (Arif, Katafygiotou, Mazroei, Kaushik, & Elsarrag, 2016; MacNaughton et al., 2016). Not only is learning transfer affected; acute and chronic exposures to airborne pathogens are also possible. Frequent exposure to elevated classroom air temperatures caused by failing or faulty HVAC systems can cause

exposures to byproducts formed from the improper maintenance associated with these systems (Aliabadi et al., 2011).

Some leaders may feel white papers and other abbreviated information modules do not provide enough information to be useful in professional development training situations. In a 2014 study, researchers concluded professional development programs were costly and did not improve professional practices (Gates & Gates, 2014). However, involving faculty and staff in efficient, professional development succeeds when leaders promote in-house involvement and do not rely on outside contract services to provide training (Zepeda, 2013; Wei, Darling-Hammond, & Adamson, 2010).

During the interviews, participants said they had informed instructors and other leaders of the situation; however, either leaders did not know about the classroom problems caused by these conditions or they just did not care about the classroom conditions. Thus, including environmental quality awareness training becomes necessary to address participants' concerns. Periodic professional development training is a part of school professional development plans; the white paper should be implemented into regular staff development programs.

In the white paper, I define environmental quality and describe people's responses to adverse environmental conditions. I offer proactive methods to alleviate reactions to unwanted exposures and recommend leaders make pristine college classrooms a consistent reality. Implementation of the information in the white paper could help leaders assure students, faculty, and staff that the schools' primary objective is to provide

a comfortable and safe learning environment. As a caveat, faculty and staff will gain additional knowledge about appropriate environmental quality in schools.

Project Description

I conducted a qualitative study using a phenomenological approach to explore students' perceptions of poor environmental quality in accelerated medical technology training classrooms at two community colleges. In individual interviews, students described their responses to elevated temperatures in the classrooms. I collected the interview data and performed data analysis on students' responses. Themes emerged regarding students' classroom experiences when HVAC systems failed; they described how this phenomenon affected learning transfer, persistence, attendance, motivation, and remaining at their schools. Thematic analysis of the data allowed me to obtain deeper insight into students' feelings and concerns as they attended these schools.

This project was intended to communicate to leaders the idea that environmental quality is essential in learning transfer. I recommend administrators incorporate the results of this white paper as part of community college professional development plans. School leaders can include the information in the white paper to train team members to recognize the physiological and psychological responses from students who may be encountering adverse environmental quality conditions in their classrooms. Using the information in the white paper can also help staff efficiently communicate with facility managers about how HVAC system function affects classroom environmental quality. As

a caveat, the white paper can be shared with other local community colleges that have similar IEQ problems.

Community college leaders typically hold quarterly professional development training during the school year. The white paper can serve as an information guide to assist leaders in developing collaboration with faculty, staff, and students on the factors that constitute a positive college atmosphere and promote successful learning. Eventually, this plan should be further developed into a stand-alone learning module as part of community college health awareness programs.

Project Implementation

I met with the two community college leaders after the interviews to discuss how environmental quality awareness should be a part of their regular professional development programs. Both leaders agreed that environmental quality should be a recurring implications agenda item in their training regimens. They further indicated that faculty and staff should have a better understanding of what to look for when they notice physical signs of poor environmental quality, either from student reactions and comments or from structural problems in the classrooms.

Leaders at both colleges agreed that excerpts of the information found in the white paper should be introduced during new hire orientation. Further, they agreed to present the white paper as a part of the quarterly professional development forums in the future. In addition, excerpts from the white paper will appear on billboards throughout each school to educate students on environmental quality while assuring these students

that leaders are aware of the indoor quality of their schools. Leaders assured me that administrators, faculty, and staff would receive continuing education credit from attending environmental quality awareness training during their quarterly forums.

Potential Resources

In the future, the leaders at both schools will direct planners for the quarterly forums to include information from the white paper into the professional development agendas. These planners will adjust the segments of presentations during these conferences to accommodate the inclusion of the white paper. This adjustment will ensure forum attendees receive this information to help improve overall operations at the schools.

The goal was to assure students that leaders at their schools understand that poor classroom environmental quality hinders students from achieving learning transfer. I noted that I would be available on the second day of the forums if any questions arose about the contents of the white paper.

Potential Barriers

As of this writing, the quarterly professional development forum is a two-day training session usually held on the third weekend of the quarter. In future forums, the white paper will be part of an environmental quality awareness collaborative discussion focusing on student comments about receiving instruction in classrooms with quality problems.

Some staff members cannot attend these meetings because of schedule conflicts. Leaders at these schools have scheduled backup sessions for the following weekend for people who miss the regularly scheduled conferences. In addition, people will receive minutes of the forums' activities. Both leaders agreed that taking these steps could help further disseminate the white paper information. Additionally, each leader said that attendance of these quarterly conferences was mandatory, and that this collaborative effort was essential to school effectiveness by ensuring highly trained people were available to meet students' needs.

Project Evaluation Plan

The evaluation for this project will consist of visiting each college after the quarterly professional development forums to review the forum participants' critiques on what indoor environmental information was shared during the forum as well as student comments – written or otherwise – and address any concerns involving environmental quality. The practical action research design (Creswell, 2012) incorporates a formative evaluation of the data collected and use of subsequent responses received from training forum attendees. The leaders or their adjutants at each location will collect the data – in this stance the critiques – and provide a qualitative summary analysis (Rapport, 2010) of what attendees felt were beneficial based on the white paper information disseminated during the training forums.

In this capacity, the leaders will serve as coresearchers (Rapport, 2010) and will aid in providing a qualitative assessment of data found within the critiques. This

assessment will ensure that collaboration exists among leaders at each location and myself so that all understand the concerns students have at these school and how to address these concerns in the future. I will be the action researcher responsible for developing a useful document to provide feedback to leaders at each location. From this information, I will develop a summative analysis (Rapport, 2010) of attendees' insights from the forums regarding indoor environmental quality.

The reason I chose this method is that I am providing leaders with a white paper containing information on IEQ. The summative analysis will aid in communicating with school leaders the insights forum attendees obtained from the roundtable discussions about indoor environmental quality at their schools. The guiding premise of this project study is how the IEQ in classrooms affect student learning. Research indicates that the indoor environmental quality with its associated indoor air quality (IAQ) conditions alter classroom functions and productivity due to

- Student focus on physical aspects of overall classroom environmental quality.
- Psychological responses to IEQ conditions and how they affect learning.
- Morale issues among students and how students view leaders.
- The pressure of time involved in course completion (Haverinen-Shaughnessy et al., 2015; Lee & Horsfall, 2010; Mehrabian & Russell, 1974; Pati & Barach, 2010; Schneider, 2002; Yang et al. 2013).

Future students could benefit from the knowledge gained during the forums after school leaders apply the findings to initiate upgrades and improve the quality of the

educational facilities. I developed a series of questions to aid forum presenters in obtaining valuable feedback on the IEQ of their classrooms. These questions will aid in developing a qualitative analysis of the training forum based on information extracted from the white paper. The questions are in Appendix D.

According to Bruch and Reynolds (2012), data obtained from evaluations can help leaders and stakeholders make decisions in identifying strengths and shortcomings on how the information was received and how to fine-tune this information for future training forums, centering on how these improvements will evolve to making classroom conditions more conducive to learning.

Implementation Timetable. At the quarterly two-day professional development forums, attendees typically review and discuss current policies and procedures as well as provide information and training on new programs and directives. Discussions on topics that affect school operations and student concerns are part of collaborative sessions. In my interviews with school leaders, each leader indicated that discussing school environmental quality issues was scheduled on both days during the forums. The included white paper was prepared to help give relevant context and situate discussion around faculty and staff concerns as well as student criticisms about IEQ.

The first day of training will address school policies, procedures, and new instructional items; the new items may involve introducing new technology for staff, faculty, and students and group workshop activities. The last two hours of the session will

focus on faculty and staff concerns. At this time, school leaders and facility managers will hold discussions on building operations and environmental quality.

The second day will consist of workshop activities and roundtable discussions on classroom procedures and interactions with students. School leaders will facilitate a 2-hour question-and-answer session, led by facility managers. Student critiques will be used to discuss environmental quality issues, and facility managers will devise a plan to address these concerns. Collaborating on issues detrimental to school operations heightens cooperation and develops camaraderie, which are vital for school improvement (Datnow, 2011).

Using a collaborative approach to discuss environmental quality issues will give faculty, staff, and facility managers the opportunity to discuss the operational conditions of their respective schools, describe what is being done to maintain or improve environmental quality, and note what to look for when poor IEQ affects overall school operations.

Roles and Responsibilities of Key Members. College leaders will facilitate the professional development forums at each school and ask administrative personnel to set the agendas for each session. Managers at each school plan to use the environmental information found in the white paper during collaborative roundtable discussions. Each college will designate administrators to spearhead the total quality management (TQM) discussions (Petersen, 1999). Total quality management is steps in presenting management items where every employee must maintain the highest level of

functionality to ensure operational success; following this procedure will keep attendees focused on training (W. E. Deming, 1982).

The designated directors of the session will present environmental quality as a new segment of their training forums. They plan to extract information on the physiological and psychological effects of IAQ quality on classrooms, student concerns, and school leaders' plans to address current situations and prevent future occurrences. Attendance for these sessions will be mandatory and monitored by administrators. I will serve as an on-call facilitator, making myself available during the question-and-answer segment of these forums. I will use the white paper as a primary resource to answer questions and provide additional information if requested by attendees.

Project Implications

The participants in this project study implied that the IEQ conditions had a myriad of effects on their learning, attendance and overall persistence. This study showed participants' perceptions of the environmental quality of their classrooms and its effects on positive learning. The participants indicated that leaders at each school placed a low priority on HVAC system maintenance and showed limited concern to student complaints and physical reactions to IEQ conditions. The literature review indicated that improving IEQ can create classrooms in which student can achieve maximum learning transfer (Gennaro et al., 2014; Toyinbo et al., 2016; Turunen et al., 2014; Simons et al., 2010).

Providing school leaders with information about poor IEQ—including how to recognize the signs and symptoms of exposure and how to maintain air-handling systems

adequately—could help assure students that poor IEQ conditions will not interfere with their learning. I recommend the white paper for use in periodical leadership training forums. The paper contains information to help leaders at these schools recognize poor IEQ and ancillary phenomena (Bluyssen, 2017; Madureira, Paciência, Ramos, Barros, & Oliveira, 2012).

The white paper was written in a persuasive manner to influence leaders to take an active role in addressing IEQ problems. One way to prompt leaders to act is to help them understand that poor indoor air quality occurs because of poorly maintained HVAC systems. Leaders are encouraged to ensure facility managers are trained in basic troubleshooting of these systems as well as knowing who to contact when repairs are beyond their expertise. The literature review provided many examples indicating that these systems can create and exacerbate discomfort in classrooms (Earthman & Lemasters, 2011; Schneider, 2002; Schneider & Yin, 2011). The literature supported many scenarios in which participants were required to make sense of what they were experiencing daily.

It is important that the information in the white paper help leaders focus on actions to maintain the operational capacity of these classrooms to prevent poor learning, lack of persistence, and absenteeism. The suggestions offered in the white paper can be implemented during school professional development training to increase awareness of IEQ, associated problems, and proactive approaches to solutions.

Conclusion

In this section, I explored available sources of information to develop the white paper that leaders at both locations should add to their professional development forums. Participants in this study believed strongly that poor IEQ conditions in their classrooms affected learning. The literature review in this section supported participants' perceptions of problematic situations in their classes; several peer-reviewed articles provided testimony regarding how others have experienced similar conditions. Using previous research, I developed a white paper to inform leaders of about the causes of poor IEQ conditions and offered recommendations for responding to exposed individuals concerns.

As of this writing, school leaders hold professional development forums but provide little to no information on dealing with environmental quality conditions in school classrooms. Because students cannot miss classes under the accelerated instruction format, leaders at these schools must ensure faculty, staff, and facility managers know how IEQ affects school operations and why they must do their part to maintain an acceptable learning environment.

I suggest that excerpts of the white paper will be a part of the training forums to promote understanding of indoor environmental issues in a collaborative setting. Each location holds professional development forums quarterly. The literature review information contained in the white paper will play a critical role in these school's professional development training forums.

Section 4: Reflections and Conclusions

Introduction

In Section 3 of the project study, I described the experiences of students who attended accelerated medical technology courses at two community colleges. Students were taught in classrooms with failing or faulty HVAC systems that caused elevated indoor air temperatures. The high temperatures created environmental quality problems in classrooms at each location. In this final section, I reflect on the strengths and limitations of the project, recommend uses for its findings, and suggest future research in this area.

Project Strengths and Limitations

Project Strengths

I developed the project study using a compilation of responses obtained from a phenomenological study I conducted. I obtained data by conducting semi structured interviews with the student participants. The data analysis exposed themes delineating the essence of students' experiences. The following passages include discussion of the strengths of this project study.

The first strength of the study involved the insight gained into participants' experiences as they attended class during times when environmental quality conditions created learning challenges. The two research questions helped me develop interview questions to obtain data regarding students' experiences during class so I could understand how they made sense of the IEQ phenomenon. In data analysis, coding and

labeling the components of interview data, I was able to reveal themes related to classroom challenges experienced by students who sought to acquire advanced training in unusual environmental quality conditions.

The second strength is that the information the project may provide to help leaders recognize classroom conditions from students' perspectives. As new colleges open, or as traditional colleges age, budgetary constraints often become an issue (Earthman & Lemasters, 2004). To minimize spending, improving building conditions is usually low priority for school leaders (Filardo, Vincent, Sung, & Stein, 2006). Ignoring environmental quality in school classrooms could hinder overall student success. The project's white paper may reinforce to educational leaders the importance of addressing IEQ issues.

A third strength of this project study was that the findings may help leaders understand the importance of addressing student concerns related to instruction and learning during times of rapidly changing global climate conditions. Increasing awareness of outside climate influences on the operation of HVAC systems and the subsequent responses displayed by students and other room occupants is essential if leaders plan to be proactive in correcting IEQ issues. Understanding outside climatic influences on older school buildings is particularly crucial at a time where aging school buildings are being affected by increases in outside temperatures coupled with the natural wear and tear exerted on these facilities (Graff Zivin et al., 2018).

Finally, the fourth strength of this study was the production of a white paper. The study findings allowed me to develop a white paper for leaders to use as a guide in addressing IEQ issues at their schools. Leaders at both locations agreed to make the white paper a part of their quarterly professional development forums. Leaders' decisions to use this information showed they were committed to improving the overall quality in their respective schools.

Project Limitations

Several limitations influenced the study outcomes. The first limitation involved my concern that the information in this project study might not be used if leaders change at these colleges. Although no changes in organization structure are currently anticipated, new leaders may feel their attention should focus on administrative concerns and not the environmental quality of their classrooms.

A second limitation is the fact that the study did not include a college that incorporated green school design. Architects have designed newer schools to address how the physical environment affects learning transfer. These newer schools may have a higher rate of air quality failure than rates seen at traditional schools. New school owners typically perform limited due diligence and choose to install cheaper air handling systems (see Pierce, 2015). Knowledge of this behavior by new school owners by individuals seeking higher education could cause potential student to look elsewhere to obtain advanced learning.

A third limitation of this study was that instructors were not a part of the study. The people responsible for teaching could provide valuable information on their perceptions and meaning making when teaching in challenging environmental quality conditions. These instructors have not only faced comments and criticism from disgruntled students but also have had to adjust to the demands of school leaders. The instructors could provide information to illuminate their experiences as they attempted to teach. I hope to expand this study in the future and include instructors' views on classroom environmental quality.

Finally, the fourth limitation of the study was that I did not investigate how colder indoor air temperatures affected student learning and attendance in this region. The southwestern United States rarely has temperatures below 32°F (0 Celsius) during fall and winter months (Banner et al., 2012; IPCC, 2013). As Garfin et al. (2014) noted, the southwestern United States rarely experiences cold temperatures even when the nation experiences arctic cold fronts. However, addressing students' perceptions of colder indoor air temperatures may be important. As researchers have noted that future climates changes in the region associated with global warming may affect this region in the coming years (Van der Linden, et al., 2017).

Recommendations for Alternate Approaches

An alternate way to address environmental problems in the local area is to have state level officials visit schools when the HVAC systems are inoperative. Viewing the problem firsthand may encourage officials to mandate that schools, colleges, and

universities initiate an upgrade and renovation program. The United States is currently entering a period during which infrastructure restoration is an agenda item on many city and state budget plans (Jaffee, 2015; Mack & Wrase, 2017; Steele & Legacy, 2017). In these budget plans, buildings, bridges, and roads will receive most of the funding. Schools appeared on these renovation lists during the lead and asbestos abatement episodes late in the last century (Gazze, 2016; Koppel & Koppel, 1994; Lange, 2001; McDonald, 2000; Sireci, Levenstein, & Gibson, 2016). A similar focus on IEQ in schools could help make schools safer for future generations.

Scholarship, Project Development and Evaluation, and Leadership and Change

As a scholar, I must address the area of environmental quality from a personal standpoint. The task of researching, collecting, and analyzing data for this study was an arduous but refreshing journey. To help me focus on this project study, I acquired knowledge through researching and reading peer-reviewed articles.

In reviewing the literature, I found a considerable amount of information on environmental conditions and quality. I wanted to make sure this information lay the preliminary groundwork in understanding how participants in these studies reacted to situations where environmental factors triggered decisions involving health and safety. I also wanted this information to be suitable for future use particularly by those who have an interest in identifying, addressing, and correcting problems in their schools. In addition, I learned how the potential psychological long-term effects of poor indoor environmental quality influence people's job performance and overall health and well-

being. Conducting this study has enhanced my knowledge, which will be valuable when I am asked to provide input on various environmental issues.

I selected this project because of my observations of IEQ in a region where elevated outside temperatures are the norm. The indoor environmental conditions are affected by changing climate conditions, which require the use of HVAC systems to provide suitable work areas. The participants in this study provided data on how they made sense of their experiences while attending class under what they considered adverse conditions.

Data analysis revealed physiological, psychological, and morale issues affecting students at each school. Further, the data indicated that although leaders were managing the overall operations at these schools, they had limits on how they addressed student concerns and facility maintenance operations. I concluded that environmental quality awareness should be a part of professional development training, and this training should be ongoing throughout the school year.

Accordingly, I developed a white paper from the findings of this project study to help leaders understand and address IEQ conditions and make the classroom experience more conducive to learning. School leaders could use this information to gain knowledge on environmental quality issues while facilitating a collaborative effort to educate faculty and staff during professional development sessions. When all parties are involved in professional development training, attendees will benefit from the sharing and exchanging of information in a collaborative setting (Friend, Cook, Hurley-Chamberlain,

& Shamberger, 2010). The inclusion of information found in the white paper may effect change at each location on a continuous basis.

Reflection on Importance of the Work

I became interested in being an educator early in life. While in the military, I visited various parts of the world as an educator. After serving in the military, I realized how fortunate people are in the United States to have a system of government that allows us to discuss and make changes to situations. I witnessed children in Latin America, Africa, and Southeast Asia who did not have the opportunity to acquire an education in what Americans would consider comfortable classroom surroundings.

The primary school I attended in the southeastern United States frequently received upgrades for comfort; maintenance personnel often worked on the building and adjusted the HVAC system. However, when I entered high school, I noticed school custodians handled building upkeep; the HVAC system frequently failed during the spring and summer, and we missed several school days. If we remained in class during periods of unacceptable IAQ, the teacher brought personal oscillating fans to provide air movement and comfort.

From a macro level, stakeholders in my former community had little control over improving and maintaining local schools. Today, student participants at the project study locations viewed the conditions of these schools differently compared to when I attended primary and secondary school and expressed their concerns during the interviews. The participants described the environmental conditions present in their classrooms as they

received critical instruction. After I collected the interview data, I repeatedly reviewed and summarized the findings to ensure I had achieved the validity and trustworthiness needed to present a valid depiction of their classroom experiences.

In the future, I plan to help leaders develop the managerial mindset that environmental quality requires attention, particularly in regions in which HVAC maintenance is crucial to classroom occupancy. This information could help school leaders encourage student class participation, motivation, and attendance while improving overall morale throughout the schools. The study findings could lead to a dissemination of positive comments about these institutions of higher learning throughout the community and effect social change in the area in improving confidence in local educational institutions.

Implications, Applications, and Directions for Future Research

Implications and Applications

The participants described how they made sense of the classroom environmental quality conditions and recommended actions they could take as students to complete their training. Participants further said they preferred comfortable classrooms with air conditioning and constant air changes. In addition, they stated that leaders should make sure the HVAC systems are maintained by periodically changing the air filters and repairing mechanical attachments to the HVAC system to minimize or alleviate noise. The implications of this study could stimulate leaders to address environmental quality concerns by applying this information to improve the conditions of their classrooms. The

students said their focus should be on completing their accelerated classes and not trying to make sense of air quality and associated environmental problems.

Further, findings from this study show how students at the two colleges made sense of the environmental quality in their classrooms. I hope to help inform leaders through this study, so students will enjoy environmentally sound classrooms and reach their educational goals. Knowledge of the effects of environmental conditions on enrollment, persistence, and graduation could help stakeholders become more willing to support community efforts to provide better colleges for students. All stakeholders could benefit from obtaining copies of the white paper to learn how school leaders are addressing indoor environmental quality concerns.

Another implication of this study was the need to encourage leaders to connect to students' experiences in class by making periodic classroom visits. Leaders know students want to believe that classroom air quality and environmental conditions are conducive to learning. Students want to receive knowledge that will help them acquire future jobs. Leaders who apply IEQ knowledge can ensure students' classrooms aid in their pursuit of educational success.

Further, I assume leaders will use this study and the white paper as a part of their professional development forums for faculty and staff to identify indoor environment quality problems. The forum leaders will discuss how these issues should be addressed and provide student feedback from end-of-course comments and critiques.

Implications for Social Change

In U.S. society, scant attention has been given to the likelihood that environmental health and quality could account for the growth of cognitive disparity among socioeconomic communities. Cognitive disparity is a mental process where emotions such as doubt in current surroundings causes an alteration or inequality in feelings such as hope, anxiety, shame or fear and eventually causes negative reactions and responses in individuals (Curry-Stevens, Lopezrevorido, & Peters, 2013; Cook-Sather, 2002).

Learning transfer is most successful in classrooms in which teachers incorporate students' kinesthetic senses and learning preferences (Van Doorn & Van Doorn, 2014). The implication is that leaders would share the white paper along with the information from this study with other local college leaders to prevent students from leaving one environmentally problematic school and enrolling in another institution with the same problems.

Education consists of interactions between students and instructors seeking agreement in the learning transfer process (Shale & Garrison, 1990). Students and instructors interacting in college classrooms depend on communication and cooperation with each other to help facilitate the learning process through task achievement, social interactions, and career networking and planning (Goleman, 1995; Kristjɑnsson, 2006).

For example, Park (2016) found that students exposed to elevated temperatures performed poorly on standardized tests. In contrast, Earthman and Lemasters (2013)

conducted a study under the "green schools" principle and found that students performed better in environments that were comfortable, such as air-conditioned classrooms. These two studies showed that classroom aesthetics could thwart or motivate student success. The implication here is that to facilitate change leaders must be cognizant of what indoor environmental conditions students face in class and address these situations to ensure that learning is the primary focus in the classroom.

Using the information in this study could help school leaders assure stakeholders that the schools take environmental quality conditions seriously by moving student needs to the forefront. Further, for instructors to be competent teachers, thus enabling students to acquire knowledge, the work environment should help all parties focus entirely on achieving learning transfer (Choi et al., 2013/2014; Davies et al., 2013). The implication is that if other college leaders apply the information in this study to establish better indoor environmental conditions, the changes will have an immediate positive effect in the community in terms of student success.

Recommendations for Future Study

In this study, I presented descriptions of the lived experiences of participants who attended two local community colleges at which IEQ could have affected learning. The results of this study showed that HVAC systems and building conditions contributed to participants' perceptions that leaders were more concerned about the schools' fiscal operations; participants believed student health, safety, and attendance were low priorities. Stakeholders must take an active role in assisting college leaders in

maintaining these facilities to ensure building and school occupancy standards are met. The following recommendations for further study could help school planners establish future educational facilities.

First, further qualitative study should include community colleges in affluent communities to determine how students make sense of poor IEQ conditions and how they perceive leaders respond to their concerns. Research has shown that schools in certain areas receive more attention and funding than do schools in other areas (Banerjee, 2016).

Second, future researchers could investigate whether community college leaders and managers are proactive in using previous studies on building operations and maintenance when formulating their operational budgets. Cheryan et al. (2014) noted that characteristic and structural features are usually delineated through budgets containing traditionally expensive architectural elements that affect overall school operations. Organizational leaders sometimes prioritize HVAC maintenance and repair at the low end of their operational spending. Establishing a contingency plan to handle mechanical failure could also be included in future study.

Third, as concern for global warming heightens, future researchers could explore how students make sense of environmental conditions in class at different geographical locations when the outside temperature is consistently below 32°F (0 Celsius) and weather conditions such as sleet and snow force them to attend classes with no HVAC systems. This situation may motivate students to make decisions about attending school and prompt school leaders to decide to close schools based on their inability to handle

poor IEQ caused by weather. A phenomenological study could provide valuable information on student and instructor perceptions of their experiences.

Fourth, a future qualitative study could center on how noise from failing HVAC systems affects learning transfer in college classrooms. Participants in this study indicated that noise produced from poorly maintained HVAC systems prompted verbal outbursts from students who were trying to obtain knowledge while enduring elevated classroom temperatures. Emotional arousal initiated through potential distractors can disrupt students' self-efficacy (Schunk, 2012).

Finally, students have choices on where they attend school. A qualitative study of environmental conditions' influence on student morale and interference with learning could provide valuable information on how students view their schools, learning environments, and the leaders who are responsible for ensuring the best learning environments possible. Participants in this study indicated morale issues were integral to their concerns about the environmental quality of their classrooms.

Conclusion

This phenomenological study was a depiction of how students perceived the IEQ of their classrooms as they received accelerated medical technology courses. I studied two colleges in the southwestern United States that had a history of HVAC failure and students voicing their concerns about potential IEQ interference with learning transfer. The results of this study showed that students had difficulties obtaining learning transfer in classrooms with inadequate environmental quality.

Based on students' initial concerns regarding elevated indoor air temperatures, the findings showed several areas of interest wherein students displayed physiological and psychological reactions or responses to elevated classroom temperatures. Most of the participants said the air temperature and other environmental quality items interfered or hindered learning. Participants in this study verbalized their pleasure and disdain of their classroom situation and made suggestion on how to improve their overall learning experience. If attendance, persistence, and retention to graduation are institutional goals, leaders must be aware of situations causing potential distractions. For example, participants experienced physical ailments related to IEQ that induced coughing and sneezing. Solving the HVAC problems through regular monitoring and maintenance could ensure that IEQ will not determine whether students attend class or complain about the school's overall operational conditions.

Further, some participants indicated their trust in school leaders was diminished at their institutions because leaders knew students were obligated to complete their course of study regardless of ancillary circumstances. Additionally, participants were aware of current water quality conditions in Michigan (Shen, 2017) and west Texas (Honeycutt, 2010; Texas Commission on Environmental Quality, 2010) and what limited steps have been pursued to correct these problems. The participants indicated the same lack of attention applies to the IEQ problems they have encountered and voiced concerns about potential future health problems related to the elevated temperatures in their classrooms. This study could spark a conversation about environmental quality in schools and help

school leaders determine what can be done to maintain classroom conditions conducive to learning.

Aging global societies and the worldwide need for trained medical technicians have fostered accelerated instruction formats in local colleges. Institutional leaders are responsible for ensuring IEQ does not deter students from completing classes and entering the workforce promptly. I hope the informational white paper produced from this project study will serve as a guide to school developers, renovators, and leaders and encourage them to address IEQ problems vigorously. The approaches I recommend in the white paper could ensure that students obtain the knowledge necessary to be assets to the medical profession and communities, both locally and worldwide.

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Appendix A: White Paper

Air Quality Awareness Program Geared Toward Student Achievement

Introduction

The need for skilled medical technicians increases daily. Further, the outdoor environment is continuously changing. Cook et al. (2013) described the outdoor environment as an unpredictable frontier, changing exponentially; no one can predict erratic changes in weather patterns or earthquakes. However, global warming is real; people experience the byproducts of that warmth in their homes, workplaces, and learning institutions (Van der Linden, Leiserowitz, Rosenthal, & Maibach, 2017). Air quality control methods and associated environmental remedies exist in classrooms, but sometimes these methods may not occur or are downgraded because other building operation concerns take priority over air quality (Choitz & Prince, 2008).

According to the U.S. Environmental Protection Agency (U.S. EPA, 2017), people spend 90% of their time indoors. Providing good indoor air quality (IAQ) can result in less time lost annually from indoor environmental problems (U.S. EPA, 2017). Elevated outdoor temperatures cause people to react to physical changes experienced from these exposures; further, people may psychologically react to these exposures by trying to move to comfortable locations. In a classroom setting under these conditions, students and instructors may react to these extremes the same way they would if they were outside, thus limiting the time they must establish the learning transfer needed for student success. Additionally, faulty HVAC systems may distribute airborne particulate matter that trigger underlying physiological conditions in classroom occupants.

Purpose of the White Paper

This white paper provides insight into four main topics: (a) the physiological and psychological effects of heat exposure , (b) recommended solutions to indoor environmental air quality, (c) the benefits of environmental quality in classrooms, and (d) college leaders' role in environmental quality of classrooms. With these insights, leaders can develop and promote air quality awareness programs designed to ensure classroom comfort is maintained and maximum learning transfer is achieved—student satisfaction with the classroom environment is the overall goal.

Problem Statement

College students are required participate in instructional sessions in an accelerated format. Ancillary environmental conditions both inside and outside the classroom can become a distraction particularly when heating, ventilation, and air conditioning (HVAC) systems fail, requiring maintenance from school facility managers or HVAC contract services. Because accelerated training programs have strict completion guidelines, students must attend regardless of air quality conditions in class or risk missing vital instruction, thereby affecting the transfer of learning (Caffarella, 2010), eventual graduation, and their ability to pursue future employment.

The Modern Classroom

Leaders at newer educational facilities currently follow the green schools design criteria, which have been incorporated into initial construction planning segments (Heschong-Mahone Group, 2003; Kats, 2006). Computers, desks and lab benches are all

standard in these classrooms, and air temperature, air movement, and overall air quality are carefully placed in these design criteria. However, in buildings originally built for uses other than education and training, this lack of design could place a burden on existing HVAC systems (Kats, 2006). The results of malfunctioning HVAC systems on students include failure to receive the effective instruction required for learning and physical and mental stress from poor IAQ conditions (Schneider, 2002; Schneider & Yin, 2011; Yang et al., 2013). If conditions persist, students may lose class time; absenteeism and failure to retain students may result. Next, I discuss the effects students experience when encountering elevated air temperatures associated with indoor environmental quality.

Physiological and Psychological Effects of Heat Exposure

Physiological effects. Indoor elevated temperatures can cause the following physical reactions or responses:

- Sweating because of elevated body temperature;
- Difficulty in breathing because of little to no air movement or stagnant air;
- Potential heat exhaustion from constant loss of body fluids; and
- Lack of energy because of the air quality conditions (CDC, 2013; Schneider, 2002; Tawatsupa et al., 2013).

Psychological effects. Psychological effects include:

- Inability to concentrate on tasks because of the air quality;
- Concerns about future health problems related to poor air quality;

- Concerns about cognitive ability to complete tasks vital to course completion; and
- Distractions associated with poor air quality such as noise from air-handling equipment and airborne particulate matter from poorly maintained units (CDC, 2013; Schneider, 2002; Tawatsupa et al., 2013).

Recommended Solutions to Indoor Environmental Air Quality

School leaders do not have to purchase special monitoring equipment or hire environmental contractual services to monitor classrooms. Here are some cost-effective ways to solve current IEQ problems and improve associated indoor environmental quality conditions:

- The facility engineer or designate should be familiar with the daily operations of the HVAC system. The facility engineer facilitates the routine maintenance of the HVAC system to determine if future repairs should be scheduled. This proactive approach should identify mechanisms within the HVAC system that may need periodic replacement, such as filters, and make this a part of the daily healthy building program.
- Air-conditioning systems must have an unobstructed supply of outside air and be free of any material that may interfere with airflow (Sublett, 2011). Changing air-conditioning filters according to manufacturers' specifications will help maintain a constant airflow while ensuring the air-handling unit does not overwork and fail because of clogged filters. Additionally, if not changed,

clogged air filters will eventually release parts of the filtered particulates into classroom air, which can be inhaled by students and evoke physiological responses such as coughing, sneezing, and associated upper respiratory tract reactions (Sublett, 2011; Zock et al., 2002).

- The best environmental monitoring mechanisms are the students and instructors. As problematic conditions occur, students and instructors react, both physiologically and psychologically. Elevated classroom temperatures from inoperative air-handling systems, airborne particulate matter from poorly maintained air-handling systems, and mechanical noises generated from these systems will be immediately noticed by students and may be a topic of course critiques.

Establishing a routine environmental quality assessment program and applying these steps could ensure classroom instruction time is conducive to student learning. Students missing class because of uncomfortable conditions or illnesses acquired when attending classes under these conditions can be significantly reduced. Needed maintenance to HVAC systems can be identified, thus controlling or limiting repair costs.

Benefits of Environmental Quality in Classrooms

The benefits from achieving and maintaining environmental quality in classrooms are enormous:

- Students will be more receptive to instruction, keeping the focus on instructors conveying knowledge in an accelerated curriculum (Edwards, 2006; Haverinen-Shaughnessy & Shaughnessy, 2015).
- Students will focus during all critical phases of instruction, so learning is not competing with airborne particulate matter or noise emanating from faulty HVAC systems (Hanssen, 2004).
- Students will attend class as scheduled and not remove themselves because of IAQ problems in their classrooms, thus ensuring student persistence, student retention, and overall student satisfaction and leading to higher graduation rates.

College Leaders' Role in Environmental Quality of Classrooms

Leaders at any level of academia have an obligation to make sure any situation that interferes with learning—be it structural or psychological—is addressed and solved for the betterment of students, staff, and faculty. The proactive response of leaders in solving these problems will enhance the morale and trust of students and faculty by showing that leaders are concerned about the school and committed to supporting and serving students throughout their academic journey.

Leaders who establish a school environmental quality program demonstrate to students, instructors, and support personnel that environmental quality problems are identified, corrected, and monitored. Leaders should ensure facility maintenance personnel are trained to identify environmental quality problems, particularly HVAC-

related problems, to ensure poor IAQ and associated disruptions do not interfere with periods of accelerated classroom instruction. The Occupational Safety and Health Administration (OSHA) offers periodic training courses and workshops on environmental assessment, identifying environmental hazards, and basic HVAC operations and principles of comfort ventilation. The website is http://www. www.osha.gov/SLTC /indoorairquality/

Summary

This white paper is intended to raise awareness among college leaders that environmental quality in modern classrooms is a concern. Remember, people spend 90% of their time indoors. If classrooms have air quality problems because of faulty HVAC systems, the physiological and psychological effects can cause students to concentrate more on finding remedies for their concerns and discomfort, thus affecting learning transfer in accelerated college classrooms.

The physiological and psychological effects of indoor air quality in classrooms can evoke responses that cause students to miss class or avoid focusing during instruction time. Leaders can help facility managers monitor the HVAC systems, and students can alert both leaders and facility managers if they experience poor IAQ and associated environmental problems that may interfere with learning.

Shendell et al. (2004) noted that learning is hampered when classroom air temperatures exceed 77°F. Discomfort and lack of concentration result. Thus, I present this information to help leaders address indoor environmental problems, improve learning

transfer in class, improve persistence and attendance, and improve students' confidence in the school. In addition, recognizing and answering students' classroom IAQ concerns will improve student morale and build self-confidence.

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Appendix B: Primary Interview Questions

The following is a list of pre prepared, open-ended questions I used as a guide to collect data from participants:

1. Describe your ideal learning environment. What does it look and feel like? Please include a description of indoor environmental conditions.
2. How does this vision compare with your current experience? Please consider indoor environmental conditions in your description.
3. If different, how do you reconcile or make sense of the difference between them?
4. Can you describe a time when your environment impacted your learning? How did you become aware of the environmental conditions within your classroom?
5. What motivates you to attend class? What discourages you? Please consider past and present classes.
6. Did you ever feel indoor environmental conditions influenced your decision to attend class?
7. What role do you feel your school has in providing optimal environmental conditions to support your learning?
8. Tell me about a time when you became frustrated by the indoor environmental conditions of your classroom's learning environment. How did it make you feel? What did you do to adjust?

Appendix C: Frequency of Initial Themes in Participant Responses

Theme	Frequency mentioned (%)
1. Did I make the right decision coming here?	90
2. Hot, dusty, and muggy classrooms; can't think.	60
3. Maintenance crew; can't fix anything.	60
4. Leaders are always in meetings while we suffer.	40

Appendix D: Suggested Training Forum Critique Questions

- What aspects of the information on indoor environmental quality (IEQ) did you find most useful?
- What aspects of the IEQ information did you find least useful?
- Did you understand what to look for regarding the physiological/psychological reactions by students exposed to challenging IEQ conditions prior to the information presented in the training forum?
- Do you feel facility management has adequate training in identifying IEQ problems that stem from the general operation of HVAC systems?
- Do you perceive the IEQ conditions effect the students' motivation to perform in class?
- Do you feel leaders should take a more active stance in responding to student critiques regarding items on IEQ in their classrooms?
- Do you feel absences or students quitting school are related to the heat quality within class? Provide some examples based on what you learned from the white paper.
- Share your thoughts on how you perceive attention to air temperature can improve productivity in class and overall class completion.
- How do you think what you have learned about how students perceive heat in their classrooms influences your teaching?