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Comfort And Physical Classroom Design: Using Student Voice To Inform School Leadership

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COMFORT AND PHYSICAL CLASSROOM DESIGN: USING STUDENT VOICE TO INFORM SCHOOL LEADERSHIP

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ABSTRACT

This qualitative phenomenological study considered the comfort of students in the secondary physical classroom, seeking ways to meet the needs of 21st Century learners and to provide an equitable environment for all learners. A student survey was conducted on elements of the physical classroom space and interviews were conducted to further delve into student comfort in the classroom. As part of the interviews, students drew an ideal classroom space to further share their thoughts and ideas. Interviewees and respondents articulated the need for individual space in the classroom, for temperature control, and for the reduction of noise to optimize the learning environment. Interviewees sought a visually stimulating environment, and one in which technology was integrated, but not overwhelming. To that end, interviewees suggested that the physical classroom space should be flexible and offer a variety of study environments for students to both focus and relax. Interviewees indicated that this physical classroom environment would better meet their needs to collaborate and communicate with their peers, placing the teacher in an interactive, but supportive role in the classroom. A student comfort taxonomic structure was developed, formed from motivation theory, satisfaction and human comfort theory, and a taxonomic structure of comfort used in nursing. Through the researcher's reflection and interaction with these data as an educational leader, a series of questions based on a taxonomic structure of student comfort was developed to assess students' physical comfort, environmental comfort, sociocultural comfort, and psychospiritual comfort

across a continuum of relief, ease, and transcendence. This research, and the resulting student comfort taxonomic structure and questions derived from that structure can be used by teachers, school leaders, site managers, architects, and designers to assess student comfort in the physical classroom space.

Keywords: student comfort, comfort theory, physical classroom, 21st Century learners, equitable learning environments, optimized learning environments, alternative study spaces, secondary school leadership

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CHAPTER 1

INTRODUCTION

We shape our buildings, and afterwards our buildings shape us.

~Winston Churchill

Striving to achieve equity in the classroom must be a goal for every educational leader. Much has been studied over the last fifty years on the ways in which classrooms can be biased along gender, racial, cultural, and socio-economic differences (Parkay, Anctil, & Hass, 2014). Physical differences and learning preferences can also be quite varied among learners, leading some students to find the physical classroom space conducive to learning, while others struggle to feel comfortable. The needs of the 21st Century learner are also changing. School spaces, erected and arranged for 20th Century learning, do not properly provide for the physical needs of today's student (Meyer, 2016). Traditional classroom arrangements also favor lecture-style learning, which limits the ability of teachers to incorporate 21st Century practices, including collaboration, student-led learning, project-based learning, and technology into their curriculum and delivery. Karippanon, Cliff, Lancaster, Okely, and Parrish (2018) found that "differentiated teaching for personalised learning is neither possible nor effective in traditional classrooms" (p. 317).

Physiological needs lie at the base of Maslow's motivation theory (Webb & Norton, 2013). Basic physical comfort falls within this level, yet too often students simply do not fit properly in the desks, chairs, and tables provided. Further, a classroom's physical space configuration and furnishings often do not meet a student's security and social needs, the next levels of Maslow's Hierarchy. As such, many students are at a disadvantage. Citing Herzberg's (1959) two-factor model, Webb and Norton stated that these "hygiene factors," if not present, are

"demotivators, or…blocks to motivators" (2013, p.133). The challenges within this inequity include physical discomfort (Parcells, Stommel, & Hubbard, 1999) gender inequity (Lester, Yamanaka, & Struthers, 2016), territoriality (Kaya & Burgess, 2007), divisive grouping (Lester, Yamanaka, & Struthers, 2016), and social anxiety (Rae & Sands, 2013). An inadequate physical environment affects school attendance, classroom behavior, concentration, self-worth, and overall perceptions of education (Cencic, 2017). Citing Nicholson (2005), Cencic (2017) stated that students are "extremely aware of the symbolic messages that buildings transmit" (p. 147).

Lemley, Schumacher, and Vesey (2014) studied secondary students' perceptions and needs and revealed some unique characteristics and preferences of today's learners. The study described them as "very different type of learner[s]," who are fluent in technology, who expect choice, and who prefer "working in a social setting and solving problems at school" (p. 102). School leaders must understand the changing needs of these students and adapt to these societal transformations. Further, many schools are moving in the direction of a competency-based model of instruction over traditional Carnegie units (Sullivan & Downey, 2015). Shifting from the traditional model of an instructor-led and text-based curriculum, Sullivan and Downey, citing personal communication with Richard A. DeLorenzo, stated the "ideal" balance in the competency-based model classroom as "40% direct instruction, 40% peer instruction, and 20% individualized learning" (2006, p. 6). This shift suggests a need for physical flexibility in the classroom as well.

The challenge lies with making physical changes within existing classrooms that do not involve a complete classroom renovation, but provide fluidity (Meyer, 2016). Flexible seating, with varied adjustable and alternative seating options—creating a coffeehouse environment—has been one solution to changing classroom needs (Paterson, 2017). There are several studies

which addressed different classroom arrangements, each with strengths and challenges (Woolner, Hall, Higgins, McCaughey, & Wall, 2007), but relatively few that addressed these arrangements, the changing needs that technology brings to the classroom, and the perceived needs of 21st Century learners at the secondary level in combination.

Statement of the Problem

This problem is evident in both the researcher's former school in the United States and present school in China. The former school, a dated 1950s building with few improvements over almost seventy years, housed classrooms which remained much as they did when originally designed for classes of thirty to forty elementary students. Few changes were made to accommodate the needs of the middle and high school students that inhabited the building for the last 35 years. Furnishings consisted of traditional desks with attached chairs, and tables with traditional molded plastic one-piece backs and seats. All were standard-sized without the ability to adjust heights and with little accommodations for ease in movement. Seating was arranged in traditional manner of rows suitable for traditional front of the classroom teacher-led lectures.

Though the researcher's current school boasts a brand-new campus and classrooms integrated with internet of things (IoT) technology, the physical space is still designed with little thought of student comfort. Secondary classrooms are furnished with fixed, molded seat chairs and fixed height table desks. There is little else in the classrooms. While these furnishings are somewhat more moveable, they are in many ways inadequate to meet the varied needs of the students. Though these two learning environments are very different, they share a commonality observed in many classrooms around the world: an industrial-age design that has changed little in almost one hundred years.

The researcher's new school is a designated International Baccalaureate (IB) school. The IB framework embraces 21st Century learning, including cross-curricular teaching and learning, student-led research, and intercultural understanding and collaboration (IB.org, 2019). As the researcher's new school leaders look for ways to embrace its diverse 21st Century global learners and expand from a population of 300 students to its goal of over 1000, the use of the school's classrooms, type and arrangement of furnishings, and environmental factors should be considered. There is a visible inequity of the fit of furnishings for some students over others, and though the space is more conducive to collaboration and students seem to have more space for 1:1 technology and other materials, little effort has gone into determining the adequacy of the physical environment from the student perspective.

A school's primary function is to promote student learning. Though a school should be student-centered, too often only adults make decisions about the physical classroom space. This includes the school's architect(s), builders, those furnishing the interiors, and the classroom teachers themselves. This puts the decision-making power in the hands of those who are not the primary benefactors of the environment. Student suggestions and feedback are often missing and understudied in secondary schools worldwide.

Purpose of the Study

The purpose of the study was to examine the extent to which secondary students feel the physical classroom environment deters or promotes learning, to better understand what causes students' discomfort and creates barriers to learning in the classroom, and to understand how students feel those discomforts and barriers might be addressed by altering the physical classroom environment to best meet the needs of the 21st Century learner. The physical space is an essential consideration, as adults and children think, feel, act, and behave differently in

different environments (Cencic, 2017). Though studies have been done on the mismatch of furniture to student body dimensions (Parcells, Stommel, & Hubbard, 1999) and alternate seating configurations to accommodate varied pedagogy (Woolner et al., 2007) and to combat gender inequities (Lester, Yamanaka, & Struthers, 2016), particularly at the post-secondary level, there is a need for research that addresses the changing needs and perceptions of 21st Century learners in the secondary school environment, with the goal of achieving better equity in the physical classroom. This qualitative study expands upon Rae and Sands' (2013) writings on classroom layout theory focused on flexibility in the classroom and self-selection based on preferred learning style; Uline, Wolsey, Tschannen-Moran, and Lin's (2010) work on equity and the physical classroom; Cencic's (2017) study of school leaders' understanding of the physical school environment as a learning factor; Wilson and Cotgrave's (2016) work on student satisfaction and the learning environment; and Sigurdarottir and Hjartarson's (2011) study on the effect of 21st Century school building design on teaching practices. The study makes use of the Physical Aspects of Classroom Environment (PACE) instrument developed by Ahmad, Yahaya, Abdulla, Noh, and Adnan (2015) at Sultan Idris Education University in Malaysia. The PACE instrument, formatted as a five-point Likert scale, provides a measurement of the physical aspects of the classroom environment, including furniture, facilities, space, lighting, indoor air quality, and color, to be used by secondary school students.

Research Questions

1) How do 21st Century secondary students perceive the influence of furnishings and configuration of the physical classroom on their physiological, security, and social needs?

2) In what ways would 21st Century secondary students suggest improvements in the physical classroom space to provide for their physiological, security, and social needs?

3) How can educational leaders use student voice to better understand comfort and equity in the 21st Century secondary physical classroom space?

Conceptual Framework

The study is framed around the idea of comfort. Three complementary theories describe students' comfort in the physical classroom space: Kolcaba's (1994) comfort theory, Shin's (2016) satisfaction and human comfort theory, and Maslow's (2014) motivation theory. Kolcaba (1994) developed comfort theory around the human need for relief, ease, and transcendence, within the framework of the physical, psychospiritual, sociocultural, and environmental contexts. Kolcaba developed this taxonomic structure to allow nurses to assess a positive, holistic outcome for patients (Kolcaba & DiMarco, 2005); its concepts are easily transferable to the comfort needs of students. Shin's (2016) satisfaction and human comfort theory complements Kolcaba's comfort theory in its consideration of human optimization of the environment, with environmental modifications as one aspect of the theory. Maslow's (2014) motivation theory describes physiological needs as the base of human need, followed by security and social needs, factors which can be positively or negatively impacted by the physical classroom space (Cencic, 2017) and which can be considered as an aspect of a student's motivation to learn. In combination, an emerging taxonomic structure of these theories informed both the interview questions and the analysis of the data of this study.

Assumptions, Limitations, Scope

While the data yielded rich responses, the study is limited in its size and scope; and while the participants hail from multiple countries and cultures, they have given their perceptions of a single school site with little variation in furnishings and configuration. The researcher collected data on students' perceptions of the physical environment; however, no measurements were

collected on students' physical shapes and sizes, nor the dimensions of furnishings. Students were asked to describe possible improvements to the physical classroom, but an alternate physical space was not assembled for this study. Further, data related to student academic achievement is not within this study's scope.

The researcher is an administrator at the school site and approached the research as an intuitive inquiry through a five-cycle hermeneutic interpretation of the literature and data (Anderson & Braud, 2013).

Significance

Research suggests that an improved physical school environment does not directly yield better learning (Woolner, McCarter, Wall, & Higgins, 2012), yet furniture can "make or break" a learning environment (Meyer, 2016). Businesses seek 21st Century workers who can collaborate, apply critical thinking skills, and problem solve (Fontichiaro, 2009). Educational environments of the 21st Century, with more self-directed learning opportunities and greater collaboration, allow teachers more time to support students, and 1:1 computing leads to "gains in academic performance, graduation rates, and decreases in dropout rates and disciplinary actions [as well as] greater gains in mathematics, science and writing" (Varier, Dumke, Abrahams, Conklin, Barnes, & Hoover, 2017, pp. 969-970). Though there have been studies on varied classroom configurations and the mismatch between body sizes and furniture, there is a need for further research on the needs of the 21st Century secondary school learner and the physical environment of the classroom to provide better equity among students. Cencic (2017) stated that "the school building acts as a third teacher [and is a] factor in learning, as it conveys non-verbal messages" (p. 144). This study addressed this need to change classrooms, and the role school leaders can play to achieve greater equity among learners of different sizes, genders, ethnicities, cultures,

and preferred learning styles by making physical changes to the classroom. This study adds to the research on students' perceived physical needs in the 21st Century secondary classroom. With better understanding of what does and does not work from a student perspective, furniture manufacturers, architects, school leaders, and classroom teachers can use the research for classroom design and can conduct additional research on the ways to address these perceived inadequacies in the classroom.

Definition of Terms

21st Century Learner. Students born within and studying within the early 21st Century, noted as tech-savvy, creative, innovative, collaborative, critical thinkers, with short attention spans and an affinity to multi-task (Lemley, Schumacher, & Vesey, 2014) are considered 21st Century learners.

Active Learning. Active learning describes classroom environments which feature strategic seating arrangements to facilitate collaboration and help foster student-teacher relationships (Knaub et al., 2016).

Carnegie Units. Based on the Carnegie public school model of the early 1800s, Carnegie units feature separated core courses and 50-minute classes that are credit-based and delivered to all students at the same time and rate, regardless of individual ability (Sullivan & Downey, 2015).

Classroom Layout Theory. Altering the placement of furniture to encourage student engagement (Rae & Sands, 2013) summarizes this theory.

Competency-Based Educational Model. A competency-based educational model is a standards-based model which is student-directed, individualized, and data-based, using real-life

application and one that operates on a fluid timeline of demonstrated proficiency (Sullivan & Downey, 2015).

Equity. Equity in education is defined as equal access to learning, focused on adjustments to the classroom environment for individual learners.

Flexible Seating. Flexible seating allows for varied seating arrangements, shapes, sizes, and styles to accommodate different comfort and task performance needs.

PACE Instrument. The PACE instrument is defined as "an instrument to assess the physical aspects of classroom environment in Malaysian secondary schools from the students' perspective" (Ahmad et al., 2015, p. 1).

Physical Comfort. Physical comfort in the classroom setting is the point at which furnishings and a student's body size match and are conducive to learning (Parcells, Stommel, & Hubbard, 1999).

Preferred Learning Style. The personal choice to work in a group or by oneself in the classroom is known as a student's preferred learning style (Rae & Sands, 2013).

Studio-Style Instruction. Studio-style instruction is a classroom layout which features tables around which students collaborate, white boards, and technology to facilitate hands-on learning (Knaub et al., 2016).

Territoriality. Marking out physical space with one's books, belongings, and/or physical presence defines territoriality in the classroom (Kaya & Burgess, 2007).

Traditional, or 20th Century, Classroom Arrangements. Classrooms arranged with desks in rows facing the front of a classroom are considered traditional in their arrangement.

Conclusion

In our rapidly developing world, there is a need to address the unique qualities of 21st Century learners, their perceived needs within the classroom, and the ways in which the physical space of the classroom might better align with changing curriculum and pedagogy to meet those needs. In addressing the 21st Century classroom, Hutton, Davis, and Will (2012) stated,

> Supporting the paradigm shift from teaching to learning requires creative approaches to learners and learning environments, both formal and informal, physical and virtual. There are many moving parts in the learning process, and the development of student learning spaces requires the combined expertise of many stakeholders in the support community. (p. 149)

Students arrive in the secondary school classroom with a wide variety of differences; these differences can sometimes cause an inequity of learning. One way for school leaders to address this inequity is through assessing the physical classroom space and how it meets the needs of students. Glaze (2015) reminded us of our "moral obligation" to be advocates for equity, working for change that will create "better outcomes for our most vulnerable students" (para. 5). Yet little is known about what secondary students perceive as adequate and inadequate in today's physical classroom. This study identifies perceptions of the traditional physical classroom from the perspective of students and offers a school administrator's perspective on possible solutions to improve student comfort within the furnishings and configuration of the physical classroom space. The literature review which follows informs this study in the areas of classroom design, layout and furnishings; physical fit to furnishings and student comfort; equity in learning; the changing landscape of the 21st Century classroom; and student perceptions of learning environments.

CHAPTER 2

LITERATURE REVIEW

An educational leader must be concerned for the needs of not only the majority, but also the individual; a transformational leader must consider and address many forms of classroom inequity. The role of the physical classroom environment and a student's physical comfort within it has been less often studied from an equity perspective. Beyond physiological comfort, how the physical classroom environment makes a student feel emotionally (Uline, Wolsey, Tschannen-Moran, & Lin, 2010; Wilson & Cotgrave, 2016), including comfort with where the student is situated within the classroom (Haghighi & Jusan, 2015; Lester, Yamanaka, & Struthers, 2016) and in what classroom configuration (Rae & Sands, 2013) are other aspects of student comfort in a physical space. The changing pedagogical requirements of the 21st Century learning environment also play a role in assessing the adequacy of a classroom's physical layout including the integration of technology, a shift to student-centered learning environment, and an emphasis on collaborative learning. Though many stakeholders are involved in the classroom design process, students' perceived needs and satisfaction with the environment are important measures of an equitable and conducive learning environment. This literature review synthesizes research within the last ten years on the physical classroom environment, students' perceptions in learning, equity in learning, and the changing needs of the 21st Century learner; and suggests areas for further study.

Purpose of the Study

The purpose of the study was to examine the extent to which secondary students feel the physical classroom environment deters or promotes learning, to better understand what causes students' discomfort and creates barriers to learning in the classroom, and to understand how

students feel those discomforts and barriers might be addressed by altering the physical classroom environment to best meet the needs of the 21st Century learner.

Research Methods

The resources reviewed represent a cross-section of studies, most from the last five years. While none of the resources share all the aspects of the proposed study's direction, each relates to one or more subtopics related to the study. The resources located are from many countries, indicating an area of global interest and perceived need.

Using the University of New England online library, primarily filtered by *scholarly and peer reviewed* and *last five years*, searches were made with the following search terms:

21st Century classroom design
21st Century classroom furnishings
Student perceptions of classroom spaces
Physical space and learning
Equity in learning and physical space
Furniture and classrooms
Perceived fairness + physical classroom space
Classroom layout + equity
Classroom environmental factors
Physical comfort + learning

Results were pulled from Elsevier, Gale Academic OneFile, ProQuest, Routledge, Science Digest, Springer Link, Taylor Francis Online, and Wiley databases. Further research, including the review of the resource lists of the most relevant studies, was also conducted.

The literature reviewed has been organized under the emergent subtopics of *Equity, Classroom Design and Performance, 21st Century Learning,* and *Students' Perceived Needs*.

Review of Relevant Literature

In a recent publication, Cavicchi (2017) considered John Dewey's "concern for nurturing democratic citizenry through education" (p. 530), specifically looking at a campus's architecture

through this lens. Reflecting on Dewey's ideals, Cavicchi viewed the traditional classroom environment as one that "pacifies learners' minds, suppressing investigation" (p. 533), envisioned authentic learning as having "interrelation and balance [over] division and separation" (p. 533) and contended that segregated spaces and limits to movement block the flow of ideas. Cavicchi described classroom curriculum as emerging through collaborative experiences with the environment. The study invites thought on expanding beyond the limits of the classroom space, serving as a strong philosophical entry point into how the classroom seemingly limits, rather than expands education. Cavicchi stated, "the spaces framed as educational are often, by that very framing, diminished in spatial or educational potential" (p. 551). This investigation of the interaction of physical space and education served as a launching point for examining equity and inequity within the physical classroom environment.

Equity in the Classroom

Equity in the classroom involves finding ways to teach all students in the classroom, not just those who are engaged or more outgoing (Tanner, 2013). The best lesson plans may only be accessed by a small portion of students without equitable teaching strategies. Many strategies, such as *wait time*, *think-pair-share*, and *small groups or stations*, (Tanner, 2013, p. 323, 327) have been shown to increase equity in response and understanding of the individual student. Tanner (2013) advised that teachers should consider what students are learning beyond the subject matter, including the culture of the classroom.

Pescarmona (2016) addressed equity in a similar way, as a shared process between school leadership and teachers in practice. Stating the need for professional development (PD) opportunities, Pescarmona contended that PD has little value without reflection-in-action and reflection-on-action. Through the use of Complex Instruction, described as innovative strategies

which address social inequalities and create conditions for equal participation, pre-service and in-service teachers address the inequities of access to learning, reflecting on student interaction, participation, and inclusion and exclusion.

Gill and Tranter (2014) considered gender equity among Australian students to be vastly different among low socio-economic communities vs. middle class communities. They stated that while gender differences in middle-class classrooms have largely disappeared and even favor girls, stereotypical gender roles and a lack of professional women role models, combined with a higher turnover rate of teachers and lower educational offerings, creates a complex gender inequity for girls from poor families.

Equity, diversity, and inclusion (EDI) across disciplines are the teaching objectives discussed in Hartwell, Cole, Donovan, Greene, Burrell Storms, and Williams (2017). Focused on the post-secondary level, this cross-section of professors from community colleges, liberal arts colleges, and universities with undergraduate and graduate programs considered a diversity of student populations. Referring to the common EDI learning objectives of awareness, knowledge, skills, and action, the study addressed a variety of actions and assignments that can be used for student self-discovery; identifying bias; recognizing discrimination and injustice, such as racism, sexism, heterosexism; and exposing invisible advantages. The authors suggested exercises that require collaboration in the classroom and shifting classroom power dynamics but did not specifically address the flexibility of the classroom itself in facilitating this collaboration.

Equity related to the physical environment. There is a relationship between social interaction and physical space (Benade, 2017; Uline et al., 2010) and in turn, equity in the classroom. Uline et al. (2010) addressed inequity from school to school in a multi-phase study, stating:

> Poor-quality facilities appear to exacerbate already-existing inequities in multiple ways. Not only do students lack access to state-of-the-art learning environments available to their more affluent peers, but they may also fail to benefit from high-quality instruction, given that teachers choose to work elsewhere within environments more conducive to learning and teaching. (p. 627)

The learning environment, the study contended, is under-considered, and is impactful in a multitude of ways including the quality of teachers attracted to working in the environment (Uline et al., 2010). Uline et al.'s work has a strong focus on inequity from school-to-school, and classroom-to-classroom. What is not discussed is inequity within the classroom, based on the physical space or the way to furnish and configure the classroom to achieve equity.

Gender microaggressions, including a curriculum favoring competition over collaboration, are addressed in a study by Lester et al. (2016), which considered the impact of the physical environment, and the instructor's pedagogy and communication. The study indicated that the classroom had "symbolic or physical barriers" (p. 918) which isolated female students in a male-dominated classroom and discouraged mixed-gender learning. The authors noted, "the inability to move the furniture decreased the opportunities for students to move and interact with one another and restricted the teacher's opportunities to create more activities that involved moving around and working with peers" (p. 918). In this configuration, the instructor directed more attention to the male group further isolating the female students, and the study concluded that the environment with unmovable furniture and an accompanying traditional lecture style "perpetuated an existing culture" (p. 922).

Equity then, should be considered within the classroom itself, to provide base levels of comfort for students, to accommodate flexibility for the changing needs of the classroom and of

individual students, and to promote equity in access to learning. Environmental factors, including the classroom's physical layout, furnishings, spaciousness, and technology enhancements, all contribute to student comfort, and therefore equity, in the classroom.

Classroom Design and Performance

The physical environment is often called the *third teacher* (Benade, 2016; Cannon Design et al., 2010; Cencic, 2017), a term which incorporates curriculum, technology, pedagogy, and the inhabitants of the facility itself. Referring to the historical design of classrooms, Thomas Muller, CEO of VS Furniture stated, "environmental, ergonomic, and pedagogical factors of school design were neglected in favor of the logistical, budgetary, and bureaucratic" (Cannon Design et al., 2010, p. 18). Cannon Design et al., described the collective role of designers of classroom furniture and spaces as "understand[ing] what environmental characteristics support a collaborative approach to schooling" (p. 17).

There is far more research on the transformation of physical space at the post-secondary level than the secondary level. In fact, Vel and Higa (2016) stated, "the effort to remake higher education institutions into entrepreneurship and innovation hubs has escalated like a Cold War arms race" (p. 11). The study acknowledged that stewarding these innovations in an environment entrenched in tradition, rules, and standards is challenging. This traditional environmental entrenchment is mirrored at the secondary level, and is perhaps even more challenging to overcome, especially given the budgetary constraints of many institutions.

In a study of 82 middle schools, Uline et al. (2010) found a significant and positive correlation between quality facilities and the school climate variables of *academic press*, the degree to which a serious learning environment with high goals and expectations exists; community engagement; and teacher professionalism (p. 614). For example, a lack of exterior

views and poor natural light, as well as early morning or late afternoon sun providing glare and/or creating temperature control problems, have an impact on student comfort (Cannon Design et al., 2010; Uline et al., 2010). School climate suffers as well when overcrowded public spaces, including hallways and stairways, force people into other's personal space (Uline et al., 2010).

Kariippanon, Cliff, Lancaster, Okely, and Parrish (2017) looked at four Australian secondary schools as part of a larger study on modified, non-traditional, learning environments. Noting that a classroom's physical space and arrangement have student performance implications, they reported that modified spaces were "more enjoyable, comfortable and inclusive and allowed greater interaction" (p. 301). Further, teachers noted that project-based learning, differentiated instruction, and greater use of technology allowed for a more student-centered, personalized learning experience. Students reported that the spaces afforded a quieter and more comfortable workspace that allowed for student choice and movement.

Furnishings and body size. Furniture should be designed to make the classroom inviting and engaging; however, too often classrooms are stocked with *one-size-fits-all* solutions with a disregard for body sizes, gender differences, posture, or positioning (Benade, 2016). Studies from around the world on classroom furniture dimensions and the anthropometric characteristics of secondary students showed a significant mismatch (Castellucci, Arezes, & Molenbroek, 2015; Castellucci, Arezes, Molenbroek, & Viviani, 2015; Dianat, Karimi, Hashemi, & Bahrampour, 2011; Wang & Xue, 2014). The studies emphasized the establishment of postural health in youth (Castellucci, Arezes, & Molenbroek, 2015; Wang & Xue, 2014; Dianat et al., 2011), and noted a decrease in student interest in learning, even within an engaging lesson (Castellucci, Arezes, & Molenbroek, 2015; Dianat et al., 2011). Castellucci, Arezes, Molenbroek, and Viviani

(2015) further noted the importance of measuring students' body dimensions over time, showing a significant change in body dimensions of school-aged children in the 22-year span from 1990 to 2012 in Chile attributed to environmental changes, infectious diseases, nutrition, and poverty. Given the long lifespan and usage of much classroom furniture, this suggests that furniture designers and school leaders should consider continually updating furniture dimensions to meet the needs of students. Studies also showed a significant difference in body measurements by gender (Castellucci, Arezes, & Molenbroek, 2015; Castellucci, Arezes, Molenbroek, & Viviani, 2015; Dianat et al., 2011; Wang & Xue, 2014) and by socio-economic levels (Castellucci, Arezes, Molenbroek, & Viviani, 2015). The same studies suggested that although adjustable furniture would greatly improve the match between body dimensions and furniture heights, widths, and clearance (Castellucci, Arezes, & Molenbroek, 2015; Castellucci, Arezes, Molenbroek, & Viviani, 2015; Dianat et al., 2011; Wang & Xue, 2014), most schools continue to use fixed-height furniture, likely to accommodate space economy, aesthetic considerations, and budgetary constraints (Dianat et al., 2011).

Of the dimensions studied, seat height was highlighted as the most important variable (Dianat et al., 2011). In other studies, significant mismatches, those affecting more than half of the student population, included desk height, and seat width (Castellucci, Arezes, & Molenbroek, 2015; Castellucci, Arezes, Molenbroek, & Viviani, 2015; Dianat et al., 2011). Castellucci, Arezes, and Molenbroek (2015) noted that most studies consider these variables individually, meaning that in combination, overall mismatch is likely undervalued. Benade (2016) addressed a shift away from seat and chair ownership in today's classrooms to a shared environment of a variety of desks and seats more closely mirroring the changing workplace. This observation further spoke to the need for adjustable furnishings.

Influence on teaching and learning. Building features, such as climate control, acoustic control, lighting, and design classifications, such as circulation, outdoor spaces, flexible arrangements, have been shown to influence student achievement (Uline et al., 2010). Facility conditions, including disorder and neglect, are related to social disorder (Uline et al., 2010). Beyond the role poor facilities play in student outcomes, these physical spaces affect teachers' performance and behavior as well as the community's engagement with the school; in fact, Uline et al. (2010) stated the condition of the school far outweighs the student makeup or salary difference in teachers' employment choices.

Flexible, open learning environments allow for the creation of smaller dynamic spaces, defined by various furnishings (Benade, 2016). "It is the spatial practice of these schools to encourage self-managed learning in a collaborative environment, and students very quickly have adapted themselves to using the furniture and walls precisely as intended," (Benade, 2016, p. 802).

Larger, more flexible technology-integrated spaces, served by multiple teachers, do not come without challenges. Teachers cite concerns about keeping track of a larger number of students and parental concerns over *hands-off teaching* and *self-managed learning* (Benade, 2016). Savov, Terzieva, Todorova, and Kademova-Katzarova (2017) stated the need for an enhancement of the function of the classroom, including integration of the internet of things (IoT) and a *single-structured* learning management system capable of a full integration of the physical classroom and technology-driven pedagogy.

Layout, seat selection, and performance. The physical layout of the classroom space, from furniture arrangement to furniture selection, works to encourage and discourage activities and affects pedagogy (Kariippanon et al., 2017; Knaub, Foote, Henderson, Dancy & Beichner,

2016). Strategic seating arrangements in a flexible classroom design can promote collaboration, teacher-student relationships, and student-led learning (Brown, 2014; Kariippanon et al., 2017; Knaub et al., 2016; Young, Young, & Beyer, 2016). However, many students are still in "learning environments that greatly resemble the same classrooms that their great-grandparents might have used generations ago" (Brown, 2014, p. ii). Beckers, van der Voordt, and Dewulf (2016) concluded that students rank the functionality of the space over aesthetics, and quietness over privacy was preferred among college students seeking study space (pp. 248-249). This variety of needs is poorly serviced in a traditional secondary classroom environment.

Student performance is influenced by classroom seat selection (Haghighi & Jusan, 2015; Yang, Bererik-Gerber, & Mino, 2013). In a study of single gender and mixed-gender high school traditional row-seating classrooms in Iran, the Haghighi and Jusan (2015) study showed that female students, performing higher overall, more often sat in the front of the classroom and male students more often in the back. Using a Likert-type scale, architectural scale, and school reports on individual student academic achievement, the study concluded that *indirect-architectural* elements, for example seat proximity, visual eye-line, and temperature, were a bridge between motivation and achievement, and *direct-architectural* elements (e.g. classroom size, paint color, lighting, ventilation) affected outcomes on student performance (p. 287).

Rae and Sands (2013) approached student comfort within the flexible learning environment from another angle: allowing students to choose small clusters or individual learning space in working with a tutor. Noting that "not all students worked well in groups due to various individual or cultural reasons" (p. 490), the study concluded that engagement in whole class discussions was higher within this flexible classroom and self-selection environment.

Students come in all shapes and sizes. Fixed-sized furniture accommodates only the average student, and students are often seated in furniture not intended for their age and size. Even flexible furniture relies on user training for effective use. Further, budgetary constraints push schools and districts to make choices of furniture, layout, and capacity based on fiscal constraints rather than student comfort. Reconfiguration of space is often difficult if not impossible, and traditional views of classroom layout limit collaboration and positive student interaction. Long-term misaligned furniture affects students' lifetime physical posture, comfort, and ability to focus. More study is needed of how the physical space is used in practice to promote engagement, collaboration, and learning in the secondary school environment (Kariippanon et al., 2017).

21st Century Learning

Traditional pedagogy built around the traditional classroom features substantial amounts of information delivered through lectures and textbooks, favoring students who are good listeners and highly motivated, and creating dependent learners with weak critical learning skills (Brown, 2014). Rows of desks facing a board give the message that the teacher is more important than the student and that students should be passive listeners (Brown, 2014). The need for student agency, a term for self-initiated learning, is promoted well within the parameters of the opening learning environment but is poorly modeled in the single classroom with a single teacher as the agent (Benade, 2016), yet "classrooms continue to reflect status quo" (Brown, 2014, p. 31). The flexible classroom environment mirrors the need for 21st Century workers to be flexible, adaptable, and creative, which will also help them to "cope with the realities of *under-employment and partial employment*" (Benade, 2016, p. 805) projected for their

generation. Yet, Benade (2016) revealed that teachers feel ill-prepared by traditional teachers' colleges to collaborate effectively within this new type of environment.

O'Neill (2013) noted that when planning learning spaces, not all elements follow the same schedule. School leaders and space planners must consider the rotation schedule of technology, which can change in less than two years, to furnishings, which are often employed for a decade or more, to buildings, which can survive for centuries. Byers et al. (2018) noted that while superficial changes are made to appear to be keeping up with technology, a lack of student-centered planning maintains status quo. Planners should not only consider students' current needs but anticipate future expectations of learning spaces.

Changing needs of the student. Research suggests that the physical environment not only influences learning but also impacts teacher and student motivation, school attendance, student behavior, and even students' posture and the "negative consequences of a sedentary lifestyle" (Cencic, 2017, p. 146), yet Cencic contended that understanding the relationship of the physical environment as an important factor in learning is not currently among school heads' competencies. Cencic highlighted opportunities for the building and classroom itself to be integral to the learning process, such as promoting environmental friendliness and considering how the learning space can be tailored to the individual student, supporting varied learning styles and activities. In a study of 150 elementary school leaders, Cencic concluded that school heads perceive the physical environment to influence ecology, movement, respect, cooperation among students, ethics, and attitudes toward the greater community, and urged school building architects to work collaboratively with the school's inhabitants to understand the needs of the 21st Century learner and to appreciate that adults and children *behave, think, feel,* and *act* differently in different environments (p. 158).

Citing a study by Millennial Branding, Vel and Higa (2016) stated that "43 percent of college students would rather be entrepreneurs than employees when they graduate college" (p.11). This rising interest in and need for entrepreneurism and innovation must be matched in our schools with classrooms built and furnished to promote student collaboration, creativity, and self-directed learning.

Uline et al.'s (2010) study, noted older classrooms often lack adequate power sources and electrical infrastructure for technology, which limits the ability to arrange the classroom for varied purposes. The study further observed that classroom limitations made it difficult for teachers to work with individual students due to space limitations. Students pointed to the desk-chair combination unit as being particularly inflexible and uncomfortable.

Physical environment changes to support learning. The technological revolution has affected most physical spaces, and schools are no exception. Whether upgrading an existing building or building new, each building is expected to serve not only the needs of the present but also to serve an unpredictable future, knowing that "the only thing known for certain is that the future will be different from the present" (Sigurdardottir & Hjartarson, 2011, p. 25). In a preliminary study of 40 schools in Iceland, the authors stated that access for all should be a primary goal of good design. Specifically identifying inclusion for students with special needs, multicultural education, and access to educational resources and new media, Sigurdardottir and Hjartarson (2011) highlighted equity within the physical classroom, a topic rarely found in the literature. The study considered the impact of open space designs in 21st Century buildings and reported that teachers are more collaborative, which has been linked to school effectiveness, and that students are offered more choice.

Citing Oblinger (2005), Acton (2017) stated that in addition to incorporating technology, new designs of learning spaces create new means for student social and intellectual interaction. Calling the learning space "an entangled amalgamation of people-place-practice-process," Acton considered how the physical space enhances or limits learning possibilities, through the "interaction with living and non-living entities" (p. 1442).

Benade (2017) stated the need to prepare our students for the "twenty-first century knowledge economy" (p. 797). The author went so far as to ask the question, "Do innovative classroom and school building designs render the classroom obsolete?" (p. 797). Universities across the United States are building new facilities specifically designed as innovation and entrepreneurship centers. Purposefully separated from any college or department, these centers promote collaboration across the university (Vel & Higa, 2016). These centers could be a model for the secondary learning environment as well.

In a paper presented at the CBU International Conference of Innovation in Science and Education in March 2017 in Prague, Savov et al., (2017) shared the results of an anonymous online survey of teachers' opinions of the issues of technology integration into classrooms and presented a smart classroom concept and structural model. The authors suggested an all-inclusive system designed with the usage of the internet of things (IoT), encompassing a classroom environmental module, such as temperature, lighting; a system operation module, coordination between modules; an educational resource module, such as electronic textbooks, audio, learning applications; a communication module, such as text and voice messages, in real time or delayed, between students, teachers, and parents; and an evaluation and control module, monitoring student achievement and behavior. This futuristic technology integration concept included the physical space as a critical element, which suggested the future classroom may

include wired desks with individual cameras to monitor indicators of a student's attention and concentration among other things.

Furnishings for the 21st Century. Adaptability is the key word in an article penned by Michael O'Neill, Senior Director of Workplace Research for the high-end furniture manufacturer, Knoll. Stating that "technology in the hands of today's students is a given" (p. 12), O'Neill (2013) addressed the need to adapt existing buildings and build new ones that support a changing campus. Mobile technology allows learning to take place almost anywhere, meaning that all school spaces should be considered as learning environments. Several technology-driven configurations have emerged, including the *campfire*, which features gathering spaces with access to power that allow students to plug in to recharge technology while they are engaging, and *front porches*, wide seating areas just outside of classrooms for engagement to continue outside of class (O'Neill, 2013, pp. 17-18). The furnishings within these and other spaces play an integral role in facilitating learning, promoting collaboration, allowing individual study space, and providing adjustability and comfort to promote student learning.

When considering equity, flexible furniture may be one approach. In a study of sit-to-stand desks in a middle school classroom, Erwin et al. (2018), reported results suggesting that although the desks created some distraction and that students would have preferred some design modifications, students reported being more focused and appreciated having freedom of choice. The classroom teacher from this small qualitative study reported the desks allowed students to release energy and stay better engaged. O'Neill (2013) also highlighted the need for flexible furniture both from the standpoint of ease of movement and reconfiguration as well as adjustability of individual furnishings to adapt to the size and shape of the individual and his or her needs.

History will likely regard the technology revolution as one of the most disruptive to our society. The 21st Century classroom demands a technology structure, flexibility, and innovation in design. The learning environment is more than just a space, it either supports or fails a student's needs which affects motivation, attendance, behavior, and educational outcomes. Universities are leading the way in innovative classroom spaces as well as learning spaces outside the walls of the traditional classroom. These innovations are, however, less common in the secondary school environment. Furnishings are also becoming more flexible and more varied; however, poorly designed furniture purchased for efficiency over student comfort still dominates the classrooms of many secondary schools.

Students' Perceived Needs

There is a correlation between poor building conditions and poor student perceptions of climate and safety, especially facility deterioration (Uline et al., 2010), which can also increase stress (Wilson & Cotgrave, 2016). Uline et al. (2010) stated that the learning environment must be sufficient for students to feel "comfortable enough to take the individual and collective risks necessary for meaningful interaction and learning" (p. 601). A base level of comfort must therefore exist for learning to take place. Human beings must be comfortable before they can function optimally (Kolcaba, 1992). In fact, students' perceptions of the physical learning environment superseded past academic achievement in predicting future student achievement (Lizzio, Wilson, & Simons, 2002, as cited in Wilson & Cotgrave, 2016).

Perception of the physical environment. Spatial attributes, including room layout and furniture, highly impact student perceptions (Yang et al., 2013), and every environment comes with its own challenges. In Uline et al.'s 2010 study, students in older, deteriorating buildings perceived their environments lacking as compared to others in the district, but those interviewed

spoke of overcoming those obstacles. Conversely, Benade (2016) highlighted the challenge of an occupant of a flexible learning space to adapt to the required interaction and collaboration within the space, while working against a "primal urge to seek solitude and privacy" (p. 801).

Students' perceived needs for 21st Century learning. Unsurprisingly, up-to-date technology and spaces designed to accommodate technology were rated as highly important by university students in the Wilson and Cotgrave (2016) study at Liverpool John Moore's University. Spatial configuration differences affected students' perceptions of the effectiveness of digital technology in the classroom in a Byers et al. (2018) study. Wilson and Cotgrave found that relationships with the physical space varied somewhat by personality traits and academic disciplines, but all three groups studied rated technology as the most important factor, followed by spaciousness and a comfortable temperature. Sufficient space, along with differing spaces for varied tasks, and safety features were also highlighted in the Sandstrom et al. (2013) study of chemistry classrooms. Access to social spaces, such as a university library, was also important to 21st Century learners in the Wilson and Cotgrave study.

Student satisfaction and environmental factors. In that teachers and learners spend a significant amount of time in the classroom, the physical classroom environment should be considered an important component of student satisfaction (Osman, Ahmad, & Halim, 2011). In a study of two middle schools that were in the top quartile for faculty ratings of the quality of the facilities and in which the school served a majority of socioeconomically disadvantaged students, Uline et al. (2016) found that the buildings' flexible design was instrumental in defining the learning climate. The themes related to building quality in the study included light, aesthetics, elbow room, flexible classrooms, and security. Leadership's vision and use of the schools' spaces were also essential elements. Osman et al. (2011) found that lighting and space were

ranked at a high level of importance among students in a secondary science lab environment in Malaysia.

Examining the classroom in a way more commonly reserved for retail environments created a unique study for Childers, Williams, and Kemp (2014). Looking at the classroom as a *servicescape*, the study considered the design, such as building, fixtures; ambiance, such as temperature, lighting, music; and social atmosphere, such as attitude of instructor. While the physical environment was part of the study, the fixed classroom seating was not a significant factor in students' perceived satisfaction; however, instructor engagement played a significant role. The study suggested that incorporating role-playing, multi-media, simulations, and other active learning strategies would more effectively engage these students and lead to a higher level of satisfaction, all in line with a 21st Century flexible learning environment. Han, Kiatkawsin, Kim, and Hong (2017) also examined the *servicescape* within a Korean university and concluded that "the physical classroom environment is imperative" to student satisfaction with the course (p. 122). The study further suggested that schools should make an investment in the physical classroom space a priority.

Anyone who has sat in the middle seat of an airplane knows that an individual's perception of the physical space can have a profound impact on the ability to relax or focus. The 21st Century learner has a changing list of needs to make the learning environment a comfortable, safe, and accommodating space. The needs include ample technology support, generous desk space, flexibility in furnishings and the ability to arrange the classroom, and divided spaces for differing tasks. Environmental factors, including lighting, acoustics, and room temperature also play a role. With an emphasis on collaboration in 21st Century classrooms, school designers should consider the need for flexible meeting space both inside and outside the classroom.

Conceptual Framework

In consideration of various frameworks, the word *comfort* came to the forefront as an element of the measure of a positively-perceived physical classroom space. Two studies, based in part on the work of Kolich (2008), put forth theory based on the physical, psychological, object, and environmental aspects of seating: da Silva, Bortolotti, Campos, and Merino (2012) studying automobile seat comfort; and da Silva, Menegon, Vincenzi, de Andrade, Barbetta, Merino, and Vink (2017) considering aircraft seat comfort. Another study considered involved clothing comfort theory. Barker and Black (2009), applied this clothing comfort theory to the decision of police officers to forego wearing ballistic vests despite their ability to offer life-saving protection. While each of these offered a distinctive way to look at physical comfort, each is limited to the perspective of the physical aspects of the product or device, with limited consideration of the human psychological and social aspects of comfort.

Looking outside the areas of ergonomics and product design, Kolcaba's (1994, 2002, 2015; Kolcaba & DiMarco, 2005) well-established work on comfort theory within nursing surfaced as one better suited to meet the needs of this study. Shin's (2016) Environmental Satisfaction and human comfort theory complements Kolcaba and expands on aspects of human socialization within a physical space, and Maslow's (2014) motivation theory framework expands these ideas by ordering levels of human need. Together, these theories frame this research study.

Kolcaba's Comfort Theory Framework

Kolcaba's comfort theory originated out of a study application discovery within a master's class entitled *Introduction to Nursing Theory* (Kolcaba, 2002). Applying her work with nonverbal Alzheimer's patients in maintaining an equilibrium of comfort to minimize displays of

excess disabilities, she developed the concept of comfort as a state of "relaxed, healthy, peaceful and *individualized* [author emphasized] condition" (Kolcaba, 2002, p. 4). Developing the theory over the course of her master's and later doctoral programs, she extensively reviewed the literature from nursing, medicine, psychology, theology, psychiatry, and ergonomic disciplines (Kolcaba, 2002). Her discovery was that literature regarding patient comfort had mostly to do with pain management and an increase in worker productivity. She also sought a definition for comfort within nursing and eventually defined it herself as "the immediate state of being strengthened through having the human needs for relief, ease, and transcendence addressed in four contexts of experience (physical, psychospiritual, sociocultural, and environmental)" (Kolcaba & DiMarco, 2005, p. 188). Her definition of comfort within nursing can be more generally applied to student comfort in the classroom for the purpose of this study.

What eventually emerged was a taxonomic structure of comfort, based on a 12-cell grid. Across the top are the three types of comfort: relief, a specific comfort need met; ease, a state of calm/contentment; and transcendence, rising above pain or discomfort. Along the left are the contexts in which each state occurs: physical, specifically bodily; psychospiritual, an awareness of self, including esteem, concept, and meaning in one's life; environmental, encompassing the physical surroundings of the experience; and sociocultural, including interpersonal, family, and societal relationships; traditions, rituals, practices (Kolcaba, 1994; 2002; 2015; Kolcaba & DiMarco, 2005). This grid allowed for a nurse's assessment of a patient to go beyond a neutral absence of discomfort to an assessment of a positive, holistic comfort outcome (Kolcaba & DiMarco, 2005). Kolcaba's comfort theory has been well-studied beyond geriatric care including its application to pediatric nursing (Kolcaba & DiMarco, 2005), its incorporation into national electronic databases including the Iowa Taxonomy and the North American Nursing

Diagnosis Association, and its use as policy for the American Society of Peri-Anesthesia Nurses (Kolcaba, 2015). Comfort theory also meets the characteristics of a significant theory, including broad scope, measurable outcomes, and a wide range of applications (Kolcaba, 1994).

Comfort theory application. In considering its application to this study, comfort theory has a unique link to leadership both in the classroom and at an administrative level in schools. Comfort theory assesses the individual's levels of comfort or discomfort to develop and implement a plan for each individual and measure the outcomes of the plan. In the field of nursing, nurses are challenged with providing comfort both for what can be controlled, such as pain management, and what cannot be controlled, such as acceptance of the life-ending stage (Kolcaba & DiMarco, 2005). Similarly, teachers and administrators can control some aspects of student comfort, such as seat placement, while having less control of others, such as replacement of furnishings, size and makeup of rooms. The noted comfort interventions of psychological, social, cultural, environmental, and physical cross over well into the aspects of the classroom environment, as do those that are not as easily influenced by caregivers, including past experiences, emotional state, attitude, support system, and background (Kolcaba, 2015, p. 384). Kolcaba (2002) stated that sitting position in well-fitting furniture, freedom to move independently, and choice, aligning with Lemley, Schumacher, and Vesey's 2014 study, are central to a patient's comfort. Nursing care is ideally individualized, participatory, holistic, and proactive/preventative (Kolcaba & DiMarco, 2005). These ideals can also be applied to an individual student's classroom comfort. Kolcaba developed several comfort behaviors checklists, which could be adapted to measure the teacher's, administrator's, or outside observer's assessment of the student's level of comfort by various vocalizations, such as motor signs, performance, facial expression (Kolcaba & DiMarco, 2005). The theory is also consistent

with approaching student comfort from an institution-wide perspective. Kolcaba (2015) related best practices to institution-wide interest in the *patient experience*, which can also relate to the *student experience.*

While comfort theory could apply to the many aspects of student comfort in the physical classroom, it is limited in its scope in addressing the changing needs of the 21st Century classroom both from a teaching and learning perspective and a technological-physical space requirement. Comfort theory also tends to face more challenging and often life-threatening levels of comfort and discomfort, well beyond the typical classroom experience.

Shin's Environmental Satisfaction and Human Comfort Theory Framework

Shin (2016) challenged the limited definition of human comfort as merely a physical environment factor and suggested incorporating social factors into its framework, expanding the viewpoint to include aspects such as the norms and standards of the group, territory and privacy, and social comfort. Defining *human agency*, Shin discussed *transcendence*, a term shared by Kolcaba, with *intentionality, forethought, self-reactiveness*, and *self-reflectiveness*, expanding beyond *individual* agency to using *proxy* agency, defined as using others, and *collective* agency defined as working with others, as an important aspect of environmental satisfaction and comfort. This human agency, combined with the shared values of one's social network and the multiple worlds defined as the groups that a person inhabits, further defines the individual's comfort in an environment. Shin stated, "when human agency is understood in the context of group functioning within a given locus, the richness of human comfort can be more fully understood" (p. 13).

Shin (2016) contended that the individual seeks to optimize his or her socio-physical environment in four ways: *environmental modifications*, modifying the physical space;

behavioral adaptations, changing one's behavior within the space; *normative adaptations*, changing one's expectations of the environment; and/or *withdrawal*, removing oneself from the space (p. 16). Shin also considers the physical space's attributes as nested into a larger ecosystem.

Satisfaction and human comfort theory application. Shin (2016) expanded on Kolcaba's (2002) comfort theory in consideration of the social aspects of the physical environment and addressing human optimization of the environment. The focus on optimization by *environmental modifications* is best suited for the purposes of this study, understanding that the process of optimization is circular in nature, that environmental modifications lead to behavioral adaptations, which lead to normative adaptations, etc. Using Shin's environmental modifications optimization lens strengthens the links between the theories.

While satisfaction and human comfort theory adds to the dimensions of a student's comfort within a physical space, its proposed methodological applications do not fully match the direction of this study. Shin suggested using the theory for "embracing multiple realities that exist between a group of actors…to examine a similar phenomenon in various settings… [or using] multi-level analysis and interdisciplinary approaches (pp. 18-19).

Maslow's Motivation Theory Framework

Maslow's (2014) motivation theory describes levels of human need. Maslow contended that "the basic human needs are organized into a hierarchy of relative prepotency" (p. 9) that prioritize human motivation. Physiological needs lie at the base of Maslow's Hierarchy (Webb & Norton, 2013). Basic physical comfort falls within this level. Basic physical comfort might not be met in the classroom, for example, due to an ergonomic misfit with existing furnishings. Further, a classroom's inflexible physical space layout may not meet the next levels of Maslow's

Hierarchy: security and social needs. Citing Herzberg's (1959) two-factor model, Webb and Norton (2013) stated that these basic level *hygiene factors* if not present are "demotivators, or…blocks to motivators" (p. 133). Maslow (2014) stated that one level follows the satisfaction of another, meaning that until an individual's needs are met at each level, one cannot proceed to the next hierarchal level. Applied to the classroom, a student's physical, psychological, or social discomfort could inhibit learning.

Conceptualizing the Kolcaba, Shin, and Maslow Framework

Kolcaba's (1994) comfort theory, Shin's (2016) satisfaction and human comfort theory, and Maslow's (2014) motivation theory are useful lenses through which to approach the comfort of students in the physical classroom. In an integrated taxonomic structure, they allow for a means to categorize qualitative data; see Table 1.

Considering the global context of this study and the varied backgrounds of the participants, this method of analysis allowed for the study of comfort not only from the aspect of physical comfort, but also social comfort and cultural norms. Approaching this qualitative study through an intuitive inquiry method, the taxonomic grid offered structure to the researcher's analysis and reflection.

Table 1

An Integration of Maslow's motivation theory, Shin's satisfaction and human comfort theory, and Kolcaba's taxonomic structure of comfort to describe student comfort in the physical classroom environment with examples of interactions with the physical environment in italics.

	Kolcaba's Relief	**Kolcaba's Ease**	**Kolcaba's Transcendence**
Kolcaba's Physical	**Maslow's Physiological** **Shin's Human agency** *example: adjusting furniture to relieve back pain*	**Shin's Human agency** *example: comfortable furniture*	**Shin's Human agency** *example: need for feeling comfortable*

Kolcaba's Environmental	**Maslow's Physiological** **Shin's Human agency** *example: auditory distraction, poor lighting*	**Shin's Human agency** *example: ample personal space*	**Shin's Human agency, Shared values** *example: need for collaborative areas and private work areas*
Kolcaba's Sociocultural	**Maslow's Safety** **Shin's Human agency, Shared values, Multiple worlds** *example: social anxiety/absence of cultural comfort*	**Maslow's Belongingness** **Shin's Human agency, Shared values** *example: barriers to interaction, such as immobile furnishings*	**Maslow's Belongingness** **Shin's Human agency, Shared values, Multiple worlds** *example: need for positive social interaction*
Kolcaba's Psychospiritual	**Maslow's Safety** **Shin's Human agency, Shared values, Multiple worlds** *example: anxiety*	**Maslow's Safety** **Maslow's Esteem** **Shin's Human agency, Shared values, Multiple worlds** *example: feeling of safety and satisfaction*	**Maslow's Esteem** **Maslow's Self-actualization** **Shin's Human agency, Shared values, Multiple worlds** *example: need for support and reassurance*

Adapted from *Comfort Theory and Practice* by K. Kolcaba, 2003, p. 15. Copyright 2003 by Springer Publishing Company, Inc.

Conclusion

It is the role of the transformational leader to consider the needs of all students and to address the changing needs of students in their current environment. Equity in learning, and the role the physical learning environment plays within equity, is an important and understudied aspect of the 21st Century learning environment. Cencic (2017) stated, "the school environment is becoming an additional factor of learning, as pupils accept the symbolic messages communicated by the school buildings and surroundings" (p.144). Cavicchi (2017) inspired us to shift our environment from one that pacifies learners to one that inspires investigation and one that integrates instead of separates.

Traditional classrooms tend to promote learning among some learners, while inhibiting others (Tanner, 2013). There are many forms of equity to consider in the classroom, including gender and socio-economic equity (Gill & Trenter, 2014; Lester, 2016). Pescarmona (2016) encouraged teacher and school leader reflection and professional development regarding equity, and Hartwell et al. (2017) reminded readers of the invisible advantages many students have over others. Inequity of the physical environment is addressed at the school-to-school level by Uline et al. (2010), but there is little research to be found at the classroom level, particularly in a secondary-school environment. Uline et al. (2010) pointed out that a poor physical environment is inequitable in two ways: there is an inequity between students themselves and an inequity between schools in their ability to attract and retain quality teachers.

Secondary school design is often led by budgetary and bureaucratic decisions over meeting the physical and pedagogical needs of the student (Cannon Design et al., 2010). On a basic physiological level, the quality of the furnishings themselves has an enormous impact on student comfort. There are many studies (Castellucci, Arezes, & Molenbroek, 2015; Dinat et al., 2011; Molenbroek & Viviani, 2015; Wang & Xie, 2014) from across the globe that indicated a mismatch between fixed student desks and chairs and students' body dimensions. These studies concurred that adjustable furnishings would significantly improve furniture fit to students' body dimensions, thereby increasing comfort and equity in learning.

The layout and flexibility of the classroom space is integral to the shifting demands of the 21st Century learning environment, yet many classrooms still function on the traditional model (Beckers et al., 2016; Brown, 2014; Kraub et al., 2016; Young, Young, & Beyer, 2016). Uline et al. (2010) found a strong correlation between the quality of facilities and school climate variables, including the seriousness of the learning environment, teacher professionalism, and

community engagement, all indicators of student achievement (p. 613). Vel and Higa (2016) discussed the rapid incorporation of innovation hubs, which challenge tradition and encourage cross-disciplinary entrepreneurial thought at the post-secondary level but there are fewer studies available on similar integration at the secondary level. Larger, more open learning environments encourage collaboration, but they also come with new challenges including making the shift to student-centered learning (Benade, 2016). Further, technology integration can be limited when teacher-training is insufficient (Savov et al., 2017). Within the classroom, seat selection, which affects achievement and motivation, is another important consideration (Haghighi & Jusan, 2015; Yang et al., 2013). Flexible and varied seating layouts offer more student choice, creating higher engagement (Rae & Sands, 2013). In that students vary greatly at the secondary level, including body size, learning styles, and individual preferences, classroom design, flexibility, and furnishings all play an important role in more equitable student comfort.

Moving from passive to more active student learning, including heavily integrating technology, creativity, and collaboration, will better meet the educational needs of the 21st Century student in the workplace (Benade, 2016; Vel & Higa, 2016). Planned well, the school itself can be a tool for learning (Cencic, 2017). Good design should also consider access for all (Sigurdardottir & Hjartarson, 2011). Benade (2017) and Vel and Higa (2016) discussed the emergence of innovation and entrepreneurship centers at the university level as an answer to these changing needs.

Technology integration is an essential element of a modern classroom. Savov et al. (2017) considered the future classroom designed with the full integration of the internet of things (IoT), which could include individual student monitoring. Such futuristic ideas should be an important part of school planners' and educational leaders' thought-processes. Without a clear-

cut path to the future, flexibility in design is key. O'Neill (2013) wrote about technology-driven arrangements that integrate the need for technology power plug-ins and collaboration. Erwin et al. (2018) added to the discussion at the middle school level with a study on sit-to-stand desks as a way to provide comfort and choice to this student population with abundant energy.

Understanding the research on current classrooms and 21st Century advances is critical, but what do students perceive as needed? Wilson and Cotgrave (2016) ranked student comfort in the physical environment above past academic achievement in predicting a student's future success. Predictably, accommodating technology is primary to today's students (Wilson & Cotgrave, 2016). Student workspace; varied workspaces; environmental comfort, such as room temperature; and social meeting areas all ranked as important (Childers, Williams & Kemp, 2014; Osman, Ahmad, & Halim, 2011; Sandstrom et al., 2013; Uline et al., 2016; Wilson & Cotgrave, 2016).

Together, the literature reviewed showed a need for further study of how the physical classroom space plays a role in student comfort, in flexibility to meet the changing needs of the 21st Century student in a 21st Century classroom environment, and the means in which these ideals can be accomplished to create a more equitable learning environment in the secondary school classroom.

Student perception of the comfort of physical classroom space is often under-considered, yet vital to inform the decisions and practices of the architects, designers, builders, facility managers, school leaders, and teachers who make these decisions on building and furnishing classrooms. The methodology which follows aligns the research with this need, seeking the perceptions of students learning in traditional classroom spaces, viewed through the lens of the emerging student comfort taxonomic structure by the researcher as a school administrator.

CHAPTER 3

METHODOLOGY

The purpose of the study was to examine the extent to which secondary students feel the physical classroom environment deters or promotes learning, to better understand what causes students discomfort and creates barriers to learning in the classroom, and to understand how students feel those discomforts and barriers might be addressed by altering the physical classroom environment to best meet the needs of the 21st Century learner.

This study used an intuitive inquiry method, with five cycles of hermeneutic interpretation (Anderson & Braud, 2013). Intuitive inquiry, a phenomenological approach to research, was developed by Rosemarie Anderson in the mid-1990s. This method of inquiry "affirms intuition, compassion, and service" (Anderson & Braud, 2013, p. 246) as integral parts of research and understanding. A survey was conducted with 56 participants, followed by interviews with nine purposely-selected participants which incorporated drawings. These interviews are the primary data analyzed in the study.

This study addressed the research questions: 1) How do 21st Century secondary students perceive the influence of furnishings and configuration of the physical classroom on their physiological, security and social needs? 2) In what ways would 21st Century secondary students suggest improvements in the physical classroom space to provide for their physiological, security, and social needs? and 3) How can educational leaders use student voice to better understand comfort and equity in the 21st Century secondary physical classroom space? The study was constructed and viewed through an integration of three theories: Kolcaba's (1994) comfort theory, Shin's (2016) satisfaction and human comfort theory, and Maslow's (2014)

motivation theory within an emerging taxonomic structure which was used by the researcher in the analysis of and reflection upon the data.

Setting

The study was conducted at an international school in Wuxi, China. The pre-K through 12 school served around 300 students at the time of the study, of which about 95 were in the secondary division. All students are on one large campus; the secondary division primarily uses one three-story building on the campus. Though the school facility is new and features integrated technology, the furnishings are traditional and arranged in a standard teacher-centered classroom configuration (see Figure 1).

Figure 1: Typical secondary classroom

The school facility was designed, funded, and built by the local government for the purposes of providing an international education option to attract foreign white-collar workers, primarily in the technology industry. The campus exterior was modeled after the Stanford

University (California) quad, while the interiors were built out in a manner somewhat typical of standard Chinese public schools. Some modifications were made to address problems such as temperature control in the buildings.

New classroom furnishings are selected and purchased by the Chinese staffed administrative services department, and much of the furniture was transferred from another school, which was purchased by the school's educational management company. Neither teachers, students, nor school leadership currently has much input into the outfitting of classrooms. The layout of the classroom itself is primarily in the hands of the teaching staff, who make furniture selections from the school's stock, decorate interiors, and create a layout with minimal input from others. There was virtually no input from students on classroom features and design.

As an administrator at the school, the location was accessible for the researcher, who received permission from the school's Executive Director and Executive Principal to use the site. The research knowledge should be beneficial to the school as it will need to outfit many new classrooms as it grows from 300 students to its projected 1,000.

Participants

Participants were selected from a purposeful sampling of students at the study's site. As an international school, students arrive at the school from home countries around the world. While the primary home countries of the students are South Korea, the Chinese Autonomous Regions, and Japan, students also come from countries in the Americas, Europe, Africa, and Oceania. Students must hold a foreign passport, meaning that students from mainland China are not eligible to enroll. This multi-national perspective allowed the researcher to gain a wider

perspective of students' perceptions of the physical classroom space than a more homogeneous campus population might have revealed.

The study's 56 participants were recruited on a voluntary basis; all the school's approximately 95 secondary students were invited to take the survey and volunteer to participate in the interview if selected. Participation required parental consent and student assent. Information on the study was shared with school families via an emailed letter home, brief classroom introductions during homeroom, and a voluntary information session for parents. The information letter, the parental consent form, the student assent form, and the modified PACE survey (see Appendix A) were translated into Korean, Chinese, and Japanese using a certified translation service through Jiangnan University, Wuxi, Jiangsu, China. The survey and interviews took place outside of core class time and were minimally impactful to classroom learning. The information shared stated the value of the study to the school and to educational research at large.

Participants were asked whether they would participate in survey; in what language, specifically English, Korean, Chinese, or Japanese; and whether they would additionally volunteer for a further interview in English. Some students were English Language Learners and were unsuitable for an English language interview as their current ability to comprehend questions and respond in English was limited. English proficiency was determined both by the language chosen for the survey as well as the researcher's knowledge of the student's verbal proficiency. Of those with English proficiency, nine interviewees were selected from those with parental consent and student assent to also be interviewed.

Once the pool of potential interviewees was established, a purposeful sampling was built to first find 2-4 interviewees from the grade categories of a) 6^{th}-7^{th} grade, b) 8^{th}-9^{th} grade, and

c) 10th-12th grade. Within each of the grade groupings, students were next selected to represent both genders, and finally students' nationalities were considered to represent multiple national backgrounds. After these parameters, any additional narrowing, for example two South Korean 6th-7th grade boys, were selected randomly using a computer-generated number selection. Five girls and four boys were selected. Two students were from the 6th grade, one was from the 7th grade, two were from the 8th grade, two were from the 9th grade, one was from the 11th grade, and one was from the 12th grade. Four students hailed from Asia, two from North America, one from Africa, one from Oceania, and one from Europe.

Participant rights. Written consent from parents and student assent were obtained from all participants. Though the researcher gathered participants' grade level, gender, and preferred language for the purposes of categorization, student names or other information that could link the responses to the student were not collected. Interviewees were known by the researcher, but participants' names were not used in the study; pseudonyms were assigned. The school's identity has also been withheld. Data collected was stored on an external data drive locked in a cabinet in the researcher's home.

A student's participation, responses, or lack of participation in the study will not affect the student's status at the school nor his or her academic standing. Parents and students were advised through the consent and assent forms that participation is voluntary, that there are no consequences for non-participation, that they have the right to change their minds without consequence, that the child has the right to not answer a question, that the parent and child will be informed of any significant findings that may affect their willingness to participate, and of their rights if they are injured in participating.

Data Collection

The data sets were collected in the spring semester of 2019, following the approval of the IRB and prior to the school's year end in mid-June. First, the survey was administered by the researcher in a classroom environment. While the classroom had a supervising teacher, the supervising teacher did not participate in the survey administration and data collection. Then, 40-minute interviews were conducted in a campus classroom by the researcher.

The study employed the use of a modified version of the PACE instrument (Ahmad, Yahaya, Abdullah, Noh, & Adnan, 2015) (see Appendix A) to survey 56 international secondary students. Ahmad et al. describe the PACE instrument as "an instrument to assess the physical aspects of classroom environment in Malaysian secondary schools from the students' perspective" (2015, p. 1). The results of the modified PACE survey were used in a qualitative manner to reveal which classroom environmental factors students consider adequate or inadequate; the responses further informed the analysis of the interviews.

From the survey respondents, nine students were selected for a more extensive semi-structured interview (see Appendix B) following the survey. Interviewees were selected as a purposeful sample of English-proficient students providing parent consent and student assent. Interviewees were selected first as a representation of the grade level groupings of 6^{th}-7^{th} grade, 8^{th}-9^{th} grade, and 10^{th}-12^{th} grade, next for gender representation, and finally for nationality representation. The interviews were audio recorded, externally transcribed using rev.com transcription services, and coded by the researcher to identify common themes, initially with a general list of code words, assembled through a manual reading of each transcript in a paper format, then using Dedoose qualitative analysis software.

Students were offered the survey in a choice of English or a selection of mother-tongue languages: Chinese, Korean, or Japanese. Thirty-one respondents chose to take the survey in English, 13 chose Chinese, 11 chose Korean, and one respondent took the survey in Japanese. 31 of the respondents were female and 25 of the respondents were male.

Surveys were conducted in one of the traditional classroom environments being considered in this study. Interviews took place in English, the school's language of instruction, also within a typical traditional classroom environment.

The interview questions were inspired in part by the research of Makela and Helfenstein (2014) and framed to address the 12-cell grid of the emerging three theory taxonomic structure. As an accompaniment to the interview questions, students were invited to draw their ideas of an ideal physical classroom space as a visual representation. Makela and Helfenstein's (2014) study which made use of student-built models inspired this idea of using visuospatial data in conjunction with verbal responses "so as to neither rely overly on participants' literacy skills nor only collect easily misinterpreted visual data" (p. 417). Another study by Casanova, Di Napoli, and Leijon (2017) was also inspirational in its use of drawings of learning spaces. In this study, students were given an A3-sized sheet of paper; sticky notes, such as Post-It brand; and photos of furniture; along with scissors, tape, colored pencils, and markers to capture their ideas. The researcher supplied a similar set of tools to the interviewees to facilitate the visuospatial data.

Analysis

The researcher used an intuitive inquiry method of analysis (Anderson & Braud, 2013). The intuitive inquiry method involves the use of five cycles of interpretation, each with activities unique to that cycle. The first cycle involves clarifying the research topic through a researcher's dialog with a text or texts. This engagement with the text or texts clarifies the direction of the

research. The second cycle involves developing an interpretive lens through a thorough literature review. Next, the data are collected and a descriptive analysis of the data is prepared in the third cycle. The data are presented in this cycle in a descriptive manner, prior to interpretation by the researcher. Cycle four has two phases. First, the researcher refines the cycle two lenses through the researcher's interaction with the data. Next, the researcher presents a side-by-side comparison of the cycle two and cycle four lenses, articulating differences. Finally, in cycle five the researcher conventionally concludes the study by standing back from the research process to draw conclusions upon the entire study.

Through the personal observation of the researcher in multiple classroom environments and through engagement with key literature, the researcher engaged in the first two intuitive inquiry cycles and developed an emerging taxonomic structure of student comfort prior to the collection of data. This structure served as the lens through which the data was analyzed in cycle four, allowing the researcher to consider students' comfort through these combined theories and to refine the taxonomy. Cycle three presented the data analysis through a phenomenological approach of emerging themes, while cycle four incorporated the researcher's viewpoint as an educational leader. Cycle five synthesized these analyses.

In cycle four, these combined data were viewed through the theoretical lenses and emerging taxonomic structure of Kolcaba's comfort theory (1994), Shin's environmental satisfaction and human comfort theory (2016), and Maslow's motivation theory (2014) addressing responses from three types of comfort: relief, ease, and transcendence, within the context of physical, psychospiritual, sociocultural, and environmental aspects (Kolcaba & DiMarco, 2005, p. 189) reflecting on these as an educational leader using the intuitive inquiry

perspective (Anderson & Braud, 2013). The researcher then reflected on the findings of the first four cycles in cycle five as the basis of inquiry inherent to this phenomenological approach.

Potential Limitations of the Study

The study is limited in its size and scope. While the participants hail from multiple countries and cultures, they gave their perceptions of a single school site with little variation in furnishings and configuration. The school's student population reflects a middle- to upper-middle-class family economic status. The study collected data on students' perceptions of the physical environment; however, no measurements were collected on students' physical shapes and sizes, nor the dimensions of furnishings. Students were asked to describe an ideal physical classroom, but an alternate physical space was not assembled for this study. Further, data related to student academic achievement was not within this study's scope.

The researcher is an administrator at the study site and is familiar with the students surveyed. The researcher took an intuitive inquiry approach using five cycles of hermeneutic phenomenological interpretation, positioning herself as an educational leader within this qualitative study. The researcher considered potential bias carefully while coding data and made subjectivity visible (Merriam & Tisdell, 2016) within the 3rd cycle of analysis. Bias at this stage of analysis is further minimized with the use of multiple methods of inquiry (Roberts, 2010).

CHAPTER 4

ANALYSIS

The purpose of the study was to examine the extent to which secondary students feel the physical classroom environment deters or promotes learning, to better understand what causes students discomfort and creates barriers to learning in the classroom, and to understand how students feel those discomforts and barriers might be addressed by altering the physical classroom environment to best meet the needs of the 21st Century learner.

The analysis of the data was completed through two cycles of intuitive inquiry: Cycle 3, which took a phenomenological approach to the data and presents a descriptive analysis of the data prior to interpretation by the researcher, and Cycle 4, in which the researcher interacted with the data as an educational leader, then used the data to integrate questions into the emerging taxonomic structure of student comfort in the physical classroom space.

The chapter begins with a description of coding, themes, categories and participant demographics, then covers Cycle 3 themes and findings, expands on the researcher's processes of intuitive inquiry in Cycles 1-3, then presents the findings from Cycle 4, including the data's integration into the emerging taxonomic structure of student comfort.

Coding, Themes, and Categories from the Third Cycle

Data set one, the transcripts, were initially coded by the researcher. The researcher began with a general list of code words, assembled through a manual reading of each transcript in a paper format. These 94 code words were entered into the Dedoose program, a cross-platform app for analyzing qualitative and mixed methods research with text, photos, audio, videos, spreadsheet data and more, then added to as the researcher coded each transcript within the software, thus the initial list grew to 135 codes after the first round of coding. As a few words

seemed to be repeated within the transcripts, the researcher also made a side list of a few key words, such as “focus,” that were then searched and coded as well.

The researcher next reviewed each of the nine drawings, the second data set, that were part of the interview process and described these drawings both in the visual details of the drawings and the descriptive words used by the interviewees to elaborate on their visual ideas. The researcher’s drawing descriptions were uploaded to Dedoose for coding. The researcher used the coding from the interviews as the initial coding for the drawings. Several codes were then added that related directly to the drawings, growing to a total of 147 initial codes. The third data set, the survey results, were then uploaded to Dedoose for separate analysis. The 147 codes from the combined interviews and drawings were uploaded to connect to the survey questions as well, coding the survey questions used.

In the second round of coding, codes were filtered by each of the three data sets for codes used. Codes were put into a first round of grouping individually, then codes were merged using different font colors for each data set. Codes were then aligned, resorted, merged, and some names were changed. Parent level codes were assigned. Parent level of codes were then categorized into one of the three areas of the research questions: physiological, security, and social for purposes of alignment and assurance of coverage, as illustrated in Table 2.

Next, merged codes were separated back into the three data sets. A full list, eliminating duplicates, was made with 167 entries. Codes were reorganized into a parent, child, and grandchild alignment within Dedoose.

Themes, categories, and code words were reviewed and realigned into four emerging themes: Physical space preference and convenience, Physiological comfort, Mental security, and

Social needs. These were aligned with the research questions but defined a difference between physical space preferences and bodily comfort.

Table 2

Emerging themes in response to Research Questions #1 & 2.

Physical space preference and convenience	survey	drawings	interview
Color	X	X	X
Facilities	X	X	X
Flexibility	X	X	X
Furniture	X	X	X
Lighting/Light	X	X	X
Technology			X
Physiological comfort			
Air/temperature	X	X	X
Fit/size	X	X	X
Mental security			
Comfort	X	X	X
Choice			X
Focus/Concentration	X	X	X
Knowledge and learning	X	X	X
Feelings			X
Locations			X
Social needs			
Communication	X	X	X
Collaboration	X		X
Self-study/alone	X	X	X

Finally, through the process of analysis of the collective survey, drawing, and interview data within the theme categories, categories were further aligned, condensed, and renamed into the final themes and categories, as illustrated in Table 3.

Table 3

Themes and categories from the Third Cycle of Intuitive Inquiry in response to Research Questions #1 & 2.

Physical space preference and convenience	survey	drawings	interview
Facilities	X	X	X
Furniture	X	X	X
Color	X	X	X
Lighting/light	X	X	X
Technology		X	X
Flexibility	X	X	X
Physiological comfort			
Air/temperature	X	X	X
Fit/size/use of space	X	X	X
Mental and emotional security			
Feelings and emotions			X
Comfort	X	X	X
Choice		X	X
Focus/concentration	X	X	X
Social needs			
Communication	X	X	X
Collaboration	X		X
Self-study/alone	X	X	X

Participant Demographics

The nine students interviewed represent the broad international community; several speak English as a second language. Even for some of those who speak English as their mother tongue, the influence of living and learning in a multilingual home and/or community has subtly influenced their speech patterns. As individual portraits of the students would reveal their identities, general demographics were used to document their diversity. The interviewees' nationalities were Australian, Chinese, Canadian, Singaporean, South African, American, Korean, and German. There were two interviewees representing the sixth grade, one representing the seventh grade, two representing the eighth grade, two representing the ninth grade, one representing the eleventh grade and one representing the twelfth grade, illustrated in

Table 4. Five interviewees were female, and four interviewees were male. Each interviewee agreed to be interviewed in English and each was determined by the researcher to have a sufficient ability to understand and answer questions effectively. Each of these students were interviewed independently by the researcher and each produced a drawing as part of the interview process.

The survey was administered to 56 secondary students inclusive of the nine students who also participated in the interview. The respondents' nationalities were not collected as part of the survey; however, respondents were offered a choice of four languages for the survey to increase the participation opportunities for the respondents and to provide an increased understanding of the survey questions. 31 respondents chose to take the survey in English, 13 chose Chinese, 11 chose Korean, and one respondent took the survey in Japanese. 31 of the respondents were female and 25 of the respondents were male.

Table 4

Participant grades and percentages.

Grade	Number of participant students	Percentage of student population	Total students	Percentage of student population
6th	10	35%		
7th	9	53%		
8th	19	90%		
		Middle school	38	58%
9th	5	50%		
10th	2	33%		
11th	8	100%		
12th	3	50%		
		High School	18	60%
		Secondary total	**56**	**58%**

Cycle Three Themes and Findings

Using the intuitive inquiry method of inquiry (Anderson & Braud, 2013), the data in Cycle 3 are presented in a descriptive manner, prior to interpretation by the researcher. During the analysis of these data the researcher journaled thoughts and ideas about the findings to be explored within Cycle 4. To most authentically represent the interviewees' voices, the speech patterns of these students, primarily English language learners, was preserved. The researcher collected three types of data: results from a survey, interviews with secondary students, and drawings produced by the interviewees. Each of these three data sets are detailed below.

Surveys. The study employed the use of a modified version of the PACE instrument (Ahmad, Yahaya, Abdullah, Noh, & Adnan, 2015) (see Appendix A) to survey 56 international secondary students. Ahmad et al. described the PACE instrument as "an instrument to assess the physical aspects of classroom environment in Malaysian secondary schools from the students' perspective" (2015, p. 1). The results of the modified PACE survey were used in a qualitative manner to reveal which classroom environmental factors students consider adequate or inadequate. Survey results were further analyzed by gender, respondent grade levels, and survey language of choice as variables.

Drawings. Instructed to draw their "ideal" secondary school physical classroom, the interviewees' drawings showed configurations that mirrored the school's existing classroom space, or changes that could seemingly be made within the existing classrooms space. There was a conventionality with some aspects and a departure from the norm in other aspects. The drawings nonetheless shared some commonalities in imagined changes to the classroom space. Drawings were coded by the researcher using the descriptive words within the drawings and the researcher's written description of the visual details within the drawings.

Interviews. Nine interviews were conducted within a typical secondary classroom space. Midway through the interview, the interviewees were asked to create a drawing of their ideal physical classroom space. The remaining questions were then directed toward the interviewees' drawings.

Each interview opened by asking the interviewees to describe their most comfortable place to study and why, and next, an environment in which it is difficult to learn and why. These questions were used to learn about their preferences and led into questions about the physical classroom space.

When asked about their most comfortable learning space, Sara, Robert, Maria, and David chose home. Maria stated:

> Maria: My most comfortable place to study is my room, I think, because it's all silent and every time when I need like, uh, books or a dictionary, I can just take out from my room.

While Robert described:

> Robert: Mostly in my bedroom. Because it's a very quiet place and there is some, like, some flowers in my bedroom among foods and drink and sometimes, maybe some cats will, like, jump, other, I don't know how to say. Maybe jump on the balcony….Or some birds just.

Bradley, Ellen, Jane, and Phillip preferred the school library.

> Bradley: Hmm, I think it's in the library. 'Cause the, um, like the environment is ... Well, I mean it's not too hot, and not too cold. And everything's kinda quiet in there. I mean sometime it's noisy, but it's ... I mean it's better than at home…

> Ellen: Um, I think for the simple place for me to learn is gonna be the library in the school because it's really quiet for me, and while I'm learning I don't want other people to disturb me that often.
>
> Phillip: Oh, our library, since it's really quiet and you get a lot more things done. And you're like, for me, when you're quiet, I get a lot more things done.
>
> Jane: …one of the places that I gravitated towards, um, in self-study periods was the library. Uh, it was a pretty comfortable environment with like lots of natural light, which I personally, um, prefer. Uh, it's, uh, sort of like calming and it- it helps me focus on my studies. And also, that there were more colors in the library…the chairs are quite comfortable and I- I had access to a lot of materials, such as books and printers and other stationary equipment.

Interestingly, the classroom was not mentioned, nor was it mentioned when asked about their most difficult place to learn. Interviewees spoke primarily of public places as difficult places to learn:

> David: …if I go to like a café or study I can't really... I don't think I can work well. A because there's too much noise or like people... too many people around.
>
> Ellen: …maybe bars, or on the street or like beside the coffee, coffee shop beside the ... Yeah, beside the street it's gonna be really noisy and crowdy, make my think stop.
>
> Maria: …like a café, like where there's a lot of people. I can't concentrate on work.

Jane: …at, uh, school it probable would be (laughs) the library... um, uh, with- with all the noise and the like going in and out. And, uh, yeah, it's mainly the disturbance from- from students.

Phillip: The canteen, since it's like, it's really noisy and noisy places don't, like really allow me to study, as much.

Bradley: …one of our, um, study rooms was in the canteen…I feel like that space was like really big.

Building on these first questions, several themes and categories emerged when reviewing the data in their entirety. The emergent themes crossed the data sets and aligned with the first two research questions. Four themes emerged from these data: Physical space preference and convenience, Physiological comfort, Mental and emotional security, and Social needs. Physical space and preference encompassed six categories: facilities, furniture, color, light/lighting, technology, and flexibility. Physiological comfort yielded two categories: air/temperature and fit/size/use of space. The third category, Mental and emotional security was divided into four categories: feelings and emotions, comfort, choice, and focus/concentration. The final theme, Social needs, includes the categories of communication, collaboration, and self-study/alone.

Physical Space Preference and Convenience

The first theme of Physical space preference and convenience squarely addresses Research Question #2, capturing the respondents' and interviewees' suggested improvements to the physical classroom space. Responses about what works and areas of suggested improvement covered facilities, physical classroom space, and installations; the existing furnishings, along with recommended furnishings; the use of and impact of color in the classroom; natural and

artificial light; technology installations and personal technology support in the classroom; and flexibility within the physical classroom space.

Facilities

Questions on the survey primarily addressed whiteboards and display boards in the classroom. Respondents generally found the whiteboards to be the right size and suitably placed in the classroom. Five respondents disagreed that the whiteboards were clearly visible. Respondents also generally agreed that the display boards were suitably placed and the right size for important information. Three respondents disagreed that they were sufficient in quantity.

The drawings were rich in details about the classroom itself. The drawings show classroom standard locations for whiteboards, smartboards, and windows, which could be an indication that the students find these items sufficient in quantity and acceptably located, or it could indicate that students considered these fixed and unchangeable.

Windows. Windows were described mostly in terms of light and air circulation by the interviewees. Phillip was the only respondent to indicate a desire to change the windows in the existing space, though he could not articulate why this was important to him:

> Phillip: ...I think there's too much windows, right now...oh, yeah, because like, if there's too much windows like...I don't know how to describe it, but like, I just want four windows, don't know why.

Teacher's space. In response to how the teacher exists within the space, interviewees described a defined workspace for the teacher:

> Allison: So, the teacher has his own, or her own t-table at the front.
>
> David: I would have the teacher's desk like in a corner away from like the door.

Maria: …I put teacher's table like, beside the window, so the teachers can see if students are having any problems. Uh, uh...

Phillip: And, they have like, a, like, a teacher's desk, near the corner. So, like, they have more space to, like, put their things in.

Sara: …think the teacher, like, has their own space to work for themselves.

All but one of the nine interviewees that indicated an area for the teacher's desk in the drawings and put it in its existing location in the classroom. Most of the interviewees described the teacher's desk in the existing location in the classroom, stating their reasons for this placement:

Bradley: Hmm, well the teachers are ... I mean, uh, they would have like their own desk. And then like almost like every other classroom, they would have their own desk, and like their chair in ... like either in the front, uh ... like in the, like in the front of the classroom, either in like, uh, the corner, or like in the middle. But I feel like in the corner would be better, because the ... if their table's in the corner, then they could walk around freely in front of the whiteboard, or like the SMART Board, if they have a presentation, or they have something they need to write on the whiteboard. And students would be ... Students could see the board clearly from like ... uh, on the tables, or couches, or beanbags on the ... Uh, they would be ... They would have a clear vision of the whiteboard, and the table, or anything on the teacher's table wouldn't block the whiteboard.

David: So the teacher would have like, their own desk at the front to the... like to the side of the white board. And would stand in front of the class and like they'd all look at him or her, and um, use the white board.

Ellen, however, choose a different configuration and described her reasoning:

> Ellen: And in the middle should be the teacher's desk. The teacher can go see all the student properly in the middle…the teacher still have its own study place, it's here, like where is her place here. But only for teaching space it's gonna be in the middle…Oh yeah, this is for only the teaching, but this is the individual study. I mean, yeah working place.
>
> Ellen: Yeah, actually, for me I got this ideas because of the classroom. Because for teacher, like, if they're sitting on the, yeah, the first, the, this part of the classroom. Then it's gonna be hard to check all the students work. But if the teacher is sitting in the middle, then it's good to sit, like going around to check all the students working.

Several interviewees also questioned this teacher positioning:

> Jane: Um, although, I think, I think perhaps maybe with certain teachers or like certain classroom layouts, um ... Like it's important for the teacher to have their own workspace, I think. Um, but I think, uh, with certain ... depending on the different students and teachers, some students might feel hesitant to approach this more isolated space. Um, it can, it can, um, it can mean more privacy between the discussion, but then it might also mean that it sort of creates like a, like an isolation and the student's like, "Oh, I'm a little nervous to go over there. And it's all, it's all isolated. It's just me and the teacher... and it's a little bit scary." Like that kind of feeling. Um, but with the constant interaction during class times, um, having- having the movement, flexible desks, it's- it's not that- that much of an issue, I think.

Phillip: Well, they do sit by themself, they get isolated from the other students.

Robert: And this is teacher's desk and teacher sometimes like, (sighs) (long pause) Ok actually I don't know, what, what are they doing, in their desk.

Storage. Storage was important to the interviewees. Seven included shelving their drawings and one even suggested that lockers be installed into the classroom. Interviewees also included varied items displayed on the walls, referring to posters (3), student work (2), display (1), information (1), and map (1). Maria also specifically located multiple trash cans on her floorplan. She stated:

Maria: And I a hope there's more trash can, 'cause the class are big, if there's only one trash can, is kind of uh, is kind of hard to find because the classrooms are big.

In the drawings, David showed "bags" behind chairs, seeming to indicate a location or hanging for improved access, while Ellen showed a space for these on a wall. Phillip indicated an area for lockers inside the classroom. Storage was also mentioned frequently by the interviewees in accompaniment to their drawings:

David: Um, have like some shelves with like tools or things on them that you need for class. As well as have like a bookcase for like any books you need or anything.

Maria: And I hope there's like a cabinet, where we could put like, like books, like notebooks or scrap papers.

Bradley: And at the back of the classroom there would be like a shelf for pe- ... uh, for students to like well ... the, um ... stuff like pencil sharpeners, or other things where a student can't really bring in a backpack everywhere ... like every day around school. And there would be, um, utiliries [sic] where they could use,

uh, like use for the class at the back of the classroom. And they could just put it back after they're done with the class.

Ellen: And on the end, edge of the classroom is gonna be the place that we can put our backpack inside, and other class material we need to use in the class.

Phillip: And the lockers should be in the, like, inside the classroom, so like, like to not let, like, the people, w-when, when they transfer to class, not to use the lockers. And you'll just put in your homeroom, like every morning.

While the survey questions asked general questions about the adequacy of display space, the interviewees elaborated on the items they considered important to display in those areas:

David: And then like at the back of the classroom have like posters of like whatever classroom like for the... like posters about that class that you're in.

Ellen: I'd like to have a board that we can put all the posters, or some drawings, drawn by the student-

Sara: Like information about certain things do to edu, like, stuff that can help you with education on the walls. And at the back when everyone's, like, in Mr. Young's class, normally it has the boards with your information in it…Like, mostly in every class, but most of the classes don't have. And it looks like it could help with some more ideas in what you want to do.

Study area

Several interviewees drew and described what a few called a "study area." This type of space does not currently exist in the classrooms; however, elements of these imagined spaces exist within the current library space. All of the drawings had some departure from the traditional desks in rows configuration, except perhaps Sara's.

Allison: And I drew, like, a back space, like, with pillows and stuff, like, where you can just sit on the ground and relax and then m-, study while you're relaxing-

Maria: I hope there's a good bookshelf where, where people can, students can bring books. Like different like Korean, Chinese or English so during advisory if they are... they have nothing to do. Maybe they can take out book and sit in the carpet and maybe can read.

Phillip: Like, I, I wish there was a shelf and a carpet, for people to sit on and read, since, in my homeroom right now, every morning, we have to read 20, ten minutes, before we go to our next, first class.

David: …and then have like a little study area at the back or like, like a mat or something on the floor that you can just like relax and just study, like by yourself.

David: …you can use like the study area at the back to like form a group or whatever and collaborate.

David: But they have the study area at the back that can like, use to um... for independent study.

Jane: …I added more of like ... there was a- a corner where ... with bean bags (laughs)... and like a carpet and whatever…I feel like having a range of flexible study areas where each person can, I don't know, choose which environment or surrounding that they find more comfortable in. Um, it could be beneficial, like for example, if you had this corner, you can like all sit around.

Furniture. The survey's questions were limited to classroom tables, or desks, and chairs within the classroom. Across all of the questions, the overall responses to questions regarding the existing classroom furniture were in agreement. Most respondents were satisfied with the

tables' usage for performing learning tasks and their ability to be arranged in groups. Some middle school girls disagreed with three factors: the table's ability to hold equipment, the match of tables to chairs and chairs to tables, and the safety of the tables and chairs. Seven respondents, mostly in the middle school, did not agree that the chairs are easy to move.

Tables. As with details on the classrooms themselves the drawings are also rich with detail on the furnishings. For the most part, tables are either of a rectangular desk variety or larger group tables. Some are circular. Two interviewees, Maria and Sara, drew a table storage box under the desktop; Sara labeled this "put books inside."

Interviewees elaborated on the existing furniture's table space:

Sara: ...like the table's a bit, it comes in a triangle like... which makes it really hard to move.

Allison: I want to have a free workspace but still have my stuff around. So, and I'm really scared that my computer will fall off that table (laughs).

Allison: …but the table, for me, personally, it's too small, because I need a lot of space. Or, like, that the table breaks while I have my stuff on, so yeah, I don't think the table's very eff-, like ... I think the table's too small.

Bradley: But the table, it's shaped like in a, a curved shaped, like, uh, the side closer to us is bigger, and the f- ... side like further, it's a bit smaller. So ... But ... Uh, when we would try to fit our ... 'Cause our laptops, and then our books, it would be hard to fit everything on the table. And sometimes things would fall off, like pencil cases, and papers, and stuff like that.

Maria: …I think the table is kind of small for me to use 'cause I, especially when I have like I & S, I have to take out my laptop and notebook and my pencil case, but the space is not enough for me to put all the things.

Phillip: Doesn't really fit, since the space is really small and like, like, since we have P.E, people bring bags to put their clothes in.

Sara: Doesn't really fit because, like, the table's, the table's, like, just a small desk. And it's, like, really hard to put the kind of books you need. And then you get a lot of stuff to do, so there's a lot of books, and then you have no hand space to write.

Interviewees also elaborated on tables in their drawings:

Bradley: And, uh, like underneath these tables, they would have shelves. Like s- ... a, a space-... for students to put like stuff they don't need at the moment, like their pencil cases. Like after they take out their pencil case ... After they take out their, um, pencils, pens or rulers, they could put the stuff they don't need underneath, so it wouldn't take up as much space on the table.

Bradley: But then they would be, they would be like more or less squared or rectangle, and then students could sit, uh, on the other three sides, like which is facing the whiteboard, or the SMART Boards…So, um, the tables are big, so like more than, more than about five to seven or more students can fit on one table.

Phillip: Like, I...in my drawing, there's like, two group work s-...like, places, for people to, if they want to group work, they could, they could sit with oth- others at the large table, and if they want to work together.

Sara: And then I have all my reading books and my homework books. And then normally I'll just take out, like, whatever I need and I'll put it on. And then it's, like, really easy to work with. Because there's more space by the desk…So, I would like a table that has more space to work. And then you'd leave, because your bags are so heavy that it could put your books inside. And whenever you need your homework, you can just take it with you. But during class or during the time when you don't need to do that homework, you can just leave it in the, like, in the table, like, a place inside the table to put your information.

Chairs. Three interviewees specified details of the chairs within their drawings. Allison drew chairs with casters, Sara showed chairs with high backs and arms and Maria detailed a chair with a low base. Bradley described an alternate chair design:

Bradley: …and the chairs, m- maybe they would be made out of like metal, or ... And then they would have like, um, cushions on it or something.

Alternate seating/study areas. Of note is what interviewees have added to the space in their drawings that doesn't currently exist. These features are all soft goods: beanbags (3), couches (3), pillows (2), and carpets (5) and are shown as alternate seating/study areas. Interviewees also described the furnishings within these zones:

Allison: And I drew, like, a back space, like, with pillows and stuff, like, where you can just sit on the ground and relax…

Bradley: ... there would be like, um, beanbags, or couches, or something similar, for like peop- ... students to relax…

Jane: And, um, I think mostly in terms of furniture, um, I added more of like ... there was a- a corner where ... with bean bags (laughs)... and like a carpet and whatever.

Maria: I think it is going to be good if there's like a carpet... in front of the board and some like beanbag.

Phillip: …I wish like, there was also couches because like, sometimes the, if, if you think the c- like, the chairs aren't like, aren't comfortable enough, you could go sit on the chairs.

Phillip: …I wish there was a shelf and a carpet, for people to sit on and read,

Usage of the furnishings is further described in the fit/size section and the comfort section.

Color. There was an entire section of the survey devoted to color. Though the response to the color questions were overall in the agree range for questions about promoting spaciousness, making the ceiling appear higher, brightening the room, developing positive behavior, stimulating thinking, and allowing concentration, there was a wider range of responses to these questions. Those who marked these questions as disagree or strongly disagree were primarily middle school students. Girls also marked these questions lower than the boys, with the exception of the question about allowing concentration.

The last question, about whether the paint color is an attractive combination in the classroom received the lowest marks. There were only 12 positive responses to this question and no girls ranked this as a 5. Participants who took the survey in English and Korean submitted more negative responses to the color questions than the participants who took the survey in Chinese.

Two students, Maria and Sara, drew color and referenced wall color in their drawings, while only three students of the nine choose to use color at all in their drawings. Sara used colored pencil for emphasis of color on one wall and stated “i would like it to Be colorful or to have one color except white,” while Maria noted on one wall label “different class have different color,” though she didn’t use color in her drawing. David used color in his drawing as a means to identify like things, and Jane used color in a similar manner, to set a scene rather than to specify colors for areas.

Within the interviews, participants who mentioned color in the interviews primarily referred to their wish for color beyond the currently white walls.

> Sara: And, like, the walls, they're, like so wa, they're, like, so white. Sometimes, like, even if you use, like, one color, as long as it looks nice.
>
> Maria: And I also want the walls to be more colofu- color-colorful. Yeah, because if it's too white, uh, I, hmm, I don't really like white cause I feel like blank. So I hope the walls can... I think the walls can be more colorful.

Jane referenced color several times in her interview:

> Jane: And also, that there were more colors in the library
>
> Jane: …I do admit there are perhaps some classrooms like just the (laughs)... um, because most of the classrooms look quite similar. Well, I mean, it is the, it is like a new year in a new school... so there's a lot of, um, time for development and like continuing to make things more colorful or like decorate some of the classrooms. But I think, um, that also sometimes leads me to space out (laughs)-

> Jane: ... and then I start staring at the blank walls and then sometimes ... yeah... so, I, uh, sometimes zone out on my work and then, uh, find it hard to concentrate.

Phillip, however, had a positive reaction to the classroom paint color, "And I think the color of the classroom, right now, is actually pretty uh, good, like, not bad...yeah."

Light/lighting

The survey included five questions regarding lighting in the classroom. Most of the respondents strongly agreed that the number of lights was appropriate, that they were well-functioning, that they were not blocked, and that they lit evenly. Asked whether they agreed that the lighting met the needs for teaching and learning, most agreed or strongly agreed. Three of the respondents who took the survey in English strongly disagreed.

While the survey focused on artificial light, the two drawings which focused on light focused on natural light. Jane emphasizes natural light, calling it a "stimulus in learning," while Allison stated that natural light is important to "save energy." Natural light was also the focus of the interview responses about light and lighting, with virtually no reference to artificial light in the classroom.

> David: Um, I'd have like windows... windows on each side so you can get a lot... like let light in and stuff…
>
> Allison: So, like, I added large ... a large, big window, because, like, to save energy, so we could use energy in other spaces on the earth for people that have, like, that don't have enough energy to have light.
>
> Jane: …one of the places that I gravitated towards, um, in self study periods was the library. Uh, it was a pretty comfortable environment with like lots of natural

light, which I personally, um, prefer. Uh, it's, uh, sort of like calming and it- it helps me focus on my studies.

Jane: ... so, eventually we moved to the neighboring study room, which is a lot more quiet. It also has a lot more natural light.

Technology

There were no questions related to technology in the survey and the drawings do not refer to technology much, though five of the drawings do include a smartboard in the current location of the standard classroom. Phillip, and to a lesser extent Robert, stressed the need for electrical outlets in multiple locations in the drawings.

With a question specifically related to the integration of technology into the classroom, interviewees responded on the importance of technology in the classroom and specific technology needs. Interviewees stressed the importance of technology to daily life and the future:

Bradley: Mmm. I feel like, um, mmm, uh, everyone uses like technologies now. And if you go somewhere without technology, you will kinda feel a bit like, uh, lost. 'Cause like now in China everyone pays with their phone, or you try to like scan some QR code to, um, do something. And then I feel like in the classroom, if you ... uh, students should be encouraged to use their technology, 'cause h- ... Uh, in my opinion, I think in the future every, everything would be, uh, based on technologies. Like everywhere we go, there would be like robots, or artif- artificial intelligence.

Bradley: Which would, uh, which would, um, make our lives easier in the future. But then now we, we, we would have our laptops, and the SMART Board. I feel

like s- ... um, students could u- ... um, take this opportunity to, um, further learn how to, um, use or communicate with their technologies for like the future. Like they would have ... 'Cause in the future you like ... Um, I think jobs would be taken over by robots and artificial intelligence…So you need to learn how to, um, talk to them, or type, or yeah.

Jane: Hmm. Hmm. (laughs) So, because, um, curriculums have changed a lot, uh, over the past- past, um, throughout my school career... um, there has been a lot more use of electronic devices. Especially personal ones. And I think in ... It- it does give us more space and like a- a personal platform for us to record work freely in ways that we can understand and, uh, whatever we choose to (laughs) note down.

They also elaborated on their personal use of technology:

Allison: So, technology's important to me, because we could quickly just look up something on internet that even the teacher doesn't know the answer to.

David: Um, it's definitely important because like it's... it helps a lot. Like in heaps of ways it helps.

Ellen: I think that technology is important because, uh, during the class maybe teacher don't know everything and, we're going to ask the question. We're going to, like, we want to know. Then it's time to use internet to get some more information, more reliable information for us to know. Yeah, I think internet is really important.

Maria: Ah. So if we have classes, we can also ask teachers but if teach- If like Korean or Chinese, maybe we can't understand, then we can use a translator in our laptops to see what it means. So I think it's useful.

Phillip: When you're, like, in like, since, like, right now, we're doing presentations and, if you don't know something, you could go online and search it up.

Interviewees also reflected on the balance of technology in the classroom:

Sara: It's important, like, when you have, like, a project to do and you have to research and get more information. But not when you have something to do and you just go and do other stuff, like play games and stuff. And I know sometimes when I'm not feeling like I, um, want to study, I just do whatever I want to do on my laptop, and it's not really good. But the good part is that you can work, actually, by getting, gathering information from internet.

David: Um I reckon that you only need the main, main things with the laptops and the smart board.

Jane: …with this physical space, I think it's important to have a good balance between too much technology and not ... no technology at all…in the ideal classroom space, I don't feel like I would want to be overwhelmed, um, by technology.

Interviewees elaborated on the challenges of technology in the classroom:

Bradley: Oh, and the, uh, WiFi connection wasn't really good in some areas, so when we didn't understand stuff, it was hard to, uh, do some research on it.

Bradley: And then they would have like outlets, like... in the middle f- ... 'Cause sometimes students need to charge their, um, laptops.

Phillip: And...and more outlets, because sometimes, sometimes there isn't a lot of outlets, and people have to share…

Interviewees also appreciated the use of SMART Boards in the classroom:

Allison: So, like, I have a Smart board. Which could also be used, like, as a student computer, technically.

Ellen: But if we're not, not using this like screen, then the other method is like, like ask to use a MacBook, and searching but ... We're not sure like if any, like if all the student get an idea from the teacher. So, I think it's good to show to everyone using the screen.

David: …like if we have, how we have now with the white board with the smart board, like inner. That'd be, that'd be good.

Jane: Um, and then with technology, oh, obviously, there could be SMART Boards, which can ... which makes things easier for everybody to see. Also, there's promoted interaction for people if we go up to the board.

Flexibility

Five survey questions addressed the issue of flexibility in the classroom. Respondents generally agreed that the existing furnishings were moveable to suit group work and individual work, and that the furnishings arrangement is adaptable according to the needs of teaching and learning. There was more variance in the responses to whether the furnishings were movable to suit teaching and learning activities such a drama, acting, and role-playing, and whether the chairs in the classroom were easy to move around. All seven of the respondents that disagreed

that the chairs were easy to move were in middle school, as were all four of the respondents who disagreed that the furnishings were moveable for drama, acting, and role-playing.

In reviewing the drawings, while only Jane specifically labels the furnishings as "movable," all the drawings depict furnishings and varied spaces that allow for flexibility, even those showing a more traditional front-facing desk configuration. Flexibility was mentioned by many of the interviewees:

> David: You can also the four desks to um, like be put into groups with people and go sit with them on each of the tables and do group work…And you could also like take apart the desks and like move them, like move them around anywhere you need to.
>
> Bradley: Um, so like I said before, the beanbags and couches. Um, students can move them around, and like relax in, um, in the w- ... in whatever form they want.
>
> Ellen: …this desk can removed, like away to each other, and this place is, you can see it's quite enough for every desk being apart to each other. So, or other people want to like study quiet here, then it's a place for them to study quiet, for whatever the place they choose.
>
> Allison: Um, so I have tables which are made of wood and then, like, the legs are made of, um, like, metal... or, like, light metal that the tables are easy to move.
>
> Allison: There is one moveable chair that has, like, re-, um, balls at the (laughs) on the bottom so you can move it…then the shelf will be out of wood, and will be, like, not heavy wood, because the teacher might want to, like, move stuff if it, if the teacher doesn't like it how it, the school provided it for him or her…

Maria: Maybe we can move the tables into like a different place. If you have to study individually.

Jane: …but then, one of the benefits is that these are movable and that we can place them together to create large spaces.

Jane: Um, so, one of the factors which I wrote about is having like movable desks, which we already do have. Um, it can be used create big groups or split up into smaller groups, and also have independent work…with the space that we have, I mean, and the movable desks, people are able to go wherever they want.

Physiological Comfort

The second theme, Physiological comfort, specifically addresses the students' perceptions of the influence of furnishings and configuration of the physical classroom on their physiological needs and suggested improvements for these needs, addressing aspects of Research Questions 1 and 2. From this theme emerged two categories: air/temperature, covering air movement and temperature in the classroom; and fit/size/use of space, covering seating comfort, classroom size, student movement in the classroom, and teacher movement in the classroom.

Air/temperature

The survey addressed five questions on air circulation and six questions on air temperature. In general, female middle school respondents who took the survey in English responded negatively to the number of fans in the classroom and whether the fans functioned well. These questions, along with three more on whether the circulation was appropriate due to large windows on both sides of the classroom, whether there was good ventilation and unobstructed ventilation were judged to be satisfactory among the respondents overall.

Questions regarding air temperature drew a stronger variance. The first question, addressing whether the classroom temperature is comfortable for the teaching and learning process drew 22 negative responses. Though the majority were middle school students, the negative responses were distributed across gender and preferred survey language. While the respondents as a whole considered the temperature adjustable for teaching and learning activities, 4 respondents found the temperature too hot, while 14 found the temperature too cold. The negative responses for both extremes were primarily female respondents, and mostly from respondents who took the survey in English. Questions regarding the temperature's influence on concentration and the student's ability to remain active were mostly responded to as neutral or agreement, with the disagreement coming primarily from middle school female respondents taking the survey in English. As a whole, the survey revealed that issues of air movement and temperature were less important to high school students than middle school students and that female students viewed air movement and temperature more negatively in their existing classroom spaces.

While air temperature had some of the lower rankings within the survey, it was not as much of a topic highlighted in the drawings and interviews. David drew an air conditioning location within the drawing, and in the interview simply stated "And have air-conditioning of course, like at the front" when describing his drawing. Jane wrote on her drawing near the window "Natural light -Stimulus in learning -More energy -Can affect room temp," seeming to reflect on the various ways windows influence the physical space. Bradley mentioned air temperature twice, once in describing a difficult place to learn and once describing a comfortable place to learn:

Bradley: Uh, well on one of ... Like for d- doing the exams, one of our, um, study rooms was in the canteen. I feel like that space was like really big. And then everyone was talking. And some areas were, were like too hot, and some areas were too cold, because of like where the AC's ... like where the air conditioning was placed...We couldn't really focus.

Bradley: Hmm, I think it's in the library. 'Cause the, um, like the environment is ... Well, I mean it's not too hot, and not too cold.

And David mentioned air movement on hot days:

David: Um, I'd have like windows... windows on each side so you can get a lot... like let light in and stuff and open the windows on hot days.

Fit/size/use of space

Focused on the physical space, the survey had a significant number of questions which related to fit and size within the classroom and the furnishings, described as the "space" section of the survey.

Chairs. Six survey respondents across grades did not feel the existing chairs accommodated various body sizes. Fourteen respondents did not feel the chairs were comfortable for long periods; another 12 respondents gave a neutral response to this question. When asked about the existing chairs in the classroom, there was general agreement as to their fit and comfort:

Bradley: Um, I think that the chair is fine. Like it's comfortable.

David: Um, the chairs... the chairs are fine I reckon. Um, uh they seem... they do their job so. Yeah.

Jane: Um, this furniture so far at the school, um, it's been quite comfortable and easy to use, um, like ergonomically? (laughs).

Allison: So, the chair is quite comfortable.

Maria: And I think the chair, maybe can use chair we are having right now, this kind.

Robert: I think it's very comfortable.

Sara: And, like, the chairs, I don't know how to describe, like, the chairs are comfortable for most people, including me. Because, like, most people like to rock on it. And it's, like, really comfortable if you want to lay.

Phillip was the only interviewee to dispute the chair's comfort:

Phillip: ...and, like, also the chair isn't that comfortable, since it's like, it's shaped…

Classroom size. Ten survey questions addressed classroom size. While respondents generally agreed that several aspects of the learning space and the furniture arrangements were agreeable, including the space for group and individual activities, the furniture arrangement's suitability for group and individual activities, and the furniture arrangement's adaptability for teaching and learning, respondents were less supportive of other aspects. Eleven respondents, seven of whom were female and primarily from the middle school did not agree that the classroom space was appropriately sized for the number of students. Eight respondents did not feel that the furniture arrangement was moveable for drama, acting, and role-playing activities. Ten middle school respondents did not feel the number of students suited the size of the classroom and 14 respondents, primarily middle school students, did not agree or were neutral to whether the number of students in the classroom allowed learning and teaching activities to be

carried out comfortably. Finally, eleven respondents felt the number of students made the classroom feel crowded; in fact, a majority of middle school respondents gave either a negative or neutral response to this question. A few interviewees also commented that the classroom space was limited:

> Ellen: Yeah, I think more space. That's more, most important. If like, see I, I got the like activities place for a student to rest and have some games opp-opportunities. And they are able to moving around to check other people's work. Yeah, I think pretty much I don't need to add anything else, but more spac
>
> Phillip:I wish the classrooms were a bit bigger. Right now, it's actually kind of small.
>
> Sara: So it's, like, really stuffed…I honestly think that studying in my classroom is okay for, like, just studying as normal. But, like, it's with all of the M1s [6th grade students], it's, like, not that spacious. And then, like, in your individual classes, like, A, B, or C, then there's enough space, but then it's, like, too quiet.
>
> Sara: Mostly in the classroom. Like, we're doing A class. It's fine, because, like, there's not so much students in A. But the whole classroom in one class, like, now that we don't have our assigned seats with us, we have to be, like, in one whole class with all of the M1s [6th grade students].

Student movement. Three survey questions covered student movement in the classroom. While students generally agreed that the furniture arrangement encourages interaction among respondents in the existing classroom and that the number of students in the classroom allowed them to move freely during teaching and learning activities, ten middle school respondents did not feel the classroom space was sufficient for student movement during learning activities.

In his drawing, Bradley arranged his furnishings to allow students to have space to move. He elaborated on student movement in the interview:

> Bradley: …and this will allow them to, um, communicate, and, uh, talk to each other if they need help with anything. And, uh, this would be, uh, be better for group work. And ... 'Cause students won't have to walk around the classroom if they would have people around them already.
>
> Bradley: …during the teamwork times, the students can walk like around the table, and ... 'cause there are spaces on ... in the front where there aren't chairs, so a student can walk around, talk to each other, and have like, like around two to three students right beside them…
>
> Bradley: But then, yeah, if you, if you need someone's c- ... help, I could just go right beside them, instead of like walking across the classroom every single time I need someone's help.

Teaching and learning. Teaching and learning, those aspects specific to a classroom environment, were also addressed. Respondents described aspects of the physical classroom space that were, or that they felt would be, conducive to teaching and learning. Three survey questions related. The first asked if the space allows for teacher movement, the second asked if the furniture arrangement encourages interaction between teachers and students, and the third asked whether the number of students in the classroom makes it easy for teachers to effectively monitor students. While respondents generally agreed to all three, students in the lower grades, 6^{th}-9^{th}, disagreed more than the students in the upper grades, 10^{th}-12^{th}. Teacher movement was also a topic with the interviewees:

Allison: And, it's like, the te-, there's a lot of space so the teacher can walk around and ask, answer te, um, the s-, questions of the students.

Bradley: …if [the teacher's] table's in the corner, then they could walk around freely in front of the whiteboard, or like the SMART Board, if they have a presentation, or they have something they need to write on the whiteboard.

Bradley: I mean the teachers would be f- ... walking around freely anytime they want. There are spaces, um, in between the tables. So teachers can walk i- in between like freely.

Ellen: And in the middle should be the teacher's desk. The teacher can go see all the student properly in the middle.

Maria: …the teachers can maybe come to the tables and see if the students have any problems. So if like one group, where there's four people, like two people have questions, then teacher can come explain to the four. So instead of going one and one.

David: …the teacher would be able to walk down and like check each people. Like and walking like in front of them, and like look at each of the uh, the work that they're doing and then... yeah.

Mental and Emotional Security

The third emergent theme, Mental and emotional security, specifically addresses the students' perceptions of the influence of furnishings and configuration of the physical classroom on their security needs, and suggested improvements for these needs, addressing aspects of Research Questions 1 and 2. Focused on their security, four categories emerged: feelings and emotions, capturing interviewees emotional reactions to the physical classroom space; comfort,

as described by the interviewees; choice, which emerged as an important element of student satisfaction with the physical classroom space; and focus/concentration, especially distractions.

Feelings and emotions

Students feelings and emotions within physical spaces emerged mainly from the interviews. While there are not many references to feelings in the drawings, Jane suggests the plants create a "more lively environment" and the "comfortable corner" can be used to "refresh mind." Jane explained:

> Jane: …there's natural elements like plants. Like I- I find that, um, classrooms with plants, I don't know, it feels more lively. I don't know. It feels, it feels like a welcoming environment and with ... it adds some color and ... I- I- I- I like class-classrooms (laughs) with, um, plants,

and:

> Jane: …a pretty comfortable environment with like lots of natural light, which I personally, um, prefer. Uh, it's, uh, sort of like calming and it- it helps me focus on my studies.

Allison addressed environmentalism in her drawing, stating that "large windows…save energy." She explained:

> Allison: So, like, I added large ... a large, big window, because, like, to save energy, so we could use energy in other spaces on the earth for people that have, like, that don't have enough energy to have light. So, yeah, that's also, like, a problem with the environment right now in some countries.

In general, the drawings, meant to represent their ideal classrooms spaces, represent areas of relaxation, flexibility, and choice. Feelings were not addressed in the survey.

Interviewees' feelings within the physical space emerged from their emotive words. While there were some phrases with positive emotion, such as Jane stating "we felt a lot of freedom in moving things around the way we wanted to" and "people might be able to re, refresh themselves" there were many references to negative emotions. Maria stated:

> Maria: And I also want the walls to be more colofu- color-colorful. Yeah, because if it's too white, uh, I, hmm, I don't really like white cause I feel like blank. So, I hope the walls can... I think the walls can be more colorful. Yeah.

Jane stated that she felt "overwhelmed, um, by technology," and described an "uptight" environment:

> Jane: And then, I mean, in relaxing environments, I feel like some people might feel more freedom in expression and might be more willing to, uh, express their ideas compared to, compared to being at the desk and then maybe they're like, "Oh, I gotta focus," um, and it feels more uptight, I guess.

There were varied references to nervousness from Allison's more lighthearted comment:

> Allison: I want to have a free workspace but still have my stuff around. So, and I'm really scared that my computer will fall off that table (laughs).

to Jane's concern about teacher desk location:

> Jane: I think perhaps maybe with certain teachers or like certain classroom layouts, um ... Like it's important for the teacher to have their own workspace, I think. Um, but I think, uh, with certain ... depending on the different students and teachers, some students might feel hesitant to approach this more isolated space. Um, it can, it can, um, it can mean more privacy between the discussion, but then it might also mean that it sort of creates like a, like an isolation and the student's

like, "Oh, I'm a little nervous to go over there. And it's all, it's all isolated. It's just me and the teacher—and it's a little bit scary." Like that kind of feeling.

to this exchange with Robert about a difficult place to learn:

Robert: (Silence) oh that's hard to say. Because many, many places.

Researcher: Many places are difficult?

Robert: Yeah.

Researcher: Okay. Well maybe you could help us say what makes them difficult.

Robert: Like languages.

Researcher: Languages.

Robert: Or nervous. Some place makes me nervous.

Researcher: Okay.

Researcher: Some places make you nervous?

Robert: Yeah.

Researcher: Okay. So a lot of people around you?

Robert: Um, there's, like there's many people, classmates or teachers around me.

Researcher: Okay.

Robert: Yeah.

Bradley described feelings of isolation and loneliness:

Bradley: I think it's more important because like let's say you're at home, and you're alone. And like, I mean there's no ... I mean your parents can help you. But then they might not know what ... exactly what you're learning about.

Bradley: I mean it's better than at home, 'cause it's just kinda lonely. Because when you're stuck in your own room, all by yourself, and it ca- ... it gets kinda bored sometimes.

Bradley: Let's say if you're at home, like self-studying on a computer, some- sometimes you don't know how to phrase a question for like Google, or other search engines. But when you ask the teacher, they might understand what you're asking.

Bradley: Everyone uses like technologies now. And if you go somewhere without technology, you will kinda feel a bit like, uh, lost.

Comfort

While the survey did not have a section on comfort, comfort runs throughout the survey, including the areas of classroom temperature and chair and table usage addressed in earlier sections. Of note is that only about half of the respondents agreed that the existing chairs were comfortable for long periods. Jane mentioned that this was a problem in past years:

Jane: Um, one of the problems that we used to complain about a lot was having to sit in really long periods and that would actually cause back problems for some of the students.

Comfort is also specifically addressed in the survey in terms of the number of students in the classroom. Those respondents who disagreed or were neutral were primarily middle school level students; middle school classrooms had a larger number of students, typically 18-24.

The interviewees used a variety of methods to show comfort in their drawings. Though Robert's classroom is quite conventional in its configuration, he used nature, in the form of a

class fish and flowers on the tables, which aligned with his description of the comfort of studying at home.

> Robert: Because it's a very quiet place and there is some, like, some flowers in my bedroom among foods and drink and sometimes, maybe some cats will, like, jump, other, I don't know how to say. Maybe jump on the balcony…Or some birds just.

Along with Robert, Jane drew a large plant and Sara incorporated drawings of flowers on her walls.

Allison and Jane both mentioned areas to "relax" in their drawings and while Jane labeled a "comfortable corner." Ellen, Bradley, Phillip, Maria, David, and Allison all have alternative seating spaces with floor, beanbag, and or couch seating. Relaxation is also described by the interviewees.

> Allison: And I drew, like, a back space, like, with pillows and stuff, like, where you can just sit on the ground and relax and then m-, study while you're relaxing-
>
> Bradley: ... um ... So basically on the s- ... two sides, they would ... there would be like, um, beanbags, or couches, or something similar, for like peop- ... students to relax…
>
> Bradley: And some students might feel uncomfortable like sitting in a chair on a desk and reading. Some may like to like lie down, relax and then read. And they might, um, learn better that way. So then there would be couches, and beanbags on the side for students to, um, choose if they want to s- ... um, relax and study on the sides.

Bradley: Um, so like I said before, the beanbags and couches. Um, students can move them around, and like relax in, um, in the w- ... in whatever form they want.

Ellen: Like showing background, and beside it there is a place for some activities, like playing the card or something a rest here.

Ellen: …I got the like activities place for a student to rest and have some games opp- opportunities.

Jane: ...the comfortable corner or, um, yeah, that can, that can probably help people relax. And then, I mean, in relaxing environments, I feel like some people might feel more freedom in expression and might be more willing to, uh, express their ideas..

Comfort was primarily specifically expressed in the interviews in terms of environment and seating comfort.

Bradley: 'Cause the, um, like the environment is ... Well, I mean it's not too hot, and not too cold. And everything's kinda quiet in there. And I think that's like the most comfortable place.

Maria: My most comfortable place to study is my room, I think, because it's all silent and every time when I need like, uh, books or a dictionary, I can just take out from my room.

Robert: Uh. Like this classroom, you can, you can use like, when you see six, six, six desk, desks and uh, each desk has four, four students. And there's 24 students in one class. And this is, I think it's very comfortable to, to me. And each desk, desk can like, has a, like flower or plant, something like that.

Jane: …it was a pretty comfortable environment with like lots of natural light, which I personally, um, prefer. Uh, it's, uh, sort of like calming and it- it helps me focus on my studies.

Allison: …and then, students could choose between that, um, the chair or a normal stool. It depends on which they're more comfortable in…And I feel com-, most comfortable like, sitting in a very comfortable chair or, like, sitting on the ground...

Phillip: I also like, like, I wish like, there was also couches because like, sometimes the, if, if you think the c- like, the chairs aren't like, aren't comfortable enough, you could go sit on the chairs.

Choice

The importance of choice emerged primarily through the interviews. Although only Jane specifically mentioned a "range of study areas," visual representations in the drawings of Allison, Bradley, Phillip, Maria, and David also showed a range of study areas, indicating that a choice of different study areas is desired. The survey questions do not address choice in the classroom.

David mentioned choice when describing studying at home:

David: …you're actually by yourself and you get to um, like sit whereever you want and like get whatever you want like food and drink and stuff.

and when describing his imagined classroom.

David: …like if you don't have a full class you can split them up to like different desks and they can sit by themselves, and just do their own thing.

Several others indicated choice while describing their drawings:

Jane: ...I feel like having a range of flexible study areas where each person can, I don't know, choose which environment or surrounding that they find more comfortable in.

Phillip: ...in my drawing, there's like, two group work s-...like, places, for people to, if they want to group work, they could, they could sit with oth- others at the large table, and if they want to work toge-...like, on, by their-self, they could, they could like, sit by themself.

Ellen: …I got the like activities place for a student to rest and have some games opp- opportunities. And they are able to moving around to check other people's work.

Allison: …students could choose between that, um, the chair or a normal stool. It depends on which they're more comfortable in…If some students want to learn by their own, they can go to that tables.

Bradley mentioned it three times:

Bradley: ...there would be like, um, beanbags, or couches, or something similar, for like peop- ... students to relax, for like, um, maybe time they need to self-study, or, or they're just reading, or they have things like during advisory where you could do your own work, uh, uh, like at your own time.

Bradley: And some students might feel uncomfortable like sitting in a chair on a desk and reading. Some may like to like lie down, relax and then read. And they might, um, learn better that way. So then there would be couches, and beanbags on the side for students to, um, choose if they want to s- ... um, relax and study on the sides.

Bradley: Um, so like I said before, the beanbags and couches. Um, students can move them around, and like relax in, um, in the w- ... in whatever form they want.

Allison considered a teacher's choice:

Allison: ...then the shelf will be out of wood, and will be, like, not heavy wood, because the teacher might want to, like, move stuff if it, if the teacher doesn't like it how it, the school provided it for him or her.

And Jane contemplated future classroom choice:

Jane: Um, but with the space that we have, I mean, and the movable desks, people are able to go wherever they want. Um, although, perhaps, if there is addition of more furniture and more installments in the future, that might ... that could either limit or promote, um, movement of people to different areas they might feel comfortable in or with ... or to, like for example (laughs), if I prefer working by a window, I might move to a window.

Focus/concentration

Focus, especially distractions to concentration, was another important topic for the respondents and interviewees. The survey addressed concentration in two questions: one which covered concentration and temperature, and one which addressed concentration and paint color. Both were rated in the neutral to positive range overall. High school respondents indicated a stronger ability to concentrate overall when considering room temperature and wall paint cover.

Within the drawings, only Jane mentioned focus, but she mentioned it twice, stating "desks, movable can be used for discussion/independent work. More focus?" and "Plants make lively environment, 'green' helps focus etc. etc." She seemed to have thought about flexibility of the space and the opportunity it may present for a more focused environment. She also

emphasized her wish for more nature in the environment, which she seemed to link to her ability to focus. She stated:

> Jane: ... and then I start staring at the blank walls and then sometimes ... yeah-... so, I, uh, sometimes zone out on my work and then, uh, find it hard to concentrate.

Noise appeared to be a big challenge to the focus of interviewees. Specific to their current environment, chair noise seemed to be an issue.

> Phillip: ...the chair …also makes a lot of noise when you lean back. It's just the chair is too na- noisy.

> Sara: Then when you sit back, sometimes the chairs, like, makes much noise.

Bradley mentioned it twice:

> Bradley: And, uh, sometimes it's [a chair] a bit squeaky, like during exams, ev- ... uh, when people want to move, it's just ... Uh, people try to move really slowly 'cause of the squeaky noises.

> Bradley: …and the chairs, m- maybe they would be made out of like metal, or ... And then they would have like, um, cushions on it or something. And ... So it wouldn't make the squeaky noises.

Interviewees stated that the presence of too many people and talking are also deterrents to concentration.

> David: …if I go to like a café or study I can't really... I don't think I can work well. A because there's too much noise or like people... too many people around.

> Robert: …sometimes other st, students will, like talking about something. De, definitely loudly.

Ellen: Yeah, beside the street it's gonna be really noisy and crowdy, make my think stop…ah, noise is really important.

Maria: …like where there's a lot of people. I can't concentrate on work.

Sara: when you have homework to do and, like, people are distracting you. And you really want to get it done but then they just keep on talking. …there's a…group in our class, and they always like to sit together. And when they collaborate, they don't collaborate about work.

Phillip: …noisy places don't, like really allow me to study, as much.

Allison: …with a lot of people around me...Some people are always talking to each other and then it's distracting me from learning.

Jane: …with all the noise and the like going in and out. And, uh, yeah, it's mainly the disturbance from- from students.

Jane described a specific example:

Jane: Um, I think, though, as more and more people started going to the library, it became harder, um, for me to study effectively in the library. Um, a lot of noise would, uh, be really disturbing and then there might be kids running around or like (laughs) pulling at our belongings... so, eventually we moved to the neighboring study room, which is a lot more quiet…Uh, I think the main thing, for at least us as older kids, is that we prefer the quiet environment, um, where we can focus more on our studies…Uh, and, yeah, just the- the physical classroom itself is- it's sort of like I was describing the library. Though it was a classroom, I think some people might have started to disregard or, um, just forget that it was a

still a library... and that, um, at the very basis though it's supposed to be used for studying. It sort of became more like a social hangout place.

Bradley described another:

Bradley: Uh, well on one of ... Like for d- doing the exams, one of our, um, study rooms was in the canteen…I feel like that space was like really big. And then everyone was talking. And some areas were, were like too hot, and some areas were too cold, because of like where the AC's ... like where the air conditioning was placed. And yeah. And it was sometimes really, really loud. So it was n- ... We couldn't really focus. Oh, and the, uh, WiFi connection wasn't really good in some areas, so when we didn't understand stuff, it was hard to, uh, do some research on it.

Bradley also discussed the distraction of friends:

Bradley: ...when you really wanna focus on something, and when your friends are around, it's sometimes, uh, easy to get off tracked, or distracted by other things when, when you wanna discuss with your friends. Uh, but then during individual studies, you get to focus, and actually, um, ... And you can focus and learn ... And fo- ... You can focus about what you want to like f- ... learn, and memorize more for, uh, uh, uh, your future courses or exams.

Sara mentioned some other distractions to concentration, including note-taking:

Sara: And every time you take notes down, we focus on what we're writing and not what we are listening to," and technology "… sometimes when I'm not feeling like I, um, want to study, I just do whatever I want to do on my laptop, and it's not really good.

Interestingly, she also noted that at times it can be too quiet:

> Sara: I honestly think that studying in my classroom is okay for, like, just studying as normal. But, like, it's with all of the [students] it's, like, not that spacious. And then, like, in your individual classes…there's enough space, but then it's, like, too quiet.

Social Needs

The final theme, Social needs, specifically addresses the respondents' and interviewees' perceptions of the influence of furnishings and configuration of the physical classroom on their social needs and suggested improvements for these needs, addressing aspects of Research Questions 1 and 2. Categories within this theme include communication, between students and between students and teachers; collaboration among students; and self-study and working alone. Interviewees had a lot to say about their social and individual needs in the classroom and the ways in which the classroom facilitated or deterred these perceived needs. Their thoughts on communication and collaboration were similar, but subtly different. Carving out individual study space was important too.

Communication

Several questions covered aspects of communication. All respondents were either neutral or agreed that the school's classroom furniture was moveable for discussion and generally agreed that the furniture arrangement encouraged student interaction. However, in considering whether the furniture arrangement encouraged student and teacher interaction, while most respondents were neutral or agreed, five students disagreed.

Jane's drawing referenced "discussion" in addressing the ways moveable furniture might be configured. Referencing her drawing, she elaborated on communication:

Jane: …it could be beneficial, like for example, if you had this corner, you can like all sit around. In discussions, it can create, uh, increase (laughs) the exchange of ideas.

Sara talked about communicating in a collaborative setting:

Sara: And the table's, and it's, like, in a circle. It's good for communication.

then continued:

Sara: And, like, sometimes you get the desks that are individual.

What Sara drew, however, showed communication between students in a side by side manner. She elaborated further on communication.

Sara: Maybe sometimes you want to communicate. I'm not saying that when you communicate, that you communicate of homework. Because some people, like, just communicate just to talk, and say it's homework when it's not. I mean, I, I do that sometimes, but (laughs) the tables are really nice for communicating. But to have, like, a table that is good quality and communicate at the same time would be, like, awesome.

Bradley considered communication in the design of his ideal classroom:

Bradley: …this will allow them to, um, communicate, and, uh, talk to each other if they need help with anything.

He purposely left one side of the table without a chair, as he considered this to help with vision and interaction.

Bradley: And, uh, the side of the students' table that's facing the whiteboard, that side's empty when ... uh, during normal classes. So teachers could just

stand there and have a vision of everyone, and can like have eye contact, and talk to everyone on that table.

Collaboration

Collaboration was important to the students and the school's current classrooms were generally seen as conducive to collaboration. Three survey questions, covered elements of collaboration. Respondents generally agreed or strongly agreed that their current learning environment allowed for group learning activities, and that the furniture was movable for group discussions and encouraged interaction among students. Regarding the existing classrooms, Jane stated,

Jane: …with the classroom experiences that we've had right now, I mean, we've ... we're mostly settled in big groups, um, where we're sitting together and the teacher will interact with us as a group, um, which that, personally, I don't really mind. Um, it's, it promotes discussion between us and the teacher, as well as between ourselves.

When asked about the importance of collaboration, several interviewees emphasized friends and socialization:

Bradley: …things you didn't understand in class…your friends might know. And if, if they don't, you can go to another table, which is like really close. But then, yeah, if you, if you need someone's... help, I could just go right beside them, instead of like walking across the classroom every single time I need someone's help.

Phillip: …collaboration helps you to share ideas, like, when you run out of idea, your like, friend can help, like share the, your, their idea to help.

Allison: …I feel like I could study the most effectively with, like, one or two students around me, that, like, ha-have a little bit more knowledge to a-, in case I have questions to ask them.

Sara: …certain subjects, you would, all the students, and some of them, like me, to do something together…And it's easier to communicate with my friends because we do it, the homework, together…to make it easier.

Allison: …some students might want to have, like, a neighbor to chat with (laughs) during the class, or, like, ask questions.

Maria: Because if I have like questions or if we have things to discuss, I thin- I think it's better to be with a group. Instead of being alone.

Interviewees also emphasized the values of working together in the classroom and sharing ideas:

Bradley…I think it's more important because like let's say you're at home, and you're alone. And like, I mean there's no ... I mean your parents can help you. But then they might not know what ... exactly what you're learning about. And your friends, classmates, and teachers, which is close by in the classroom, they, they would pro- ... they would most likely know like things you don't. Like the things you want to further learn about.

Ellen: I think collaboration for me is really important, because um, for some r- for some reasons, maybe poster or PPT, something like that. We're not able to finish by ourselves, says it time for, get several ideas from other people and make one.

David: …it's pretty important like to develop the skills to be able to work, like well with other people that you don't normally work with. Um, that always helps. Like to yeah, to grow and... just you work better... yeah.

Allison: …collaboration is important to me to, like, share our knowledge that we have.

Robert: ... I think, study with each other is very important. Some, something that you don't know, that they do know you ask them instead of teacher.

Jane: …with collaboration, um, I think one of the important things is that you get to build bonds with different people. You get to learn more about them, about yourself, um, and also become more open minded, um, as you get in touch with different ideas. Um, and it's also a good way for you to share your own ideas. Um, like, for me personally, I prefer collaborative tasks- ... compared to independent tasks. I feel like, actually, I feel like a lot of people might say that (laughs). Uh, but I find discussion very fun and ... yeah.

Although none of the drawings specifically labeled collaboration, most of them showed a collaborative layout with grouped tables and chairs in some configuration. Interviewees also used their drawings to describe how collaboration would work:

Bradley: …and this will allow them to, um, communicate, and, uh, talk to each other if they need help with anything. And, uh, this would be, uh, be better for group work. And ... 'cause students won't have to walk around the classroom if they would have people around them already.

Phillip: ...in my drawing, there's like, two group work s-...like, places, for people to, if they want to group work, they could, they could sit with oth- others at the large table, and if they want to work together.

Bradley: …during the teamwork times, the students can walk like around the table, and ... 'cause there are spaces on ... in the front where there aren't chairs, so a student can walk around, talk to each other…

Maria: I think if we take the tables, like four tables together, I think when we have to divide to groups, maybe it can be in our table groups and if we have questions about the problem, maybe in table group we can discuss and solve.

Jane: … there's promoted interaction for people if we go up to the [SMART] board.

David: …you can use like the study area at the back to like form a group or whatever and collaborate.

Ellen: …I think for this in my drawing, is really helpful to, for the collaboration because of this kind of ch- like chair and tables. That student can work in four people per group, and then do whatever the things that teacher ask him to do.

Self-study/alone

The survey included two questions that specifically addressed individual studies. Respondents substantially agreed overall that the existing learning space allowed for individual learning and that the furniture was movable for individual studies.

The interviewees had varied thoughts on the need for individual study space in the classroom. Some felt this was an important part of their learning in the classroom:

David: Um, I think that's also like a learn... It- it- it's like important. It depends like what you need it for, like um, like what you're doing. Like if you're studying for a test the independent like learning is good, and yeah, like you need that.

Robert: Uh, study, study with myself is like, it's more quiet.

Sara: When, like, I only, like having individual studies is when are, when you have homework to do and, like, people are distracting you. And you really want

to get it done but then they just keep on talking. And then, I don't know…so I think most of us need individual studies.

Jane: And then, with independent work, I think one of the main things is that there tends to be more personal development? I mean, you'll- you'll tend to look more into yourself and then, um, try and pull out different ideas and concepts. And then it's more of an exercise where you train your own brain and, um ...

Yeah, with independent work you learn to (laughs) be independent?

While some interviewees seemed to think more about other students need for independent study space:

Allison: …some students need, like, quiet study. Or, don't want anything around them.

Ellen: …for some reason I guess, like the individual learning space is really important, is um, the quiet brings to the like, people, a really ... How to say? Bring, bring them a clear thinking, and a thinking place, but not collaborate to other people. But their own think, is their own thought to, yeah, to do their work. I think. (laughs).

And Maria didn't seem to have much use for individual study space at all, stating:

Maria: … if I have like questions or if we have things to discuss, I thin- I think it's better to be with a group. Instead of being alone.

Within the drawings, Allison showed an "individual tables" example on a post-it note, and drew seven staggered, board-facing individual desks with chairs on the floor plan. Jane referenced "independent work" as an example of a configuration, while Phillip showed two individual desks as one seating option of his floor plan with their own individual power outlets.

Sara's drawing appeared to show individual desks, though they are not labeled to indicate a self-study layout.

As with collaboration, the interviewees elaborated substantially on incorporating individual study space into the classroom. Whether or not they seemed to personally need individual study space, most of the students seemed to plan space for it.

> Allison: Um, so, in the middle I drew some individual tables, so ... And then I have some groups tables. If some students want to learn by their own, they can go to that tables.
>
> Bradley: ... um ... So basically on the s- ... two sides, they would ... there would be like, um, beanbags, or couches, or something similar, for like peop- ... students to relax, for like, um, maybe time they need to self-study, or, or they're just reading, or they have things like during advisory where you could do your own work, uh, uh, like at your own time.
>
> David: But they have the study area at the back that can like, use to um... for independent study…. like a mat or something on the floor that you can just like relax and just study, like by yourself.
>
> Phillip: Like, on, by their-self, they could, they could like, sit by themself…Like, hmm, there's like, individual like, like, single tables by this side, so they don't get that disturbed.
>
> Bradley: But then during individual studies, um, students are allowed to move around the table, like on all four sides. So then they could have more s- ... personal space and ... to self-study.

> David: And you could also like take apart the desks and like move them, like move them around anywhere you need to…so it could be used like for a quiet study, like if you don't have a full class you can split them up to like different desks and they can sit by themselves, and just do their own thing.
>
> Ellen: This desk can removed, like away to each other, and this place is, you can see it's quite enough for every desk being apart to each other. So, or other people want to like study quiet here, then it's a place for them to study quiet, for whatever the place they choose.

However, when asked if there was a place that "you could study by yourself?" within his drawing, Robert answered "no."

From Cycle 3 four themes emerged: physical space preference and convenience, physiological comfort, mental security, and social needs, which aligned with research questions 1 and 2. Data was presented in Cycle 3 in a phenomenological manner, allowing the themes and categories to emerge from these data. The researcher next revisited the intuitive inquiry Cycles 1,2, and 3 in preparation for Cycle 4.

Intuitive Inquiry

The intuitive inquiry method of analysis (Anderson & Braud, 2013) uses five cycles of interpretation, each with activities unique to that cycle. Cycle 1 involves clarifying the research topic through a researcher's dialog with a text or texts. In Cycle 2 the researcher develops an interpretive lens through a thorough literature review, then data are collected and a descriptive analysis of the data is prepared in Cycle 3. Cycle 4 has two phases: the researcher refines the cycle two lens through interaction with the data, then the researcher presents a side-by-side comparison of the two lenses, articulating differences. In Cycle 5 the researcher conventionally

concludes the study. Intuitive inquiry requires self-reflection and a personal voice. I will therefore describe the analysis in the first-person for this section of Chapter Four.

At the beginning of my process, I was not aware of the Intuitive Inquiry method; yet when I found this method of inquiry, I felt I had discovered one that both met my needs for listening to students' voices and for reflecting as an educational leader on the physical classroom space. Anderson and Braud (2013) described this hermeneutic approach as "five successive cycles of interpretation" (p. 247). This section is a summary of my process through the first three cycles as well as the reflections and analysis of Cycle 4.

Cycle 1

The first cycle is described as one that stems from a researcher's passion and interests. Anderson and Braud (2013) described engaging in an imagined dialogue with a text, texts, photographs, statistical findings, or similar. Though I did not purposefully begin this research with this approach in mind, in considering Cycle 1, I can, nonetheless, vividly recall a similar engagement, an "aha" moment I had while sitting in the front room of my house.

I came into my educational career in an unusual manner. With an undergraduate degree in interior design and space planning, I worked for a number of years in furniture manufacturing before switching careers and beginning my journey into education as a fundraiser for an independent school. Fifteen years later I had experience across a variety of educational administration positions and had obtained both a master's degree in educational administration and my principal licensure. I was also running an independent school as a co-executive director.

I was researching the physical classroom space and I was thinking deeply about students whom I had observed in the classroom: tall lanky high school basketball players, seemingly folded into desk and chair units and petite sixth grade students in the same units whose feet

didn't touch the floor. It seemed that in the effort to make a *one-size-fits-all* piece of furniture, manufacturers had in effect made furniture that was *one-size-fits-no-one*. Statistics from my literature review were beginning to confirm that observation. I was also thinking about equity in the classroom, and my obligation as an educational leader to provide an equitable learning environment for all; I wondered how much physical discomfort distracted these students from learning and if it put some at a disadvantage.

Though in retrospect it seems obvious, my 'aha" moment occurred when I realized that my education in design, my experience in furniture manufacturing, and my education and experience in educational administration had suddenly merged into one cohesive research topic that bridged my varied experience. I realized that I had found my topic, and my passion.

Several texts suddenly fused. Lester et al.'s (2016) study on gender microaggressions, Parcells et al.'s (1999) work on the mismatch of student body dimensions and classroom furniture, Cencic's (2017) work on leadership understanding the impact of the physical school environment, Rae and Sands' (2013) study on classroom layout, Woolner et al.'s (2007) research on the impact of learning environments, and the work of Margaret Wheatley, whose take on leadership as an alignment with nature fascinated me. Revisiting these texts again and again, among others, shaped this research.

As I reflected on this initial spark of inquiry, I sought to engage in an imagined dialogue, as described by Anderson and Braud (2013). I circled back to mental images of students in those desk/chair units, captured in my notes:

Journal reflection: Two extremes in the desk/chair

Though I do not have a photo on which to reflect, I can nonetheless reflect on two images within my mind's eye: a 6'-7" basketball player and

dwarfed student, each sitting in standardized furnishings and within a traditionally structured classroom layout.

The mental image of the basketball player is in a desk/chair unit, at the back of the room near the door. Slouched down with legs extended far beyond the front of the desk, the student in essence invades the space of the student in front of him. Bars are on one side of the desk which connect the desk to the chair, preventing movement on the right side as well. This student appears almost caged. I reflect on what it must be like to be this student. He no doubt has continual challenges in physical environments in which he does not fit and has likely come to accept this and adapt to the best of his abilities. The simple ability to move would seemingly be a relief, yet the structure of this remembered environment discourages movement, and places the teacher in the dominant role with space only at the front of the room (see Figure 2).

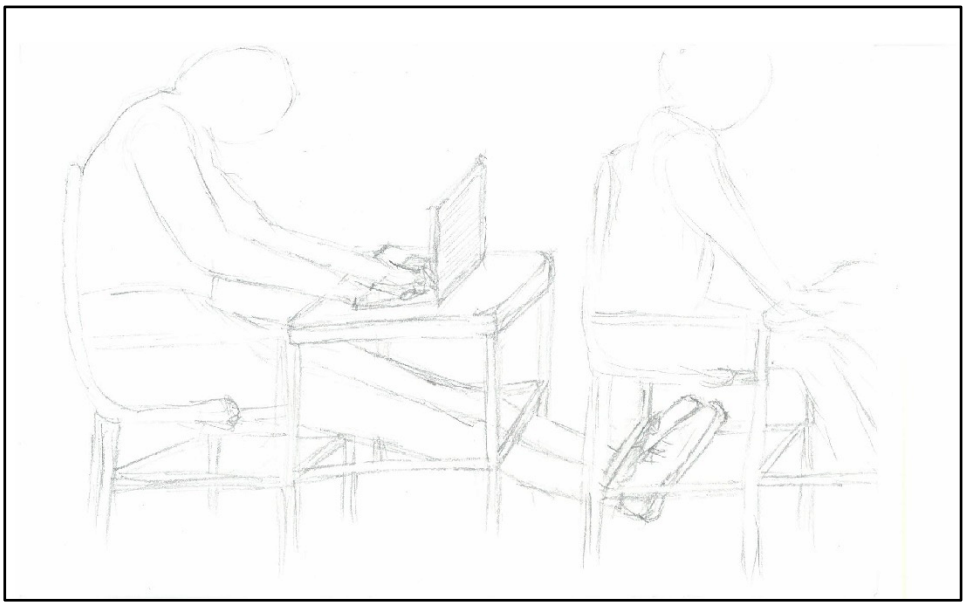

Figure 2: Researcher's sketch of student #1

In contrast, I also mentally reflect on the image of a dwarfed student. The simple act of getting into the chair involves a frontal approach to crawl up and in. Once seated, his legs stick straight out. To move to a bent-knee seated position, the student's back isn't supported. The best accommodation for this student was an additional chair to use as a foot support, like an ottoman. Not all teachers allowed this to happen, as other students then requested the same (see Figure 3).

Adjustable furnishings could support a greater number of students, but not necessarily these outliers. The restrictive environment of the classroom layout feels a deterrent to learning in some respects to all students. I reflect on how uncomfortable I feel when squashed between two large individuals on a bench seat, or on a restaurant seat in which my feet do not quite touch the floor, yet it isn't for me to determine how the students feel; I shouldn't project my discomforts on them. As an educational leader, it is my obligation to provide an equitable learning environment and there seems an inequity in the physical environment of many classrooms. I want to know how the students feel in their learning environments and what they think will make a difference.

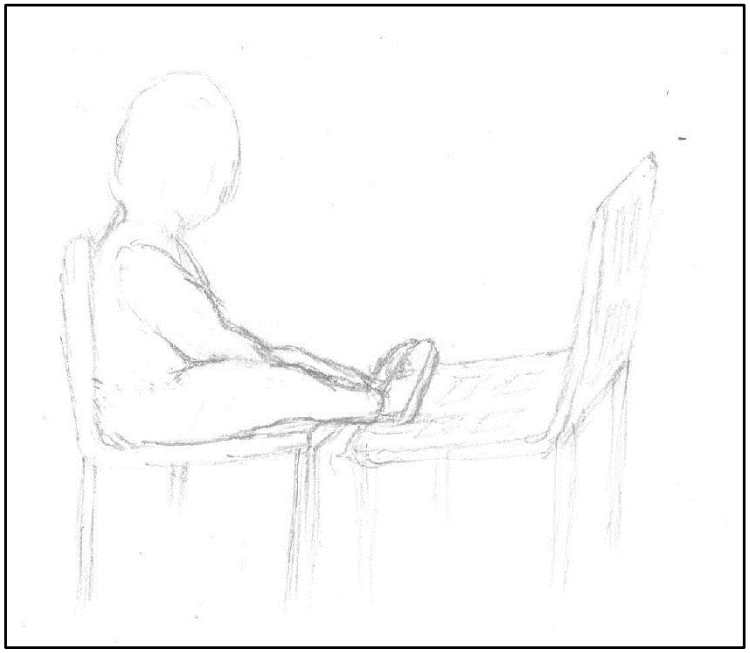

Figure 3: Researcher's sketch of student #2

Cycle 2

Anderson and Braud (2013) described Cycle 2 as a literature review which develops a preliminary lens, developing the researcher's understanding prior to the gathering of data. In *The Undiscovered Self*, Jung (1958) offered "The more an individual object dominates the field of vision, the more practical, detailed, and alive will be the knowledge derived from it," (p. 36) and Wheatley (2006), referring to Faraday and Maxwell's research on space, stated "it was an important shift in focus—to look behind the small, discrete, visible structures to an invisible world filled with mediums of connection" (p. 51). With these texts as inspiration, delving deeply into the research revealed varied data on these areas of inquiry and assisted me in narrowing in on student comfort in the physical classroom space. It also expanded my understanding of comfort beyond the physiological aspects to include students' security and social needs. It is

during this stage that I found a synthesis between Kolcaba's (1994) comfort theory, Shin's (2016) theory of environmental satisfaction and human comfort, and Maslow's (2014) theory of human motivation. The emerging taxonomic structure of student comfort was an outcome of this cycle.

Cycle 3

Beginning with the collection of data, Anderson and Braud (2013) described Cycle 3 of intuitive inquiry as preparing a descriptive analysis which "invites readers to come to their own conclusions about [the data] before they read the researcher's interpretations in Cycles 4 and 5" (p. 247). During this Cycle, I have relied on the students' voices, responses, and drawings to tell the story while I journaled my own thoughts and interpretations as I engaged with these three data sets. Anderson (2000) described this as the "researcher's capacity for reflective listening," initiating "a field of sympathetic resonance that facilitates each participant's capacity to listen to the depths of their own experience" (p. 37).

Cycle Four Findings

Cycle 4, phase 1

It is Cycle 4 that is perhaps most unique to Intuitive Inquiry. Having interacted with these data in Cycle 3, I reengaged with these data as an educational leader, by reviewing audio recordings, reflecting on the drawings, and considering the survey results.

Working in different environments during the data analysis, I journaled reflections on my own physical space and my decisions on where to locate myself over multiple days and why. Several journal reflections captured my reflections while I was engaged in Cycle 3:

Journal reflection: Settling into the University of Warsaw Library

In planning to work on my dissertation in Warsaw, Poland, I arranged for access to the University of Warsaw library. Knowing that I would have an opportunity to put many hours in over the summer, I wanted to access a location that would be conducive to working and away from the apartment we rented. In my second day using the library I have taken some time to reflect on my study preferences as I consider this unfamiliar space.

Yesterday, I began my morning at a coffee shop, enjoying an Americano and a small breakfast. While the food was good, the atmosphere was in many ways less than desirable. Background chatter isn't so troublesome for me, especially when it is in a foreign language; however, the loud, albeit good music, and family of flies that inhabit the shop make it less than conducive for thinking and working. After a short stay there I made my way over to the university library (see Figure 4).

After expecting a building several hundred years old, I was surprised upon entering the University of Warsaw's new, glass-framed building, likely built in the last 20 years or so. Working my way through the space, I landed on

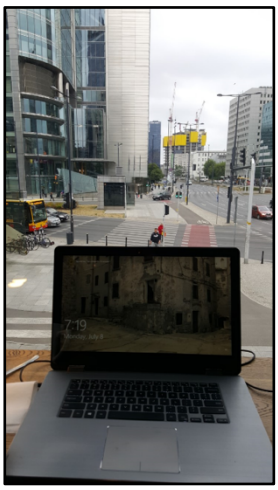

Figure 4: Warsaw coffee shop

a bright atrium and planted myself for the day. There were a few challenges, such as the internet access popping off on occasion and the sun's annoying brightness at times, but overall it was a good space to work.

As I entered again today, thinking about the student interviews and drawings I have been coding and describing, I contemplated what makes a comfortable learning environment for me. I walked around and considered my options: single desks tucked among stacks of books were appealing, but the dark atmosphere made me worry I might get sleepy. At the top of the stairwell in an open atrium, there were a few alternate seating options, such as beanbag chairs and even a tent like you might find in a child's room (see Figure 5 and Figure 6). These each have their own whimsical appeal but seem better suited for casual reading or just hanging out. I needed a table on which to spread out, access to power, and a location that would keep me alert. After, considering several options I ended up in the same room as the day before. Though the uneven sun coming through the glass ceiling has its drawbacks including uneven light and some issues of warmth, overall the combination of access to power, ample desk space, a suitable chair for working, and bright light for these aging eyes, along with a minimum amount of noise made this the best option. I also appreciate still being around some stacks of books and an external view with some greenery (see Figure 7 and Figure 8).

And herein lies the important detail. I had options. On another day with another task, such as casual or even school-focused reading, I would likely

choose a different seating and working option. My decisions are task-oriented. Though I am still in the discovery process of what is thematic within the students' voices, I felt it was important to capture my own process as I considered an unfamiliar space and my decision-making process in choosing a suitable working environment.

Figure 5: U of Warsaw tent

Figure 6: U of Warsaw alternate seating

Figure 7: U of Warsaw exterior view

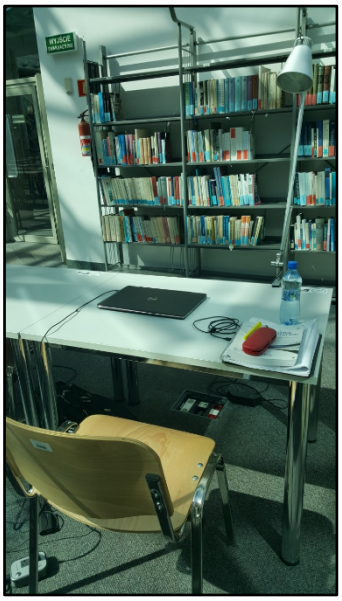

Figure 8: U of Warsaw workspace

Journal reflection: At a coffee shop in Los Angeles

It is ironic that I am working on the focus and concentration section of my analysis while I am contending with four gentlemen engaged loudly in a conversation about family and real estate at a coffee shop in Los Angeles. One of the things that I have noticed in returning to English speaking areas is that the distraction of conversations in one's language is far greater than conversation in different languages. I am thinking about this in terms of students' ability to focus. I often do work in coffee shops, including this one that I have used for many years, yet when I compare this to the library I used at the University of Warsaw there are distinct differences in my ability to focus and concentrate. One of the things I have noticed is the use of materials: coffee shops have an abundance of hard surfaces, whereas libraries are carpeted; the difference in sound absorption is evident.

Journal reflection: At a coffee shop in China

Back in China, I am back at my favorite Starbucks working as I have for most of the last year. While I enjoy the atmosphere overall with little traffic on the weekends due to its financial district location, I am suddenly more conscious of the small table I use and how confining it can feel. I can appreciate the students' desire for more workspace, given that I have half of my belongings on the floor. Without a laptop, traditional desks likely had sufficient space, but with the daily integration of technology it seems clear that more space is necessary (see Figure 9).

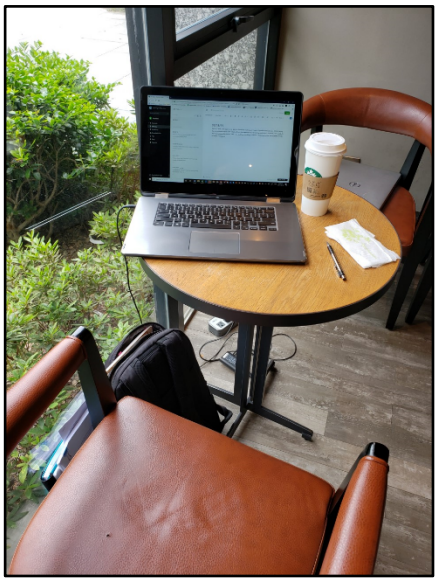

Figure 9: China coffee shop workspace

Further within my journal reflections, I considered several aspects of the data as I reviewed them. To stay within the parameters of using Cycle 3 to more objectively present the data, I used my researcher's journal to capture my thoughts and ideas about the data. Within these journal reflections, I considered conventionality with the drawings; physical comfort, choice and the concept of growth; teacher isolation; study areas; and noise. I also did an exercise in grouping the code words for student voice outcomes.

Journal reflection: Conventionality within the drawings

I've noted that there is a certain amount of conventionality to the placement of certain aspects of the drawings. For example, even though this is an ideal space, most of the participants drew the existing classroom space, more or less, without thought to how an "ideal" classroom might be totally different. This even included certain internal aspects of the room that could be easily changed, such as the placement of whiteboards and smartboards, display areas, and even

> the location of the teacher's desk. Consider the "adaptation" aspects of Shin when you look at this. I think there is something to be said for students putting their own restraints on the creative process. This could mean they haven't explored it deeply enough, it could mean that they consider these aspects positive, or it could mean that they focused on what is possible and probable within their own spaces, vs. fantasy. How ingrained is the conventional classroom space into our collective minds? Is the conventional space all bad? It is definitely food for thought.

Shin (2016) described four stages of the optimization process of an individual's interaction with the physical space: *environmental modifications, behavioral adaptations, normative adaptations,* and *withdrawal* (p. 16). In asking interviewees about suggested environmental adaptations of their spaces, it may be that they have made normative adaptations, described by Shin as "the adjustment of one's expectations and norms about the setting" (p. 16) in their responses to the ideal classroom setting. I explored this further in another journal entry:

> Journal reflection: Physical comfort and choice within the drawings, growth
>
> Taking a minute to reflect upon the analysis of the drawings prior to moving on to the next data set, within the drawings I feel an overall sense of two desired things: physical comfort and more choice. It's not that the students are saying what we have is bad, they just want to expand upon it. Grow the classroom--which leads me to the idea of nature. It is a new school; it is in a growth period. The students haven't drawn uniquely new spaces, rather they have sought ways to grow the spaces, to increase comfort and provide options for different people and different activities. What I don't see is students focused on

> the teachings of the teachers as much as finding a comfortable place for learning, whatever that looks like for them. Teachers clearly have a place in the room, but for all but one the teacher is relegated to the side. Even for the student who put the teacher in the middle, her thought was that the teacher would have an easier time engaging with the students in that location. These are student-centered classrooms, in keeping with what they learn about being IB learners. I need to pick up Wheatley again to review the connections to the patterns of nature.

Revisiting Wheatley (2006) made me realize that this shift with the integration of technology in the 21st Century classroom from a teacher-centered physical classroom space to a student-centered physical classroom was already happening. Wheatley (2006) stated, "In many fields of science, we glimpse how life uses the information it gathers not just to preserve itself, but to grow and generate new capacities" (p. 98) and continued,

> Think about how we generally have treated information. We've known it was important, but we've handled it in ways that have destroyed many of its life-giving properties. For one thing, we haven't been interested in newness…we live in a society that believes it can define *normal* and then judge everything against this fictitious standard…in life, newness can only show up as a difference. If we aren't looking for difference, we can't see that anything has changed; consequently, we aren't able to respond (pp. 99-100).

Clearly these data show us that for the interviewees, this shift away from what was *normal* has already happened. We as teachers and educational leaders must embrace this information. Expanding on these data, it is of great interest to me to understand

how students see the role of the teacher in the classroom. Another journal reflection addressed in this.

Journal reflection: Teacher isolation

I worked on the facilities section today. A few things of interest came to the forefront: First, the section that describes the teacher's isolation (their word) at the corner desk is fascinating. This definitely needs to be explored further. I continue to be intrigued by the students' perceptions of the teacher in the classroom space. I think teachers might be surprised, perhaps even shocked, to understand this. As an educational leader, I am also trying to decide whether this is a good thing or not. More upon which to reflect.

Interviewees indicated that the teacher's role was supportive and seemed to rely as much or more on technology and assistance from classmates, than on the knowledge of the teacher. The question for me as an educational leader then becomes whether our teachers are embracing this model or hanging on to a more teacher-centered model of instruction. Certainly, the configuration of the classroom space still looks teacher-centered in the existing classrooms, as shown in Figure 1.

Journal reflection: Study areas

Second, fleshing out this section revealed that the students created the "study area," fashioned somewhat out of elements of the library, without any specific questions or references to it from me. This area seems to hit several aspects of comfort, notably physical comfort and the comfort of choice and flexibility.

The *study area* emerged as a common element preferred in the library space of the school and imagined in the ideal classroom space. Linked to this was the idea of choice and flexibility

of the learning space. Interviewees and survey respondents also expanded upon personal space within their study spaces to have room to spread out their belongings and store their materials.

Another common thread which has emerged from student voice is this disturbance of noise. I reflected further on this in my journal:

Journal reflection: Noise

I also want to think about what they have said about noise as I look through this next data set. I want to consider noise literally and as a metaphor for the "noise" in their lives. What needs to be quieted to help them focus? What noise is in their brains? This might be something to discover within their words.

References to noise were abundant, from the inability to focus in a noisy café or a noisy library to the specific squeak of the chairs in the existing classroom. As an educational leader, I expanded upon this theme as symbolic of the distractions students face in their day-to-day lives, from the disagreement they may have had with a parent on the way to school to the pressure to succeed to the everyday challenges of socialization in secondary school. There is indeed a great deal of “noise” with which to contend. Yet it seems that the physical classroom space could be adapted to feature more quiet features, including soft surfaces to minimize ambient noise and a more comfortable learning environment to separate oneself from student chatter as needed.

In an attempt to solidify themes with these data, one of my journal entries explored the idea of making sentences out of the codes. The first set of sentences are linked to the emerging themes from the data.

Journal entry: Sentences built on codes

On mental security: To make me *comfortable*, you need to reduce the *distraction* of *noise*, make my *materials convenient*, and give me *choice*, or it will be *difficult* to *focus* and *learn*.

On physiological comfort: *Desk size* and *teacher movement* are important.

On social comfort: I need *choices* of *collaborative* or *quiet/independent study* areas.

On physical space preferences and suggestions: *Technology* is *necessary* and *important*, including *laptops*. Also important are *chairs* and *desks* that can be *moved* into *groups* as well as the *teacher's desk location.*

The second set of sentences linked to the individual interviewees themselves.

Journal entry: Descriptive sentences based on interviewees most frequent codes

For Bradley: I want to be able to *move around* to *get help* from my *friends* and sit on *couches* and *beanbags. Bigger desks* for our *laptops* with good *vision of the whiteboard* will help us *focus*.

For Jane: I like the *library* because it limits *difficult distraction*. I like to *move desks* for *discussion*.

For Philip: I need less *noise* and more *outlets*.

For Allison: I am looking for *flexibility* and *comfort.*

For David: I seek *quiet, independent study, by myself* in a defined *study area*.

For Ellen: I seek *quiet, independent study* with a *teacher* close by.

For Maria: I like *laptops* and other *materials handy* for *group discussion*.

For Sara: I *communicate* through *writing, books,* and *homework*. I'd like a *smaller class size*.

For Robert: I seek *comfort* through *nature.*

Anderson and Braud (2013) described this first phase of Cycle 4 as a set of interpretive lenses, one that refines and transforms the Cycle 2 lenses from this engagement with the Cycle 3 data. Revisiting these journal entries and reflecting on them as a whole allowed me to personally engage with these data. To further this, I next reengaged with the integrated taxonomic structure from Cycle 2, shown in Table 1, developing a list of questions in each area of the grid. My intent was to use these questions with the data sets to address the third research question: How can educational leaders use student voice to better understand comfort and equity in the 21st Century secondary physical classroom space? Table 5 reflects the questions developed. After developing these questions to address each square within the grid, I reengaged with the data analysis in Cycle 3 to address these questions.

Physical Relief. *Did the students recount any aspects of physical discomfort in the physical classroom?* Some survey respondents found the air temperature uncomfortable, both too hot and too cold. For the most part, both survey respondents and interviewees ranked the existing furniture as comfortable.

How can we provide students physical relief in the physical classroom? A review of the air conditioning and heating units in the classroom space and unregulated hallways might provide solutions for a more consistent temperature control across the school.

Physical Ease. *In what ways did the students share how they would be comfortable in the physical classroom?* Interviewees mentioned choice, flexibility in the learning environment, movement, space, and varied seating options as ways to increase their physical comfort in the classroom.

Table 5

An Integration of Maslow's motivation theory, Shin's satisfaction and human comfort theory, and Kolcaba's taxonomic structure of comfort to describe student comfort in the physical classroom environment with integrated questions from the fourth inquiry cycle.

	Relief	**Ease**	**Transcendence**
Physical Comfort	Did the students recount any aspects of physical discomfort in the physical classroom? How can we provide students physical relief in the physical classroom?	In what ways did the students share how they would be comfortable in the physical classroom? How can we make students more physically comfortable in the classroom?	What reasons did the students state for needing physical comfort in the classroom? How will the students feel in having this level of physical comfort in the classroom? What will physical comfort in the classroom look like for students?
Environmental Comfort	Did the students express any discomfort with aspects of the physical classroom environment? How can we provide students physical classroom environmental relief?	What did the students tell us about how they can be comfortable with these aspects of the physical classroom environment? How can we make the students more environmentally comfortable in the classroom?	What reasons did the students state for needing environmental comfort in the classroom? How will the students feel in having this level of environmental comfort in the classroom? What will environmental comfort look like for students in the classroom?
Sociocultural Comfort	Did the students express any discomfort with the social aspects of the physical classroom environment? How can we provide students social relief in the physical classroom?	What did the students tell us about how they can be comfortable with the social aspects of the physical classroom environment? How can we make the students more socially comfortable in the physical classroom?	What reasons did the students state for needing social comfort in the physical classroom? How will the students feel in having this level of social comfort in the physical classroom? What will social comfort look like for students in the physical classroom?
Psychospiritual Comfort	Did the students express any discomfort with mental and emotional safety and security aspects of the physical classroom environment?	What did the students tell us about how they can be comfortable with the mental and emotional safety and security aspects of the physical classroom environment?	What reasons did the students state for needing mental and emotional safety and security comfort in the physical classroom?

How can we provide students mental and emotional relief in the physical classroom?	How can we make the students more mentally and emotionally comfortable in the physical classroom?	How will the students feel in having this level of mental and emotional comfort in the physical classroom? What will mental and emotional comfort look like for students in the physical classroom?

Adapted from *Comfort Theory and Practice* by K. Kolcaba, 2003, p. 15. Copyright 2003 by Springer Publishing Company, Inc.

How can we make students more physically comfortable in the classroom? Providing more variance in work spaces in the classroom should increase students' physical comfort.

Physical Transcendence. *What reasons did the students state for needing physical comfort in the classroom?* Interviewees mentioned the need to relax, to be able to focus better, and to express their ideas as the reasons for needing physical comfort.

How will the students feel in having this level of physical comfort in the classroom? Students will feel more relaxed, less confined, and freer to choose.

What will physical comfort in the classroom look like for students? Students will use a variety of choices of seating and study areas in the classroom that best meet their current task needs. The effect of physical differences will be minimized among students.

Environmental Relief. *Did the students express any discomfort with aspects of the physical classroom environment*? Survey respondents and interviewees specified a lack of color and a lack of posters, student work, and other displays as things that made them uncomfortable. Interviewees described feeling blank and a having lack of focus. Interviewees also cited a lack of storage space and insufficient desk space for materials as areas of discomfort in the physical classroom. Further, interviewees cited a need for varied learning environments within the classroom and some survey respondents and interviewees stated that the classroom was too small for its inhabitants. Finally, interviewees specifically noted that chairs in some of the classrooms squeak, distracting students from learning.

How can we provide students physical classroom environmental relief? Color and varied textured surfaces could add to the visual interest within the classroom. Displays specific to the classes within the classroom could add a warmth to the space. Additional storage and workspace, both at the classroom level, such as shelving, and the individual space level, such as larger work surfaces, would provide relief. Varied spaces, such as the "study areas" drawn by several of the interviewees would provide choice, and relief from the single seating option currently in place. Capping the number of students in a classroom at one time would relieve overcrowding. Repairing or replacing squeaky chairs would relieve noise distraction.

Environmental Ease. *What did the students tell us about how they can be comfortable with these aspects of the physical classroom environment*? Interviewees suggested ways to bring additional storage space into the classroom, varied learning spaces, more spacious workspaces, and individual storage spots to increase their comfort in the physical classroom environment. Interviewees suggested and drew display areas for additional visual interest.

How can we make the students more environmentally comfortable in the classroom? School leaders can be mindful in the choice of colors, materials, and displays in the classroom environment. School leaders and teachers can provide more flexible classroom spaces with a choice of seating and work environments. Desk spaces can be designed to allow for more space per student for necessary books, supplies, technology, and writing space. Abundant power sources will allow for ease in the use of technology.

Environmental Transcendence. *What reasons did the students state for needing environmental comfort in the classroom?* Students stated the need for more personal space to be able to function optimally in the classroom. Students also expressed a need for a more visually stimulating environment to increase focus and concentration.

How will the students feel in having this level of environmental comfort in the classroom? Students will feel more physically comfortable, focused, and organized with their materials and their thoughts and actions.

What will environmental comfort look like for students in the classroom? Students will have ample space to work, varied space for varied tasks, and a visually engaging classroom.

Sociocultural Relief. *Did the students express any discomfort with the social aspects of the physical classroom environment?* Though interviewees were generally positive about the social aspects of the classroom, the distraction of others and specifically noise came up as areas of discomfort.

How can we provide students social relief in the physical classroom? Flexible work environments which allow students to move to individual work spaces may assist students with focus in the classroom. Installing soft surfaces, including floor carpets, upholstered furniture, and soft surface wall installations, such as cork boards and felt boards, would decrease ambient noise in the classroom.

Sociocultural Ease. *What did the students tell us about how they can be comfortable with the social aspects of the physical classroom environment*? Interviewees placed a high value on communication and interaction with their peers. Survey respondents aligned with aspects of the interview responses. Flexibility in the classroom space was one aspect that students ranked as important. Teacher movement was another. Interviewees stated in their interviews and reinforced in their drawings the need for individual study space in the classroom, even if it wasn't their personal preferred space**.**

How can we make the students more socially comfortable in the physical classroom? A flexible classroom with the ability to regroup furniture easily and provide both collaborative and independent space will provide for students' sociocultural needs. Space conducive to teacher movement is also important.

Sociocultural Transcendence. *What reasons did the students state for needing social comfort in the physical classroom*? Interviewees described their strong reliance on the assistance of other students as a primary need in the classroom; in fact, students seemed to have a preference of classmate assistance and collaboration over teacher assistance in their work. Friendship, and working with friends, was another aspect mentioned as comfortable in the classroom.

How will the students feel in having this level of social comfort in the physical classroom? Students will communicate, collaborate, and feel well-supported working with others in the classroom, as opposed to the loneliness and isolation some students described in other spaces.

What will social comfort look like for students in the physical classroom? Students will be grouped, working together, while allowing students, through flexibility and variance, to also work individually within the same space. Students will have freedom to move from space to space easily and with educational intent. The teacher will provide a supportive role in this collaborative environment.

Psychospiritual Relief. *Did the students express any discomfort with mental and emotional safety and security aspects of the physical classroom environment?* Interviewees expressed some aspects of the physical classroom space that made them uncomfortable, including white walls, and abundance of technology, and cramped space. Interviewees also mentioned the isolation of the teacher at the desk, with one student, Jane, calling it "a little bit scary."

How can we provide students mental and emotional relief in the physical classroom? Creating a more visually stimulating environment, with ample workspace and specific intent

with technology should provide ease to students. Decentralizing the teacher's workspace may also allay student discomfort.

Psychospiritual Ease. *What did the students tell us about how they can be comfortable with the mental and emotional safety and security aspects of the physical classroom environment?* Students cited natural lighting, integration of nature, and color as aspects of the environment that were calming. Choice was also an important aspect of student psychospiritual ease, as was a lack of noise.

How can we make the students more mentally and emotionally comfortable in the physical classroom? Bringing in natural elements, such as plants, and natural colors into the physical space, along with plenty of natural light will make for a more soothing environment for students. Variety in spaces and work areas will also put students at ease. Minimizing noise through both classroom management and surface materials will also assist in providing a more desirable psychospiritual environment for students.

Psychospiritual Transcendence. *What reasons did the students state for needing mental and emotional safety and security comfort in the physical classroom?* Interviewees stated that aspects such as elements of nature were calming and allowed for more open conversation and a better environment for learning. Interviewees cited noise as a major distraction from learning and mental well-being in the classroom space.

How will the students feel in having this level of mental and emotional comfort in the physical classroom? Students will feel well-supported and listened to about their needs in the physical classroom space. Students will be calm, relaxed, and feel both physically and mentally comfortable in their environment.

What will mental and emotional comfort look like for students in the physical classroom? Students will look at home in the physical classroom, moving easily from space to space, content and focused on their studies at hand.

Cycle 4, phase 2

Anderson and Braud (2013) described the second phase of Cycle 4 as a "lens-by-lens comparison" of the Cycle 2 and Cycle 4 lenses, articulating the differences and changes made. Reviewing and considering what I believed the findings would be confirmed a few of my anticipated outcomes and dispelled other expectations. While I expected the emphasis to be on students' physical comfort and environmental comfort; in fact, the areas of sociocultural and psychospiritual comfort came into play much more than anticipated. Anticipating that students' comfort and areas of need would lie along Maslow's physiological and safety levels gave way to an understanding of students' needs, more squarely in the loving/belonging and esteem levels. This is evident in reviewing the taxonomic structure and the resulting responses to the questions formed from it.

In working with the developing taxonomic structure of student comfort in the physical space, I also came to understand Kolcaba's (2003) taxonomic structure as a comfort continuum, going from relief, to ease, to transcendence. Developing the questions within the grid was the major advance from Cycle 2 to Cycle 4, allowing me to use the structure to assess the data derived. While Cycle 3 of this Intuitive Inquiry squarely addressed the first two research questions of this study, 1) How do 21st Century secondary students perceive the influence of furnishings and configuration of the physical classroom on their physiological, security, and social needs? and 2) In what ways would 21st Century secondary students suggest improvements in the physical classroom space to provide for their physiological, security, and social needs? It

is the engagement of the reflective inquiry in Cycle 4 that addressed the third research question, 3) How can educational leaders use student voice to better understand comfort and equity in the 21st Century secondary physical classroom space? which linked the emerging taxonomic structure to these data in an interpretive manner to be used to assess student comfort within a physical classroom space. The resulting revised taxonomic structure allowed for a succinct summarization of the data in each area of the grid, ultimately addressing each of the three research questions: student perceptions, students' suggested improvements, and using student voice to better understand comfort and equity.

Looking at equality and student comfort in the 21st Century secondary physical classroom space, Intuitive Inquiry Cycle 5, detailed in Chapter 5, draws conclusions on this study, considers the ways in which this study may be used, and makes recommendations for further study.

CHAPTER 5

CONCLUSION

The purpose of the study was to examine the extent to which secondary students feel the physical classroom environment deters or promotes learning, to better understand what causes students discomfort and creates barriers to learning in the classroom, and to understand how students feel those discomforts and barriers might be addressed by altering the physical classroom environment to best meet the needs of the 21st Century learner. This study was conceived and executed as a phenomenological study, one which "ferret[s] out the essence or basic structure of a phenomenon" (Merriam & Tisdell, 2016, p. 227). Within this framework, the researcher must decide how his or her personal understandings will be included in the study (Bloomberg & Volpe, 2016; Creswell, 2013). The researcher chose a heuristic inquiry, in which analysis of her own experience was included as a part of the study (Merriam & Tisdell, 2016). The researcher used the intuitive inquiry method with its five cycles of inquiry, a hermeneutical circle of the whole to the parts to the whole (Anderson & Braud, 2013). Cycle 5, in which the researcher presents a final interpretation and theoretical offerings, reevaluates the prior research in conjunction with the findings, and determines the significance of the findings (Anderson, 2011), is inclusive within this chapter.

After Cycle 1 of the intuitive inquiry method, in which the researcher clarified the research topic through a creative process and Cycle 2 in which the researcher developed a preliminary interpretive lens through a literature review, the analysis of the data was completed through two additional cycles of intuitive inquiry: Cycle 3, which took a phenomenological approach to the data and presented a descriptive analysis of the data prior to interpretation by the researcher, and Cycle 4, in which the researcher interacted with the data as an educational leader,

then used the data to integrate questions into the emerging taxonomic structure of student comfort in the physical classroom space. The analysis in Cycle 3 addressed the first two research questions 1) How do 21st Century secondary students perceive the influence of furnishings and configuration of the physical classroom on their physiological, security, and social needs? and 2) In what ways would 21st Century secondary students suggest improvements in the physical classroom space to provide for their physiological, security, and social needs? The analysis in Cycle 4 addressed the third research question, 3) How can educational leaders use student voice to better understand comfort and equity in the 21st Century secondary physical classroom space? In this chapter Cycle 5 interprets those collective findings and their implications, including the strengths and limitations of the research; makes recommendations based on those findings; makes recommendations for further study; and summarizes the significance of the work.

Interpretation of the Findings

The third cycle of the intuitive inquiry process stood back from the researcher's analysis, allowing a collective student voice to emerge from the data sets. Interpretations numbers 1-7 of these findings address the first two research questions. Cycle 4 of the intuitive inquiry process allowed the researcher to reflect on these data sets and the Cycle 3 outcomes. Interpretation number 8 of these findings addresses the third research question.

1. Students need space for optimal functioning. While the secondary school resides within a large three-story building, respondents and interviewees cited the need for more space in several ways. First, ample desk space was sought to hold the necessary equipment for class, including laptops, books, and notebooks. Some tables and desks in the classrooms were considered too small. Further, interviewees described a lack of desired storage space within the

classroom and in or around desks for convenient access to books and materials. Some middle school respondents also viewed the classroom space as inadequate for the number of students in the class, while interviewees noted that adequate space was desired for both student movement and teacher movement in the classroom.

2. Students prefer a visually stimulating environment. As a new school, there was little emphasis placed on the visual classroom environment in the first year. Respondents and interviewees noted that the white walls were sterile and lacked the warmth of color and visuals such as posters and displays of student work. The integration of nature and natural lighting was mentioned by several interviewees as well, and was represented in their drawings.

3. Students seek a classroom environment with a comfortable air temperature. Survey respondents had a wider variance of responses regarding room temperature than other questions. Female respondents in particular cited air temperature as a deterrent to concentration and remaining active. Interviewees also mentioned spaces with a regulated temperature as being ideal.

4. Students are distracted by noise in the physical classroom space. Noise emerged as a major cause of discomfort, distracting students from focus and concentration. Specific to their environment, the noise associated with a specific style of chair's movement seemed particularly annoying the interviewees. The presence of too many people and excessive talking were also cited as a distraction to learning.

5. Students prefer to collaborate and communicate with their peers, with the teacher in an interactive, but supporting role in the physical classroom space. Interviewees discussed the need to move furniture and alternate seating arrangements specific to their desire to collaborate and communicate with their peers. In fact, even when asked specifically how the teacher

interacts with students in the space, interviewees placed the teacher in a supportive role, interacting with student groups over teacher-led front of the classroom instruction.

6. Students seek the comfort of a variety of study environments and flexibility within the physical classroom space. Interviewees sought flexibility and a variety of study spaces within the classroom. Of note was that almost every interviewee both spoke of, and drew, alternate learning spaces in their ideal classroom space. These study areas were described as spaces to perform both independent work and collaborative work and generally featured soft surfaces and a more relaxed atmosphere. There were no spaces of this type in the school's classrooms at the time the interviews were conducted.

7. Students prefer a physical classroom space which integrates, but balances technology. Interviewees described technology as necessary and useful and considered it an essential element of the classroom. Interviewees, however, also pointed to the potential distractions of technology, and sought to balance time with and without technology in the classroom.

8. Educational leaders can use student voice to identify ways to improve the physical classroom space to better meet the needs of 21st Century learners. The researcher bracketed thoughts and experiences through reflective journaling during the initial data analysis, then used those journals to fully explore these data as an educational leader. This allowed the students' voices to speak to the first two research questions, while allowing the researcher's own thoughts to emerge in viewing these data as a transformational leader. The Cycle 4 analysis of these data sets resulted in a set of questions derived from the student comfort taxonomic structure. This method can be replicated, and the questions derived provide a means to use student voice as a tool within other educational settings.

Strengths of the research

The research benefited from a triangulation of data, including the survey, interviews, and drawings. Each data set provided a unique perspective of the secondary physical classroom space. Further, the integration of the researcher's journals and reflections, and specifically the intuitive inquiry method's fourth cycle, allowed the researcher to reflect on the findings through the conceptual lens and to develop a taxonomic structure of student comfort with reflective questions aligned to each section of the grid. This student comfort model could be used for a variety of student learning spaces.

Limitations of the research

While the triangulation of the data made for a rich inquiry into a secondary physical classroom space, the collection of data from a single site limits the scope of the research. Of note is the Uline et al. (2016) research theme of safety and security. Safety did not surface as a theme within this school site but could play a significant role in other settings. The school's identification as an International Baccalaureate school may also affect the students' tendency toward a student-centered, collaborative environment as this is a tenet of this educational framework.

Implications

The results of this study can be used to identify ways to increase student comfort, provide for a more equitable learning environment, and better meet the needs of the 21st Century learner in the physical classroom space. A series of questions developed from a taxonomic structure of student comfort can provide a practical means for the assessment of an existing classroom environment. Cencic (2017) stated:

> It is generally believed that the staff model their behavior on leaders, which means if school leaders understand the physical school environment to be an important factor of learning, school staff (teachers and other professional staff) will also do so. (p. 141)

It will take the attention of school leadership to promote student voice in the design and usage of the physical classroom space; without it "…human beings tend to resort to simply coping with the given environment rather than actively managing it and this may be related to users not being involved in the design process and thus not 'owning' their space" (Lester et al., 2016, p. 54). Shin (2015) described this behavior as a 'normative adaptation' mode of optimization, in other words, learning to live with it. Leaders must be thoughtful and deliberate in their assessment and alignment of the physical classroom space with the needs of students.

In reviewing this study's student voices, interviewees and respondents articulated the need for individual space in the classroom, for temperature control, and for the reduction of noise to optimize the learning environment. These articulations concur with the findings on functionality of space (Beckers et al, 2016; Osman et al., 2011; Sandstrom et al., 2013; Wilson & Cotgrave, 2016), temperature control (Cannon Design et al., 2010; Haghighi & Jusan, 2015; Uline et al., 2010), classroom space (Uline et al., 2010), and noise (Beckers, et al., 2016; Kariippanon et al., 2017; Uline et al., 2010) found in the empirical literature.

Interviewees sought a visually stimulating environment, and one in which technology was integrated, but not overwhelming. This is supported by the Lemley et al. (2014) study which found that "students were not as concerned with technology as they were with autonomy, relevance, and connectedness" (p. 101). To this end, interviewees suggested that the physical

classroom space should be flexible and offer a variety of study environments for students to both focus and relax, aligning with Lester et al.'s (2016) contention that the inability to move furniture decreased opportunities for student interaction and restricted teachers' ability to promote peer activities. Lester et al. further stated that this lack of opportunity promoted little incentive to vary teaching away from the front of the classroom. Interviewees indicated that this proposed physical classroom environment would better meet their needs to collaborate and communicate with their peers, placing the teacher in an interactive, but supportive role in the classroom. Varier et al. (2017) concurred, stating that "educational environments with greater collaborative and self-directed learning opportunities allow teachers to spend more time facilitating and supporting students" (p. 970).

This research, and the resulting student comfort taxonomic structure and evaluative questions can be used by teachers, school leaders, site managers, architects, and designers to assess student comfort in the physical classroom space.

Recommendations

Use student voice to understand the physical classroom environment

Too often, decisions about the physical classroom space are made by adults, without consultation with students. From the teacher, who may consider his or her own preferences primary; to school administrators, who may prioritize aspects like aesthetics and budget; to facilities managers, who may first consider classroom maximization, furnishings' availability, and price; to designers, who may be far removed from the end-user; adults often drive the look and feel of the classroom space without consultation with students. Yet, students' perceptions of the physical learning environment superseded past academic achievement in predicting future student achievement (Lizzio, Wilson, & Simons, 2002, as cited in Wilson & Cotgrave, 2016) and

Uline et al. (2016) found a significant and positive correlation between quality facilities and *academic press*, the degree to which a serious learning environment with high goals and expectations exists. Using student comfort questions derived from the emerging student comfort taxonomic structure could provide a multi-faceted view of student comfort in the physical classroom space. Feedback from students is essential to this process. Educational leaders and classroom teachers will benefit from a more comfortable and engaged student body and students will benefit from student agency, resulting in equity and choice in the classroom space.

Consider flexibility and movement within the physical classroom space and provide varied study environments in the classroom

Interviewees prioritized classroom flexibility, student and teacher movement, and varied learning spaces both in their verbal responses and their drawings. Interviewees expressed a need for varied spatial configurations and furnishings for both varied tasks and for collaborative and independent study. Flexibility and movement have also been shown to increase equity within the learning environment (Lester et al., 2016, p. 918) and provide for a more student-centered classroom (Benade, 2016; Kariippanon et al, 2017; Knaub et al., 2016; Young, Young, & Beyer, 2016). Interviewees offered that this would provide for a more relaxed, focused environment for students. Educational leaders and classroom teachers will benefit from classroom environments better aligned with the learning needs of 21st Century students. Students will benefit from the comfort of choice and have opportunities to work with a wider range and variation of students, which will promote collaboration and a more equitable learning environment.

Ensure sufficient workspace

Interviewees cited a need for additional workspace, storage space, and personal space, which aligned with the Wilson and Cotgrave (2016) study in which students ranked the

importance of spaciousness as second only to technology in the physical classroom space. Changing 21st Century tools, including a laptop in conjunction with textbooks, notebooks, calculators, and other items require increased surface space per student. 21st Century learning environments further require space sufficient to join workspaces for collaborative study. Uline et al. (2010) observed that overcrowding affects the school climate and Haghighi and Jusan (2015) concluded that *direct-architectural elements*, including classroom size, affected outcomes on student performance (p. 287). Beckers, van de Voordt, and Dewulf (2016) concluded that students rank functionality of the space over aesthetics (p. 248). Students will benefit from room for better organization of their personal space, while educational leaders and classroom teachers will benefit from a more satisfied student body and a more organized classroom.

Take steps to minimize noise

Interviewees and respondents cited noise as a major deterrent to concentration and focus. This aligns with several empirical studies including Kariippanon, et al., 2017; Uline et al., 2010; and Beckers, van der Voodt, and Dewulf (2016) which concluded that students ranked quietness over privacy (p. 248). Noise reduction measures, including installing sound absorbing furnishings and environmental items, including soft furnishings, rugs or carpeting, corkboards or felt boards, and/or panels which explicitly reduce noise are suggested. Further, flexible classroom spaces would allow for student and teacher conversations to be grouped to further minimize noise. Educational leaders and classroom teachers will benefit from a quieter environment, which should promote student learning and may reduce classroom behavior issues. Students will benefit from a more calm and relaxing learning environment.

Provide a visually stimulating environment incorporating natural lighting, natural elements, and a comfortable air temperature

Respondents and interviewees suggested natural elements as important to the learning environment, including window views, natural lighting, and plants within the classroom space. A comfortable room temperature was cited as an important element to learning and is supported by the literature (Cannon Design et al., 2010; Haghighi & Jusan, 2015; Uline et al., 2010). In both their verbal responses and in drawings, interviewees stated their desire for more color in the classroom and for visuals linked to learning displayed in the classroom. Educational leaders and classroom teachers will benefit from a more visually appealing classroom environment with a more student-centered approach to learning. A properly moderated room temperature will also assist with student concentration and comfort. Students will benefit from a more visually appealing classroom with an emphasis on learning-related visuals. A comfortable temperature range will minimize the distraction of students being too hot or too cold to concentrate.

Ensure the physical classroom space promotes communication and collaboration; and is student-centered

Though the teacher's desk was placed in the front by most interviewees, the classroom was described and drawn in a collaborative manner. Interviewees indicated that communication and collaboration were paramount to their learning. The teacher desk area was seen as intimidating to some and as primarily a teacher workspace to others; interviewees described the teacher as moving around the classroom to assist students rather than standing at the front lecturing. This mirrored the shift to 21st Century learning and was supported by the literature including Brown (2014), which stated that traditional classroom structures create dependent learners with weak critical learning skills, and Benade (2016) which stated that student agency is

poorly modeled in the single classroom with a single teacher as the agent. Educational leaders will benefit from a physical classroom space more aligned to the needs of 21st Century learners. Classroom teachers will benefit from a physical classroom space which deemphasizes lecture-style learning and provides for more teacher movement and teacher-student interaction within the physical classroom space. Students will benefit from a more student-centered classroom which promotes communication and collaboration with peers and in which the teacher can work more directly with individual students or with small groups of students.

Integrate, but balance technology in the classroom

Interviewees considered technology a staple in the classroom and suggested ways in which to support technology through ample access to electricity and sufficient space to work. Byers et al. (2018) cautioned that superficial changes made to create the impression of keeping up with technology often lacked a student-centered approach, while Uline et al. (2010) noted that an inadequate electrical infrastructure limited the ability to arrange the classroom for varied purposes. Interviewees attached importance to technology's power to provide access to resources, but also valued human interaction as an essential element of the classroom. More emphasis was placed on collaboration than technology support in the physical classroom space. Technology-driven furniture configurations described by O'Neill (2013) such as the *campfire*, which features gatherings spaces with access to power, incorporate both the need for collaboration and technology support effectively. Educational leaders and classroom teachers will benefit from a classroom aligned to technology integration and student-centered research. Students will benefit from support for technology as a tool, while still placing an emphasis on human interaction in the classroom.

While the results of this study can be applied most directly to the institution at which the study was conducted, the recommendations can be generalized across secondary schools. Emphasis should be placed on the integration of student voice into the design and usage of the secondary physical classroom space; the use of the emergent questions from student comfort taxonomic structure can be universally applied to assess the physical classroom space against students' perceptions and recommendations.

Recommendations for Further Study

Conduct a study with a larger group of students in multiple locations and in varied environments

While this study revealed themes that aligned with the existing literature, it was limited to a modest number of students from a single school. The study could be replicated in other countries, in other-sized schools, in schools with students of a differing socio-economic status, and in classrooms with more fixed physical classroom spaces.

Replicate the study in a school with a more student-centered physical classroom space

While interviewee preference and suggestions indicated the desire for a more flexible and student-centered classroom space, the scope of this study did not include altering the physical classroom space to these specifications. Replicating this study in a more flexible and varied learning environment would further reveal the value of these student perceptions and suggestions.

Use the student comfort taxonomic grid to research comfort in the physical classroom space at different grade level

The scope and focus of this study were on the secondary classroom space, as there was a gap in the literature about classrooms at this level. The resulting student comfort taxonomic grid

may have value at the primary and post-secondary levels as well. These levels may also reveal further insight into student comfort.

Conduct a study with an emphasis on social and emotional needs within the physical classroom space

The development of this study was conceived with an emphasis on physical comfort; however, the outcomes revealed a strong social and emotional element to the responses. A study with an emphasis on these elements may provide further depth into how students feel and socialize within the physical classroom space.

Expand from the study of formal learning spaces to informal learning spaces

The focus and emphasis of this study was on a traditional formal aspect of the physical classroom space. However, when asked about a preferred learning space, none of the interviewees cited the formal classroom. A study focused on informal learning environments, especially in the age of technology, may provide further insight into student comfort.

Conclusion

Space is formed through an interaction of living and non-living entities, an amalgamation of people, place, and practice which must be considered in unison (Acton, 2017). This qualitative phenomenological study considered the comfort of students in the secondary physical classroom, seeking ways to meet the needs of the 21st Century learner and to provide an equitable environment for all learners. A student survey was conducted on elements of the physical classroom space and interviews were conducted to further delve into student comfort in the classroom. As part of the interviews, students drew an ideal classroom space to further share their thoughts and ideas. These data were analyzed first for their own emerging themes using student voice, and later through the reflections of the researcher as a school leader.

The study not only provided insight into the ways in which students are both comfortable and uncomfortable within the physical classroom space, but also provided reflective insight for the researcher as an educational leader seeking to understand the linkage between the furnishings, flexibility, and environmental factors which affect students' physical, environmental, sociocultural, and psychospiritual comfort. Working within the theoretical lenses of motivation theory, satisfaction and human comfort theory, and a taxonomic structure of comfort used in nursing, the researcher developed a series of questions based on the taxonomic grid which can be used both by the researcher for further inquiry into the phenomenon as well as by others seeking insight into students' classroom comfort.

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Appendix A

PACE Instrument Questions

Table presents 55 items in 6 constructs (adapted from Ahmad, et. al, 2015, pp. 8-10)

No.	Items
Furniture	
	Tables in my classroom…
1	can be used to perform learning tasks (writing, drawing)
2	can be used to hold equipment (books, paper, computers)
3	match existing chairs
4	are safe to use (sturdy, not easily broken)
5	can be combined to form groups
	Chairs in my classroom…
6	are able to accommodate various body sizes
7	match existing tables
8	are comfortable to be used for long periods of time
9	are safe to use (sturdy, not easily broken)
10	are easy to move around
Facilities	
	White boards in my classroom…
11	are of the appropriate size to suit the needs of teaching and learning
12	are suitable placed
13	are clearly visible (example: writing)
	Display boards in my classroom…
14	are suitable placed
15	are of the appropriate size to contain important information (example: timetables)
16	are of sufficient number to display learning information
Space	
	The learning space of my classroom…
17	is of appropriate size in accordance with the number of students

18	allows for student movement during learning activities
19	allows for teacher movement when monitoring students' learning activities
20	allows group learning activities
21	allows individual learning activities
	The arrangement of furniture in my classroom…
22	is movable to suit group activities (discussion)
23	is movable to suit individual activities (tests, revisions)
24	is movable to suit teaching and learning activities (drama, acting, role-playing, facilitation)
25	encourages interaction among students during the learning process
26	encourages interaction between teachers and students
27	is adaptable according to the needs of teaching and learning
	The number of students in my classroom…
28	suits the size of the classroom
29	does not make the classroom crowded
30	allows me to move about freely during teaching and learning activities
31	makes it easy for teachers to effectively monitor students
32	allows learning and teaching activities to be carried out comfortably
Lighting	
	The lighting in my classroom…
33	is appropriate due to an adequate number of lights
34	is appropriate due to well-functioning lights
35	is appropriate because no equipment blocks the light from reaching students
36	illuminates the entire room evenly
37	meets the needs of learning and teaching activities (presentation)
Indoor Air Quality	
	The air circulation in my classroom is appropriate due to…
38	the number of fans corresponding to the size of the classroom
39	large windows on both sides of the classroom
40	well-functioning fans
41	good ventilation
42	unobstructed ventilation
	The temperature in my classroom…

43	is comfortable for the teaching and learning process
44	is adjustable according to teaching and learning activities
45	is not too hot
46	is not too cold
47	enables me to concentrate on teaching and learning
48	enables me to remain active
Color	
	The paint color in my classroom…
49	makes the room appear more spacious
50	makes the ceiling appear higher
51	brightens up the classroom
52	develops positive behaviors
53	stimulates thinking
54	allows me to maintain concentration on learning
55	is of an attractive color combination

Appendix B

Interview Questions

1) Describe your most comfortable place to study and explain why. This place could be at home, at school, or anywhere else.
2) Describe a space or environment in which it is difficult for you to learn and explain why. This place can also be any place you choose to describe.
3) What is the most important purpose of learning in a physical classroom for you?
4) Thinking about the chair and table combination (shown a photo from the existing classroom), describe how well you and your belongings "fit" with the furniture.

Using these materials provided, I would like you to take about 10 minutes to draw a quick sketch of what you think an ideal secondary school classroom looks like. I will then ask you some questions about your drawing.

5) Describe the furniture and materials in your ideal classroom drawing, including shape, size, texture, and materials.
6) Describe how the space could be used for collaboration with your classmates.
   In what ways is collaboration important to you?
7) Describe how the space could be used for individual quiet, focused study.
   In what ways is an individual learning space important to you?
8) Describe how the teacher works within this space.
   Does the teacher have his or her own workspace?
   How does the teacher interact with the students in this space?

9) How does technology fit within your ideal classroom?

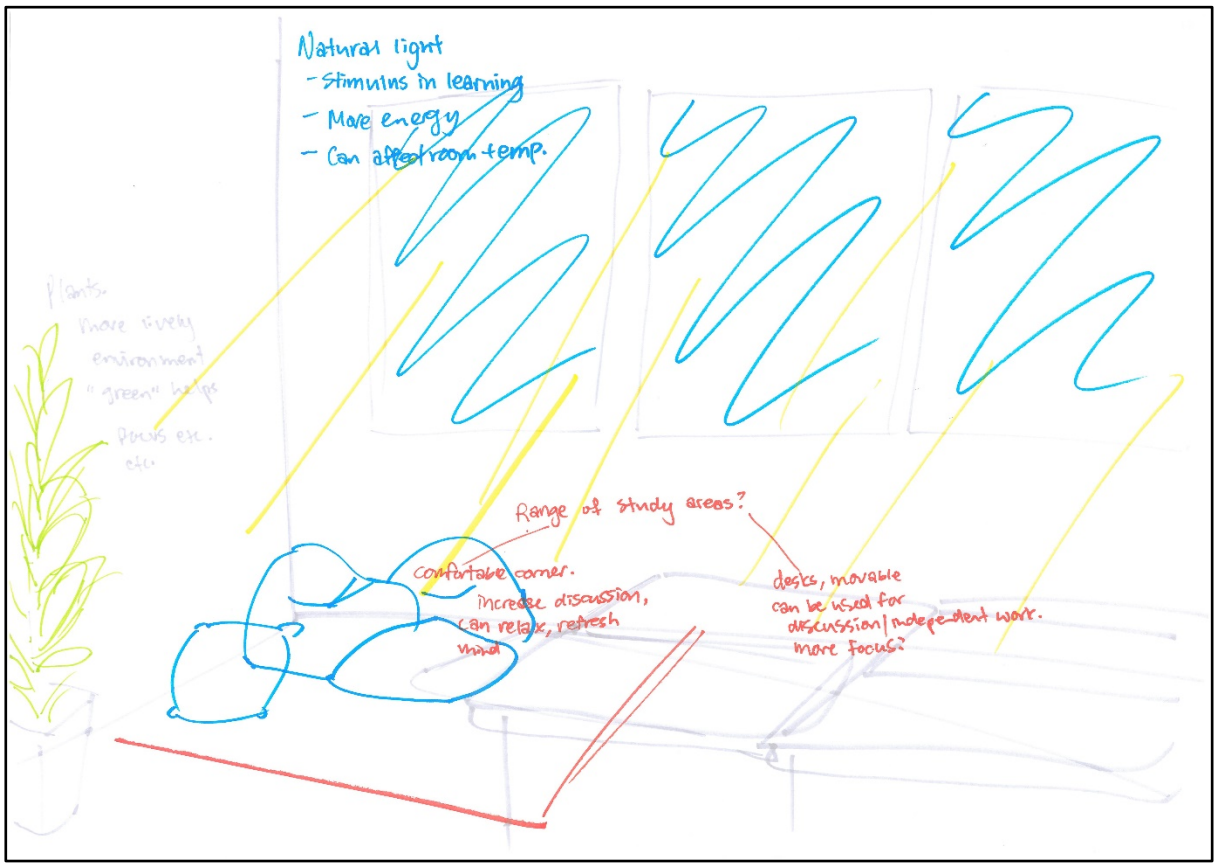
In what ways is technology important to your learning within the classroom?

10) Is there anything else you would like to mention about a classroom's physical space?

Appendix C

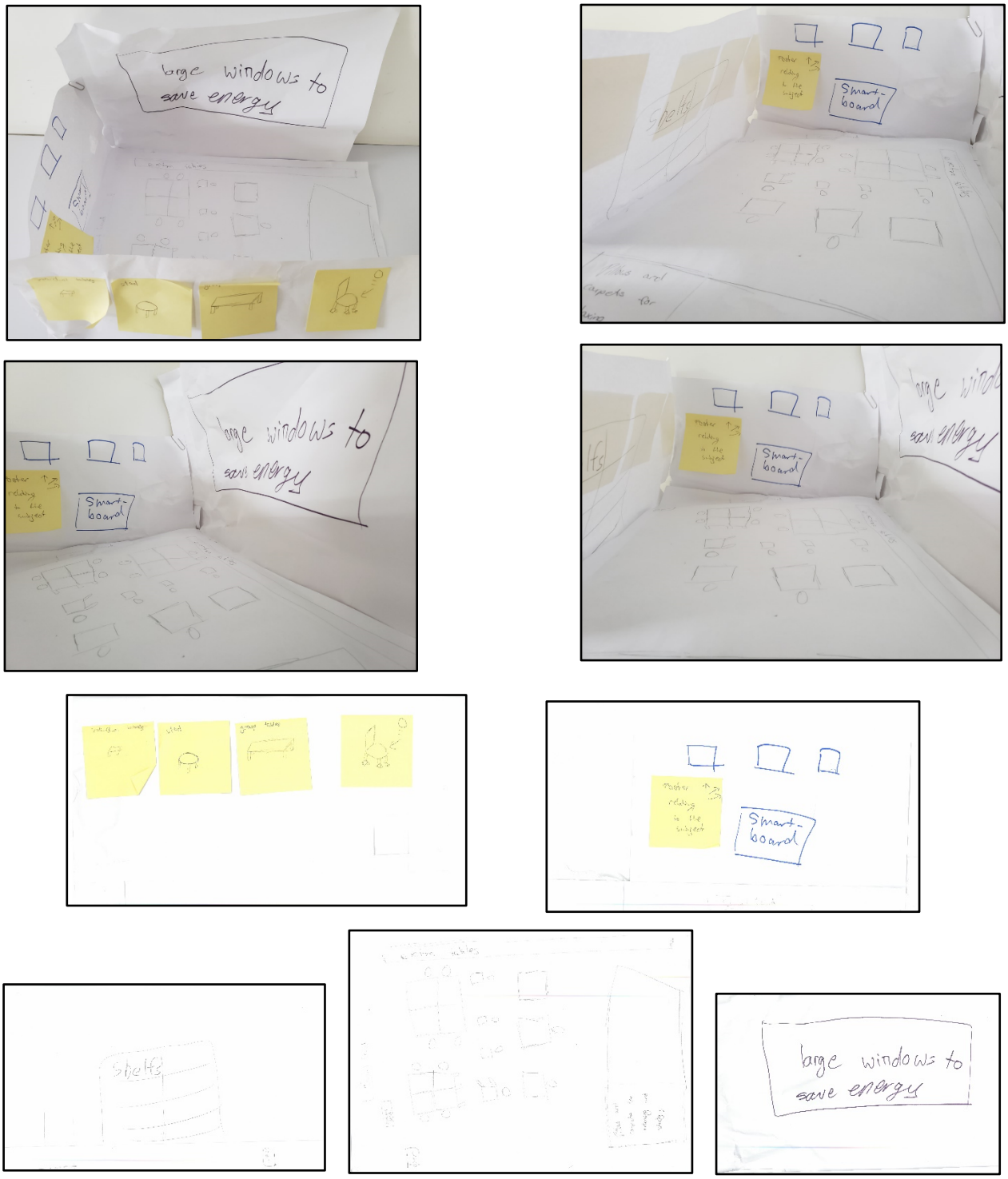
Student Drawings

Drawing #1: Jane



Jane's drawing features the corner of a room with a plant large windows, a carpet, beanbag chairs, and pillows. Color marker in blue, red, green and yellow is the medium used for the drawing. Jane's drawing includes descriptive words. Near the plant is the statement "Plants make lively environment, 'green' helps focus etc. etc." At the windows it states "Natural light - Stimulus in learning -More energy -Can affect room temp" and on the floor is says "Range of study areas?"and "Comfortable corner. Increase discussion, can relax, refresh mind" and "desks, movable can be used for discussion/independent work. More focus?"

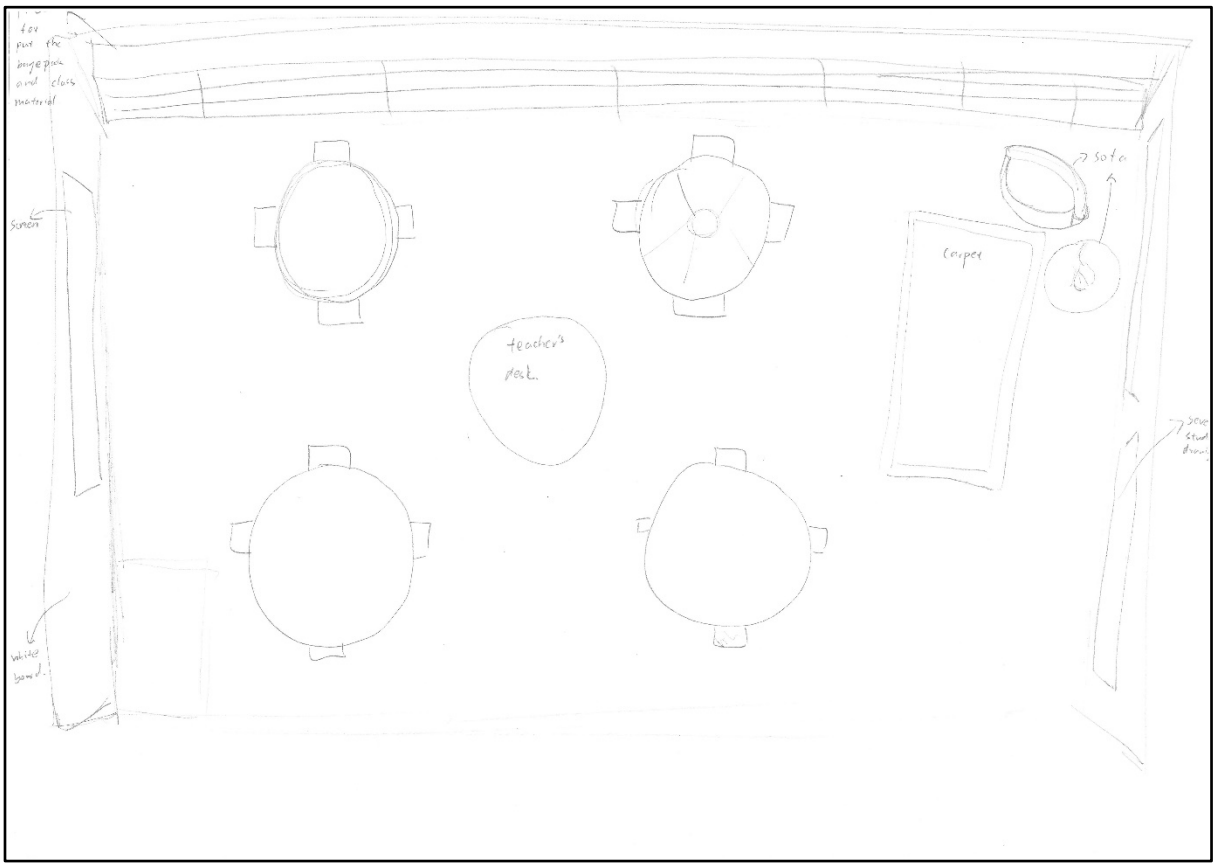
Drawing #2: Allison



Allison went beyond the use of a single sheet of paper and created a three-dimensional representation of her ideal space. Using multiple sheets of paper and tape she built a three—

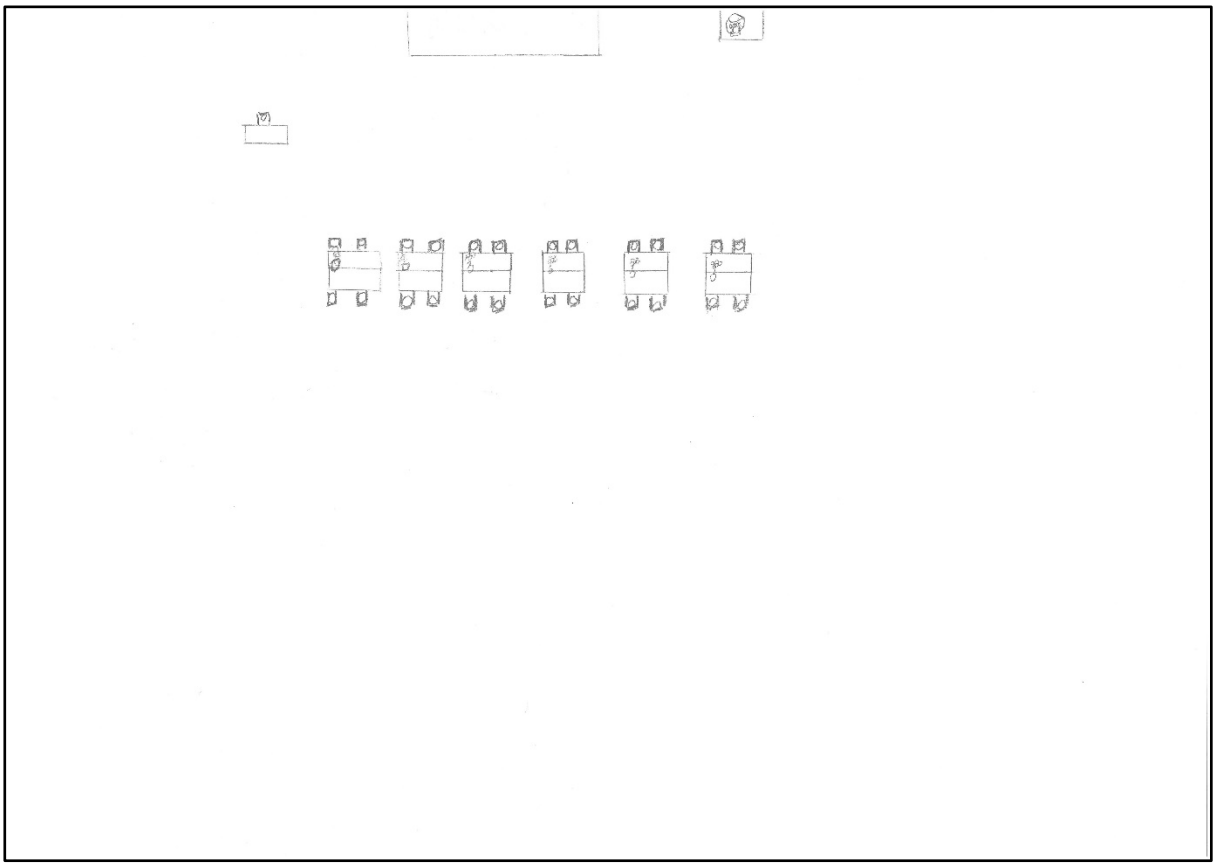
sided room with a floorplan at the base and wall details. The floor uses a representation of the existing classroom space with a smartboard at the front and a teacher's desk in the corner. Allison drew a long rectangular box on one wall, labelling it "extra tables;" the opposite side shows just a door. "Pillows and carpets for relaxing and studying" are shown at the back of the room, while the center has two table groupings of four desks with four chairs, and seven staggered, board-facing individual desks with chairs. One of the interior walls of the ideal space shows a large rectangle. Within it, boldly in marker it is labelled "large windows to save energy." The front of the room wall shows a smart board with three rectangles above it. A sticky note indicates these are "poster[s] relating to the subject." The third interior wall has "shelfs" drawn and features a door cut out. Attached to the outside of this three-dimensional representation are four yellow sticky notes with drawings of the furnishings: 1) "individual tables," 2) "stool," 3) "group tables," and 4) a chair with a caster detail for rolling.

Drawing #3: Ellen



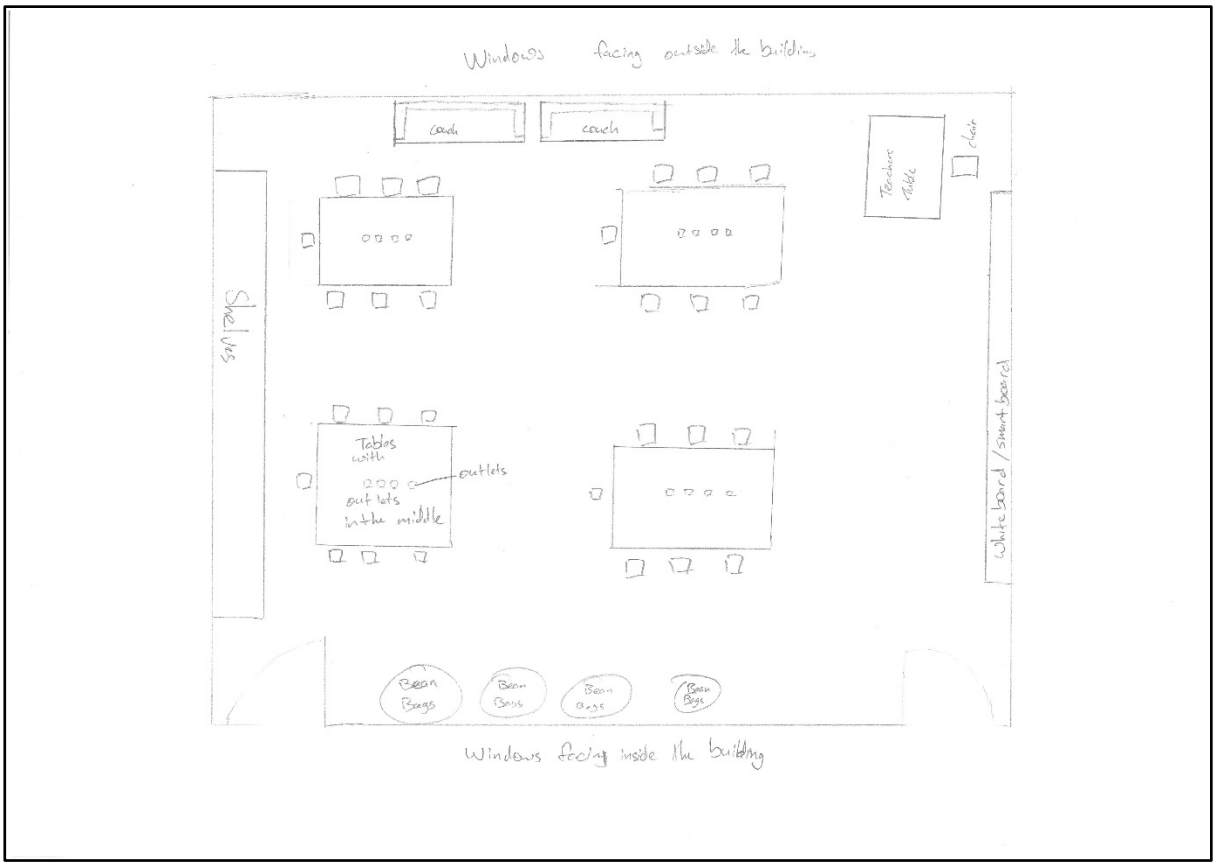
Ellen's drawing is a floorplan with detail of three walls in perspective drawn in pencil without the use of color. The fourth wall is not present in the drawing. Ellen describes shelves along one wall as "for put the bagepack [sic] and class material." On a second wall she notes a "screen" and "whiteboard." In an opposite corner from the boards, she describes the rectangles on the walls as "several student drawings." In that corner, she has drawn a "carpet" and "sofa[s]." The center of the room features four round tables with four chairs. In the center of the room is a circle with the words "teacher's desk."

Drawing #4: Robert



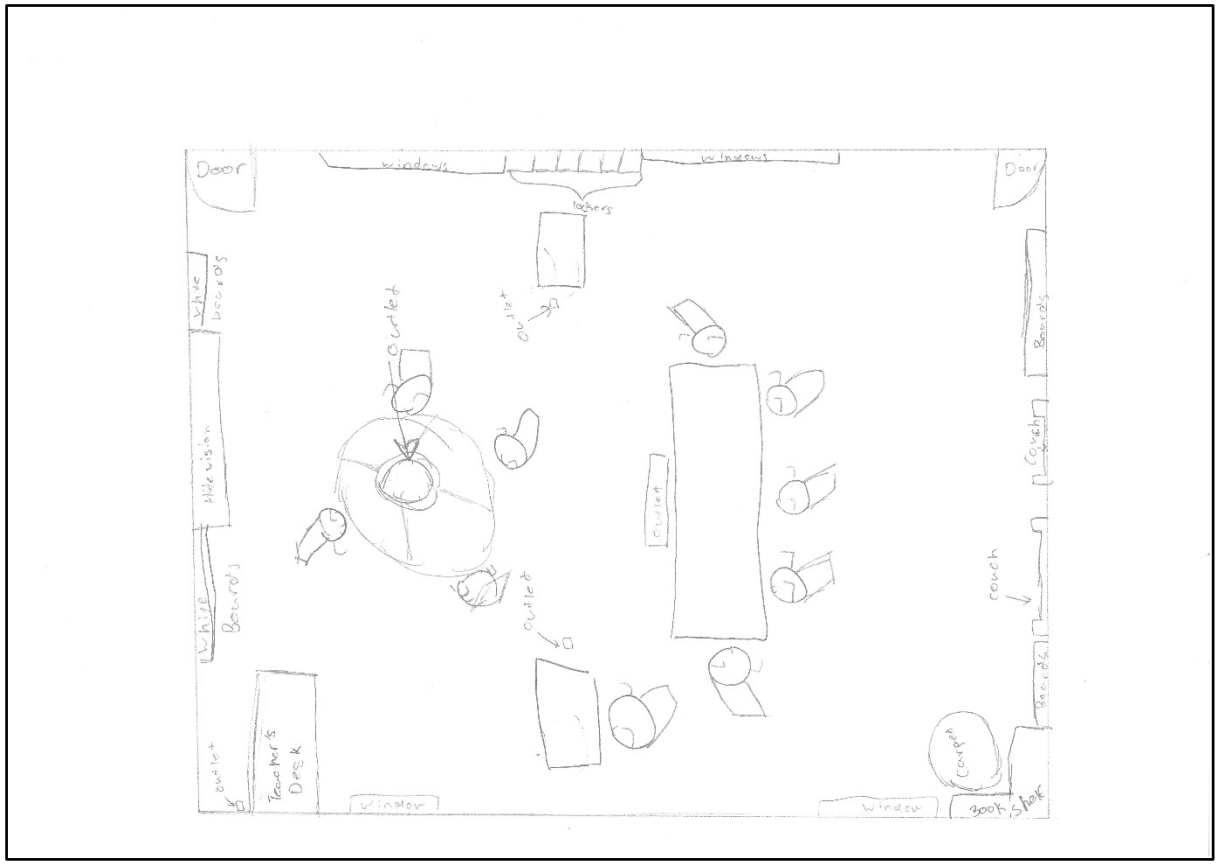
Robert's drawing is a small floorplan, using only a fraction of the paper provided. It is rendered in pencil without any coloration. The primary element of the drawing is a group of six table sets, each with four chairs. Each appears to be two tables pushed together. The desks are arranged in a linear fashion. Robert has drawn a small vase with flowers on each of these tables. In a far corner is the teacher's desk. There is a rectangle centered on a wall behind the teacher's desk which Robert indicated is a whiteboard. Next to this is a rectangle with a fishbowl.

Drawing #5: Bradley



Bradley's drawing is a floorplan design rendered in pencil with some descriptive words. On the wall labeled "windows facing outside the building" are two labeled "couches." On the opposite wall, labelled "windows facing inside the building," there are four circles labelled "Bean Bags." At the front of the room is a rectangle labelled "whiteboard/smartboard." Beside it is a "teacher's table" and 'chair." The remaining wall has a long rectangle labelled "shelves." In the center of the room are four large tables with seven chairs arranged around them. Each table has four outlets in the middle. One table labels these "outlets" and says "tables with outlets in the middle." The end of each table that is closest to the whiteboard/smartboard does not have a chair.

Drawing #6: Phillip



Phillip put a lot of detail into his floorplan, drawn in pencil and without color. There are several distinct areas drawn and labeled. Working clockwise, at the front are two whiteboards that seem to mimic the existing boards which slide in front of the smartboard, which he has labelled "Hide vision." The interior window wall has two windows, two doors, and an internal area labeled "lockers" on the middle of the wall. The back wall has two "boards" and two "couches." In the corner there is a cornered bookshelf and a circle labelled "carpet." Along the outside wall there are two windows and the "Teacher's Desk" in the corner with a labelled "outlet." In the middle of the room there are an additional four areas labelled "outlet." Power sources are an emphasis of this drawing. In the front of the room there is a circle of four desks and chairs with power at the center. On the sides there appears to be two individual desks, each

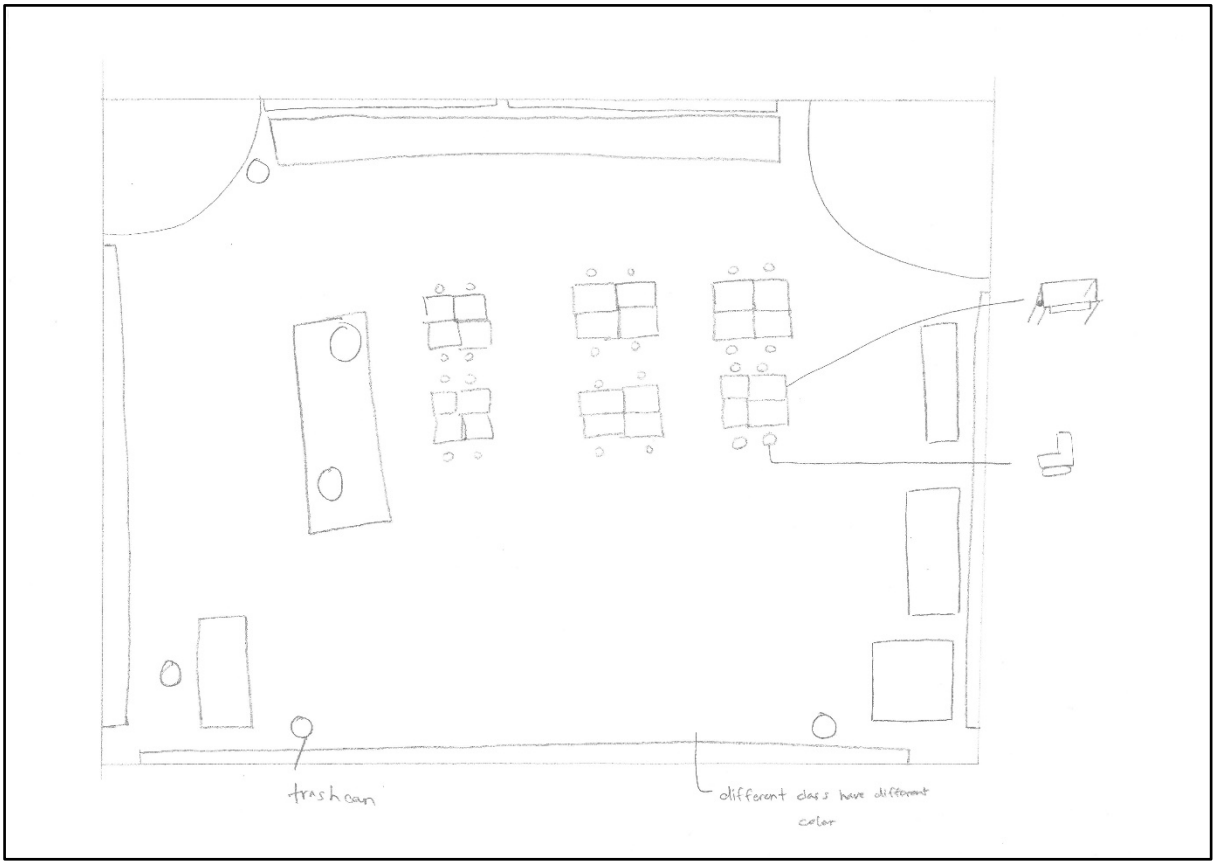
with additional outlets. Toward the back there is a long table with seating for five with an outlet rectangle, indicating that there are multiple outlets at this location. Of note is that there is not power indicated at the couches nor at the carpeted area.

Drawing #7: Sara

Sara's drawing is not a floorplan, but rather what seems to be a view of a wall or walls with furnishings in front. Sara uses some color for emphasis. In a rainbow pattern. Her emphasis in the drawing seems to be on two aspects: desks and walls. There are four desks drawn in a traditional linear layout. Though two of the desks don't face each other and are separated, she includes "ways to communicate" between them with cross arrows. She also labels books on top of the desk and a desk shelf within another labelled "Put Books inside." Of note is that the chairs at these desks have arms and taller backs. The walls in Sara's drawing are both

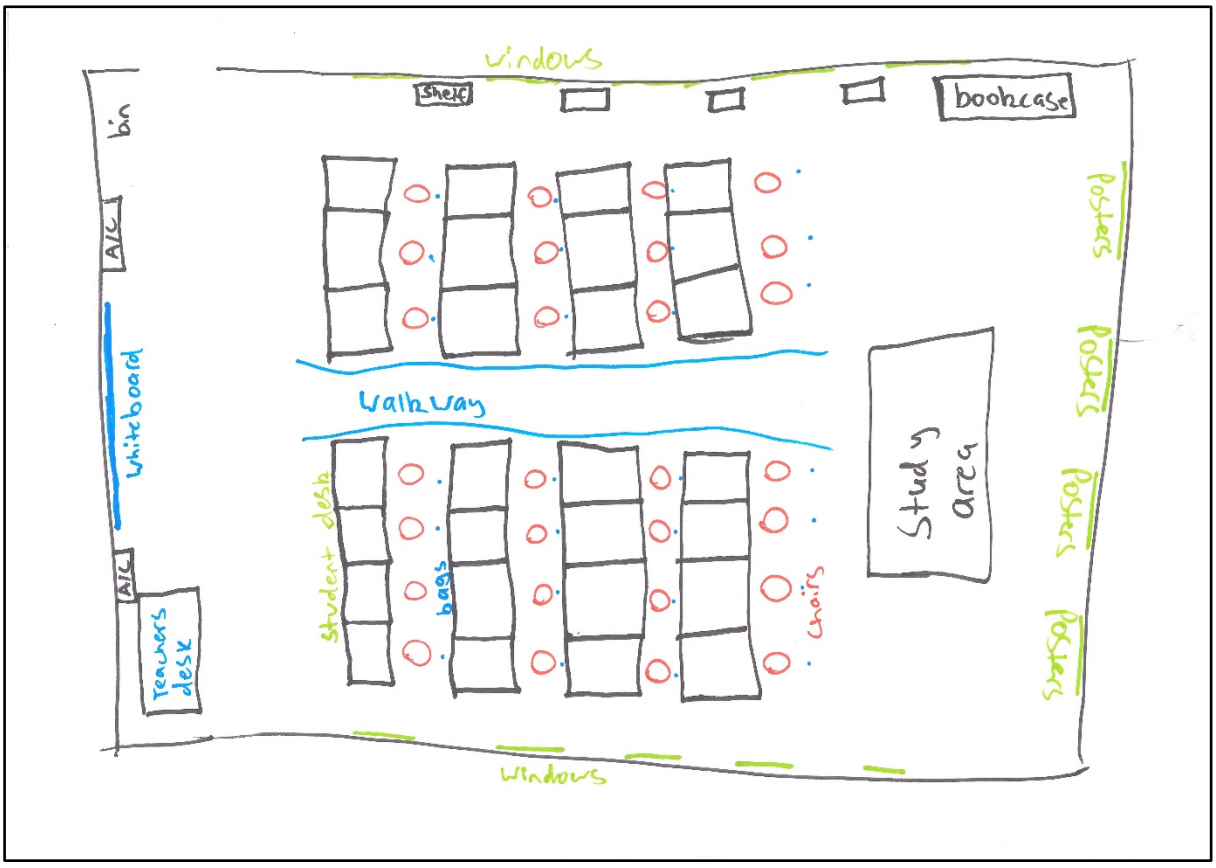
labelled and in one part colored. At the top four areas are defined. 1) “normal drawings of subjects” 2) what appears to be a representation of aspects of the “IB Learner Program” 3) a drawing labelled “map and 4) four small sheets labelled “By.” On the sides of the drawing are two walls. From the colorful one there is an arrow to the other pointing to a box saying “Same.” The rainbow colored wall features a flower, and some butterflies labelled “Pics.” The word “information” is also on the wall. On the opposite wall are the words “color,” “Pic,” and “Books” which is above what appears to be a shelf with some books on it. Sara shares a written statement front and center on the drawing: “i would like it to Be colorful or to have one color except white.”

Drawing #8: Maria



Maria's floorplan is drawn in pencil without color. There is little labelling overall, so the drawing is interpreted based on the researcher's knowledge of the existing classroom space. The hallway wall shows the swing of the two doors, two windows in the middle with what appears to be a bookshelf below. The front of the room has a thin rectangle which appears to be the existing whiteboard/smartboard, with a teacher's desk in its existing location. The exterior window wall shows a long rectangle which appears to indicate the windows. In the front of the room there appears to be a rectangular carpet and beanbags. Maria describes this area in this way during the interview. The back area has some rectangles which seem to be shelving or similar. In the back middle section there are six groups of four desks with four chairs. Maria has marked one desk and one chair with a pull out detail showing a side view of the chair and a 3-dimensional view of the desk. The chair seems to be cushioned with a low profile base, and the desk looks standard with a table shelf below the work surface. There are three small circles in the room, one of which is labelled "trashcan." Maria also notes on a wall label "different class have different color."

Drawing #9: David



David's floorplan drawing is rendered in colored markers of black, green, blue and orange. Windows are indicated on opposite walls. One has four shelves and a bookcase, as labelled. The back wall of the room is labelled with four "posters, while the front wall has a "whiteboard" two "a/c" units, and a "bin." In the corner is a "teachers desk." The student desks are arranged in a traditional manner, front facing to the whiteboard, four on one side and three on the other, with a labelled "walkway" between. Blue dots behind the student chairs are indicated to be "bags." Behind this area at the back of the room in a rectangle labelled "study area."