ABSTRACT

ALTINBASAK, ECE. Designing Schools for Future: Comparison of Teacher Attitudes and Preferences toward Classroom Environment (Under the direction of Celen Pasalar, Ph.D., Assistant Professor of Landscape Architecture).

Previous research suggests that the physical arrangement of classrooms is an important factor for learning. Classrooms can provide students and teachers with environment to accommodate innovative instructional activities and facilitate positive learning interactions. The design of classrooms and their shapes can also influence teachers and their decisions on instructional activities differently. However, classrooms are both physical and organizational units where there is a complex relationship between the built structures and their arrangement, teachers, students, and the distribution of the space. One of the difficulties of identifying conclusive research findings about the environmental factors that would promote better learning is the diversity in teachers and their attitudes, which has not been a focus much in environment-human behavior studies and literature related to classrooms.

The purpose of this study is to investigate the relationships between classroom environment teachers' current classroom arrangements (i.e. teacher-centered and student centered classrooms) and their classroom design preferences (i.e. expandable and variations of L-shape classroom designs) based on teachers' attitudes and behavioral outcomes. The outcome variables under investigation include teachers' motivation towards education; environmental response and awareness; teacher movement in classroom; furniture movement; motivational strategies; technology use; satisfaction with current classroom arrangement; teaching methods; and instructional area. The main purpose of this study is to understand how teachers behave in different classroom environments and what motivates

them to make changes in spatial arrangement. One of the most unique aims of this study is measuring teachers' environmental awareness and examining its associations with teachers' current classroom arrangements and design preferences. The Environmental Response Inventory (ERI) assessment instrument was adopted to help define and measure differences in the way teachers interact with the environment. Within a descriptive correlational research design, specific classroom arrangements and designs were selected to study the relationship between classroom environment, teacher attitudes and preferences. A survey questionnaire was the instrument used for data collection. In order to address the associations between the variables and answer the main research questions of the study, multiple analyses techniques were also used.

The results of the study revealed the relationships between teachers' current classroom arrangement (teacher-centered and student centered classroom environments); teachers' classroom design preferences (expandable and variations of L-shape classroom designs); and teachers' attitude and behavioral outcomes. The results further provide understanding on how teacher attitudes and behaviors differ in different classroom arrangements and what motivates them to make spatial changes in classroom settings. Future planning and design of these classroom spaces need to be based on behavioral processes that motivate innovative learning opportunities.

Designing Schools for Future: Comparison of Teacher Attitudes and Preferences toward Classroom Environment

by
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DEDICATION

This dissertation is dedicated to my grandmother, Serife Levent,

and her endless love.

BIOGRAPHY

Ece Altinbasak was born in Mersin, Turkey on October 15, 1987. She has completed a BLA in Landscape Architecture and an MA in Design. She is particularly interested in built environment-human behavior relations, ecological psychology, and design of learning environments. She has previously been involved in and conducted research studies related to architectural, environmental, and community design. In 2012, she was awarded the Fulbright scholarship and moved to the U.S. to pursue her Doctorate of Philosophy in Design under the guidance of Assistant Prof. Celen Pasalar, Ph.D. at North Carolina State University (NCSU) in Raleigh, North Carolina. During her participation in the PhD program, she has presented at numerous international environmental design conferences and worked as a Teaching and Research Assistant at the North Carolina State University, College of Design through assisting both research and practice-oriented graduate and undergraduate level classes. She has also worked as an Economic Development Analyst at the NCGrowth Initiative, University of North Carolina Kenan Institute of Private Enterprise through leading a funded project on innovation zones and art districts.

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CHAPTER 1 INTRODUCTION

1.1 Introduction

It is undeniable that education is critical the evolution of modern societies. However, there are factors that affect schools in various ways, such as social, political and technological movements. Unfortunately, the schools have failed to keep up with the changes and transformations and still mostly facilitate the educational attitudes and philosophies adopted from the past century (Baker, 2012).

Educational buildings, where teaching and learning activities take place, are also important part of the education system. School buildings serve not only as educational facilities, but also as an important asset of the community and as a source of dominant aspects of education (Moore & Lackney, 1994). But more importantly, the extent to which school buildings enhance education has become an important issue for policy makers, educators, and design researchers, where it is also seen as a major focus in the fields of architecture and education (Chaney & Lewis, 2007).

On the other hand, the previous research studies show that the quality of schools in the U.S. has decreased over the past years (Kozol, 1991; Lewis et al., 1989 as cited in U.S. Department of Education, National Center for Education Statistics, 2000). The physical

conditions and overall design of the schools are out-of-date affecting the quality of teaching, learning, as well as teacher motivation and student achievements (Filardo, 2008).

In the last few decades, calls have been made for educational reforms and school programs such as “A Nation at Risk”, “The New American Schools Development Corporation (NASDC)”, “EAI’s Alliance for Schools That Work”, which focused on developing curriculum and outcome-based education to improve the quality of schools in the U.S. (Chubb & Moe, 1991 as cited in Lackney, 1994). Subsequently, school buildings and classrooms have been deteriorating and struggling with overcrowding conditions. Most importantly there is a growing gap between educational programs and the design of educational facilities due to lacking the proper collaborations between school staff, teachers and designers (Lackney, 1994).

The needs in today’s education system raise several that require immediate attention - what kind of schools and classrooms would we like to have in the future and how should we improve the schools that we have today? Even though the structure of classes and the overall educational activities have been transforming globally, we still observe traditional classroom settings where students are seated in rows regardless of the teaching methods that the teachers engage in and the teachers’ interaction levels with students. Moreover, traditional classrooms are based on the concept that teacher is the only authority where students are not directed to see their peers as a source of learning or supported to interact and teach each other (Sharan, 1999).

However, ideally, learning should occur in an environment that can allow students to engage with the concepts that are being used by teachers with a maximum opportunity. This approach promotes the idea that students should become a part of the teaching practice in classrooms, rather than being passive receivers. In addition, it is important to have a broad sense of communication in classroom environments. It is teachers' task to create an environment for students for "the collision of reflections" that will eventually lead to students' skills and intelligence to express their opinions and develop outcomes forming bases for knowledge building. Therefore, teachers' role in classrooms and their interaction with students through their attitudes and motivational strategies play a crucial role in the overall teaching-learning process (Turner, 2007).

1.2 Overview of Concepts of Schools and Educational Trends

The history of schools in the United States may not give us the answers to the current concerns directly, but can provide a basis to show how architectural design and layout of schools are assciated with the evaluation of educational trends, pedagogical changes, curricular missions, teaching methods, and cultural values (Schools for the future, 2009). Therefore, in order to better establish an understanding of schools for future, a brief overview of the educational trends and concepts of schools in the United States is essential. This review provides an explanatory and useful basis for future research presenting how educational trends and concepts of schools aimed as well as shaped the changes in school buildings.

According to Lippman (2010) the history of school design can be mainly categorized under six periods demonstrating what kind of trends, and innovations framed the concepts and how the physical environments were designed to enhance the pedagogies behind the movements in the twentieth century (see Figure 1-1).

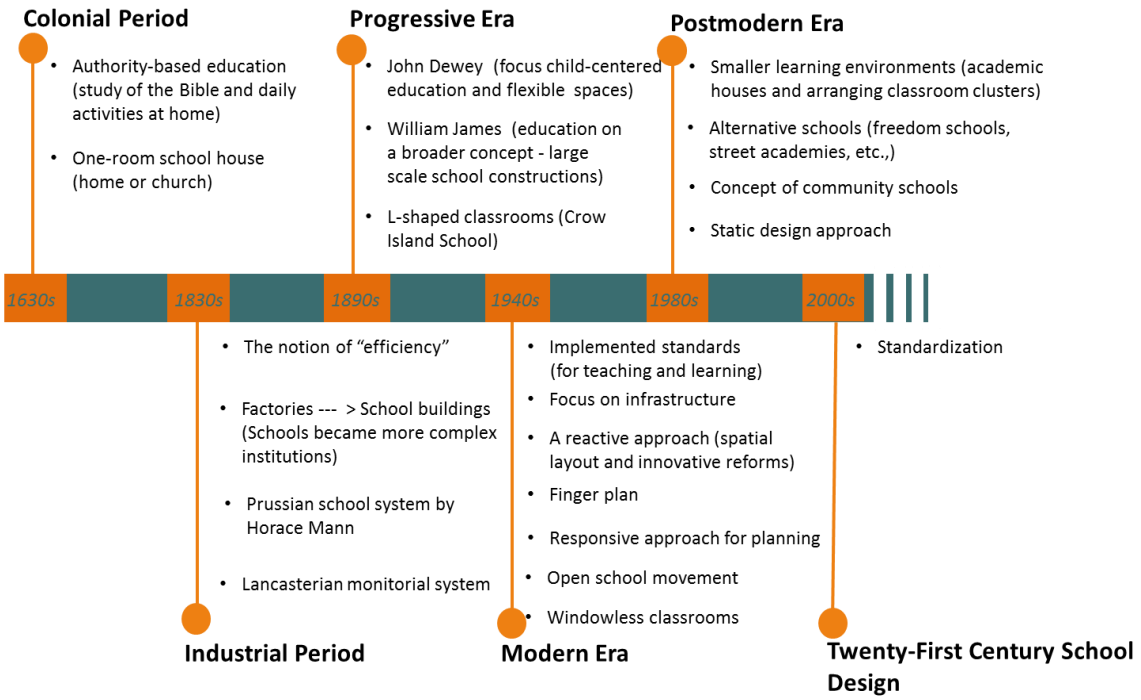


Figure 1-1: Overview of Concepts

In order to understand the purpose and the evaluation process of today's classrooms and their semantic and functional positions in the past, below is a brief summary of the periods where we can follow the concepts and changes chronologically.

Colonial period (1630s-1830s): Through coming from a colonized and agrarian society, this period shaped formal learning environments in which the form of education was based on delivering directly the information directly from teacher to student. The goal was to teach children a trade or a skill (Tanner&Lackney, 2005 as cited in Lippman, 2010) based on the notions of discipline and order (Finkelstein, 1975). The form of education in the colonial period was built upon the authority and had a definite practice of instruction in which students were not expected to interpret and give their point of views about what they were taught. Instead, they were only required to memorize the entire text, which was mostly about religion (Spring, 1986). Accordingly, public education during this period was usually taking place in church or home whereas the private education was only for the nobles. Since children at that time were expected to support their families, the primary focus of this period was teaching daily activities of home in one-room schoolhouses in which children used to spend only a few hours depending on their daily housework. There was limited interaction among the students, since they were expected to abandon all their spontaneity but just listen to the authority in the classroom, whereas collaboration was prohibited and accepted as cheating. Children were being punished for such activities (Finkelstein, 1975). Consequently, those learning facilities were organized like churches, where the form of classroom arrangements was based on arranging the chairs and desks in rows and also were barred to the floor in the classrooms (Bissell, 1995 as cited in Lippman, 2010).

Industrial Period (1830s-1890s): As a result of the industrial revolution and rapid development of factories, this period represents the concept of “efficiency”, which eventually

influenced the design of school buildings as well. Based on the notion of "manufacturing", the form of education was heavily criticized by some of the educational reformers such as Henry Barnard, James Carter, and Horace Mann, who advocated that free public education was a fundamental task of the country in order to achieve a strong economic progress (Reese, 2011).

During the early nineteenth century, the charity school movement and juvenile reformatories emerged as part of the general movement of reducing crime and poverty through the idea that educational institutions can solve the problems of society. The charity school movement was considered as the first-main approach that accepted schools as a mechanism to prepare and socialize children into an industrious way of life. Charity school movement also created a basis for another movement called *the common school reform* (Spring, 1986).

In consequence, "*the common school*" movement emerged from the needs of educating children in schools or churches that aimed to prepare and adapt them to the new industrialized environment by gaining better skills in a more formal way. Subsequently, as the cities expanded, the need for larger educational spaces arose and the "*Lancasterian monitorial system*" was pursued. As a result, children were started to be educated massively in urban areas (Bissell, 1995; Rieselbach, 1992; Rivlin&Wolfe, 1985 as cited in Lippman, 2010).

Lancasterian monitorial system was introduced by Joseph Lancaster in 1798 in England and it was accepted as revolutionary for its time. The main idea behind this system was grounded in the organizational structure that supports the idea of massive public education by employing older and more experienced students as "*monitors*" in order to instruct the other students in the classrooms. This movement has been considered as one of the milestones in the history of US schools (Rayman, 1981). As a result, school buildings became more compounded environments keeping up with not only the growing mass of students but also the pedagogical changes in education, whereas there was a clear shift from teacher-based education to a more interactive form of teaching. Furthermore, with the development of the "Prussian school system" by Horace Mann, the idea of graded classrooms emerged based on the growing notions of age difference and developmental abilities among students (Lippman, 2010).

Progressive Era- Responsive in Idea and Reflexive in Education (1890s-1930s): During the late 19th century, a progressive movement emerged in Europe, as well as in the US as a result of a general critique of the public education. This concept was based on a child-centered education arguing that needs of states, church, or the economy should not be leading factor in shaping a child's development. This progressive movement in education was followed by the educators such as Friedrich Frobel in Germany, Maria Montessori in Italy, and John Dewey in the United States (Walden, 2009). As one of the major influences of progressive movement, educators started to think that educational programs needed to fit children's needs rather than children fitting the program (Pasalar, 2002). This new movement

also brought the idea of interaction, hence children learning from each other as well. Therefore, participation became an important aspect of the education. The concept of flexibility (referring to the way that teachers and students manage their interactions) was introduced and the school structures were used to provide more stimuli to students to have more choices while working on tasks. During this period, the idea of L-shaped classrooms (Crow Island School) and large scale school constructions were introduced (Lippman, 2010).

Modern Era (1940s-1970s): During the modern era, implemented standards for teaching and learning with a focus on schools' infrastructure, a reactive approach emerged promoting new spatial layouts, windowless classrooms and innovative pedagogic reforms (Lippman, 2010). One of the most important innovations was the open-school movement, a concept that influenced the design of schools from the late 1950s to 1970s. These schools were planned with large, open and flexible spaces, which were adaptable to team teaching and small-group instructions. However, this movement failed as soon as it began to be implemented due to noise, visual distraction and similar affects (Walden, 2009).

Postmodern Era (1981-2000): During this time period, the concept of smaller learning environments (i.e. academic houses with classroom clustered around the common areas), alternative school to public schools (freedom schools, street academies, etc.,), concept of community school, and static design approach rather than seeing places as dynamic transactions emerged. During this period, teachers were still not aware of how to organize

their classrooms were not educated to learn how arrange their classrooms that would foster teaching and learning process (Lippman, 2010).

Twenty-First Century School Design: Conceptually, today's education is based on standardization of the curriculum as well as the school buildings. However, this standardization does not acknowledge that schools, children, and communities of practice are not analogues (Gardner, 1999; Ogbu, 1987; Sutton, 1996 as cited in Lippman, 2010). Because within each different context (such as suburban or urban) each school environment operates differently and has its own unique characteristics (Lave & Wenger, 1991; Wertsch, del Rio & Alvarez, 1995 as cited in Lippman, 2010).

In summary, although some educators and developmental psychologists acknowledge that effective learning occurs from activities when students and teachers work collaboratively (Dewey, 1956), schools have failed to keep up with the contemporary changes and transformations to contemporary concepts and movements. Instead, the schools continued to educational attitudes coming from the past century (Prohansky & Wolfe, 1975; Lewis et al., 1989; Kozol, 1991; US Department of Education-National Center for Education Statistics, 2000; Wagner, 2000; Chaney & Lewis, 2007; Baker 2012).

1.3 Physical Arrangement and Spatial Layout

During the early 1950's psychologists and other behavioral scientists began to show increasing interest in the relationships between built environment, human behavior and

experiences. Through the development of the field of ecological psychology, research in classroom design started to pay attention to how classrooms function. The literature shows that the spatial arrangement and layout of classrooms have an influence on social interaction of both teachers and students, are important factors in implementing educational goals, communicate a symbolic message what is expected to happen in a particular place, and can communicate expectations of behaviors (Prohansky & Wolfe, 1975; Riwlin & Winstein, 1984; Gump, 1987).

1.4 Overview of Environment-Behavior Studies in Classroom Design Literature

Even though human beings have always been examining their environments since the dawn of history, employing research as a tool for designing better educational buildings is relatively a new approach. Early research efforts in 1930s showed the impact on educational buildings focusing on school lighting and ventilation. Research efforts later became more comprehensive in time and started to focus on different issues related to educational environment (McGuffey, 1982).

In the early 1950s, the relationships between the properties of physical settings and human behavior and experience were studied by behavioral scientists and psychologists representing a new field, which were known as “architectural psychology”, “environmental psychology”, and “ecological psychology”. The origins of this focus area can be tracked down to the seminal studies that took place in the late 1950s and 1960s (e.g., The Hidden Dimension,

Function as the Basis of Psychiatric Ward Design, Image of the City, Notes on the Synthesis of Form, One Boy's Day, and so on) (White, 1979).

Through this new approach, the field of architecture started to recognize the psychology of physical structures and architects began to acknowledge that the form and appearance of a building could influence certain behaviors that take place in when considering the occupants as active players of the environment. As a result, it has been widely accepted that physical settings such as schools, classrooms, libraries, offices and others define and shape the patterns of behavior (Ittelson, 1974). Through the development of environment-behavior studies, it was also claimed that behavior in an environment will be influenced by our awareness of the setting and the need to adapt to it. Therefore, not only the physical setting itself, but also the users' awareness can change the function of use of the space and values (Ittelson, 1974).

The following chapter provides an extensive overview of the literature on classroom environment, behavior, and teacher attitudes. Previous research evidences are reviewed and gaps in the existing literature are outlined. The third chapter provides the conceptual framework for the study and further elaborates the theoretical foundation used for the research explaining the purpose of the study, and the research questions. The fourth chapter presents the methodological framework of the study through explaining the research strategy, sampling and target population, data collection tools, analysis strategies, description of variables and data preparation. The fifth chapter reports the findings. A summary of the

major findings are further discussed in relation to the study's research questions in chapter six. The study concludes with a discussion of the findings and their implications, future prospects, and directions for future research.

CHAPTER 2 LITERATURE REVIEW

This chapter aims to provide an evaluative report of studies found in literature related to the subject areas of this study and establishes a context and theoretical basis for the research. Literature that relates to this study can be grouped under three main categories. The first category focuses on school design and the use of space in relation to activity patterns informing how spatial organization influences certain factors and variables. The second category focuses on classroom environment informing which classroom settings enhance interaction between students and teachers. This section also provides further understanding on the relationship between space and learning and how physical environment can improve the learning environment by preventing problem behaviors before they occur. The final section of the literature focuses on practice of teachers providing information on how certain teacher attitudes and characteristics (such as motivation, environmental response and awareness, technology use, motivational strategies, and instructional area) are associated with physical environment.

2.1 Design of Schools and Research

Schools are complex environments with a range of people, including students, teachers, and staff, within a physical setting that includes the building as a whole, outdoor spaces, classrooms, which help shape the organizational structures including timetables, curricula and management (Woolner, 2015). School settings provide the environment that aims to

achieve the educational goals, facilitate formal/informal intergroup processes including academic activities, communication, and movement patterns occurring within and through spaces (Pasalar, 2003). Previous research reveals which aspects of physical environment can interfere with learning without suggesting solutions. Because sometimes improvements suggested for different elements can conflict with each other. For instance, ventilation to improve air quality contributes to poor classroom acoustics; but more often they do not fit with more specific educational purposes as when open shelving to encourage independent learning threatens air quality through becoming dusty (Woolner and Hall, 2010 as cited in Woolner, 2015; Stringer, Dunne, & Boussabaine, 2012).

Therefore, in order to better understand how schools and their design as physical settings contribute to educational activities and processes, Woolner (2015) argues that cross-disciplinary and interdisciplinary understandings are necessary drawing perspectives from both architecture and education. Review of previous research studies about educational facilities reveals that physical attributes directly or indirectly influence individuals' activities, movements and interactions. Therefore, there is need to explore the dynamic interactions between the behavioral characteristics of users and physical aspects of school environments.

2.1.1 Activity Patterns in School Environments

In most general terms, school environments include different activity settings, which are systematically connected and afford a series of behavior. Each activity setting has distinct relationships to one another, to the overall physical environment, and to behavioral,

educational and social structure of the school community. Depending on the settings' features and spatial relations with each other certain behavior occurs frequently and continuously with the definition of the boundaries enclosing a setting. Some environments cultivates limited access through well-defined boundaries between settings allowing specific activities to occur, while some combine the places where sights overlap to advantage advancing easy access and allowing different types of activities to occur (Bechtel, 1977; Pasalar, 2003).

Due to the deliberate and goal-oriented nature of schools, activities are divided into a set of specialized units to achieve optimal learning and interaction for students. Schools compose subsystems, such as grades, teams, and individual classroom units. In order to maintain a continuum in educational activities, each school develops both formal and informal mechanisms that tie these subunits together. These mechanisms become the model of the activity system by forming the transactional environment for each of the subunits. The curricular processes provide the flow of activities, paths of communication, the means of collaboration among teachers, and the channels of monitoring for both teachers and students. In respect to today's changing demands and societal needs, it is necessary to consider the dynamic nature of schools in terms of their spatial definitions and educational process. Generally the school administrations figure how the social environment will shape like in schools by controlling the activities taking place within the spatial boundaries. They distribute activities spatially and designate areas in which the activities are to take place.

Each of these processes constructs the activity system of schools both temporally and spatially (Moleski and Lang, 1986).

2.2 Classroom Environments

Although researchers from different backgrounds may conceptualize the classroom space differently, they often share one thing in common that they classrooms as a site for solving problems where teachers and children are emancipated in order to make students more effective learners (Smeyers, 2013). It is also important that the classroom environment is a direct expression of the educational philosophy and it takes an active part in the educational process (Proshansky & Wolfe, 1975). It also has a preconceived cultural image (David & Wright, 1975) and this image is embedded in our society (Martin, 2002). However, they are complex environments including different dimensions and variables (See Figure 2-1).

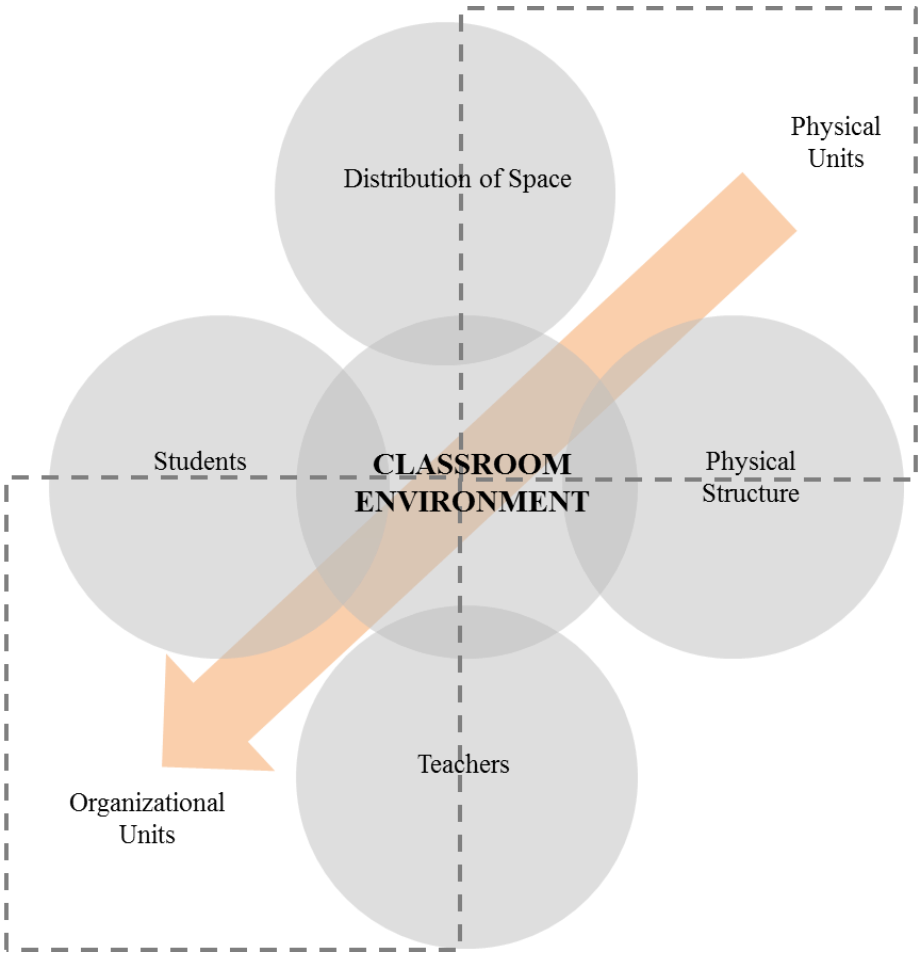


Figure 2-1: Main units of classroom environment

In the literature, there is a difficulty of identifying conclusive research findings about the environmental factors related to classrooms that would promote effective teaching and learning, for a number of reasons (Martin, 2006):

- Lack of agreement about the nature of effective learning and how this may relate to the appearance of hard work and concentration.

- Lack of agreement about relevant factors or processes in the learning environment', and difficulty in understanding how they interact (for example, the factors included in different studies of class- room environments range from physical conditions and resources to social groups and relationships, curricular aims and activities, time-tabling, teaching strategies, values, images, rules and routines).
- Difficulty in measuring learning processes and outcomes (leading to a tendency to focus on students' observable behavior, such as time on task).
- Variability in the physical aspects of school environments.
- Diversity in students (their preferences and educational needs as well as personal characteristics like age and gender).
- Diversity in teachers: their preferences, personal characteristics and teaching styles.

2.2.1 Space and Learning

Review of the previous research demonstrates the absence of the link between the physical learning environment and student learning (Woolner, McCarter, Wall, & Higgins, 2012; Woolner et al, 2007; Higgins et al, 2005). While it is assumed that the physical environment impacts learning (Durán-Narucki, 2008; Kumar, O'Malley, & Johnston, 2008), it is still difficult to directly demonstrate the relationship and claim that better environments produce better learning. Previous contradictory and inconclusive research evidence, as well as contemporary experiences of school settings, show that the relationship between education and physical environment is both complex and interactive (Woolner, McCarter, Wall, &

Higgins, 2012; Gislason, 2010; Higgins, Hall, Wall, Woolner, & McCaughey, 2005; Saint, 1987; Weinstein, 1979).

Interactions between the settings occur in both directions, with the ability of the users to make positive changes to their environments influencing the quality of the learning experience. Architect Sandra Horne-Martin (2002, 2004a, 2004b, 2006) has researched and written about this aspect of use of the school environment, and argues that education and training are necessary in order to empower teachers to alter their classrooms to suit their teaching. However, the physical adequacy of the premises, together with the school-level factors such as student behavior, attendance and levels of achievement, influence how likely teachers are to try or, more importantly, to succeed in fitting their classroom spaces to their pedagogical goals. The challenge for research in this area is to understand how attributes of the physical setting for learning interact with characteristics of the school community to create environments that are more or less successful in terms of student and teacher satisfaction and student learning. One of the under-researched aspects of learning environments is how much space is available - the classroom area provided and the number of students accommodated. There has been substantial research studying the impact of class size (in terms of the number of students) on learning. However, US researcher Lorraine Maxwell points out, ‘less attention has been paid to spatial density, amount of space per person’ (Maxwell, 2003). There are in fact suggestions related to the impact of reduced space on classroom activities, attitudes, attainments and social relationships among students. It has been found that a crowded setting is likely to be noisier and more difficult to ventilate,

presenting problems that can interfere with learning (Woolner et al, 2007; Woolner & Hall, 2010).

2.2.2 Spatial Layout and Its Effects on Academic Outcomes

The spatial structure of the classroom refers to how students are seated, where the students and teacher are in relation to one another, how classroom members move around the room, and the overall sense of atmosphere and order. The research on classroom environments suggests that classrooms should be organized to accommodate a variety of activities throughout the day and to meet the teacher's instructional goals (Weinstein, 1992; Savage, 1999).

In addition, the classroom should be set up to set the stage for teachers to address the academic, social, and emotional needs of students (MacAulay, 1990). The standards for determining which spatial layout is most appropriate to fulfill these functions include ways to maximize the teacher's ability to see and be seen by all his or her students; facilitate ease of movement throughout the classroom; minimize distractions so that students are able to actively engage in academics; provide each student and the teacher with his or her own personal space while ensuring that each student can see presentations and materials posted in the classroom. Arranging the physical environment of the classroom is a way to improve the learning environment and prevent problem behaviors before they occur. Research on the classroom environment has shown that the physical arrangement can affect the behavior of both students and teachers (Savage, 1999; Stewart & Evans, 1997; Weinstein, 1992), and that

a well-structured classroom tends to improve student academic and behavioral outcomes (MacAulay, 1990; Walker, Colvin, & Ramsey, 1995; Walker & Walker, 1991). In addition, the classroom environment acts as a symbol to students and others regarding what teachers value in behavior and learning (Savage, 1999; Weinstein, 1992).

Most researchers agree that well-arranged classroom settings reflect the following attributes:

- Clearly defined spaces within classrooms that are used for different purpose and that ensure students know how to behave in each of these areas (Quinn, Osher, Warger, Hanley, Bader, & Hoffman, 2000; Stewart & Evans, 1997; Walker, Colvin, & Ramsey, 1995; Walker & Walker, 1991). For instance, classrooms will contain a high-traffic area around commonly shared resources and spaces for teacher-led instruction or independent work, such as rows of desks. A classroom for students with learning/behavior problems may have separate quiet spaces where a student can cool down or work independently (Quinn et al., 2000; Walker, Colvin, & Ramsey, 1995), include personal spaces that each student can call his or her own (Rinehart, 1991; Quinn et al., 2000), and provide areas for large and small group activities that set the stage for specific kinds of interactions between students and teacher (Rinehart, 1991; Walker, Colvin, & Ramsey, 1995). There may also be spaces to store items, computers, or audio-visual equipment.
- Seating students in rows facilitates on task behavior and academic learning; whereas more open arrangements, such as clusters, facilitate social exchanges among students (MacAulay, 1990; Walker & Walker, 1991).

- It is useful to strategically arrange the classroom to limit student contact in high-traffic areas, such as the space surrounding the pencil sharpener and wastebasket, and instructional areas; and, to seat easily distracted students farther away from high-traffic areas (Bettenhausen, 1998; Quinn et al., 2000; Walker, Colvin, & Ramsey, 1995; Walker & Walker, 1991).
- All students should have a clear view of the teacher and vice versa, at all times (Quinn et al., 2000; Rinehart, 1991; Stewart & Evans, 1997; Walker et al., 1995; Walker & Walker, 1991; Wolfgang, 1996). In addition, the traffic pattern in the classroom allows the teacher to be in close physical proximity to all students (Shores, Gunter & Jack, 1993; Wolfgang, 1996).
- There is some evidence that it is useful to limit visual and auditory stimulation that may distract students with attention and behavior problems (Bettenhausen, 1998; Cummings, Quinn et al., 2000).
- There is good reason to strategically place students with special needs or behavior problems in close proximity to the teachers' desk (Bettenhausen, 1998; Wolfgang, 1996). Shores and his colleagues (1993) recommend that this should be done not only to monitor student problem behaviors, but also to facilitate teacher delivery of positive statements when compliant or otherwise appropriate behaviors are exhibited.

In summary, the literature shows that it is important and advantageous to have classroom that are orderly and well organized (Bettenhausen, 1998; Stewart & Evans, 1997 as cited in Kaser, 2007).

2.2.3 The Relationship between Educational Approaches and Design of Learning Facilities

School environment consists of social, cultural, temporal, physical (both built and natural) aspects, as well as real and virtual environments (McGregor, 2004). Different types of practices, instructions, and interactions, on the other hand, can change the nature, use and experience of learning environment. These relationships and the practices of teaching and learning mediated in learning spaces have been found to have an important effect on learning outcomes through the complex relationships of teaching (Oblinger, 2006).

According to Blackmore et al., (2010), the main assumptions that build the design disciplines of learning facilities can be summarized as follows:

- Educational objectives and practices have fundamentally changed from the teacher-centered 20th century factory model and therefore learning spaces must address the educational needs of learners in the 21st century (Chism, 2006; Fisher, 2002; Temple, 2007). The relationship between space and identity formation is embedded historically in environmental psychology principles (e.g. Good and Adams 2008, Carter 2006, Ferrer-Wreder et al 2008), and more recently around issues and notions of personalization.
- Design principles are open to the re-interpretation according to the cultural context as typical school buildings and classroom layouts symbolize culturally specific understandings and philosophies of education as well as to resource distribution

(Bateman, 2009), for example, the Reggio Emilia's notion of the 'environment as the third teacher'(New, 2007; Rinaldi, 2006).

- Changing learning spaces based on the above principles will have subsequent effects in influencing teacher pedagogies and therefore student learning (Oblinger, 2006; Sanoff, 1995; DEECD, 2009; Flutter, 2006). In other words, good design leads to good teaching practices and improved learning because the quality of the building design has flow on effects on teacher and student behaviors, morale and practices and therefore learning outcomes.

In the literature, there are three progressive approaches that can represent best relationship between educational methods and the design of learning places; Reggio Emilia (Diana School), Montessori, and Waldorf (Steiner) schools as they relate to shaping the classroom and school environment.

2.2.3.1 Educational Philosophy of Reggio Emilia and Design Disciplines

In most general terms, this concept represents a collection of schools for young children in whom each child's intellectual, emotional, social, and moral potentials are carefully improved, refined, and guided. The school system that developed based on Reggio approach have become one of the most innovative movements in education through its assumptions, curriculum and pedagogy, the method of school organization, and design of the physical environments as well over the past 50 years (Edwards, Gandini, & Forman, 1993). One of the main emphasis in this approach is perceiving children as unique subjects with own rights rather than simply needs, and having people as resources to not simply resolve or answer

questions, but rather to guide children observe and explore answers. Furthermore, the Reggio approach is based on the philosophical viewpoint that all knowledge derives from the process of self-and social construction; therefore establishing communication structure in the social system in the school is crucial (Rinaldi, 1993).

The key notions, which are inherent in Reggio approach, can be summarized as follows:

- The image of the child: This notion represents an educational belief that children have unlimited potential to learn and are driven by curiosity and imagination, when they are valued, listened, and loved. Valuing children through listening, and giving them time and space to express themselves can be seen as the essential attribute of the Reggio approach, in which this attribute is called "pedagogy of listening" for a better understanding of the learning process (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006).
- The expressive arts in the pre-school establishment: This notion expresses the importance of using arts as a tool for learning through daily detailed drawing activities where students are also engaged in expressive exercises such as sculpture, dramatic play, shadow play, dancing, music, ceramics, constructing, writing and so on. It is accepted that, inherently, young children are artistic enough with a full capacity for sharing their perceptions and feelings. Their imagination also operates as a major part in child's exploration for knowledge and understanding (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006). This conception in the Reggio approach along with the idea of image of the child created and shaped one other important aspect of the approach, "atelier". This

idea was guided through the belief that every child is a creative child, full of potential with the passion to create in many ways through using many languages where they can explore in ateliers with diverse materials and sources (Gandini, 2005).

- Progettazione: In most general terms, this key element represents the notion of "emergent curriculum" or "child-centered curriculum" (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006). Rather than establishing the curriculum in advance, in emergent curriculum, teachers are expected to express general objectives and make assumptions about what direction the activities and projects might take in order to be prepared appropriately. However, the curriculum is developed and materialized in the process of each activity and/or project and should be adjusted flexibly when needed (Gandini, 1993) and it continues to emerge as the children learn and grow (Finegan, 2001).
- Community and parent–school relationships: This aspect represents the Reggio educators understanding of learning and teaching, as it is defined as "pedagogy of relationships", which can be traced through the key role given to participation at every level; both within school between children and also outside of the school between families and school and the community as well (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006). According to Reggio approach, education needs to occur in a sense that each child is seen in relation to other children, family, teachers, the school environment, community, and society (Gandini, 1993). Other than defining "developing relationships" as a goal in this approach, collaboration among children also refers to

how children get along with each other in a social sense as well (Krechevsky & Stork, 2000).

- Environment: One of the most important aspects of the Reggio approach is the creation and use of the physical environment. The basic principles of physical space in Reggio schools can be best described as a series of linked spaces that are connected to each other, with a maximum opportunity for children to move without restrictions (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006).
- The most distinguishable features of physical environment in Reggio schools are: (1) piazza (the central meeting places where children share their play and activities, and collaborate), (2) mirrored interiors (to represent the philosophy of “seeing oneself”), and (3) ateliers where children work in the art studios with a professional artist called atellerista (Abbott & Nutbrown, 2001). Since schools are multi-sensory environments, creating environments, which allow children to engage with different materials and textures is also an important feature of physical environments through “aesthetic codes”. The term "aesthetic codes" comes from Rosario and Collazo (1981) who looked at the kind of children's artwork valued by teachers in two preschool classrooms. Rosario and Collazo elaborate on Pierre Bourdieu's study on the sociology of perception in which Bourdieu described aesthetic perception as a social construction that is learned either consciously or unconsciously (Tarr, 2001). In Reggio approach, pedagogues accepted aesthetics as a stimulating promoter in teaching and learning, and the classrooms of Reggio have become a source of

aesthetic inspiration in the design of early learning facilities which were followed in both U.S. and Canada (Vecchi, 2010 as cited in Apps & MacDonald, 2012). The outdoor spaces, on the other hand, should encourage children to create a link between the indoor and outdoor spaces helping them to understand what is happening "on the outside" (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006).

- Teachers and documentation: Cooperative working is one of the most important aspects of Reggio approach where teachers work in pairs, each pair of co-teachers is responsible for a small group of students (Abbott & Nutbrown, 2001). In Reggio approach, teachers have the opportunity to interact and collaborate with both each other and professionals such as artists and scientists (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006). One other important aspect related to teachers is that it is teachers' responsibility to document children's experiences in the classrooms through taking notes, making observations, and recording conversations among children systematically as a basic-usual activity (Finegan, 2001).

Reggio approach suggests that all knowledge derives from the process of self-and social construction. It is also necessary for the teachers to create a personal communication with each child and establish this system and/or network of relationships in the social system within the school (Rinaldi, 1993).

Education, in Reggio approach, is seen as a part of a larger ecological system. Therefore, school are expected to create an environment with opportunities for teachers to interact with both children and other teachers as well. Since the relationships and communications can be promoted through layout of school setting, which unifies and arranges all the elements (such as light, air, plants, colors, textures, open space, and etc.), this approach, in fact, acknowledges the built environment as the “third teacher” (Edwards, Gandini, & Forman, 1993; Finegan, 2001). Therefore, the physical environment of the classroom and the school itself becomes an important element in Reggio approach, rather than perceiving classrooms as a room, which simply contains desks and chairs. Based on the literature review, the design principles of Reggio approach that shaped classroom environments can be summarized as follows:

- Using "transparency" in the physical environment by using transparent materials allowing natural light (Apps & MacDonald, 2012)
- Having diverse materials in terms of color and texture (Edwards, Gandini, & Forman, 1993; Finegan, 2001; Tarr, 2001).
- Creating a central meeting space and mini ateliers in the classroom (Edwards, Gandini, & Forman, 1993; Abbott & Nutbrown, 2001).
- Connecting the outside-open space with classrooms (Valentine, Scottish Consultative Council on the Curriculum, & Learning and Teaching Scotland, 2006; Apps & MacDonald, 2012).

- Organizing and arranging the learning settings in classrooms based on experiences, which are particular to the environment through the heuristic approach of documentation.
- The classroom environments should be flexible enough in terms of layout and arrangement so that the children can move freely and explore the tasks and materials without restrictions. However, it has been found that conventional and/or traditional classrooms are difficult to meet these expectations. Because traditional classrooms are designed to enhance teacher or authority-based teaching model, this supports an archetype that forms and conceptualizes teachers as a source that performing on "the stage" where students are seated in rows and facing the front wall and the teacher. Therefore, the inherent message that those traditional classrooms deliver to both students and teachers drives the function in the classroom and play an important role in the overall teaching and learning process (Apps & MacDonald, 2012). On the contrary, educators in Reggio schools pay great attention to what the physical environment affords, and teach children in classrooms where they call the physical environment as the "third educator" (Gandini, 1998 as cited in Tarr, 2001).
- Other than the thoughts on classroom layout, giving flexibility to children to allow them to make changes in the material and furniture sorting and/or arrangement are also found to be important design implications in the Reggio approach (Gandini, 1999; 2005).

In summary, Reggio approach has shown how interaction and collaborations between children, teachers, atelieristas (artists), parents and the community in early childhood can have a powerful influence on all learning that occurs in classrooms, whereas certain physical aspects of the classroom environments can support and enhance the overall learning process through increasing children's awareness and can provide places for wonder, curiosity, and the expression of ideas (Tarr, 2001).

2.2.3.2 Educational Philosophy of Montessori and Design Disciplines

In most general terms, the Montessori education is a child-centered educational approach based on scientific observations and experimentations of children from birth to adulthood. The materials used by Montessori emphasize the sensory discrimination to improve the cognitive achievements of children with mental retardation, which led to the development of a full activity-based educational program for children from birth through age 12 (Lillard, 2011). The main purpose of Montessori education is to raise children and offer them freedom without anarchy, and discipline without rigidity. One of the main aspects of Montessori education is that the education should fully develop children's positive potentials that will make them happy and useful members of society. In order to meet this requirement, the education should be based on scientific principles (Wentworth, 1999). Therefore, in Montessori, it is very important to provide opportunity and stimulation under the control of trained Montessori teachers where children experience, gain new impressions and learn by doing. This guidance requires an understanding of the child development. Thus, Montessori approach recognizes the child's spontaneous interest in learning, and values the child's right

to learn by him or herself freely through emphasizing the importance of creativity and concentration (Orem, 1974).

Montessori approach emphasizes the importance of physical environment by expressing that "the environment must be prepared" with tools that promote learning opportunities by encouraging learners to explore their environments through self-directed and co-operative learning activities (Lippman, 2010).

This approach suggests that the prepared environment plays a crucial role in the teaching and learning experiences, and constantly provides additional guidance with respect to developing it. Accordingly, the teacher is responsible for the environment more than in traditional approaches, and the environment should be adjusted based on the child and his/her needs. The teachers should help the children to engage their attention and concentration with the help of the environment (Dyck, 2002). Because education in Montessori is based on the idea that children can independently choose the educational activities when they are developmentally ready. Therefore, the design and arrangement of the physical classroom environment to facilitate independent learning is a crucial part of the Montessori education. One of the most important characteristics of Montessori classroom is the attention given to visual order and beauty, careful display and arrangement of artwork, furniture, and the cooperative activities within the classroom where the entire school is defined as the "Children's' House" (Fisher, 2008). In addition to the importance given to physical

environment and display of art works, one other innovative aspect occurred in Montessori schools is the design and use of L-shaped classroom environments (Dyck, 2002).

2.2.3.3 Educational Philosophy of Waldorf and Design Disciplines

Waldorf (Steiner) education is a humanistic pedagogical approach, which is based on the educational philosophy of the Austrian philosopher Rudolf Steiner (1861-1925), the founder of anthroposophy in which the word is derived from "anthropos" (man) and "sophia" (wisdom), representing the notion of a modern spiritual scientific understanding of the human being and the world (Uhrmacher, 1995). Even though Steiner's ideas on education are based on the beliefs on individual development, the Waldorf School takes its starting point from anthroposophical spiritual science (anthroposophy), which views the human being as composed of body, soul, and spirit (Ullrich, 1994). In Waldorf education, one of the main concerns is the development of the soul of the school-age child. Steiner suggests that children grow through the following stages (Uhrmacher, 1995):

- The first stage is defined as the time of imitation where children from birth to age seven learn by empathy and doing, because human beings develop as imitators through imitating their surroundings. Therefore acting morally and doing good things are very important. Steiner suggests that in this first stage of development, learning passes through the child's entire physical being. Also, Waldorf education suggests that for the emotional development of children who are under nine, it is important that they develop their relationship to the world, as people tend to do when they conceive

of it imaginatively. So, if teachers themselves are not dreamers, then they cannot turn children into dreamers as well (Steiner, 1996).

- In Waldorf education, teachers do not teach children to read or memorize the information that they deliver until the age of seven, the phase that the second stage begins. Because they believe that the etheric body is still tied to and working on the physical body before age seven (Steiner, 1967). The second stage, which lasts until the age of fourteen, depends on teaching through vivid pictures, images, and rhythm, because these awaken the forces of feeling. Because Steiner defines this stage as the phase of feeling, which is related with the rhythmic system-the heart and lungs where children capture the information mainly through image and rhythm during these years. Also, Steiner suggests that children who are in this stage develop the need for authority, which should not be misled the desire for controlling the child but rather by "the child's natural response to its teacher" and not "an enforced authority. It is the kind of authority which creates the right rapport between child and teacher" (Steiner, 1986). Also, Steiner states that after the age of nine, the need for authority changes from an inherent belief in everything teacher says to a need for explanation. Thus, teachers should be aware of this change and must adapt their relationship with children (Uhrmacher, 1995; Childs, 1996).
- The last stage (to the age twenty-one), is described as “the release of the astral body, the body of consciousness” in which thinking and judgment are the two key elements of the stage.

The instruction in the Waldorf School begins with an artistic point of view, where the educators develop writing from art, and then reading from writing (Steiner, 2001). The curriculum in Waldorf School is aimed to be integrated into Gardner's multiple intelligences. Steiner's approach is based Gardner's model and perception, which suggests beginning with the child's need and constructing a curriculum accordingly. Teachers, on the other hand, should nurture and encourage child's imagination in order to develop in a healthy way, using pedagogical approaches that avoid mass media and information technologies, especially screen-based technologies, particularly in the early years (Leonard & Willis, 2008).

According to Steiner (1996), spaces that have rectangular shape activate human thinking an can keep it to rigid and linear, where they represent "being efficient" and "narrow minded". On the other hand, circular spaces represent a more spiritual and heightened sense of feeling. Therefore, Steiner proposes that these two shapes together reflect "thinking" and "feeling" through architectural design as well. Accordingly, the classroom for the youngest grades should be designed more rounded, whereas the classrooms for older children should be more rectangular as the child's thinking development keep evolving (Poplawski, 2009; Jolley, 2010).

Along with the pedagogical perspective behind, the Waldorf buildings follow Steiner's claim whereby "school must be a utilitarian building which demands an artistic form". Therefore, the built environments are designed carefully, based on Steiner's pedagogy, in which "right angles and symmetries are avoided both horizontally and vertically. Color and light are also

manipulated in a specific manner, related to color plans developed for ages and activities. Steiner suggests that different colors and their application in spaces deliver different messages. He further argues that red, being a more active color and blue, being a more passive color, relate to the mental concentration (Jolley, 2010). This approach shaped the Waldorf classrooms in a way bright red color is used for that first grade, orange color is used for the second grade, blue purple color is used for the eighth grades where the color is gradually loses the red/active color as students in each grade gets mature and become less active beings (Walden, 2009).

Having children to meet and interact with the nature, as well as gaining an appreciation for the nature is also an important aspect of Waldorf education. Therefore creating small courtyards in addition to being surrounded with natural elements is also a one of the unique aspects of Waldorf Schools. Similar to Reggio approach, the importance of art in Waldorf education, on the other hand, also influenced the school's architecture through including different materials in classroom design (Jolley, 2010).

2.2.4 Importance of Addressing Multiple Intelligences through Classroom Design

The theory of multiple intelligences differentiates intelligences into specific modalities, rather than accepting intelligence as dominated by a single general ability, often called a "g factor." Gardner defined the first seven intelligences in Frames of Mind (1983) and added the last two in Intelligence Reframed (1999). The nine distinct intelligences include:

- Verbal-linguistic intelligence: well-developed verbal skills and sensitivity to the sounds, meanings and rhythms of words.
- Logical-mathematical intelligence: ability to think conceptually and abstractly, and capacity to discern logical and numerical patterns.
- Spatial-visual intelligence: capacity to think in images and pictures, to visualize accurately and abstractly.
- Bodily-kinesthetic intelligence: ability to control one's body movements and to handle objects skillfully.
- Musical intelligences: ability to produce and appreciate rhythm, pitch and timber.
- Interpersonal intelligence: capacity to detect and respond appropriately to the moods, motivations and desires of others.
- Intrapersonal: capacity to be self-aware and in tune with inner feelings, values, beliefs and thinking processes.
- Naturalist intelligence: ability to recognize and categorize plants, animals and other objects in nature
- Existential intelligence: sensitivity and capacity to tackle deep questions about human existence such as, "What is the meaning of life? Why do we die? How did we get here?"

According to Gardner (1999a), intelligence is (a) the ability to create an effective product or offer a service that is valued in a culture, (b) a set of skills that make it possible for a person to solve problems in life, and (c) the potential for finding or creating solutions for problems,

which involves gathering new knowledge. Gardner argues that students possess all nine intelligences and where they differ is in the strength of these intelligences. Gardner argues that these differences challenge educational systems that presume everyone can learn the same subject matter in the same way and that a uniform measure can be used to evaluate student learning. The theory of multiple intelligences was developed based on Gardner's study of people from different places in everyday life and professions. Gardner argues that all human beings have multiple intelligences in varying amounts whereas each person has a different intellectual profile. Different parts of the brain locate these intelligences and they can either work both independently and together. These intelligences can be feed and strengthened, or overlooked and weakened. According to Gardner, we can improve education by addressing the multiple intelligences of our students and strengthen how children learn and how teachers teach. The work of researchers (Caine & Caine, 2001; Diamond & Hopson, 1999; Jensen, 2005; Sylwester, 2004; Zadina, 2014) offers knowledge for application in the classroom (Lunenburg & Lunenburg, 2014). In order to address the need for different teaching strategies, it is important to realize that there are different learning styles whereas physical characteristics of classroom environment must closely align with the teachers' own philosophies of education. These environments can help optimize learning for the whole class as different zones and provide the potential to influence the student-teacher interaction as well as motivation and engagement (Campbell, 1991; Freedman, 2005).

Nair & Fielding (2005) argue that when theory of multiple intelligences properly applied in schools, it provides students with opportunities and experiences that motivate them to be

more engaged in subjects that may not otherwise be among their interests. Different school spaces can nurture multiple intelligences and help build learning environments that are superior to traditional classrooms (see Table 2-1).

Table 2-1: Multiple intelligences and school spaces

	Linguistics	Logic-mathematical	Musical	Bodily-kinesthetic	Spatial	Naturalist	Interpersonal	Intrapersonal	Existential
Traditional Classroom	X	X					X		X
Learning Studio	X	X	X		X	X	X		X
Advisory Grouping	X	X	X	X	X	X	X	X	X
Cave Space	X	X						X	
Campfire Space	X	X							X
Watering Hole Space	X	X					X		X
Performance Space			X	X	X		X		X
Amphitheater	X	X	X	X	X	X	X	X	X
Café	X	X	X				X	X	
Project Studio		X			X	X	X		
Library	X	X	X		X	X	X	X	X
Outdoor Learning Terrace	X	X	X	X	X	X	X		
Greenhouse		X		X	X	X	X		
Distance Learning Center	X	X	X		X		X		
Graphic Arts		X	X		X		X		X
Fitness Center			X	X	X	X	X		
Playfields				X	X	X	X	X	X
Blackbox Theater			X	X	X		X		
Entrance Piazza	X	X	X	X	X	X	X	X	X

2.2.5 The Role of Social Interaction and Mobility in Classrooms

In classroom environments, the interpersonal relationship between teacher and students is an influential component of the learning process for students. Existing research reveals that associations between pupils-teacher interaction and academic outcomes motivate particular teacher-student relationships to be more powerful for students' academic achievement and attitudes (Brekelmans, Wubbels & Brok, 2002). According to the results of Programme for International Student Assessment (2013) good teacher-student relations and high teacher morale are correlated to students' academic performance, independently of their socio-economic and demographic variables (Programme for International Student Assessment, 2013). Accordingly, teaching and learning processes unquestionably require interaction and are human-centered by its nature (Johnson, 1990). This interaction is mediated by the physical arrangement, whereas teachers adapt their teaching to the environment available (Martin, 2002).

Therefore, the extent to which spatial layout of classrooms enhances the interactions is an important aspect of the learning environments. Because, the existing literature suggests that the type and the frequent use of space are associated with the whole spatial system, in which people adapt and locate their activities (Penn et al., 1999; Pasalar, 2002). However, that there is need for a change in classroom environments in order to increase the interactions between students and teachers in alignment with contemporary educational attitudes (Sanoff, 2002). Most of the schools in the U.S and their spatial layouts are observed to be unintelligible,

uninviting, and irresponsive to teachers' and students' needs (Sanoff, 1994; Wolfe & Rivlin, 1987; Pasalar, 2002).

Furthermore, traditional classrooms do not meet these expectations, since they are designed to enhance authority-based teaching model and support an archetype that forms and conceptualizes teachers as a source to perform on "the stage" where students are seated in rows and facing the front wall and the teacher. Therefore, the inherent message that these traditional classrooms and their physical layouts deliver to both students and teachers drives the functions and mobility influencing the social interaction between teacher and students (Apps & MacDonald, 2012).

2.2.6 The Role of Designers in Space and Learning

Obtaining knowledge, exploration and discovery are important aspects of learning and they must be reflected the design of school environments. The need for a new form of learning environment, on the other hand, has emerged as a response to current learning styles and teaching methods along with different activity settings throughout the pedagogical shifts (Sanoff, 2009). Therefore, the design of schools and classrooms engage with the dialectics of modern education and respond to both requirements and goals of educational approaches that are employed where spatial structure follows the curriculum painstakingly (Hertzberger, 2008).

In schools, as different programs depend upon different physical environments, it is the designers' responsibility to recognize and fulfill the needs for new kinds of spaces that make teaching most effective for the teacher and learning most effective for the students (National Research Council (US) Building Research Institute, 1963). In order to meet today's educational goals and keep up with the innovative changes in education, designers must change their positions through thinking beyond aesthetic considerations and move forward to an academic and intellectual position toward resolving issues and creating places that are aimed to promote opportunities for development (Allacci & Lippman, 2007; Lippman, 2002 as cited in Lippman, 2012).

2.3 Teachers' Role and Practice in Classroom Environment

Teachers have various responsibilities and play various roles in classrooms such as managing the classroom environment, providing effective teaching, and affecting student achievements. In literature, there is evidence that there is an association between teacher effectiveness and students' achievement that as teacher effectiveness increases, lower achieving students are first to benefit (Sanders & Rivers 1996; Marzano, Marzano, & Pickering, 2003) and teachers become more effective when physical characteristics of classroom meet their expectations and needs (Martin, 2002).

Malcolm Seabourne (as cited in Grosvenor, Lawn, and Rousmaniere, 1999), a historian of school buildings in England suggests that the buildings shape the teaching methods. The

separate classroom concepts indicated that teachers were trusted to be independent and had greater privacy. The classrooms were designed and built to represent and shape a particular form of teaching behavior. The way a school is designed reflects the social ideas and the educational missions they support (Grosvenor, Lawn, and Rousmaniere, 1999). The shape of spaces, furniture arrangements, and signs are physical cues that transmit the silent messages that both teachers and students will respond to. For example, these environmental messages can stimulate movement, call attention to certain things, encourage involvement, and invite students to hurry or move calmly. This environmental influence is a continuous process and how well it communicates with the users depend on how well the environment is planned. Classroom arrangement reflects assumptions about activities and behaviors (Sanoff, 2009). However, roles involve sets of expected behaviors, but behaviors are not always performed as expected since individuals differ. They differ according to their competence, their motivation, their personal needs and their values. Different individuals will perform differently in the same role, because role requirements interact with personal characteristics (Hayman, 1975). At the same time, the teacher's role is constantly changing from providing direct teaching to planning, designing and organizing learning experiences for the students (Zalantino & Sleeman, 1975). More recent developments encourage teachers to take the role of co-learner and mentor as well (Dyck, 1997).

Teachers' role in classrooms requires accommodation and adaptation to the environment. The teacher has to create conditions under which certain stimulation becomes attractive to the students. The teacher also gets the same stimulation from the environment, changes it for

the use of students and obtains feedback from students' behavior in return. The teacher has to operate that information in relation to the educational goals and make sure that the behavior will bring students' responses that are aimed (Adams & Hiddle, 1970). Thus, teachers' role can be seen as the manipulators since they are the ones who apply changes in the classroom environments based on their preferences. Therefore, classrooms can be perceived as "teacher-designed" environments. Accordingly, it is important to understand teachers' attitudes and motivations in relation to physical arrangement of their environment. They have the ability to affect a wide range of environmental qualities within their classrooms. Therefore, in the process of teaching and learning, the physical environment arranged by the teacher provides the setting for learning while acting as a participant in the process (Martin, 2006; Loughlin & Suina, 1982).

However, research about teachers and teaching processes are mainly focused on problem-solving approaches related to educational matters. However, there is very limited research focusing on the interaction between teachers and physical environment (Smeyers, 2013).

2.3.1 Teachers and Physical Environment

Teaching is an interactive and human centered activity (Johnson, 1990). This interaction is frequently mediated by furniture and materials accessible and used by teachers (Johnson, 1990). The existence of physical environment itself is not enough for effective teaching and educational planning. For instance, a well-organized reading area cannot phase out the need for effective teaching of reading or reading problems (Proshansky & Wolfe, 1975). Every

teacher, though, as David and Wright (1975) suggests, should become a designer, responsible for preparing the environment to achieve his or her objectives. According to Gibson (1966, 1979), the substances and surfaces in a physical environment provide immediate information about the setting's function and what is immediately perceived is what the environment affords (called affordances). From this perspective, desks in a classroom that are arranged in rows facing a central platform are likely to suggest lecture style activity, whereas tables clustered in the room likely to suggest collaboration (Graetz & Goliber, 2002). The preferences for a specific setting, on the other hand, arise from people's cognitive impressions of their environments (Graetz & Goliber, 2002). There are four cognitive determinants of environmental preferences: coherence (or ease with which a setting can be organized cognitively); complexity (the perceived capacity of the setting to occupy interest and stimulate activity; legibility (perceived ease of use); and perception (Kaplan and Kaplan, 1982).

Therefore, certain types of classroom arrangements can leave different impressions of the settings, however, these impressions are likely to change if the teacher attempts to use the classroom in a manner that does not agree with its affordances, such as using a lecture hall when collaborative activities are needed (Graetz & Goliber, 2002).

2.3.2 The Role of Teacher Motivation and Attitudes in Classrooms

Since psychologists have adopted various approaches to study the concept of motivation, there is not one single/universally accepted definition of motivation. McGeoch and Irion

(1952) define motivation in a more comprehensive way and bring together the definitions put forward by others who have maintained that all activity except purely reflective action is motivated. According to them: *"A motive or motivating condition is any condition of the individual which initiates and sustains his behavior, orients him toward the practice of a given task, and which defines the adequacy of activities and the completion of the task".* Most of the definitions have singled out the role of motivation as an internal force that helps in the arousal and direction of behavior. According to Russell (1971), motivation has been defined in a variety of manners. Despite these variations, there are three overlapped characters that each include: (1) it is a presumed internal force, (2) energizes for action, and (3) determines the direction of that action (Ahmed, 1989).

Dörnyei (1998) argues that motivation accommodates the momentum to trigger learning and later the driving force to sustain the long and often tedious learning process. Gardner (1985) claims that motivation compounds four elements: a goal, a desire to achieve the goal, positive attitudes toward learning, and effortful behavior to that effect. Since motivation plays a very important role in the learning process, there is more emerging interest in research that examines the nature and role of motivation in learning process in the past decades (Ozturk, 2012).

Teacher motivation is related to teachers' attitude to work and teachers' desire to engage in the pedagogical processes within the school environment. Therefore, it determines their involvement or non-involvement in academic and non-academic activities that occur in

classrooms. Teachers are the ones that translate educational philosophy and objective into knowledge and skill transferring them to students in the classrooms. Hence, the classroom environment is important in teachers' motivation. If a teacher experiences the classroom as a functional, safe, healthy, and happy place for teaching and optimal learning, he/she tends to participate in the process of management, administration, and the overall improvement of the school more than expected. A teacher who is intrinsically motivated can be observed to undertake a task for its own sake, the satisfaction it provides or for the feeling of accomplishment and self-actualization it promotes (Ofoegbu, 2004).

The concept "attitude", is one that has been frequently studied in social science. There is no universally accepted convention where definition and measurement are integrated. A psychological definition of attitude identifies a verbal expression as behavior. Those who hold to a psychological definition of attitude recognize that social structure is important in creating and maintaining social order. However, they claim that if behavior is to change, attitude changes must come first (Dollard, 1949; Krech & Crutchfield, 1948; Kutner, Wilkins, & Yarrow, 1970; Lewin, 1999 as cited in Chaiklin, 2011).

2.4 Environmental Response and Awareness

From an ecological approach to behaviors, one of the main assumptions made in environment and behavior relates to the view of the person as a goal-directed cognitive organism, influencing and being influenced by the environmental process of which he or she is a part, and is an expression of his or her behavior to the physical world (Ittelson, 1974).

The learning environment can become a powerful teaching tool at the control of the teacher, or it can have a misguided influence on both children' and teachers' behaviors. As Loughlin and Suina (1982) state, more importance needs to be given to the arranged environment and the mindful use of it in support of teaching and learning goals. However, this has not been common to observe in schools, although understanding of environmental influences is important for all teachers. Lacking awareness of physical and spatial needs in the classroom environment can interfere with the optimal functioning of the classrooms. Proshansky and Wolfe (1975) states that a great deal of attention is generally given to lesson plans but little attention is given to space planning (Martin, 2002).

The Organization for Economic Co-operation and Development (OECD) issued a report about the quality of the physical environment and education in schools as expressed by the study participants (1988).The report reveals that teachers are responsible for creating stimulating and exciting spaces where teaching and learning occur. The report also reveals that lacking awareness of the potential of an environment could be rectified through staff training in issues concerning the environment, including architectural and design matters. The study participants speculated that by raising such standards among teachers, teachers would impart this knowledge to their pupils who, in later life, would apply this understanding in their own environments. In a study conducted by Lackney (1997), it is revealed that teachers recognize that some environmental qualities are in part their responsibility even if they are unable to control them. This raises the importance of educators becoming more aware of the opportunities that the physical setting presents to them. The knowledge of the

relationships between physical surroundings and actions should be presented to teachers as a practical tool that they can use. Loughlin and Suina (1982) believe that a well-trained teacher can predict behavior in classroom settings. This is another piece of evidence expressing the need for teachers to understand space. The ability to predict behavior in certain settings can allow teachers to arrange spaces supporting specific activities (Martin, 2002).

2.5 Technology use in Classrooms

Classrooms can host a wide range of activities: individual study, one-on-one discussions (teacher-student or student- student), small/large group work, and teacher-directed instructions or lectures. A classroom may be operated by a single teacher or group of teachers throughout the day. It may also be reorganized by moving walls and allowing teachers to be engaged in team-teaching or multiclass projects. The need to accommodate diverse options in classrooms motivates flexibility and adaptability of the classroom environments. Schools have recently implemented technology more often in order to reconstruct learning. Through increasing individualized instruction and providing access to vast amount of data and information, technology has changed how teachers teach and how students learn in classrooms. Schools today generally use a wide range of technologies in classrooms, including laptop computers, the internet, e-mail, video communication via tape or broadcast, networked printers, and library file servers whereas using videos and cameras has also made the distance learning feasible for many schools. Therefore, the increased use of technology in

classrooms has effected how classrooms are designed. In general, the effects of technology on classroom design include:

- Providing additional space for computer workstations (15–20 sq. ft. per station), wall- or ceiling-mounted TV and VCR, and a video projection system.
- Adding wiring for voice, video, and data capabilities. Wiring should be accessible to deal with upgrades, and electrical outlets. Data drops should also be ample for the classroom (Tenbusch and Vaughan, 1998). Given the advancements in technology and the rapid increase in wireless communication (NSF, 1999), much of the wiring in the classrooms may quickly become outdated. Therefore, more consideration should be given to both wireless and wired communication systems (Butin, 2000).

The introduction of technology in the classroom is one of many educational reforms made within the last years (Johnson, 2006). Technology integration is linked to a variety of teaching reforms. According to Vermette, et al. (2001), many reforms do not change practices in classrooms. However, technology integration is one reform that when implemented it changes the teaching practices. However, the types of activities supported by technology resources are not compatible with all teaching practices (Johnson, 2006).

Welliver's Instructional Transformation Model (1989 as cited in Johnson, 2006) provides a framework to conceptualize and structure the technology use into teachers' practices (see Figure 2-2). This model was developed from a study of technology adoption behaviors of teachers and has been used to guide research (Hooper & Reiber, 1995), as well as the

professional development training efforts in the school systems (Wang, 2000). Marcinkiewicz and Welliver's (1993) research validates the Instructional Transformation Model and the proposed developmental and hierarchical stages of computer usage and adoption by teachers, while Hooper and Reiber (1993) redefine the model to allow for maturity in the teachers' pedagogical use of computers (Johnson, 2006).

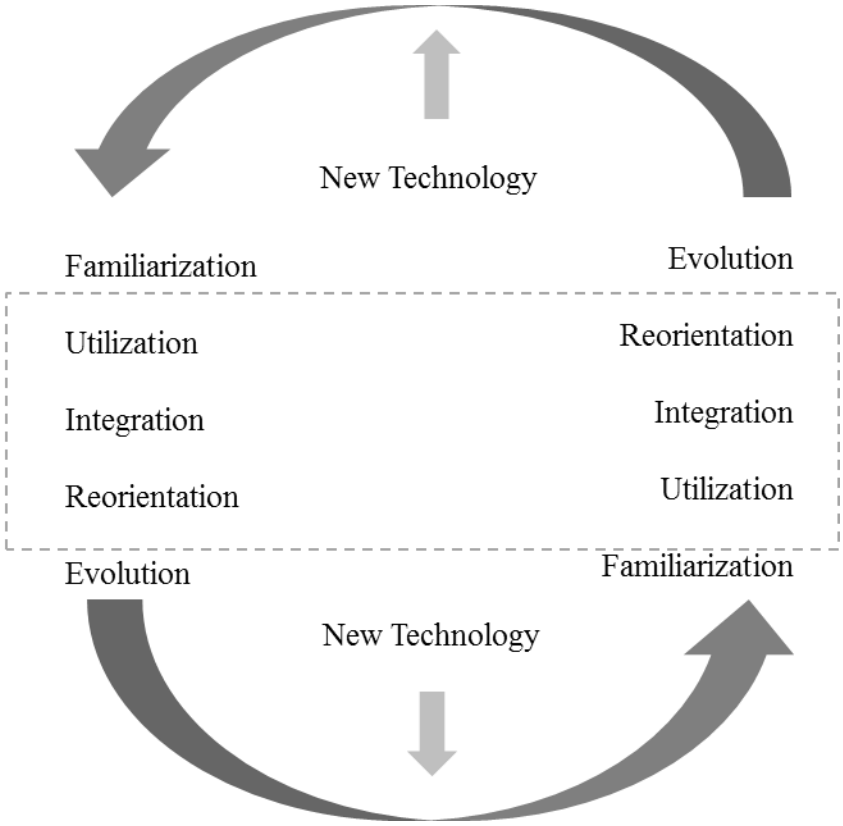


Figure 2-2: Welliver's intructional transformation model

Although utilization, integration, and reorientation stages of this model are factors that are dependent on the physical characteristics of environment, there is still lacking research that examines the relationship between technology use and physical environment.

When students utilize technology as a tool or a support for communicating with others, they are in an active role of obtaining information carried by a teacher, textbook, or broadcast. The student is actively making choices about how to generate, obtain, manipulate, or display the information. The use of technology allows more students to actively think about information, make choices, and execute skills than a typical in teacher-centered lessons would do. Moreover, when technology is used as a tool to support students in performing authentic tasks, the students are in the position of defining their goals, making design decisions, and evaluating their progress. The teacher's role in this case changes as well. The teacher is no longer the center of attention as the mean of information, but rather plays the role of facilitator, setting project goals and implementing guidelines and resources and providing suggestions and support for student activity by moving around. As students work on their technological equipment and tools, the teacher moves around the room, looking over shoulders, questioning about the reasons for various choices, and suggesting resources that might be used. Project-based work and cooperative learning approaches eager this change in roles, whether or not the technology is used. However, the use of technology enhances this new role for teachers stimulating students’ intellectual activities. Furthermore, the use of technology affords the setting for peer to peer coaching among students who are technology savvy and eager to share their knowledge with others.

2.6 Summary

The literature review has revealed that the physical arrangement of the classrooms can serve as a powerful setting for providing students with effective instruction and facilitating (or inhibiting) positive teaching/learning interactions. It is also suggested that the physical arrangement of the classrooms should be reflective of the diverse characteristics of both students and teachers and be consistent with specific learner needs.

The literature further provides the following highlights:

- The role of schools and their design as a physical setting requires cross-disciplinary and interdisciplinary understandings that are driven by perspectives from both architecture and education (Woolner, 2015).
- The analysis of previous research studies about educational facilities reveals that physical characteristics directly or indirectly influence individuals' activities, movements and interactions. Therefore, there is need for more exploration about the dynamic interactions between the behavioral characteristics of users and physical aspects of school environments.
- Arranging the physical environment of the classroom can contribute to improvement of the learning environment and prevention of the problem behaviors before they occur. Research on classroom environment has shown that the physical arrangement can affect the behaviors of both students and teachers (Savage, 1999; Stewart & Evans, 1997; Weinstein, 1992).

- The classroom environment is a direct expression of the educational philosophy and it takes an active part in the educational process (Proshansky & Wolfe, 1975). They are also complex structures where there are a variety of different dimensions and variables in which physical units through distribution of space and physical structure have an influence on students and teachers behavioral and academic outcomes (Martin, 2002).
- There is a difficulty of identifying conclusive research findings in literature about the environmental factors that would promote effective teaching and learning in school, for a number of reasons. Diversity in teachers (preferences, attitudes such as motivation, motivational strategies, environmental response and awareness, and personal characteristics) is the least studied topic area. However, classrooms are "teacher-designed environments" and they have the ability to affect a wide range of environmental qualities within their classrooms. Therefore, in the process of teaching and learning, the physical environment arranged by teachers provides the setting for learning and at the same time acts as a participant in this process (Martin, 2006; Loughlin & Suina, 1982).

In summary, in order to address the need for different teaching strategies, it is important to realize that there are different learning styles. The physical characteristics of classroom environments must closely align with teachers' own educational philosophies and preferences while optimizing the learning for the whole class. Teachers' instruction,

motivational strategies, assessment techniques and the use of physical environment are also found to be associated with their beliefs, values and attitudes.

Therefore, this study investigates the associations between classroom environment (i.e. teachers' current classroom arrangements and teachers' preferences on classroom design) and teachers' attitudes and characteristics.

CHAPTER 3 CONCEPTUAL FRAMEWORK

This chapter explains the theoretical perspective along with the underlying theories; the purpose of the study; the conceptual framework developed; and the research questions associated with the study.

3.1 Theoretical Perspective

In order to identify and understand the theory base and the underlying logic for designing and conducting this study, this section aims to explain the theoretical lens that shapes what is examined, the assumptions generated, and the questions asked within the scope of the study.

3.1.1 Ecological Psychology

Hawley (1950) states that ecology is the study of the links and relationships between organisms and their environments (as cited in Stokols, 1977). Ecology, which evolved as a biological science, argued that all organisms interact with each other and as a science it shows the connections between environmental features by studying their interdependence. At the beginning of the 1920's, sociologists also began to apply some of the ecological ideas to the human studies like population research. "Human ecologists" studied the changes in the neighborhoods by analyzing the attributes and movements in lower and higher social classes. In general, human ecologists studied large group of people or large areas (Wicker, 1979, p.1). Human ecologists and biological ecologists shared some methods and assumptions

in order to understand the relation between organisms and their environments. Wicker (1979) indicates the shared assumptions as follows:

> *"Organisms cannot be considered to exist or act in isolation. Every organism, whether it's a lodgepole pine or a human being, is linked with other organisms in a complex network of relationships. All organisms effect by forces inside themselves, such as hunger pangs or genetic programs that incline their roots downward, as well as by external forces. Living organisms adapt- that is, they act in such a way to achieve a harmonious working relationship with their environment".*

In ecological perspective, environment is composed of all external forces which make organisms strongly influenceable and responsive, and behavior is the result of the reactions (see Figure 3-1) made by organisms (Stokols, 1977).

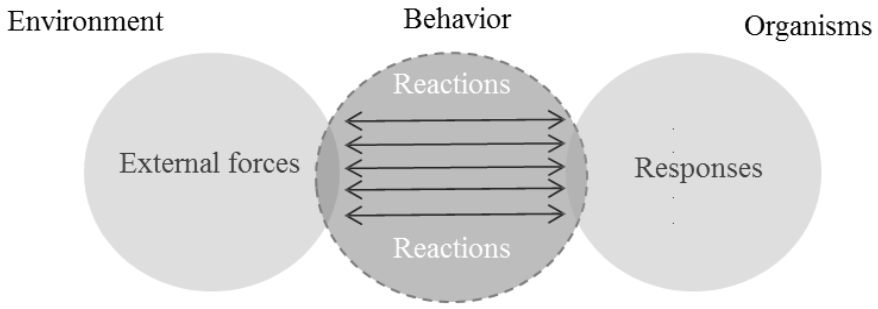


Figure 3-1: The relationship between environment, organisms, and behavior

Note: The figure is generated based on the non-graphic information from the *Perspectives on Environment and Behavior: Theory, Research, and Applications,* Stokols (1977).

In 1940's, psychologists started to pay more attention to ecological approaches (Wicker, 1979). In his published paper, Kurt Lewin (1944) stated that restrictions and potentials of the environment are the first steps for analyzing process, specifically when studying behavior of individuals or groups. Even though, he was the first person advocating for ecological psychology, Lewin's approach to environment was dependent on people's perception, instead of existing conditions of their environment (as cited in Wicker, 1979).

Stokols (1977) explains the definition of environment and behavior - as a scientific area - by referring to it at three different levels. As for the first and most general definition, he refers to Kuhn's (1962) notion of a paradigm or "*universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners*" (Kuhn, 1962 as cited in Stokols, 1977). As for the second and narrower definition, he refers to Proshansky, Ittelson and Rivlin's (1970) operational definition of "*a particular research domain in terms of the unique concerns and activities of those scientists who identify with the area*". For the last and later definition, Stokol suggests that the field must be perceptible from other actual research areas (Stokols, 1977).

According to Stokols (1977), environment and behavior research field can be distinguished in two related areas: ecological psychology and environmental psychology. While both areas focus on the relationships between human behavior and the constructed or natural environment, ecological psychology focuses on the whole process shared by groups, which adjust to their both physical and social conditions in their environment. Environmental

psychology, on the other hand, highlights the influence of the environment on individuals by concentrating on more intrapersonal processes like perception, cognition and learning (Stokols, 1977).

Swartz and Martin (1997) argue that ecological psychology has an extended background that roots into early 1900's in the history (see Table 2-1). They explain the evolution of ecological psychology by dividing it in three main influences:

Table 3-1: Origins of ecological psychology

1909 Parsons, F.D. *"Choosing a vocation"*	1924 Kantor, J.R. *"Principles of psychology"*	1935 Koffka, K. *"Principles of gestalt psychology"*
"satisfaction can be achieved through knowledge of both individuals and environments, not merely one or the other"	*"as the person is a function of the environment and the environment is a function of the person, the unit of study in psychology should be the individual as that individual interacts with the contexts which produce behavior"* *B= f(P,E)*	*"understanding an individual's behavior cannot be gleaned from examining either the person or the environment in isolation, but is dependent upon simultaneous consideration of both"* *"idea of geographical environment"*

Note: The table is generated based on the non-graphic information from the *Applied Ecological Psychology for Schools within Communities: Assessment and Intervention*, Swartz&Martin (1997).

Even though ecological psychology has a background and some roots in the past developments of related fields, it was not known as a particular study field until later in the 20th century (Swartz & Martin, 1997; Heft, 2011). Beginning with the roots emerged from the studies of Kurt Lewin (1935, 1944 and 1951), ecological psychology had its actual beginning with Roger Barker and started to arise through different theoretical approaches (Bechtel et al., 1987; Swartz & Martin, 1997).

3.1.1.1 Analytic Levels in Environment-Behavior Research and Ecological Psychology

In the area of environment-behavior; even though ecological psychology, environmental psychology, environmental sociology and human ecology are derived from different perspectives, they all overlap and share similar approaches at different levels (see Table 3-2).

Table 3-2: Analytical levels of environment-behavior studies

Levels of Analysis	Antecedents / Levels	Intrapersonal Process		Environmental Dimensions		
		Physiological processes	Psychological processes	Physical environment	Social environment	Cultural environment
	Micro		Environmental Psychology			
	Intermediate		**Ecological Psychology**			
	Macro			Environmental Sociology, Human Ecology		

Source: Stokols, 1977

The analytical levels of environment-behavior studies, which was proposed by Stokols (1977), and the “intrapersonal process” and “environmental dimensions” were expanded upon Lewin’s notion that behavior is a result of the combination of personal and situational impacts and display the interactionist perspective of the study area (see Figure 3-2).

$$\text{Behavior} = f \left\{ \begin{array}{c} \text{Physiological and} \\ \text{psychological process} \end{array} \quad \text{x} \quad \begin{array}{c} \text{Physical, social, and} \\ \text{cultural dimensions of the} \\ \text{environment} \end{array} \right\}$$

Figure 3-2: Formulation of the behavior in interactionist perspective

According to Table 3-2, the intrapersonal process of environmental psychology falls under the field of ecological psychology. However, ecological psychology is interested in understanding the individual and small group behavior in constructed environments and makes predictions of behavior at the intermediate level. As the level of behavioral analysis moves from micro to macro, ecological psychology can also be tracked through the shift from short-term, laboratory experiments to longitudinal, naturalistic investigations. In summary, these different levels of analysis include and are associated with different kind of methodological strategies that help to understand and determine people’ adaptation to their environment (Stokols, 1977).

3.1.1.2 Theoretical Approaches in Ecological Psychology

Patton (2002) argues that while most theoretical perspectives are connected to certain branches of knowledge or methods (such as the derivation of hermeneutics from linguistics or the ground connection of heuristic within humanistic psychology), ecological psychology speaks for and associates with different theoretical intentions since it has different assumptions in the way that researchers study the human experiences and the problems to understand how they are related to their environment (Jacop, 1987 as cited in Patton, 2002).

Regardless of different approaches in ecological psychology, what they share as a common and primary assumption is that "behavior is a function of the person and the environment, and the unity of the study is the natural environment" (Swartz & Martin, 1997). One important reason for having different perspectives in ecological psychology is the differences between the ways that how theorists see and approach the problem and its units. Since ecological psychology's main focus is to understand people's reactions and adaptations to their environment, the meaning of the built environment is a crucial determiner (Rapoport, 1982).

According to Fuhrer (1990), theorists' different approaches to the problem in ecological psychology, has also a connection to the gap between the actual and perceived environment. Through this difference, theorists and researchers build their explanatory models by defining the environment that they tend to analyze; either the level of the study unit is individual or group. In other words, in ecological psychology, behavior is the result of the integration of

following dimensions including perceived environment, actual environment, individual and group (Swartz & Martin, 1997).

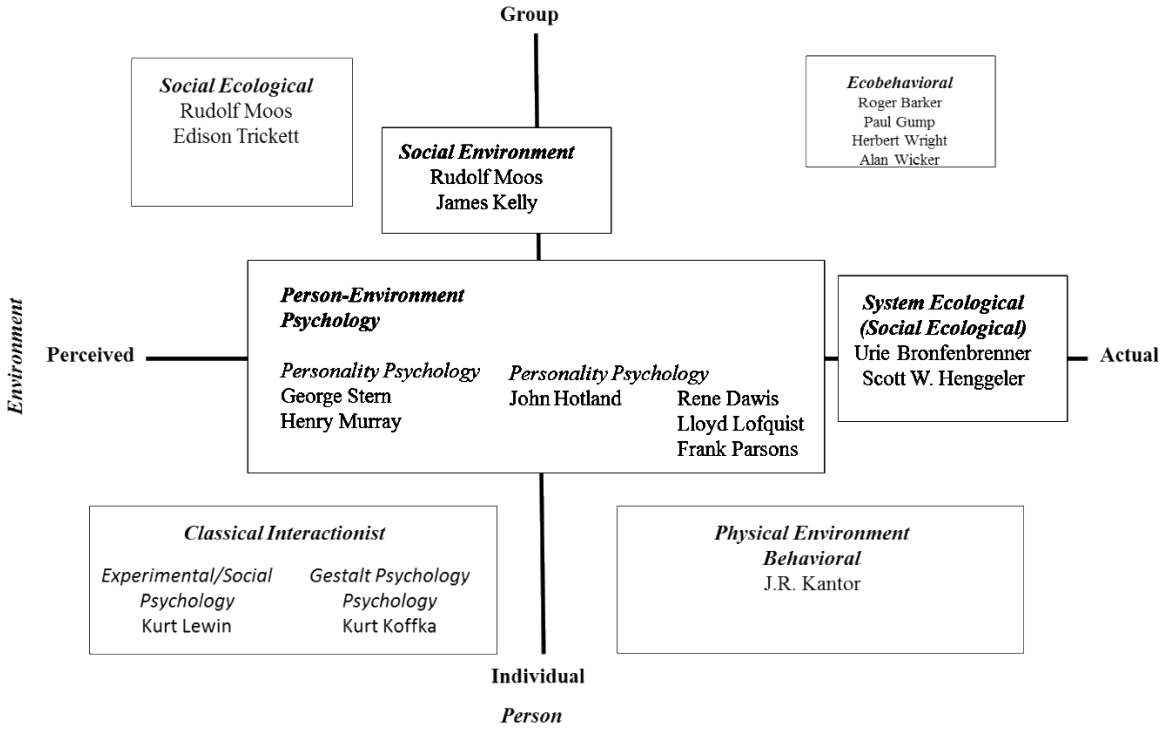


Figure 3-3: Matrix of influential ecological psychology theorists by subspecialty
Source: Swartz & Martin, 1997

In summary, ecological psychology is the description of a concept that has been practiced by three different psychologists who engaged with different approaches in their studies: the perceptual psychologists James Gibson (1903-1979), the child and social psychologists Roger G. Barker (1903-1990) and Urie Bronfenbrenner (1917-2005) as child psychologists (Heft, 2011, p.1). Since this study applies some aspects of Gibson's, and Barker's theories,

the next section provides a brief summary of what those theories are and how applicable they are to the framework of this study.

3.1.2 Summary of the Theory of Behavior Settings and Theory of Affordance

3.1.2.1 The Theory of Behavior Settings

Kurt Lewin's approach to environment was based on people's perception rather than their existing environment. In other words, Lewin examined the environment as an indirect influence on people's behaviors. Roger Barker and Herber Wright, as students of Lewin's, were also engaged in developing a new ecological viewpoint in psychology. Through publishing their article, named as Psychological Ecology and the Problem of Psychosocial Development (1949), they advocated for the ecological view in psychology as an independent branch by criticizing the traditional psychological approach in some ways. According to their statement, the most important disadvantage of traditional psychological approach is taking people into laboratories and observing them in prearranged conditions or tasks (Wicker, 1979).

In Roger Barker's ecological psychology - later called as eco-behavioral science by him - Barker and his colleagues invented an experimental observation method to observe and note children's activities and behavior patterns during their daily lives. Instead of examining the environment performing at individual level, Barker's approach was based on finding higher-order structures that arise through the actions of two or more individuals in mutual environment - with environmental objects and other features as well. This whole

surrounding/environment was called milieu, and the active structures that generated shared and coordinated actions by individuals were called behavior settings (Heft, 2011). Barker (1978) argues that, a behavior setting is place where native people can find individual motives which gives them satisfaction. In other words, a behavior setting is composed of opportunities for people. However, in the same setting, people can obtain satisfaction differently. Therefore, behavior settings also introduce obligations to their inhabitants as well. Barker considered these obligations as the results of the basic or natural form of behavior settings. Assuming that the people of a setting try to achieve purposes to find satisfaction in their own terms, the setting also keeps on functioning at a level that each occupant defines satisfaction for himself. Thus, each inhabitant in a setting, come up against a situation with three ways. (1) Immediate/direct way to the goal; (2) operating and (3) maintaining the setting to achieve and keep their goals (Barker, 1978).

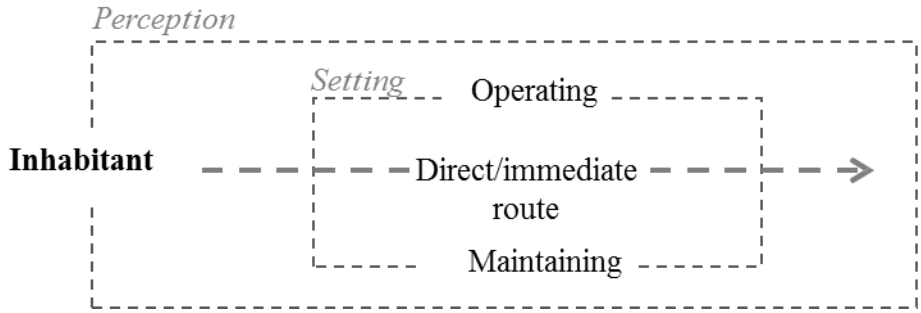


Figure 3-4: Quasi-stationary level of functioning of a setting based on perception

Note: The figure is generated based on the non-graphic information from the *Habitats, Environments, and Human Behavior*, Barker (1978).

The main characteristics of the theory of behavior setting can be summarized as follows (Barker, 1968 as cited in Thorleifsdottir, 2008):

- They occur naturally as a function of the collective actions of a group of individuals.
- They have a specifiable geographic location.
- They have temporal boundaries that are self-generated and maintained by the dynamics of its occupants.
- The boundaries are discriminable; they can be perceived.
- They are quasi-stable; they manifest mechanisms in response to perturbations and in so doing, within limits they preserve their integrity.
- They exist independently of any single person's experience of them.
- Individuals who occupy a particular behavior setting are to an appreciable degree interdependent.

In summary, the significance of this theory is that it has the potential to help researchers to conceptualize and examine the relationship between behaviors and milieu, which are empirically linked but conceptually incommensurable levels of phenomena (Barker, 1978).

3.1.2.2 The Theory of Affordances

In most general terms, the theory of affordances mainly focuses on the act of perceiving. Its approach to the problem is based on the theoretical grounds for a philosophy of direct realism (Heft, 2011). In Gibson's ecological psychology, perceiving and acting are related notions and perceiving is a perception-action process (Thompson et al., 2010). Gibson argues that

composition and layout of surfaces compose what they afford. Therefore, the “values” and “meanings” in the environment can be perceived directly, and what is immediately perceived is what the environment affords - which is called affordances (Heft, 2010).

Heft (2010; 2011) argues that what Gibson refers is the perceived functional significance of environmental features, and ties the affordances to properties of the environment taken relative to an individual. In other words, affordances are relational properties of the environment taken with reference to a specific individual.

To summarize the theory of affordance, affordances are properties of the environment that are both objectively real and psychologically significant. They are neither the only properties of the environment nor the perceiver, but they are relational properties within an environment-perceiver system. Thus, the meaning arises from the relationship of perceiver and environment. The meaning is a property of the environment-individual systems and eventually can be found in a public, shared domain of experience (Heft, 2010; 2011).

3.1.3 Applicable Aspects of the Theories from Ecological Psychology

Based on the ontological assumptions of the theory of behavior settings, we can collect information about the pattern or higher order structure of teacher behaviors that occur in classroom environments. Although the theory of behavior settings has been widely used through conducting direct observations in real world settings, this study proposes the

collection of behavioral data through self-reports in order to reach a large number of sampling and information from different school settings.

On the other hand, the concept of the theory of affordances is a useful way for understanding and explaining the essential qualities of environment psychologically. Therefore, to be able to create multi-functional classrooms, as well as increase the amount and type of affordances, it is important to understand whether or not the availability of classroom affordances (classroom environment attributes) differs in classroom settings where teacher attitudes are different than each other.

Table 3-3: Applicable aspects of the theories from ecological psychology

	The Theory of Behavior Settings	**The Theory of Affordances**
Application of the Theory	**Methodological**	**Conceptual**
	Collecting both behavioral data and information about classroom settings through self-reports in order to capture patterns.	Defining behaviors as affordances (based on current classroom arrangements) in order to study the variability in different teacher attitudes.

3.2 Purpose of the Study

This study does not attempt to describe 'ideal' learning environments, but rather describe and analyze the relationships between classroom environment, practice of teachers, and their attitudes and behaviors. It also seeks to understand how teachers behave in different classroom environments and what motivates them to make changes in classroom arrangement. The primary purpose of this study is to expand the understanding of how classroom environment is associated with teacher attitudes. In an inquiry into the relationships between classroom environment and teacher attitudes and classroom behaviors, teachers' current classroom arrangement and their classroom design preferences are utilized as indicators of physical environment whereas certain dimensions are utilized as indicators of teacher attitudes and behaviors.

3.3 Conceptual Framework

An examination of the existing literature about educational facilities has indicated that physical characteristics of school and classroom environments have an influence on both behavioral and educational outcomes of teachers and students impacting directly or indirectly individuals' activities, movements and interactions. Therefore, there is need to explore more about the dynamic interactions between the behavioral characteristics of users and physical aspects of school environments. The literature also indicates that classroom environments are complex structures where there are a variety of different dimensions and variables. Hence, there is a difficulty of identifying conclusive research findings about the environmental

factors that would promote effective teaching and learning in classroom for several reasons as it has been discussed in the literature review.

Yet diversity in teachers' attitudes, personal characteristics and teaching styles, are the least studied ones among those identified difficulties. However, the literature shows that teacher attitudes and motivational strategies play a crucial role in the overall teaching-learning process. Because classrooms can be defined as "teacher-designed environments" and their role can be seen as the "manipulators" since they are the authorities who make changes in the classroom environments based on their preferences and attitudes toward the environment. The literature review has pointed out the importance of teachers in classroom environments and has clarified the gap and/or a need for establishing a better understanding about how teacher behaviors through their classroom arrangements are associated with teacher attitudes.

Thus, Figure 3-5 illustrates the conceptual framework of the study. Classroom environment variables under the physical environment and the individual-level control variables are defined as independent variables. Teachers' current classroom arrangements and their classroom design preferences are used as indicators of classroom environment. Teacher behaviors and attitudes are defined as dependent variables whereas motivation towards profession, environmental response and awareness, teacher movement, furniture movement, motivational strategies, instructional area and teaching methods are used as indicators of teacher behaviors and attitudes. Gender, age, years of experience and type of school setting are used as indicators of individual-level control variables. These control variables are not the

focus in the study and are not included as a part of the research questions. However, since their existence might have influence over the dependent variables they were included in the research model together with other independent variables.

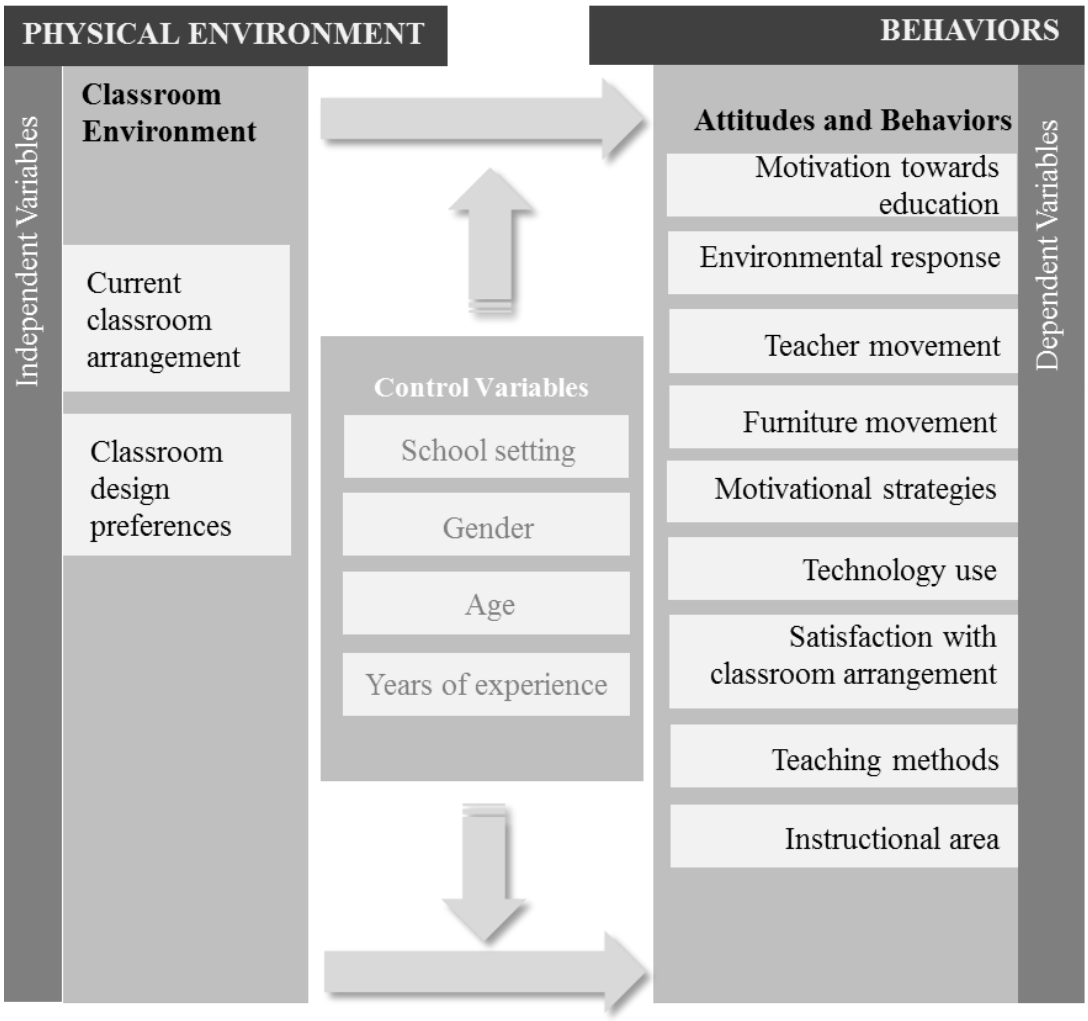


Figure 3-5: Conceptual framework of the study with variables and indicators used

3.4 Research Questions

Within the conceptual framework of this study, the following central questions and sub-questions are formulated:

RQ1: What is the relationship between classroom environment and teacher motivation?

In order to address this question, following sub-questions are established:

RQ1a: Is there an association between teachers' current classroom arrangements and teacher motivation?

RQ1b: Is there an association between teachers' classroom design preferences and teacher motivation?

RQ2: What is the relationship between classroom environment and teachers' environmental response and awareness?

In order to address this question, following sub-questions are established:

RQ2a: Is there an association between teachers' current classroom arrangements and teachers' environmental response and awareness?

RQ2b: Is there an association between teachers' classroom design preferences and teachers' environmental response and awareness?

RQ3: What do teachers find important in order to create a better classroom environment?

In order to address this question, following sub-questions are established:

RQ3a: What are the teachers' classroom design preferences?

The purpose of this question was to explain what teachers prefer on classroom design overall or in order to meet certain needs and purposes such as multiple teaching

methods, better student-teacher interaction, teacher movement, circulation, and technology use.

RQ3b: What are the issues that teachers define important for achieving a better classroom environment?

The purpose of this question is to explain what teachers find most important for achieving a better classroom environment such as class size, flexibility in furniture, flexibility of movements, and variety of technology use.

RQ4: What motivates teachers to change their classroom arrangements?

The purpose of this question is to explain the issues that teachers define the most important for changing their classroom arrangement.

RQ4a: What type of activities do teachers use in open areas?

The purpose of this question is to address the needs of teachers for open spaces, including both indoor and outdoor open spaces.

RQ5: What is the relationship between teachers' attitude toward education and classroom environment?

In order to address this question, following sub-questions are established:

RQ5a: Is there an association between teachers' current classroom arrangement and instructional content area?

RQ5b: Is there an association between teachers' classroom design preferences and instructional content area?

RQ5c: Is there an association between teachers' current classroom arrangement and teaching methods?

RQ5d: Is there an association between teachers' classroom design preferences and teaching methods?

RQ6: What is the relationship classroom environment and teachers' practice of using technology in instruction?

In order to address this question, following sub-questions are established:

RQ6a: To what extend teachers' use of technology, affect their current classroom arrangement?

RQ6b: Is there an association between teachers' practice of using technology in instruction and their current classroom arrangement?

RQ6c: Is there an association between teachers' practice of using technology in instruction and their preferences on classroom design?

RQ7: What is the relationship between classroom environment and teachers' motivational strategies?

In order to address this question, following sub-questions are established:

RQ7a: Is there an association between teachers' current classroom arrangement and their motivational strategies used in classroom?

RQ7b: Is there an association between teachers' classroom design preferences and their motivational strategies used in classroom?

RQ8: What is the relationship between classroom environment and teacher movement?

In order to address this question, following sub-questions are established:

RQ8a: Is there an association between teachers' current classroom arrangement and teacher movement?

RQ8b: Is there an association between teachers' classroom design preferences and teacher movement?

RQ9: What is the relationship between classroom environment and teachers' levels of satisfaction?

In order to address this question, following sub-questions are established:

RQ9a: Is there an association between teachers' current classroom arrangement and level of satisfaction?

RQ9b: Is there an association between teachers' classroom design preferences and level of satisfaction?

RQ10: Is there an association between frequency of furniture movement and classroom environment?

In order to address this question, following sub-questions are established:

RQ10a: Is there an association between teachers' current classroom arrangement and furniture movement?

RQ10b: Is there an association between teachers' classroom design preferences and furniture movement?

In addition, associations between the independent variables are also studied to assure that there is no interaction between the two independent variables.

CHAPTER 4 METHODOLOGY

This chapter explains the research design of the study and contains five sections, which include a summary of the research approach adopted, an overview of the population and sample, a detailed summary of the data collection tool and distribution methods, a detailed description of the data analysis strategies and procedures used, and finally, a detailed description of variables and data preparation process.

4.1 Research Design

Based on the purpose of the study and nature of research questions within the described conceptual framework, a descriptive correlational research design is employed in order to address the associations among the identified variables (Tabachnick & Fidell, 1996; Gavin, 2008; Creswell, 2011). Although there are different types of correlational research, the commonality among all types of correlational research is that the purpose is to explore relationships between variables. The main purpose of a correlational study is to determine the relationships between variables, and if a relationship exists, to determine a regression equation that could be used to make predictions to a population (Creswell, 2009; Simon & Goes, 2011).

The general characteristics of correlational strategy: a focus on naturally occurring patterns; the measurement of specific variables; and the use of statistics to clarify patterns of

relationships (Groat & Wang, 2002). There are two types of correlational research designs within the framework of correlational research. The first type involves the relationship studies, explicitly focusing on the nature and predictive influence of such relationships. The main characteristics associated with the relational design are: data collection of two or more variables from each individual in the sample; data collection at a single frame in time; analysis of data as a single group rather than creating sub-groups; reporting correlational coefficient (e.g., Pearson Product Moment, multiple R) and discussing them in terms of strength, direction, and/or statistical significance; and making interpretations from the statistical results about the relationships. The second type of correlational research design, casual-comparative (sometimes called predictive design), on the other hand aims to identify variables that can effectively predict some outcome or criterion. While the general characteristics of casual-comparative design are similar to those for relational designs, different characteristics include taking contribution of each predictor variable into account; producing a regression equation which can be used to predict the criterion variable from data collected only on predictor variables; and making interpretations from the statistical results about the predictive process (Groat & Wang, 2002; Creswell, 2009).

This study employed the relational approach of correlational research design. Through employing a questionnaire survey tool for data collection, this investigation is positioned to explore the relationship among the study variables indicated in the conceptual framework. As it will be discussed in the “data analyses strategies” section, when more than one predictor variable is used to predict a criterion, casual-comparative approach is also employed through

multiple regression analysis, as it is a powerful statistical procedure that can estimate the collective as well as the individual contributions of all predictor variables.

In summary, a correlational study design was utilized within the framework of this study since this research aims to understand the associations among a complex set of real-world naturally occurring variables (i.e. a range of characteristics of both physical features of classrooms, and of people/teachers) that may vary with the setting or circumstances being studied, and that are likely to influence the dynamics of social-physical interaction (Groat & Wang, 2002).

Since this study focuses on understanding the attitudes and using them as indicators of behaviors, the survey approach was the preferred method for answering these types of questions since they involve asking participants about their unique experiences or personal thoughts about physical environments, their attitudes and behaviors.

4.2 Population and Sample

All teachers who participated in this study resided in Wake County, North Carolina. In total, 234 middle school teachers were involved in the study. Two main groups of sample were obtained. The first group included 196 practicing teachers from 8 different middle schools that were under the Wake County Public School System. Approximately 20% of teachers from schools did not complete the entire survey. Missing data was then removed; therefore the number of participants from schools was dropped to 154. The second group of sample

consisted of 80 middle school teachers who were pursuing doctoral studies in College of Education at North Carolina State University.

Middle schools were considered in this research was since they serve as a transition and important stage for students between elementary and high school levels. Middle schools build the foundation for high school success and teachers are invaluable asset in assisting students in making the academic and social transition between elementary and high school levels. During the middle school movement in 1960s, it was recognized that young adolescents are not simply older elementary school students nor younger high school students, but that there are powerful transitions that impact upon cognitive, social, and emotional lives of young teens, which occur during this time of life demanding a thoroughly different and unique approach to education (Armstrong, 2006). It is also the middle school years that students start developing career competencies as well as knowledge, skills, and abilities that they need in order to cope effectively to make the transition to the next level of education, and to develop an educational plan to ensure their academic growth and development (National Occupational Information Coordinating Committee-NOICC, 1989 as cited in Middle School Program Planning Guide 2016-2017, 2016).

In North Carolina Wake County School System, middle schools (grades from 6 to 8) are organized into interdisciplinary teams in which two to five teachers assume joint responsibility for the instructional program of a specific group of students. For instance, while the population of a middle school may be 1,200 students, a sixth grader may be on a

team of 50 to 145 students. This system provides advantages for students, teachers and parents. But most importantly, through collaboration as a team, teachers are better able to address students' needs (Middle School Program Planning Guide 2016-2017, 2016). In summary, the middle school system of Wake County School System is designed to allow and encourage teachers to better personalize instruction to meet the needs of their students.

Therefore, this study designated Wake County, North Carolina as an appropriate geographic location for this research and used teachers as “experts” for providing a broad data base that helped to explore teachers’ attitudes and motivations in relation to how classroom spaces are structured.

4.3 Data Collection Tool

In order to address the research questions proposed; a survey questionnaire was designed and used to empirically examine and measure teachers’ attitudes, behaviors, and motivation in relation to the physical characteristics of classroom design. The survey included likert scales (rating scales), ranking questions, open-ended questions (comment/essay box questions), dichotomous questions, and demographic questions. The literature suggests that an attitude scale/questionnaire can simply group people with respect to a particular attitude and can allow us to study the ways in which such an attitude relates to other variables through surveys. The survey instrument of this study included: *a motivation towards education scale*, which is a five-point likert scale containing seven items from well-tested psychometric scales measuring motivation towards education; *an environmental response and awareness scale*,

which is a five-point likert scale containing seven items from a well-tested psychometric scale; and questions related to their: *current classroom arrangements; preferences on classroom design; movements and interaction with students in classroom; motivational strategies; their technology use; satisfaction; instructional area; and teaching methods*. Each of these variables is explained individually in the "Description of Variables, Data Preparation, and Coding" section.

The survey also included a copy of the research study's approval letter from the Wake County Public School system, as well as a cover letter including information about the researcher, why the study is being done and what the research purpose is, how the results will be used, how "confidentiality/anonymity" will be taking place, how long it would take to complete the survey, and what the contact information (e-mail address, mailing address, and phone number) is for further inquiries and/or concerns.

4.3.1 Sampling Strategies and Instrument Distribution Methods

An invitation letter was sent to all the middle schools under the Wake County Public School System (WCPSS) through a list available on the website of WCPSS, which listed 36 middle school facilities. School principals were contacted via e-mail and phone calls. They were informed about the research, and were invited to participate in the study. Eight middle schools agreed to participate in the study. Depending on the school principal's choice, two methods were used for distributing the survey to the schools: in-person distribution and online distribution. During in-person distribution, the researcher distributed hard copies of

the survey to all teachers within the participant schools during their weekly meetings, with the request that the survey be filled out and given to the school principal or to the person who was assigned by the school principal to collect the completed surveys. The other way of distributing the survey was online, which was created by the "Qualtrics" survey tool. Through some school principals' suggestions, the school principals were also asked to circulate the survey through their listservs in order to increase the response rate. The online version of the survey was also circulated among the middle school teachers who are pursuing doctoral studies in College of Education at the North Carolina State University using the college's listserv. This strategy aimed to increase the variety in teacher responses and get more opinions from experts (teachers).

4.4 Data Analysis Strategies

The unit of analysis used for the study is teachers. All statistical analyses were conducted with the SPSS software program with a priori level of significance of .05. Following the exploratory factor analysis, Internal consistencies (Cronbach a) were calculated for all scales except single-item measures, for which internal consistency cannot be computed. The study utilized various types of data analysis. Following sections provide a detailed explanation about the statistical tools used and the procedures that were followed.

4.4.1 Descriptive Statistics

Descriptive statistics were used in this study in order to summarize the data in an understandable and meaningful way (Sommer & Sommer, 2002) through quantitative

descriptions of the sample. Particularly, descriptive statistics were useful to describe classroom characteristics and the patterns of attitudes and personal characteristics of the subjects and their demographic background/information, such as gender, age, years of experience and school settings. Contingency tables (or frequency tables) were used to tabulate categorical data. For categorical data, contingency tables showing a matrix or table between independent variables at the top row versus a dependent variable on the left column, with the cells indicating the frequency of occurrence of possible combination of levels were used.

4.4.2 Exploratory Factor Analysis

Factor analysis is typically utilized to analyze a larger set of *j* measured variables with a smaller set of k latent constructs, to see if the *k* constructs will explain a good portion of the variance in the original $j \times j$ matrix of associations (e.g., correlation matrix) so that the constructs (or factors), can then be used to represent the observed variables. These constructs can be used as variables in following analyses/steps and "can be seen as actually causing the observed scores on the measured variables" (Thompson & Daniel, 1996 as cited in Henson, 2006). In summary, exploratory factor analysis (EFA) is a technique to: explore and analyze the possible number of constructs and the underlying factor structure of a set of variables; and provide a means to explain variation among variables (items) through newly created variables (Child, 1990). Typically, the Kaiser criterion, which means all factors with eigenvalues (indicating the amount of variance explained by each principal component or each factor) greater than one, is used in EFA analysis (Costello & Osborne, 2005).

The purpose of exploratory factor analysis in this study was to investigate the theoretical constructs (or factors) that might be represented by a set of items and assess the quality of individual items before establishing the internal consistency reliability of scales. The specific procedures of EFA followed (descriptives, factor extraction, rotation, scores, and option) in this study are described under each scale's "data preparation" section.

4.4.3 Correlational Analysis

This study investigated the relationships between the physical characteristics of classroom environment (i.e. teachers' current classroom arrangement and teachers' classroom design layout/shape preferences for both specific purposes and in general) and teachers' behavioral and attitude characteristics, which were described in the conceptual framework. In order to answer relational questions, correlational analysis was used as a tool in this study. Since the research questions of the study aims to examine associations between variables rather than predicting the outcome variables, Chi square tests were the preferred method. In order to investigate correlations with non-continuous and/or frequency/categorical data, we can find relationships between variables that contain frequency data using a test called the chi-square test ($\chi 2$) for independence. In this test, both variables are treated as a nominal data even when one and both are ordinal. Under the null hypothesis, it is assumed that there is no association between the row and column variables (Tang, He, & Tu, 2012). This test is also known as an enumeration statistic, which means it does not measure the value of a set of items, but compares the frequencies of various categories of items with the frequencies that are expected if the population frequencies are as hypothesized by a researcher. Specifically, it

does not require equality of variances among the study groups or homoscedasticity in the data. Advantages of the Chi-square include its robustness with respect to distribution of the data, its ease of computation, the detailed information that can be derived from the test, its use in studies for which parametric assumptions cannot be met, and its flexibility in handling data from both two group and multiple group studies (McHugh, 2013).

Since the independent variables of the study were nominal categorical, Pearson's Chi square test was used to test for independence between the nominal and ordinal categorical variables of the study. When more than 20% of cells had values lower than 5, Likelihood Chi square test was used as an alternative to Pearson's chi square test as it does not require to have values more than 5 in each cell (Agresti, 1996; Gavin, 2008). In order to examine the associations between two ordinal variables (interactions between the individual level variables of the study), Linear-by-linear test was performed and reported when no more than 20% of cells had expected count less than 5. The Kruskal-Wallis H test, as a rank-based nonparametric test, was also an alternative to determine if there were statistically significant differences between two variables on an ordinal level. However, due to the failure to meet the fourth assumption of Kruskal-Wallis, which requires the distributions in each group (i.e., the distribution of scores for each group of the independent variable) to have the same shape (which also means the same variability) this test could not be computed.

Besides looking at the Chi Square significance value, strength of association was calculated when there was significant evidence found of a relationship between the variables. In terms of measuring the strength of associations between the independent and dependent variables,

Cramer's V, as a measure of strength, was calculated to measure the strength of the association between one nominal variable either with another nominal variable, or with an ordinal variable reported. When calculating Cramer's V, both of the variables can have more than two categories. It applies to either nominal X nominal crosstabs, or ordinal X nominal crosstabs, with no restriction on the number of categories (Agresti, 1996). On the other hand, in order to measure the strength of association between ordinal categorical variables (i.e. to examine the interactions between the individual level variables of the study), Gamma, as a measure of association for ordinal variables, was calculated and reported. The Gamma ranges from -1.00 to 1.00, a Gamma of 0.00 reflects no association; a Gamma of 1.00 reflects a positive perfect relationship between variables; a Gamma of -1.00 reflects a negative perfect relationship between those variables (Agresti, 1984).

4.4.4 Content Analysis

The survey included two open-ended questions describing (1) the motivations for teachers to change their classroom arrangements and (2) the activities they use in open areas. Open-ended questions were utilized and preferred for the following reasons:

- The researcher did not know all the possible answers to a question.
- A range of possible answers was too large that the question would become unmanageable to put in a multiple-choice format.
- The researcher wanted to avoid suggesting answers to the respondents.

- The researcher wanted answers in the participants' own words (Sommer & Sommer, 2002).

Therefore, in order to analyze the open-ended questions of the study, a conventional content analysis method was used. In comparison to direct content analysis, in which the researcher uses existing theory or prior research to develop initial codes, a conventional content analysis allows researchers to gain a richer understanding of a question or phenomenon. This type of design is usually appropriate when existing theory or research literature on a question or phenomenon is limited. In this type of analysis, researchers avoid using preconceived categories, instead allowing the categories and names for categories to flow from the data. Therefore, the initial codes and meta-codes were derived from the data, and were defined during the data analysis (Kondracki & Wellman, 2002).

MaxQDA, a qualitative text analysis tool, was used to address open-ended questions. The unit of analysis was words. Particularly, MAXDictio, a quantitative text analysis extension of MaxQDA, was utilized to create an index of the words and explore the vocabulary. This tool was useful for coding textual material systematically and converting the qualitative data into quantitative data. The following strategies were used in this phase of analysis:

- Defining evaluative categories
- Coding text segments
- Grouping codes and creating meta-codes
- Analyzing the data descriptively and statistically

4.5 Description of Variables, Data Preparation and Coding

The following sections aim to provide a detailed understanding of the collected data through explaining what the variables are, how they were constructed, and how they were prepared and/or transformed in order to make them usable for analysis. The variables used in this study fall into two main categories: classroom environment (independent variables) and teacher attitude and characteristics (dependent variables).

4.5.1 Explanatory/Independent Variables

4.5.1.1 Teachers' Current Classroom Arrangements

This variable was conceptualized as an indicator of physical environment through teachers' current classroom arrangements. Through an intensive review of literature, six most commonly-used classroom arrangements that would represent typical classrooms were identified and drawn on AutoCAD software (see Figure 4-1). In order to address this variable, teachers were asked to choose the arrangement that represent the arrangement they use most frequently in their classroom. The following classroom arrangements were used in the survey:

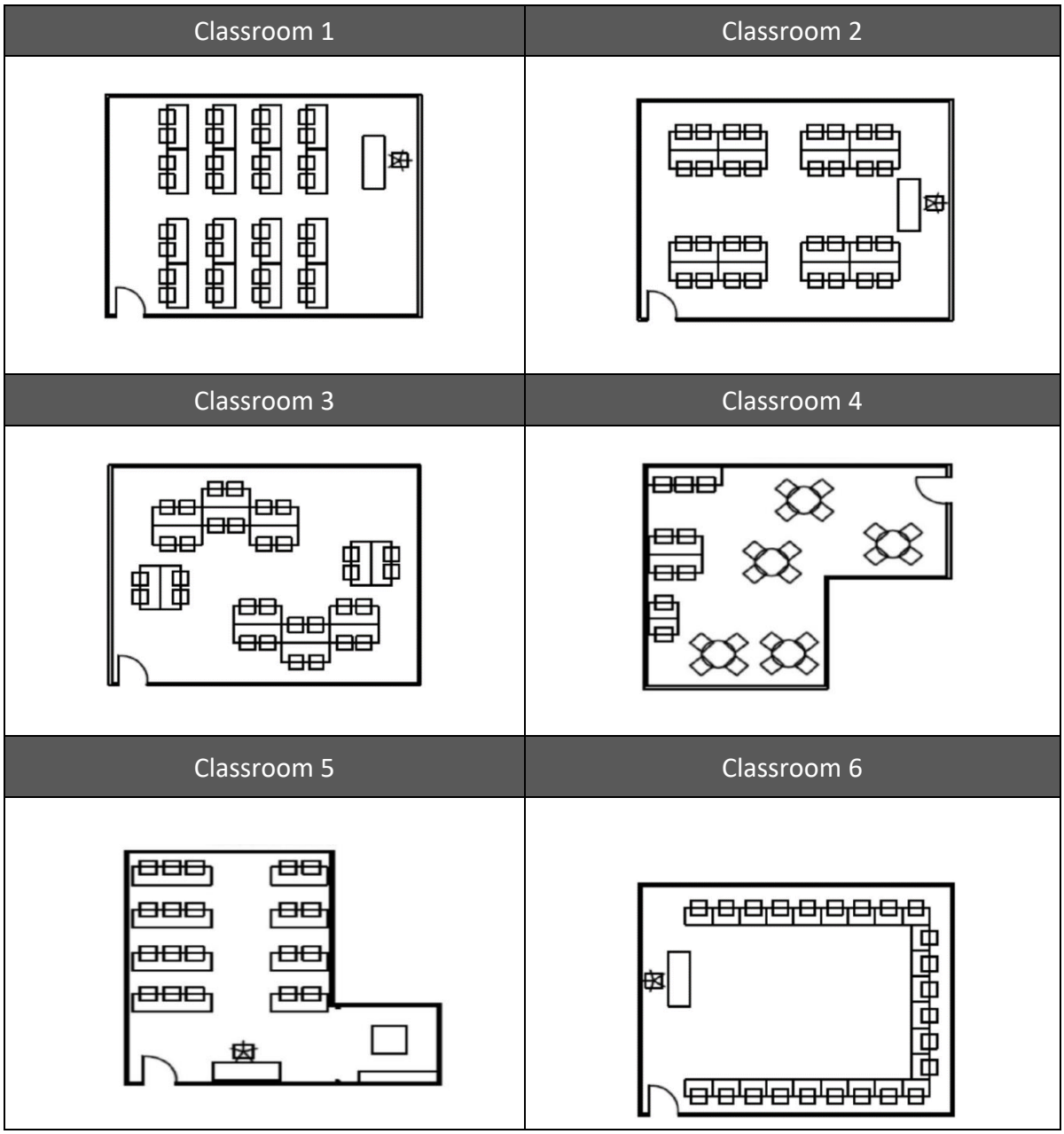


Figure 4-1: Images used to represent teachers' current classroom arrangements

The purpose behind this question was to understand what kind of classroom environments were being used by teachers. The literature suggests that the architectural facility provides

the setting for all the interactions among teachers, students, and materials through its physical attributes. Social interaction among teachers and students are also affected by the classroom layout and arrangement (Gifford, 1987 as cited in Spencer & Blades, 2006). In traditional classrooms, typically students are seated in rows and teachers are positioned far away from students who are seating in the back rows. Therefore, although traditional classrooms are useful for teacher-centered classes (such as lectures), they are not effective environments for classes in which interaction and teacher movement are important and required. Martin (1999) argues that the arranged environment can work in partnership with the teacher and the spatial organization is the key for arranging furniture in order to create appropriate movements and accordingly support the learning activities that the teachers intend to do. Spatial organization is an important issue beyond aesthetics and it can influence so many behaviors as teachers use the spatial organization to define spaces for tasks, plan planning patterns, and arrange the furniture. Through the arrangement of furniture new spaces are created. These spaces and their relationships will eventually influence behavior and activity patterns whether or not they are planned. Therefore, different behaviors are expected to occur in different classroom arrangements and layouts.

Unfortunately, very few studies in the literature have addressed teacher movement and its relation to physical environment. Martin (2004b) argues that this lack of empirical data leads both educators and designers towards an unclear direction where socially complex classroom environments are designed, utilized and managed based on ambiguous knowledge. In her empirical research study, Martin (2002) found that there two main categories of classroom

arrangements exist: teacher-centered and student centered classrooms. Freiberg, Moores, & Moores (2007) argue that these two environments are not totally on one side or another but definitely have some certain contrasting characteristics (see Table 4-1).

Table 4-1: Classroom discipline compared in teacher-centered and student-centered

Teacher-centered classrooms	Student-centered classrooms
Teacher is the sole leader.	Leadership is shared.
Management is a form of oversight.	Management is a form of guidance.
Teacher takes responsibility for all the paperwork and organization.	Students are facilitators for the operations of the classroom.
Discipline comes from the teacher.	Discipline comes from the self.
A few students are the teacher's helpers.	All students have the opportunity to become an integral part of the management of the classroom.
Teacher makes the rules and posts them for the students.	Rules are developed by the teacher and students in the form of a classroom constitution or compact.
Consequences are fixed for all students.	Consequences reflect individual differences.
Rewards are mostly extrinsic.	Rewards are mostly intrinsic.
Students are allowed limited responsibilities.	Students share in classroom responsibilities.
Few members of the community enter the classroom.	Partnerships are formed with business and community groups to enrich and broaden the learning opportunities for students.

Source: Carl Rogers and H. Jerome Freiberg (1994). Freedom to Learn, 3rd Edition, p. 240. Columbus: Merrill Publishing. Adapted by permission of Prentice-Hall, Inc., Upper Saddle River, NJ as cited in Freiberg, Moores, & Moores (2007).

These classroom types are further defined in the following sections (Martin, 2002):

Teacher-centered Arrangements (Teacher Teaching or Teacher Dominated Profile)

Martin's study found that in this classroom type, students are seated in rows and the teacher's location remains stable at the front of the class with a mobility factor (the total area covered by the teacher -in square meters- during the lesson) of 20% and a degree of centeredness (defined as being the time spent by the teacher at specific locations as a percentage of the total lesson time) of 50%.

In this type of classroom environments: the focus of attention is the teacher (usually the whole class is focused on the teacher-no students on task); they can also be labelled as having a teacher-centered pedagogy; lessons follow the conventional order, that is, an introduction period, followed by the teacher teaching the whole class and sometimes setting up an activity (Martin, 2002).

Student-centered Arrangements (Students on Task Profile or Student Dominated)

In this type of classroom arrangement, typically students are seated in clusters and the classroom is arranged in a way to create a physical arrangement to support that the focus of the activity is on students working either individually or in groups. In this type of classroom arrangements: more teacher-student(s) interactions occur in this cluster; they can be labelled as having a child-centered pedagogy; lessons typically follow either an "teacher initiated iterative" profile in which lessons begin with teacher directed input and follow pupils on task

activities or “pupil initiated iterative” in which pupils usually know what the task is when arriving in class and they start working on the task autonomously.

In her study, Martin (2002) found that where teachers address the whole class (teacher-centered classrooms), they are less mobile with an inverted Pearson correlation ($r = -0.42$) and where teachers address groups or individual pupils (student-centered classrooms), they are more mobile with a positive correlation ($r = 0.41$).

Therefore, based on what previous studies have found, the typical classroom arrangements that were given to teachers in this study’s survey were grouped based on what kind of classroom arrangement type they represent. Since Classroom numbers 1, 2, 5 and 6 had fixed-teacher positions with an arrangement where students are seated in rows, they were grouped and coded as “Teacher Centered” as they do not support students-on-task cluster of activities. Classroom numbers 2 and 4, on the other hand, are grouped and coded as “Student Centered” as there are no fixed-teacher positions and students are seated in clusters (see Figure 4-2). This variable was a nominal categorical independent variable.

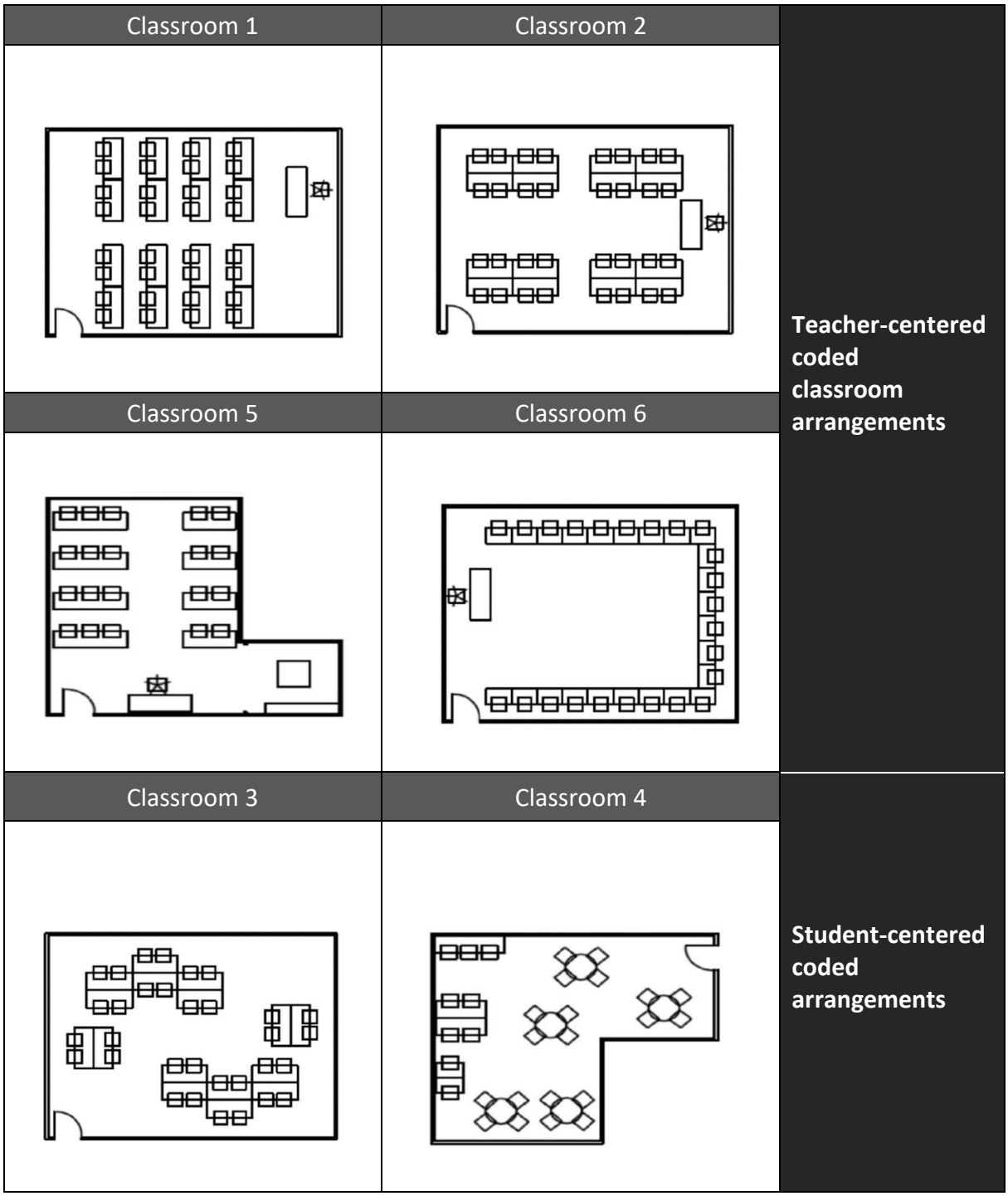


Figure 4-2: Teachers' current classroom arrangement variable coding scheme

Furniture Flexibility

In order to understand the hierarchy of designability of classrooms, furniture flexibility variable was employed as a construct that measures the degree of control of change that teachers have over the physical elements of the classroom setting. The literature suggests that in examining teachers use of the classroom space, architectural elements should be classified in terms of hard (fixed elements) and soft architecture (semi-flexible and flexible elements). This classification is a further development of Steele's (1973) division of space (Martin, 2002).

Therefore, in order to address teachers' flexibility (designability) in changing classroom arrangement, teachers were asked whether the tables and chairs are fixed in their classroom and given three choices to choose from: fixed, semi flexible (movable but heavy); and flexible. As literature suggests (Martin, 2002), "semi flexible" and "flexible" choices were grouped and coded as "flexible" and "fixed" choice remained as it was and coded as "fixed" in the survey data preparation and coding process. This variable was a nominal categorical variable.

4.5.1.2 Classroom Design Preferences

One of the main purposes of this study was investigating teachers' preferences on classroom design as this research conceptualizes teachers as "experts" and classrooms as "teacher-designed environments". Therefore, an intense review of literature was conducted to identify the classroom designs (spatial layouts) that have been found "innovative" by previous

research studies in the field of design and education. The sources of information were: historical developments of school buildings; results of architectural psychology and environment-behavior research; and descriptions of innovative school projects. In addition to the rest of sources in literature, main sources of generating images for this variable were: the book titled “Modern Schools: A Century of Design for Education” written by Hille (2011); the book titled “Schools for the Future: Design Proposals from Architectural Psychology” edited by Walden (2009); and the articles titled “Activity-enhancing arenas of designs: A case study of the classroom layout” by Amadeo & Dyck (2003). Influences of other specific features of classrooms outcomes (such as lighting, colors, class size, etc.,) on behavioral and academic outcomes have already been discussed in the previous chapters. However, how spatial layout of classrooms (spatial configuration/shape) influence teaching and learning activities and what teachers think about its influences were not addressed as the other features of classrooms were addressed in the literature and very little effort has been made. However, even though furniture and furnishings may be rearranged, shapes can limit what can occur within the layout (Lippman, 2004).

Sanoff (1994) emphasized on the importance of integrating research findings, participation in the design process, and the development of design of school settings, which enhance activities and meet users’ needs, objectives, and preferences. He also discusses the importance of the physical, intellectual, and effective aspects of child development by illustrating the ways that relate behavioral objectives to spatial needs. In his research, Moore (1986 as cited in Amadeo & Dyck, 2003) studied the influences of spatial definitions of

classroom settings on child development and found out that significantly more exploratory behavior, social interaction, and cooperative behavior occurred in spatially well-defined behavior settings than the moderately or poorly defined ones. In their research, Amedeo and Dyck (2003) studied specific shapes of classroom and teacher perceptions and preferences. They found that teachers perceive the influences by various structural forms on teaching and learning activities to differ, whereas their perceptions of such differences are mediated by their educational attitudes.

In this study, the classroom layouts generated and used to understand teacher preferences on classroom designs were variations of L-shaped and expandable classrooms. The reason behind focusing on these designs was that they were the most distinguishable innovative classroom layouts (shapes) existing in the classroom design literature as they were also found to accommodate more multifaceted activities (Dyck, 1994).

Literature starting from 1970s shows that L-shape classrooms started to vary from rectangular format classrooms and they were designed to catch up with innovative approaches occurred in teaching and learning activities. The reason why L-shaped classrooms were found innovative was because: they afford flexibility (using the legs of "L" for separate activities or groups); they provide permanent zones for small groups to work; they provide opportunities to create additional, although temporary, activity settings as integrated, flexible and variable systems although the furnishings and furniture in the classroom can be reorganized for individual, one-to-one, small group, and large group

activities (Lippman, 2004). Overall, the literature suggests that L-shaped variations of classrooms: can afford multiple activity settings; provides more opportunities for students to work independently and in small groups; and are integrated, flexible, and variable environments (Sanoff, 2002 and 2009; Lippman, 2004).

Expandable classrooms, on the other hand, is a concept aroused from the academic houses, which is based on creating flexible learning spaces to allow students and teachers to collectively explore in diverse set of spaces (Sanoff, 2009; Lippman, 2010). In literature, it has been found that academic house type school environments are more associated with satisfactory spatial properties than other type of environments (Knapp, Noschis, & Pasalar, 2007). Amabile (1996) also found that open classrooms generally contain less structure, fewer teacher-initiated constraints on performance, and more individualized effort. Since many of the differences between open and traditional classrooms concern extrinsic constraint, the intrinsic motivation hypothesis of creativity would lead to predictions of higher creativity among children in open classrooms. Expandable classrooms - as a type of open-plan classrooms - have also been reported to facilitate better teacher-to-teacher interactions and 'social support' (Ahrentzen and Evans, 1984 as cited in Higgins, Hall, Wall, Woolner, & McCaughey, 2005).

The main purpose of expandable classrooms is to provide a common space that can be used when the two neighboring teachers need to collaborate. Through doors or expandable walls, they can be either completely or partially opened in order to create one large classroom space

for collaborative tasks or purposes; or they can be closed off so that students can work separately. These expandable sections can sometimes have a small common space in between so that individuals also can find a common space in between classrooms for small or large group activities when walls are expanded (Grayson, 2010).

In summary, the purpose of this variable was to expose teachers to some innovative classroom layouts in terms of geometric shapes as alternatives to traditional classrooms. It also aims to extend the knowledge in the field of architectural psychology on geometric variations of classroom layout (shape) and its relation to teachers' behavioral and attitude outcomes while exploring what teachers prefer. Thus, in order to address this variable, six classroom layouts were generated through 2D and 3D architectural softwares. In literature, these classroom layouts were designed as alternatives to traditional classrooms and found to be innovative and successful for students' achievements and better student-teacher interaction. Therefore, teachers were exposed to six classroom layouts, in which each pair of classrooms contained: equal class size; similar furniture; similar table arrangement; same color scheme; and similar connection to outdoor (see Figure 4-3).

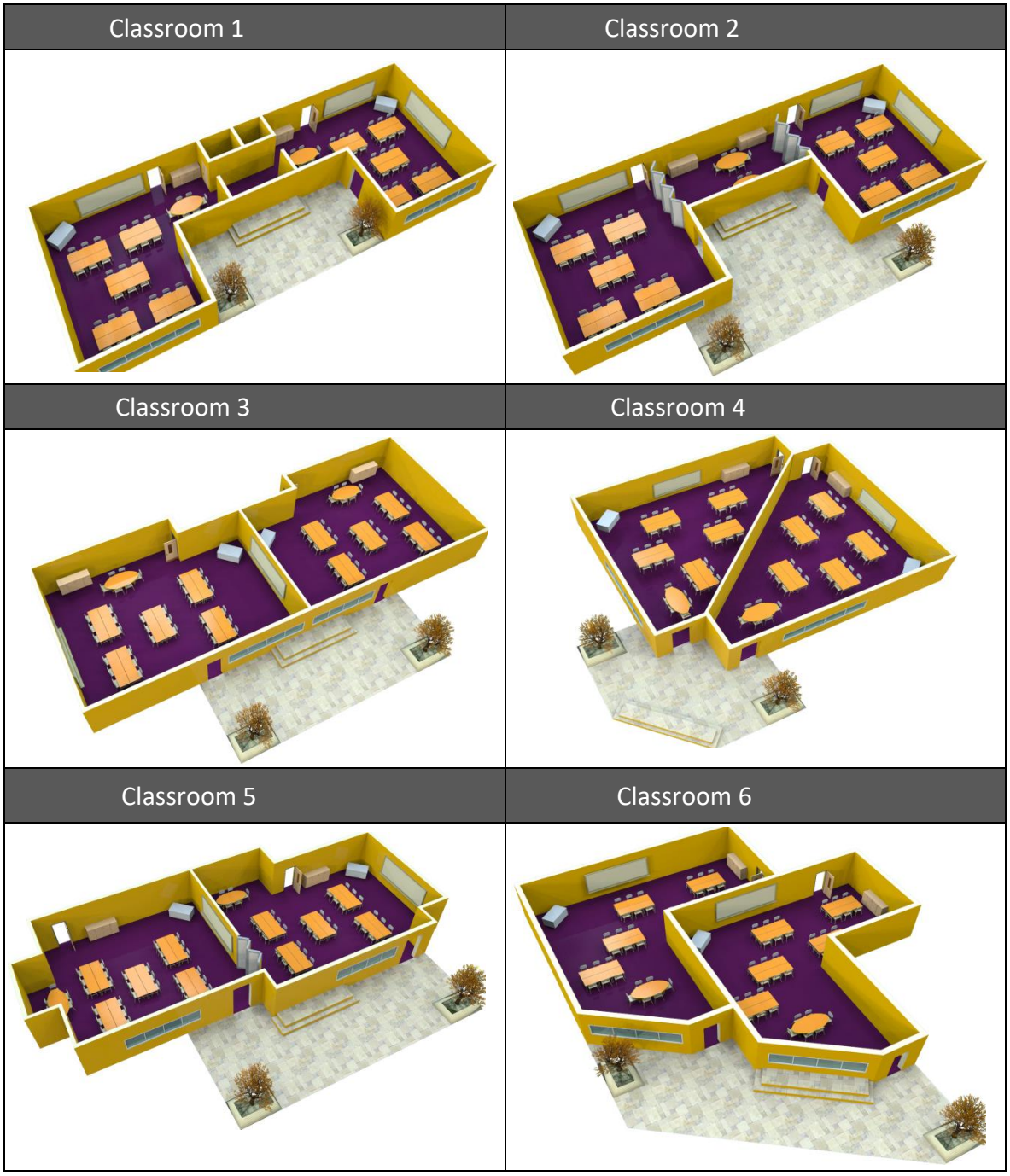


Figure 4-3: Images used to represent innovative classroom designs (layouts/shapes)

In the survey, in order to clearly state that the layout of the classroom was the focus of the research, these explanations were written within the question for teachers to avoid misinterpretations of the images and the question itself. As it has been discussed in the previous chapters, since different purposes and needs (such as activities and teaching methods) require different physical environments, teachers then were asked to select the best classroom layout (shape) that would satisfy each of the statements below:

- Best layout for lectures
- Best layout for class discussions
- Best layout for group studies
- Best layout for independent student activities
- Best layout for multiple teaching methods
- Best layout for interaction between students
- Best layout for teaching movement
- Best layout for circulation
- Best layout for technology use
- Best layout for overall.

Creating groups and coding the classroom designs during the analysis process was based on the pair of classroom's shape. Since classroom numbers 3, 4 and 5 are pair of classrooms that can be opened through a door or an expandable door when needed, they were grouped and coded as "expandable". The overall shape of these pair of classrooms allows creating a one big open classroom when needed. And since the classroom numbers 1, 2, and 6, on the other

hand, are variations of L shape classrooms and can provide different functions to users (as discussed in the previous section), they were grouped and coded as “variations of L-shapes” (see Figure 4-4). Teachers who participated in the survey did not know what the criteria was, so they were not informed about how these classrooms can be expanded or how the legs of L shape classrooms can create spaces for different activities and purposes. If more information was provided through either extra explanation in the question or the images themselves explicitly exposing the purpose and/or the criteria of coding, then this variable could have caused prejudice or bias teachers’ judgement. Therefore, the images were intentionally not explicit and clear about what they can afford. This variable was a nominal categorical independent variable.

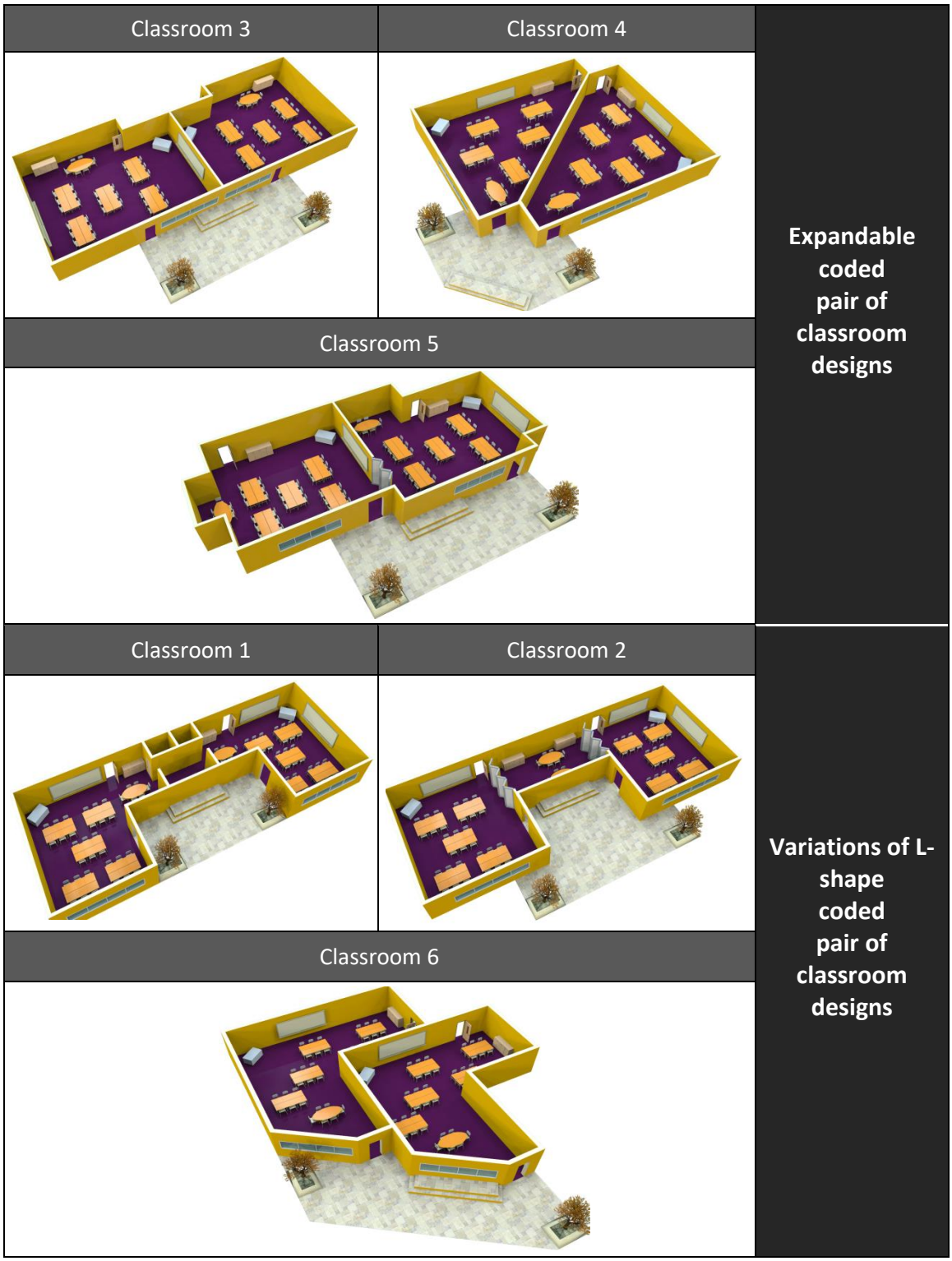


Figure 4-4: Teachers' classroom design preferences variable coding scheme

4.5.2 Outcome/Dependent Variables

4.5.2.1 Motivation towards Education

Motivation is often described as intrinsic, which arise through personal interests and inherent feelings of satisfaction (Alexander, 2006), or extrinsic in which the results or rewards are high grades, money, or gold stars (Covington, 2000). Motivation towards work is defined internal state that empowers, initiates, directs, and sustains our behaviors in an organization (Leonard et al., 1999; Woolfolk, 2001). Teacher motivation can be defined as the drive, energy, or desire in teachers to be committed to making efforts to help students learn as best as they could (Choi, 2014). Recent studies have shown that school teachers experience a lack of motivation (Jesus & Lens, 2005). Teachers' motivation has been found vital for optimal human functioning in the workplace because teachers who are highly motivated are more engaged in their work. More importantly, teacher motivation has been found to be correlated with students' motivation (Fernet, Senecal, Guay, Marsh, & Dowson, 2008).

Herzberg, Mausner, and Snydermann (1959 as cited in McKinney, 2000) identified a two-factor approach for understanding employee motivation. First, they divide employee behaviors into two categories: motivation and hygiene factors. The state that motivators in this intrinsic category include achievement, recognition, responsibility, advancement and work itself. In contrast, hygiene factors are rewards extrinsic to the content of work (McKinney, 2000).

According to Dörnyei & Ushioda (2011), there are four major aspects of teacher motivation: intrinsic component, contextual factors, temporal dimension, and negative influences. The intrinsic factor is related to teachers' internal desire to educate people and improve their lives, where the intrinsic rewards are based on witnessing the changes in students' behavior and performances due to the teachers' action, and improving their own skills and knowledge in a valued discipline. The contextual components are attributed to external conditions and constraints, which can be categorized into two groups: school-based factors such as school leadership and societal-level factors such as the status and image of teachers in society. The temporal dimension of teacher motivation is based on career perspectives. It has been found that if a teacher believes that his dedication to teaching does not bring further career advancement, he will lose interest in the job and his work morale will be negatively influenced. Finally, negative influences are associated with stress, restricted teacher autonomy, low level of self-efficacy, and relatively closed career paths (Choi, 2014).

Scale Construction

In this study, The Teacher Motivation Questionnaire (McKinney, 2000) was used to obtain information regarding teacher motivation and was administered to the teachers. The questionnaire was developed using intrinsic and extrinsic factors as motivators. Frederick Herzberg's motivation-hygiene theory was used as a theoretical basis and a 5-point likert scale was used to record the responses. The construction and structure of the Teacher Motivation Questionnaire was developed and focused on the motivation and hygiene factors proposed by Herzberg. The intrinsic factors contain: achievement, recognition, work itself,

responsibility, advancement, and possibility of growth. Intrinsic factors tended to make tasks more interesting, enjoyable and psychologically rewarding. Herzberg associated hygiene factors and factors with the context or setting of the organization as extrinsic, factors such as: policies of the organization, administration, technical supervision, salary, working condition, status, job security, effects on personal life, interpersonal relations with supervisors, peers and subordinates (McKinney, 2000).

The original survey questionnaire included sixty-one items that focused on motivation and hygiene factors. Six areas served as intrinsic motivation and seven areas served as extrinsic motivation on the survey questionnaire. Validity of the Teacher Motivation Questionnaire consisted of a review panel of two college professors, two psychologists, two public school administrators, and four classroom teachers. This review panel made minor suggestions for improvement. Subsequently, the survey tool was changed, and all thirteen content areas were thought to reflect motivational factors described in the literature. The reliability of the Teacher Motivation Questionnaire was also established through using the Spearman Rank Order Reliability Test, which resulted in a reliability coefficient of +. 80. Homogeneity of the Teacher Motivation Questionnaire was determined by using Cronbach's coefficient Alpha from SPSS (McKinney, 2000).

Although the original scale involved both intrinsic and extrinsic statements related to factors that may affect teachers' personal motivation as a teacher, intrinsically motivated behaviors only were targeted in this study as they are engaged in for the pleasure or the satisfaction

derived from performing them rather than extrinsically motivated behaviors, in which behaviors are not performed for the activity itself but rather as a means to an end (Fernet, Senecal, Guay, Marsh, & Dowson, 2008). In literature, teachers have also been found motivated more by intrinsic than by extrinsic rewards (Herzberg, 1968).

Initially, seven items were drawn from the existing questionnaire. The selected items then were modified and narrowed down to a more middle school context. Teachers rated the resulting 7-item motivation scale on the extent to which they agreed with each statement using a 5-point Likert scale (1 = strongly disagree, 2 disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly disagree).

Exploratory Factor Analysis

The purpose of exploratory factor analysis as a method was to assess the factor structure of the scale items, which were used to measure middle school teachers' motivation levels toward education as well as to prepare the data for further analyses through dimension reduction (to drop poor factors and variables). Seven questions related to motivation towards education were factor analyzed using maximum likelihood analysis with Varimax (orthogonal) rotation. The procedure followed in this analysis as it follows:

Descriptives: Univariate descriptives and the initial solution were requested to check for any irregularities in the data.

Extraction: We have chosen maximum likelihood as the method of extraction as it has many desirable statistical properties. As there is no agreement in the literature about how many factors the scale measures (after asking for factors with eigenvalues greater than 1 to be retained), we have then fixed the number of factors to extract to 1 to see if any of the items were below the cut-off point (.4). As a rule of thumb, variables should have a factor loading of at least .4 onto one of the factors in order to be considered important.

Rotation: The goal of rotation is to simplify and clarify the data structure. We have chosen Varimax rotation as it is by far the most common choice among orthogonal methods and it produces more easily interpretable results.

Scores: We have asked for factor scores to be calculated and saved.

Options: To help interpretation we have asked the factor loadings to be ordered by size and factor loadings less than 0.10 to be omitted from the output.

The analysis yielded one factor explaining a total of 36.140% of the variance for the entire set of variables. The factor remained to be labeled as motivation.

Table 4-2: Total variance explained for the motivation towards education scale

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.530	36.140	36.140	1.839	26.277	26.277
2	1.188	16.969	53.110			
3	1.022	14.599	67.709			
4	.688	9.833	77.542			
5	.566	8.089	85.631			
6	.525	7.495	93.126			
7	.481	6.874	100.000			

Extraction Method: Maximum Likelihood.

As a result of this step, none of the items were eliminated because they all contributed to the factor structure and met the minimum criteria of having a primary factor loading of .4 or above (see Table 4-3).

Table 4-3: Factor matrix and communalities for the motivation towards education scale

Factor Matrix[a]		**Communalities**	
	Factor		
	1	Initial	Extraction
Item 1. I set goals for myself and achieve them.	**0.427**	.165	.183
Item 2. I spend some of my free time on self-improvement on teaching by reading articles, attending workshops and meetings, etc.	**0.444**	.208	.198
Item 3. I know my teaching is effective in helping students to learn	**0.519**	.256	.270
Item 4. I am satisfied with my current job	**0.462**	.237	.213
Item 5. I would like my students to learn more	**0.423**	.255	.178
Item 6. I like to spend a lot of energy to make my classes interesting	**0.758**	.366	.575
Item 7. I am personally responsible for part of the education of every student I teach	**0.472**	.278	.223

Extraction Method: Maximum Likelihood.

Extraction Method: Maximum Likelihood.

a. 1 factors extracted. 4 iterations required.

Note: Factor loadings over .40 appear in bold.

Therefore, a mean score was calculated for each teacher during the coding process based on the likert scale. Although this variable was based on mean scores and could be treated continuous, since the nature of the data structure was based on categories and not normally

distributed, repeated values emerged and creating a meaningful model became difficult due to overlapping values when treated as continuous. In order to avoid this, 25th and 75th percentiles of the data were calculated to transform the variable into categories. Based on motivation mean scores, values below 25th percentile (mean score value = lowest thru 4) were coded low, in between 25th and 75th percentiles (mean score value = 4.01 thru 4.4286) were coded medium, and above 75th percentile (mean score value = 4.4287 thru highest) were coded high. This variable was treated a nominal categorical variable to simplify it with manageable categories because the quantitative differences between the categories were uneven and treating as continuous resulted in overlapping values which made obtaining a meaningful model difficult.

Internal Consistency Reliability

Internal consistency reliability is a measure of how well the items on the test measure the same construct or idea. At the most basic level, there are three methods that can be used to evaluate the internal consistency reliability of a scale: inter-item correlations, Cronbach's alpha, and corrected item-total correlations. As Table 2-1indicates, Cronbach's Alpha for the 7 items motivation scale was calculated and found nearly .70 (7 items; α= .683).

Table 4-4: Reliability statistics of the motivation towards education scale

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.683	.700	7

Table 4-5: Inter-item correlation matrix of the motivation towards education scale

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7
Item 1	1.000	.315	.272	.133	.166	.302	.167
Item 2	.315	1.000	.259	.038	.235	.330	.212
Item 3	.272	.259	1.000	.370	.099	.401	.130
Item 4	.133	.038	.370	1.000	.120	.404	.178
Item 5	.166	.235	.099	.120	1.000	.290	.473
Item 6	.302	.330	.401	.404	.290	1.000	.348
Item 7	.167	.212	.130	.178	.473	.348	1.000

4.5.2.2 Environmental Response and Awareness

In this study, The Environmental Response Inventory (McKinney, 1977) was used to obtain information regarding teachers' environmental dispositions and was administered to the teachers. The Environmental Response Inventory (ERI) is a multiscale, broad-bandwidth assessment instrument, which was developed to help define and measure differences in the ways persons habitually interact with the environment. The ERI is composed of 184

statements, which were designed to measure environmental attitudes regarding a number of environmental premises such as architecture, recreation, conservation, leisure activities, and geography. The instrument was designed in a way that respondents are asked to respond to each of the statements on a 5 point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). Eight subscales can be measured and one validity score can be obtained through the responses. The eight different subscales are: Pastoralism, Urbanism, Environmental Adaptation, Stimulus Seeking, Environmental Trust, Antiquarianism, Need for Privacy, and Mechanical Orientation (McKechnie, 1977).

In this study, the Urbanism and Pastoralism subscales were selected as the focus as Urbanism refers to "appreciation to varied stimulus patterns of physical environment, the enjoyment of not open spaces, but the densely populated, fast-paced, unstable, and culture filled life found in many metropolitan areas" (McKechnie, 1977). The reason behind focusing on the urbanism scale was because high scores on the urbanism scale are typically described as "responsive to urban aesthetics, critical, skeptical, and concerned with philosophical problems", while low scorers are typically described as "conscientious, nonverbal, opportunistic, and generous". Pastoralism subscale, on the other hand, was described as the polar opposite of urbanism subscale through referring to "being resistant to development of land and self-reliant in natural surroundings". Since identifying and assessing teachers' environmental response and awareness (whether being responsive to characteristics of physical environment or not) was one of the main focuses of this study, the urbanism and pastoralism (which reflect both negative and positive statements toward the same construct)

were considered as the most meaningful subcategories which fit the aim of the study and were more applicable to teachers' context.

The first version of the original scale, which was developed in 1968 and containing 218 items, was first administered to 800 respondents through the United States. In order to identify the underlying factors and establish the factor structure, Factor Analysis was conducted. In the final version of the scale, reliability of the Environmental Response Inventory was established through using split-half and test-retest reliability. First sample consisted of 814 participants (420 males, 394 females) who were mainly undergraduates from UC Berkeley. In the second sample, 255 participants (118 males, 137 females) who were the residents of Marin County that were contacted via door to door solicitation and included.

The validity of the scale was established through correlating the data from this study to data from a different study in which 50 people (25 males, 25 females) from sample 2 collectively completed the Leisure Activities Bank (LAB), the Adjective Check List (ACL), the Strong Vocational Interest Blank (SVIB), the California Psychological Inventory (CPI), the Minnesota Multiphasic Personality Inventory (MMPI), the Study of Values (AVL), and the Myers-Briggs Type Indicator (MBTI). LAB is a self-report measure of leisure and recreational behaviors. ACL is a self-description that is composed of a choice of 300 different adjectives. SVIB is a scale of vocational interests. The CPI is a scale about

interpersonal behavior. The MMPI is a personality inventory. And, AVL measures six different value orientations (theoretical, economic) In the first sample (McKechnie, 1977).

Scale Construction

Initially, seven items were drawn from the existing scale. Teachers rated the resulting 7-item environmental response and awareness scale on the extent to which they agreed with each statement using a 5-point Likert scale (1 = strongly disagree, 2 disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly disagree).

Exploratory Factor Analysis

Exploratory factor analysis was conducted for the same purposes as they were described for the motivation scale. The procedure followed in this analysis as it follows:

Descriptives: Univariate descriptives and initial solution were requested to check for any irregularities in the data.

Extraction: We have chosen maximum likelihood as the method of extraction as it has many desirable statistical properties. We have asked for factors with eigenvalues greater than 1 to be retained, rather than specifying the number ourselves. We have asked for a Scree plot to be provided to help us determine the number of meaningful factors.

Rotation: The goal of rotation is to simplify and clarify the data structure. We have chosen Varimax rotation as it is by far the most common choice among orthogonal methods and it produces more easily interpretable results.

Scores: We have asked for factor scores to be calculated and saved.

Options: To help interpretation we have asked the factor loadings to be ordered by size and factor loadings less than 0.10 to be omitted from the output.

According to the output of exploratory factor analysis, there are two relatively high (factors 1 and 2) eigenvalues, which was predictable since the items were drawn from two sub-categories that were described as polar opposites to each other in the original scale (urbanism and pastoralism). Factors 1 and 2 explain 30.729% and 17.871% of the variance respectively – a cumulative total of 48.600% (see Table 4-6).

Table 4-6: Total variance explained for the environmental response and awareness scale

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	**2.151**	30.729	30.729	1.150	16.434	16.434	1.592	22.738	22.738
2	**1.251**	17.871	**48.600**	1.497	21.391	37.825	1.056	15.087	37.825
3	.999	14.278	62.878						
4	.899	12.836	75.714						
5	.727	10.384	86.098						
6	.586	8.377	94.475						
7	.387	5.525	100.000						

Extraction Method: Maximum Likelihood.

As a result of the analysis, a total of two items (Item 1 and 3) were eliminated because they did not seem to contribute to a simple factor structure and failed to meet a minimum criterion of having a primary factor loading of .4 or above. According to the factor loadings, one item loaded onto Factor 1 (Item 2), which was related to pastoralism and reflected a negative statement towards urbanism. This factor was labelled “Environmentally Exclusive” to define anti-urbanist environmental dispositions.

The four items that loaded onto Factor 2 (Item 4, 5, 6, and 7) were related to urbanism and expressed personal orientation toward the natural environment, including basic environmental experiences. This factor was labelled “Environmentally Passive”. (see Table 4-7)

Table 4-7: Factor matrix and communalities of the environmental awareness scale

Factor Matrix[a]			**Communalities**[b]	
	Factor		Initial	Extraction
	1	2		
Item 1. I often feel that I am a part of the environment around me	0.245	-0.056	.097	.063
Item 2. I often have strong emotional reactions to buildings	**0.999**	-0.001	.137	.999
Item 3. Building projects which disrupt the ecology should be abandoned and the land returned to its natural state	0.11	0.169	.059	.041
Item 4. I often feel uneasy in a large crowd of people	0.183	**0.404**	.182	.196
Item 5. I find street noise very distracting	0.156	**0.428**	.194	.207
Item 6. I do not like the variety of stimulation one finds in the city	0.147	**0.843**	.413	.733
Item 7. Cities contain the least desirable aspects of modern life	0.016	**0.639**	.354	.408

Extraction Method: Maximum Likelihood.

a. 2 factors extracted. 6 iterations required.

Note: Factor loadings over .40 appear in bold.

Extraction Method: Maximum Likelihood.

b. One or more communality estimates greater than 1 were encountered during iterations.

Therefore, during the coding process of each factor (environmentally inclusive and environmentally exclusive), a mean score was calculated for each teacher. Similar to the motivation scale, although this variable was based on mean scores and could be treated continuous, since the nature of the data structure was based on categories and not normally

distributed, repeated values emerged and creating a meaningful model became difficult due to overlapping values when treated as continuous. In order to avoid this, 25th and 75th percentiles of the data were calculated to transform these variables into categories. Therefore, values below 25th percentile (mean score value = lowest thru 2.50) were coded low, in between 25th and 75th percentiles (mean score value = 2.51 thru 3.50) were coded medium, and above 75th percentile (mean score value = 3.51 thru highest) were coded high based on the mean scores within the "Environmentally Inclusive" factor. Also, values below 25th percentile (mean score value = lowest thru 2) were coded low, in between 25th and 75th percentiles (mean score value = 2.01 thru 4.00) were coded medium, and above 75th percentile (mean score value = 4.01 thru highest) were coded high within the "Environmentally Exclusive" factor. These variables were treated as categorical variables in which teachers were assigned into groups.

Internal Consistency Reliability

Internal consistency reliability for Factor 2 (Environmentally Inclusive) was examined through using Cronbach's alpha. The procedure followed in this step is as it follows:

Model: We have chosen Alpha as it is by far the most common choice among other studies.

Statistics: Descriptives for item, scale, and scale if item deleted, and correlations between the items (inter-item) were requested.

As Table 4-8 indicates, after eliminating 3 items, Cronbach's Alpha for the 4 items was calculated and found nearly .70 (4 items; α= .661).

Table 4-8: Reliability statistics of the environmental awareness scale

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.661	.673	4

Since Factor 1 (Environmentally Exclusive) was a single-tem construct, internal consistency reliability could not be assessed for this variable.

4.5.2.3 Teacher Movement

Movement is an important part of teaching-learning experience as it provides the mean for communication and interaction between teachers and students, and influenced by the physical environment (Martin, 2004a). Higgins, Hall, Wall, Woolner, & McCaughey (2005) found that improved student and school-level learning is an outcome of not only changes to the school's systems and processes but also changes to its physical environment and communications (see Figure 4-5). They also imply that changes to one area are likely to be associated with changes in communication and interaction (Higgins, Hall, Wall, Woolner, & McCaughey, 2005).

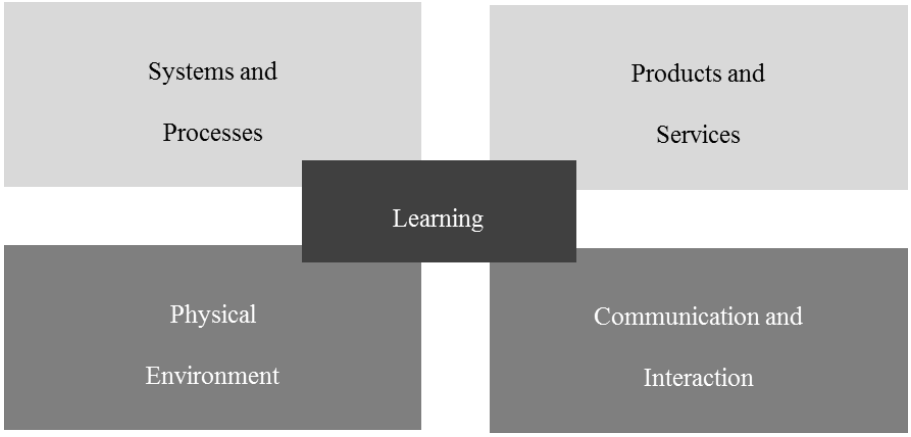


Figure 4-5: Conceptual framework of interactive elements of learning

In order to address this issue, two indicators have been employed. The first one was structured based on a single item question in which teachers were given a statement about moving around frequently in classroom to interact with students. Teachers were asked to rate the item on the extent to which they agreed with the statement using a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, and 5 = always). This variable was treated as a categorical variable.

The second indicator was structured based on the findings of previous environment-behavior studies. In literature, it has been found that circulation can promote the kinds of access a space has, the traffic that takes place, and how much movement there is, and this can lead either to better understanding of the space or to spatial confusion (Rivlin and Wolfe, 1985). Because spatial organization is the task of arranging furniture to create appropriate spaces for movement and learning activities, spaces and their relationships will influence behavior, whether planned or not (Martin, 2004). As it has been mentioned in previous sections, Martin

(2002; 2004a) found that where teachers address the whole class (teacher-centered classrooms), they are less mobile with an inverted Pearson correlation (r = -0.42) and where teachers address groups or individual pupils (student-centered classrooms), they are more mobile with a positive correlation (r = 0.41). Therefore, teachers' current classroom arrangement was also conceptualized to be used as an indicator of teacher movement to compare with what teachers indicate about how often they move around in the classroom to interact with students. Therefore, in addition to teachers' self-report on frequency of movement in classroom, teachers who practice in a teacher-centered classroom environment were grouped and coded as "less teacher movement", and teachers who practice in a student-centered classroom environment were grouped and coded as "more-teacher movement" hypothetically in order to address teacher movement.

4.5.2.4 Furniture Movement

The purpose of this variable was to address the frequency of classroom arrangement change. In order to address this issue, teachers were asked how often they change their classroom arrangement in the survey through using a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, and 5 = always). In order to obtain in-depth information on the subject, a follow up question (open-ended) was also used in the survey in which teachers were asked to indicate their main reasons for changing their classroom arrangement. Teachers were also asked if the course material they use require changing the classroom arrangement. They rated this item through using a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, and 5 = always).

4.5.2.5 Motivational Strategies

Motivational strategies refer to instructional interventions employed by the teacher to elicit and stimulate student motivation (Guilloteaux & Dörnyei, 2008). The motivational strategies used by teachers in classroom are key factors that determine success in teaching and learning experience. In literature, it has been found that motivational strategies that teachers use can effect students' motivation toward learning (Hootstein, 2002; McCann and Turner, 2004 as cited in Fives & Manning, 2005; Cheng & Dörnyei, 2007; He, 2009). A list of motivational strategies used by teachers in class with a total of 102 items, which was developed by Dörnyei (2001) and called "Motivational Teaching Practice (MTP)" was used as an initial pool for addressing motivational strategies. The items that were found more applicable to middle school context and better fit to the aim of this study were drawn from the list. Initially, seven items were drawn from the existing list. Teachers rated the resulting items on the extent to which they agreed with each statement using a 5-point Likert scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, and 5 = always).

This variable did not attempt to serve as a scale, but rather to collect information on motivational strategies used by teachers in classroom. Therefore, the purpose of this variable was to: explore the extent to which some of the motivational strategies used by teachers; and address their relation to physical environment. Therefore, following statements were used in the survey:

- Item 1: I set class rules myself rather than allowing my students to do so
- Item 2: I encourage my students to give suggestions for improving the course

- Item 3: I give immediate feedback to my students
- Item 4: I start all my lessons with the same presentation technique
- Item 5: I use tasks that allow my students to interact with each other
- Item 6: I teach my students self-learning strategies
- Item 7: I encourage my students to learn from each other

Item 5, 6, and 7 are motivational strategies that are related to specific learning styles. Item 5, I use tasks that allow my students to interact with each other, and Item 7, I encourage my students to learn from each other, are associated with cooperative learning, which emphasizes and encourages interaction between students in classrooms. This strategy aims to provide venues to hear, speak, and talk within instructional context (Pilegard & Fiorella, 2016). The importance of cooperative learning (or sometimes referred as“group work”) in classrooms that it allows teachers to address both intellectual and social learning goals and improves students’ academic skills through working together on a task that might otherwise be too complex for them to complete individually (Coates & Mayfield, 2009). Item 6, I encourage my students to learn from each other, is on the other hand, a motivational strategy related to generative learning, which aims to enhance students’ self-assessment through encouraging them to reflect on their learning experiences to make them self-regulated learners (Pilegard & Fiorella, 2016).

4.5.2.6 Technology Use in Classrooms

The use of technology in classrooms can be defined and characterized in various ways (Liu, 2011). The purpose of this variable was to address the following: the extent to which teachers' practice of using technology in instruction; the factors in teachers' decision to use technology in instruction; the extent to which use of technology affects teachers' classroom arrangement. The overall purpose of this variable was to use these indicators of technology use to examine the associations between use of technology, physical environment, and other teacher attitudes and characteristics. In order to address these indicators of technology use in classroom, a survey tool, which was developed by Moorhead Area Public Schools, was employed to obtain information regarding teachers' use of technology in classroom. The original survey questionnaire included twenty-four items that focused on technology use.

Initially, two items were drawn from the existing questionnaire as they were found to be the best fit to the purpose of this research. In the first question, teachers were asked to select the best item that describes their current practice of using technology in class. The items were: "I seldom use technology to deliver instruction"; "I almost exclusively use whole group presentation style either using an interactive whiteboard, PowerPoint or other instructional software to explain or demonstrate concepts or instructions"; "I often use whole group presentation style, but sometimes facilitate students in their use of a variety of information resources and hands-on activities"; and "I almost exclusively facilitate student learning by encouraging students to use information resources and hands-on activities". In the second question, teachers were asked to rate the relevance of the following factors in their decision

to use technology in instruction: “Implementing national, state or local technology standards”; “Observing my colleagues successfully using technology to teach a concept”; “Using scientifically-based research that suggests a particular technology application improves student learning”; “Motivating and engaging learners”; and “Creating a more learner-centered classroom with students exploring their own questions and building their own knowledge”. Teachers rated these 5-item on the extent to which they agreed with each statement using a 4-point Likert scale (1 = very relevant, 2 = relevant, 3 = somewhat relevant, 4 = not a consideration).

In addition to these two questions, one last question in which teachers were asked if their use of technology affect their classroom arrangement was added to the first two questions. Teachers were asked to select the item that represents best this affect from a 5-point scale (1 = never, 2 = rarely, 3 = sometimes, 4 = most of the time, 5 = always). All of these questions addressing teachers’ use of technology in various ways were treated and coded as categorical variables.

4.5.2.7 Satisfaction with Current Classroom Arrangements

In order to be able to explore the relationships between teachers’ current classroom arrangement, preferences on classroom design, and satisfaction with the current physical arrangement, a single-item question was generated and used in the survey. Teachers were asked to rate a likert scale on an extent how satisfied they are with their current classroom arrangement (1 = very dissatisfied, 2 = dissatisfied, 3 = neutral, 4 = satisfied, 5 = very satisfied).

4.5.2.8 Teaching Methods and Instructional Areas

Another interaction between users and the physical environment occurs in the use teachers make of their environment and how it affects their behavior. Horne-Martin (2002) found that style of teaching and room organization are linked, although it is not clear which is cause and which is effect. There is evidence (Ahrentzen & Evans, 1984) that more open classrooms do have some direct effect on how teachers teach (Higgins, Hall, Wall, Woolner, & McCaughey, 2005). In order to address teaching methods, a single item question in which teachers were asked to indicate their primary teaching methods was used. The teaching methods listed in the question were: lecture; discussion; small groups; debates; class projects; and tutorial. Also, in order to address teachers' primary instruction area, an additional single item question in which teachers were asked to indicate their instructional area was used. The instructional areas that listed in this question were: music; art; physical education (PE)/health; technology; language; social studies; math; science; other.

4.5.3 Individual Level Control Variables

Independent control variables are demographic characteristics of individuals such as sex, age, years of experience in teaching, and school context. Sex of the individual is defined by male or female. Age is identified numerically in years and categorized by 21-30 years, 31-40 years, 41-50 years, and 51 years and older. Teaching experience is identified numerically in years and categorized by 1-5 years, 6-10 years, and 10 years and more. School context is defined by urban, suburban, and rural. These variables were treated as independent variables and tested for independence with the outcome variables.

CHAPTER 5 DATA ANALYSIS AND FINDINGS

This chapter reports the data analysis and findings of the survey questionnaire divided by the research questions pointed out in the conceptual framework and relevant to the variables under investigation. Two fundamental goals drove the collection of the data and the subsequent data analysis. Those goals were to: (1) develop a base of knowledge about what type of classroom environments are currently being used and preferred by teachers; (2) provide summaries about the sample and measures (outcome variables); and (3) examine the associations between classroom environment and teacher attitudes and behaviors. The survey questionnaire was utilized to address these issues. The chapter starts with descriptive analyses in order to capture patterns and summarize each of the variables under investigation. Then the chapter follows with answering the research questions positioned in the conceptual framework.

5.1 Descriptive Analysis

The purpose of this section is to describe the basic features of the data in this study. In order to form the basis for further analysis (inferential statistics), summaries about the sample and measures were described through quantitative descriptions to show what the data is like. In total, 234 teachers participated in the study. Of these 234 subjects, nearly two third of participants (65.8%) were from middle schools (8 schools) that were under the Wake County

Public School System, whereas the rest of participants were teachers who were pursuing doctoral studies in College of Education at North Carolina State University (see Table 5-1).

Table 5-1: Summary of participants

Data source	N	Percent
Schools	154	65.8
(8 Middle Schools)		
Teachers from NCSU Graduate School	80	34.2
Total	234	100

5.1.1 Demographic Characteristics

Table 5-2 represents the descriptive statistics of demographic characteristics, which are school setting, gender, age, and years of experience. In regards to the subjects' school settings: 21.8% percent of participants' schools were located in urban areas, nearly half of participants' (49.6%) schools were located in suburban areas, and 28.6% of participants' schools were located in rural areas. Of the 234 participants, almost four fifth of participants (82.1%) were females whereas only one fifth were males (17.9%). In terms of the age of the subjects, the subjects varied in their ages between the four indicated categories: 17.5% were between the ages of 21-30 years old, 17.9% were between the ages of 31-40 years old, 23.5% were between the ages of 41-50 years old, and 41% were between the ages of 51years or older. In regards to the subjects' years of experience in teaching: majority of

participants - nearly two third of (68.8%) -had 10 years or more of experience, 12.8% of participants had 6 to 10 years of experience, and 18.4% of participants had 1 to 5 years of experience in teaching.

Table 5-2: Descriptive statistics of demographic variables

	N	Percent
School Setting		
Urban	51	21.8
Suburban	116	49.6
Rural	67	28.6
Gender		
Male	42	17.9
Female	192	82.1
Age		
21-30 years	41	17.5
31-40 years	42	17.9
41-50 years	55	23.5
51 years or older	96	41.0
Years of Experience		
1-5 years	43	18.4
6-10 years	30	12.8
10 years and more	161	68.8
Total	234	100.0

5.1.2 Classroom Characteristics

Following sections aim to describe quantitative descriptions of teachers' current classroom environments through frequency distributions in order to have a better understanding of what kind of physical environments participant teachers currently teach in. Characteristics that

analyzed under this category are: type of current classroom arrangement (teacher or student centered); furniture flexibility and frequency of classroom arrangement change; policy restrictions; and connection to outdoor.

5.1.2.1 Teachers' Current Classroom Arrangements

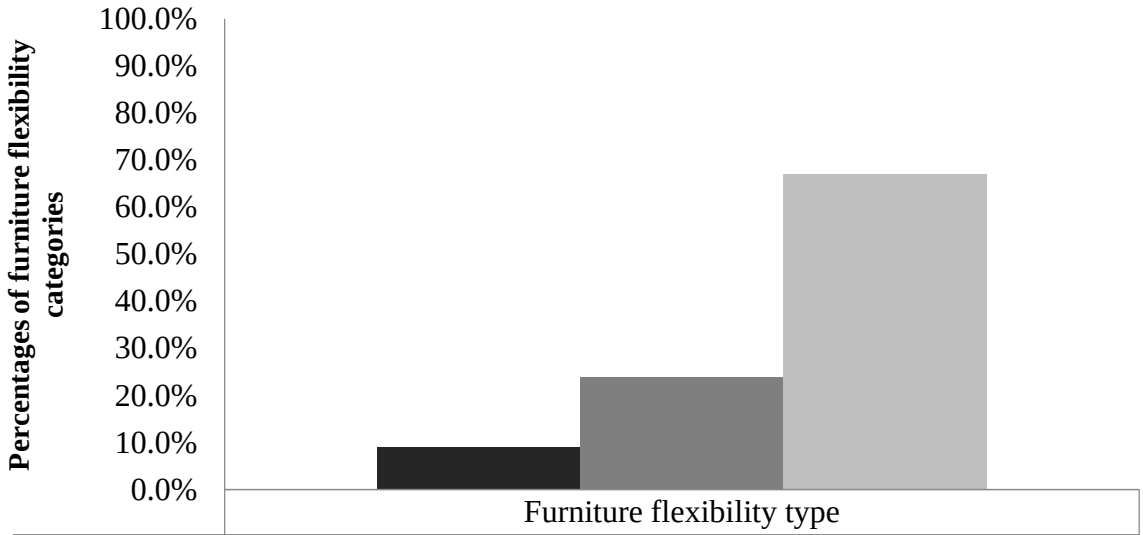
In the survey, teachers were given six different images that represent typical classroom environments to pick from the one that represents their current classroom arrangement best. Table represents the descriptive statistics of teachers' current classroom arrangement based on the coding process as it has been described in the description of the variable. According to the results of most-frequently used classroom arrangements, almost three third of classroom environments (77.4%) fell under the category of teacher-centered classroom environments whereas 22.6% of classrooms were student-centered classrooms.

Table 5-3: Frequencies of most-frequently used classroom arrangements

	N	Percent
Most frequent arrangement		
Teacher-centered classroom	181	77.4
Student-centered classroom	53	22.6
Second frequent arrangement		
Teacher-centered classroom	165	70.5
Student-centered classroom	69	29.5
Total	234	100

5.1.2.2 Furniture Flexibility

In the survey, teachers were asked a question if the tables and chairs were fixed or flexible in their classrooms. Of the 234 participants, 21 of the participants indicated their tables and chairs were fixed in their classroom. As Figure 5-1visually represents the descriptive statistics of furniture flexibility, nearly two third of participants' classrooms (67.1%) had flexible furniture, which allowed them to make changes if they wanted or needed to. 23.9% of participants' classrooms had semi flexible furniture, which are movable but heavy. On the other hand, 10% of participants' reported that furniture in their classrooms was fixed, which would not allow them to make changes in arrangement even if they need to.



	Furniture flexibility type
Fixed	9.0%
Semi flexible	23.9%
Flexible	67.1%

Figure 5-1: Frequency distributions of furniture flexibility categories

5.1.2.3 Policy Restrictions

As Figure 5-2indicates, the majority of participants (89.7%) reported that there are no policy restrictions about changing classroom arrangement in their schools. 10.3% participants, on the other hand, were found to have policy restriction about changing the arrangement in their schools.

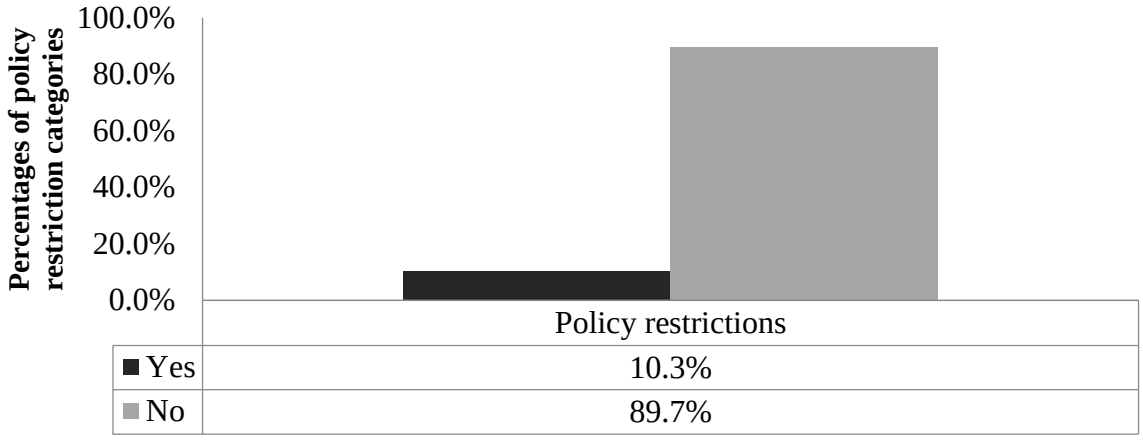


Figure 5-2: Frequency distributions of policy restriction categories

5.1.2.4 Connection to Outdoors

As Figure 5-3represents participants' classrooms' availability of a direct connection to outdoors, nearly four fifth of participants (78.6%) reported that their classrooms do not have a direct connection to outdoors, whereas one fifth of participants (21.4%) reported that their classrooms had direct connection to outdoors.

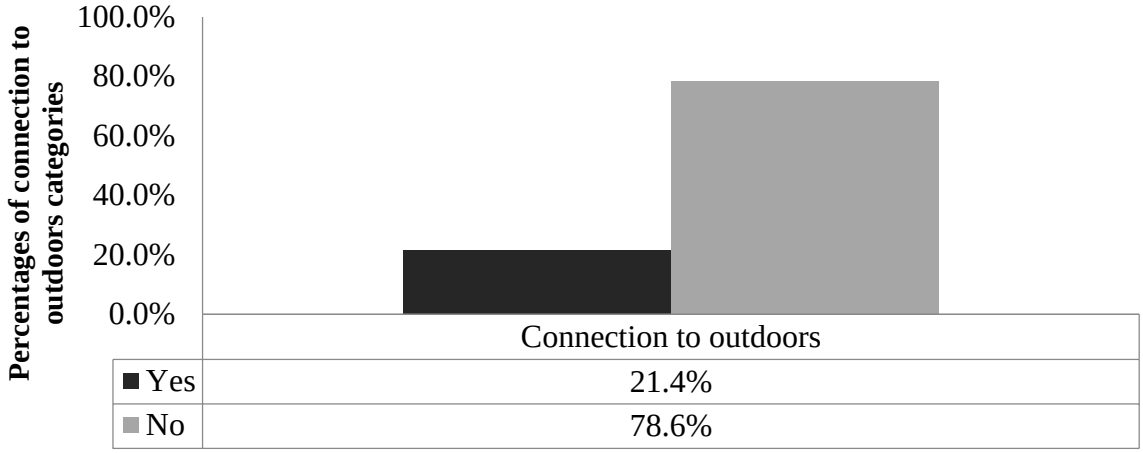


Figure 5-3: Frequency distributions of connection to outdoors categories

5.1.3 Teacher Attitudes and Behavioral Characteristics

Following descriptive statistics describe what kind of teacher attitudes, behaviors and characteristics the participants show. These characteristics are: factors that teachers' find important in order to create a better learning environment; motivation towards profession; environmental response and awareness; motivational strategies; satisfaction with current arrangement; practice of using technology and factors in decision to use technology in classroom; effect of technology use in physical arrangement; primary instruction area and effects of course material on classroom arrangement change; and teaching methods.

5.1.3.1 Factors for Achieving a Better Classroom Environment

The downloaded data set for this rank order question included a column for each item being ranked. In each column, the ranking each participant awarded that particular item was present. A mean score was calculated for each item on the list. The data then was transposed,

so that the items on the list were rows and the mean ranks for each factor were columns. In this case, since respondents were asked to rank 1 as highest rank, a lower would mean score signify a higher rank. Therefore, as Figure 5-4indicates, class size (M = 3.70) was found to be the most important factor for achieving a better classroom environment. Following to class size, indoor-outdoor connection (M = 5.56), and flexibility of furniture (M = 6.21) were found to be the second and third most important factors respectively for achieving a better classroom environment.

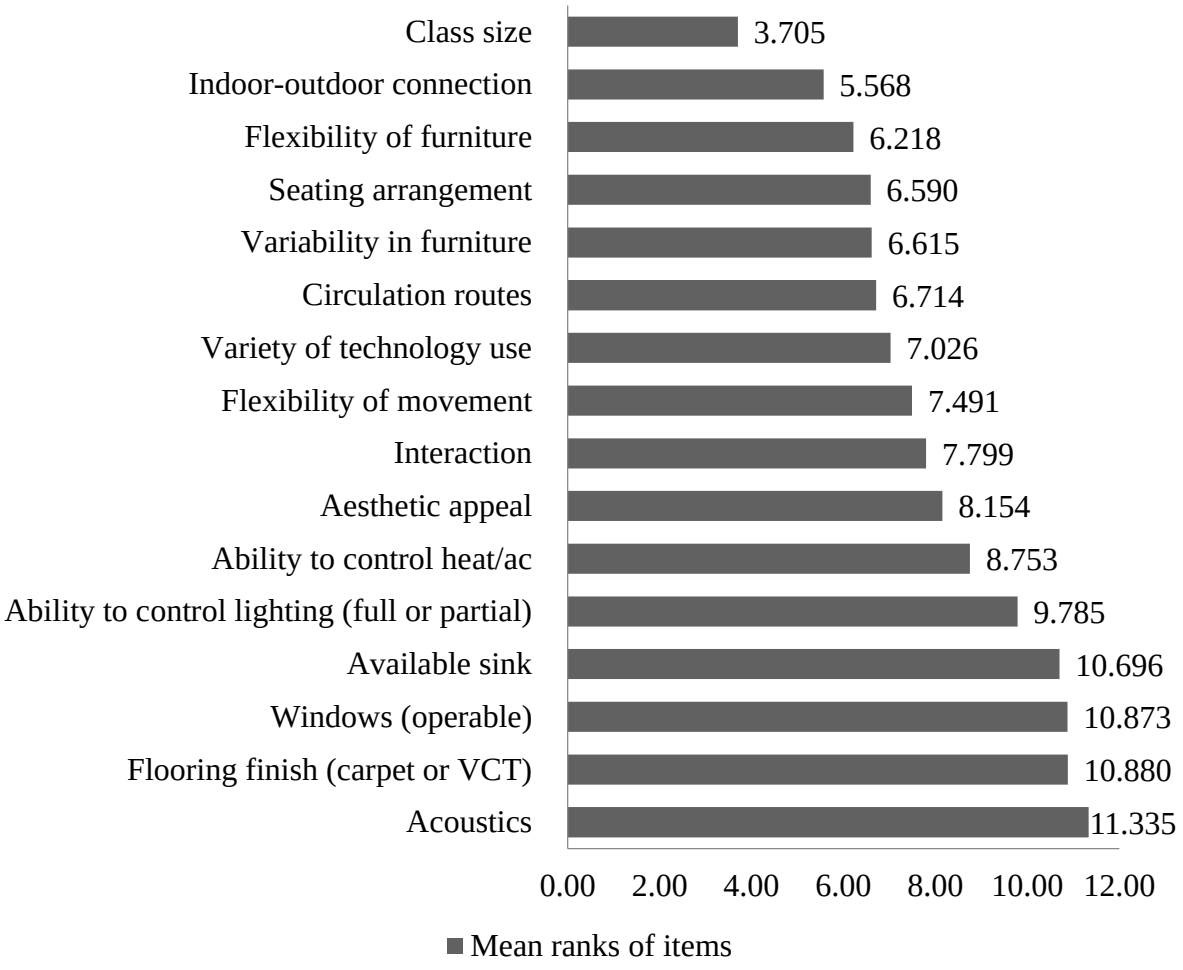


Figure 5-4: Mean ranks of factors for achieving a better classroom environment

5.1.3.2 Motivation towards Education

Since this variable was addressed through a multi 5-point Likert scale, a new subscale was created to give teachers a total motivation score based on calculating the mean scores and was first treated as a continuous variable for descriptive purposes. Table 5-4presents descriptive statistics of teachers' motivation towards education. The mean of motivation towards education was found to be 4.25 (SD=0.39).

Table 5-4: Descriptive statistics for motivation towards education

	N	Minimum	Maximum	Mean	Std. Deviation
Motivation mean scores	234	2.43	5.00	4.2540	.39601

However, since the data was originally categorical and not normally distributed, repeated values emerged in data and creating a meaningful model became difficult (overlapping values occurred) when the variable treated as continuous during further analysis. In order to avoid this situation, 25th and 75th percentiles of the data were calculated to transform the variable into a categorical variable under the advice of statisticians. Based on motivation mean scores, below 25th percentile was coded low, above 75th percentile was coded high and in between 25th and 75th percentiles were coded medium. Therefore, coding process was based on: lowest thru 4=1, 4.01 thru 4.4286 2, 4.4287 thru highest = 3.

As Figure 5-5represents the frequency distributions, the majority of the participants were found to be moderately motivated towards their profession. Only 22.6% of the participants were found to have high motivation towards their profession whereas 30.8% of the participants were found to have low motivation towards their profession.

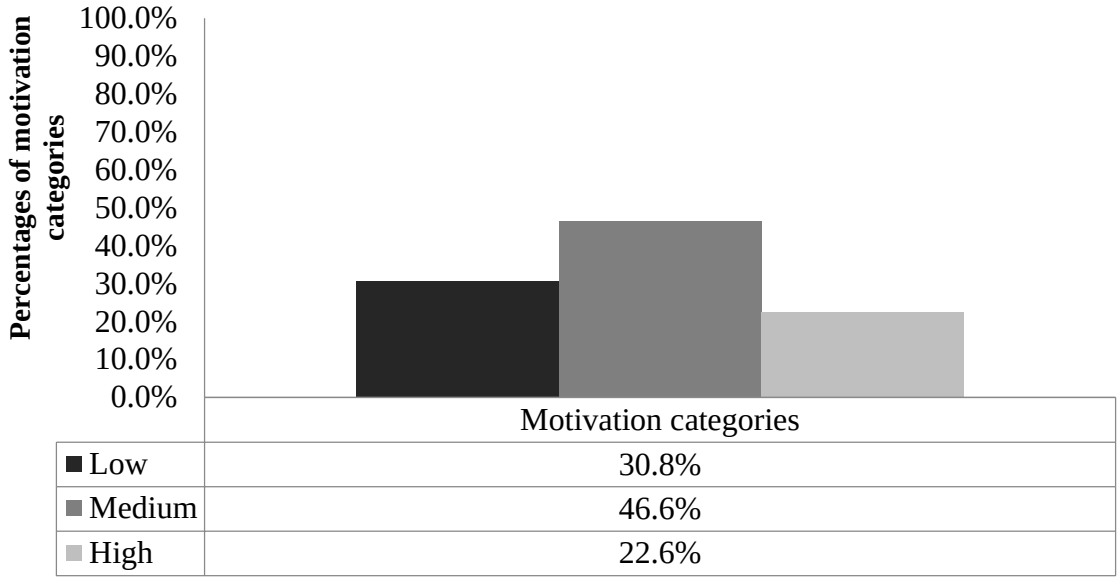


Figure 5-5: Frequency distributions of frequency of motivation towards education categories

5.1.3.3 Environmental Response and Awareness

Similar to the motivation towards to education variable, same problems of having overlapped /repeating values and not normally distributed data occurred within the environmental response factors (environmentally inclusive and environmentally exclusive) when they were treated as continuous. Therefore, similar to the motivation scale, 25th and 75th percentiles of the data were calculated to transform these variables into categories. Therefore, values below 25th percentile (mean score value = lowest thru 2.50) were coded low, in between 25th and

75th percentiles (mean score value = 2.51 thru 3.50) were coded medium, and above 75th percentile (mean score value = 3.51 thru highest) were coded high based on the mean scores within the “Environmentally Inclusive” factor (pro-urbanist / being responsive to urban aesthetics, critical, skeptical, and concerned with philosophical problems). Also, values below 25th percentile (mean score value = lowest thru 2) were coded low, in between 25th and 75th percentiles (mean score value = 2.01 thru 4.00) were coded medium, and above 75th percentile (mean score value = 4.01 thru highest) were coded high within the “Environmentally Exclusive” factor (being resistant to development of land and self-reliant in natural surroundings).

As

Figure 5-6indicates, the majority of participants (55.1%) were found to be moderately environmentally inclusive. Also, 15% of the participants were found to be lowly environmentally inclusive while almost 30% of the participants were highly environmentally inclusive.

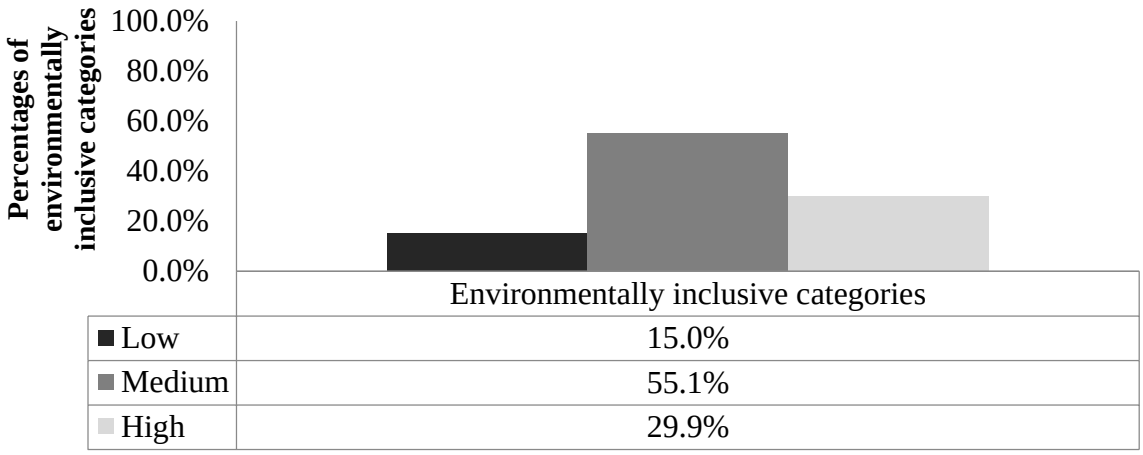


Figure 5-6: Frequency distributions of environmentally inclusive ER categories

In terms of environmentally exclusive ER factor, almost 25.2% of the participants were found to be lowly, 68.8% of the participants were moderately and only 6% of the participants were found to be highly environmentally exclusive (see Figure 5-7).

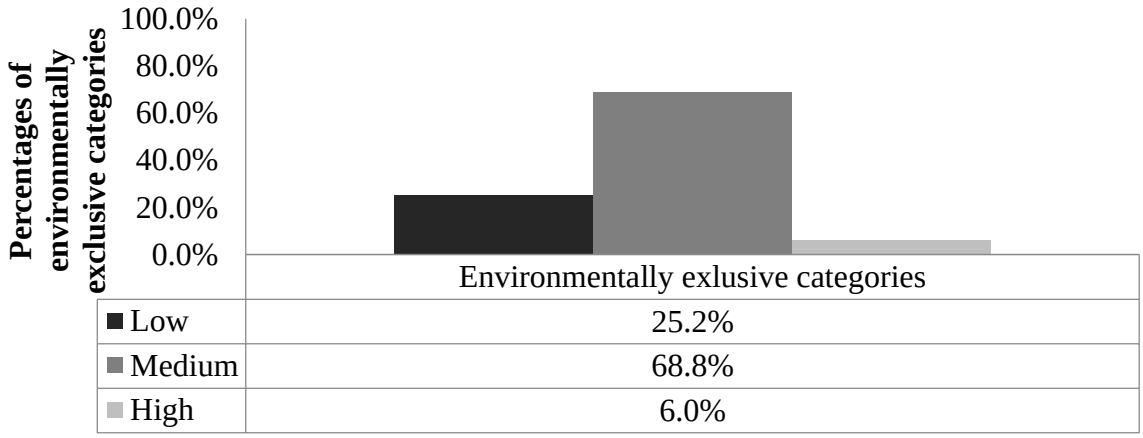


Figure 5-7: Frequency distributions of environmentally exclusive ER categories

5.1.3.4 Teachers' Motivational Strategies in Classroom

The purpose of this variable was to understand how often the motivational strategies related to cooperative learning and generative learning were being used in classrooms and their associations with classroom environment. Majority of participants' (64.9%: most of the time / always) were found to set class rules themselves rather than allowing the students to do so (Item 1), whereas only 12.9% of participants were found to never / rarely use this strategy in their classrooms. 44.9% of the participants reported that they always/most of the time encourage their students to give suggestions for improving the course they teach (Item 2). Majority of participants (81.7%) also reported that they always / most of the time give immediate feedback to their students (Item 3). Nearly only one fourth of participants (23.6%) were found to start all their lessons with the same presentation technique (Item 4).

As for the statements that were relevant to interaction between students and "cooperative learning" under the motivational strategies (Item 5: I use tasks that allow my students to interact with each other and Item 7: I encourage my students to learn from each other), majority of the participants were found to use them always/most of the time in their classes (85.2% for the Item 5 and 78.2% for the Item 7).

As described in the description of variables section, strategies that were relevant to" cooperative learning" (or group work) typically imply the importance of the interaction between students through encouraging student to work and learn together. As for the second interest of research under motivational strategies, which was "generative learning" (or self-

regulated learning) strategies, 71% of the participants were found to use this strategy always/most of the time (Item 6: I teach my students self-learning strategies) in the survey). As described in the description of variables section, this learning style implies the importance self-regulated learning (see Figure 5-8).

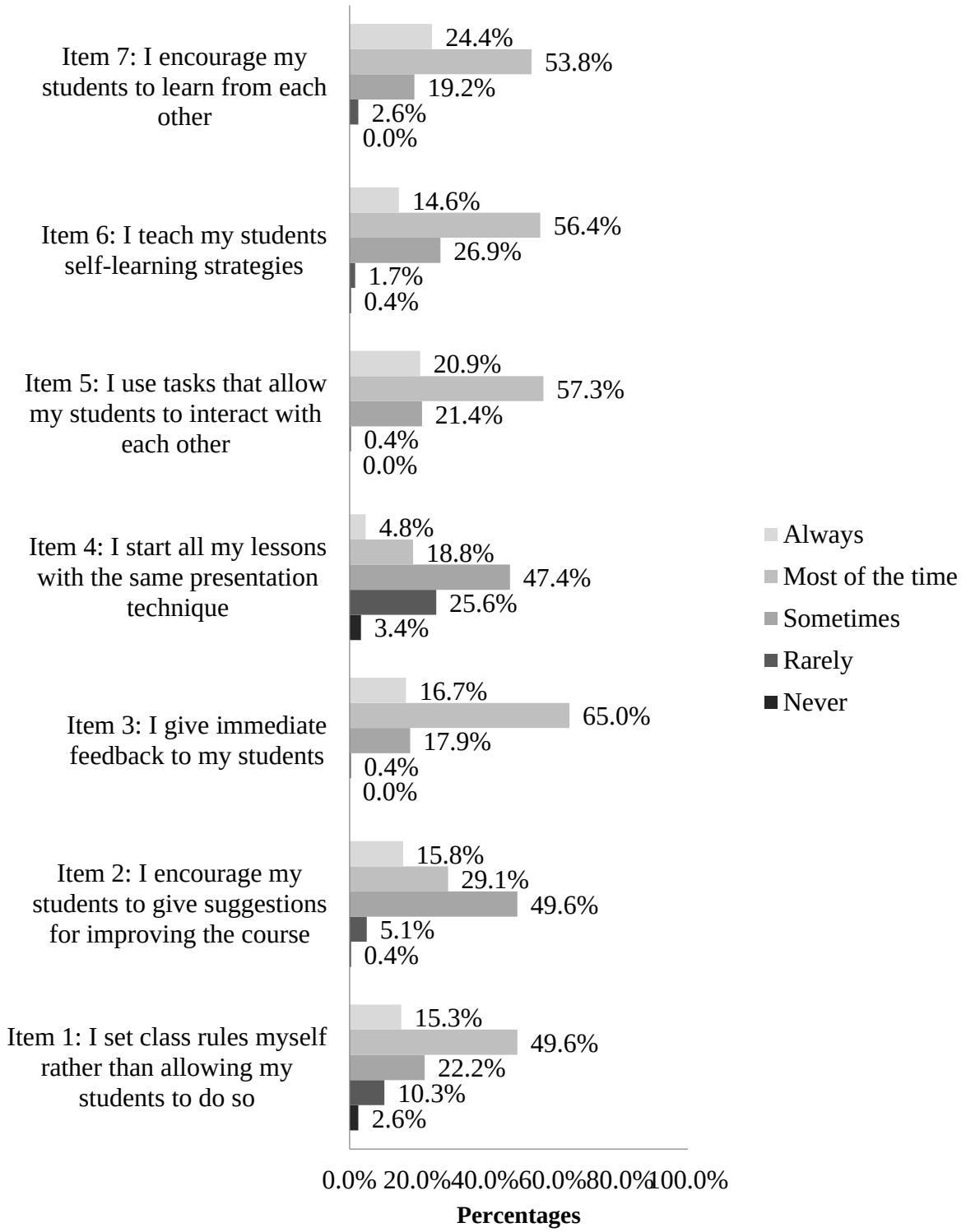


Figure 5-8: Frequency distributions of using motivational strategies

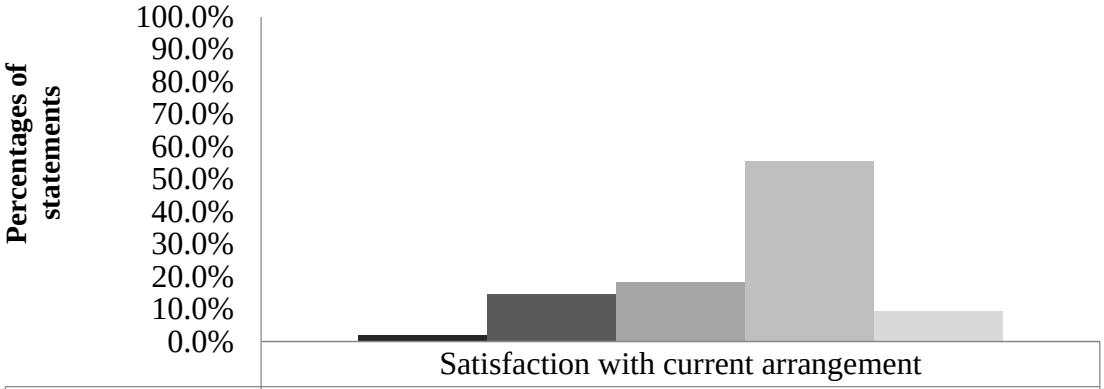
5.1.3.5 Satisfaction with Current Classroom Arrangement

This variable was addressed through a single 5-point Likert scaled item. According to the descriptive statistics, the mean of satisfaction with current classroom arrangement was 3.55 (SD=0.92), which indicates a moderate satisfaction with current classroom arrangement overall (see Table 5-5).

Table 5-5: Descriptive statistics for satisfaction with current classroom arrangement

	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction mean scores	234	1	5	3.555	0.92596

As can be seen in Figure 5-9, only 65% of the participants were found to be very satisfied / satisfied with their current classroom arrangements. While 16.6% of the participants were found to be very dissatisfied / dissatisfied with their current classroom arrangements, 18.4% of the participants were found to be neutral about how satisfied they were with their current classroom arrangements.



	Satisfaction with current arrangement
Very dissatisfied	2.1%
Dissatisfied	14.5%
Neutral	18.4%
Satisfied	55.6%
Very satisfied	9.4%

Figure 5-9: Frequency distributions of satisfaction with current classroom arrangement categories

5.1.3.6 Teacher Movement

In terms of moving around frequently to interact with students, nearly half of the participants (55.1%) indicated that they always move around to interact with student. Nearly one third of participants (36.3%) reported that they move around most of the time. Only 1.7% of the participants indicated that never/rarely move around in classroom. 6.8% of the participants, on the other hand, indicated they sometimes move around to interact with students (see Table 5-6). Accordingly, the mean of frequency of teacher movement was found to be 4.44 (SD=0.71), which indicates a high frequency.

Table 5-6: Descriptive statistics for teacher movement

	Frequency	Percent
Never	1	0.4
Rarely	3	1.3
Sometimes	16	6.8
Most of the Time	85	36.3
Always	129	55.1
Total	234	100.0

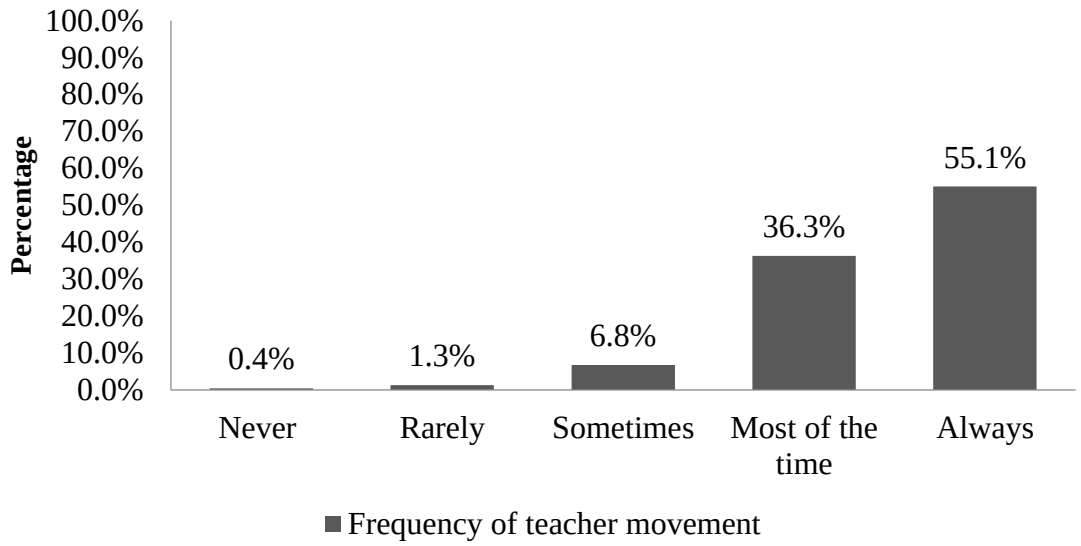


Figure 5-10: Frequency distributions of teacher movement categories

5.1.3.7 Furniture Movement

In the survey, teachers were asked how of then they change their classroom arrangement through using a single 5-point likert scaled item. Since not all participants had flexible or

semi-flexible tables and chairs, only the teachers who indicated that they had fixed furniture (N = 21) were excluded from this phase (see Table 5-7).

Table 5-7: Descriptive statistics for furniture flexibility

	Frequency	Percent
Fixed	21	9.0
Semi flexible	56	23.9
Flexible	157	67.1
Total	234	100.0

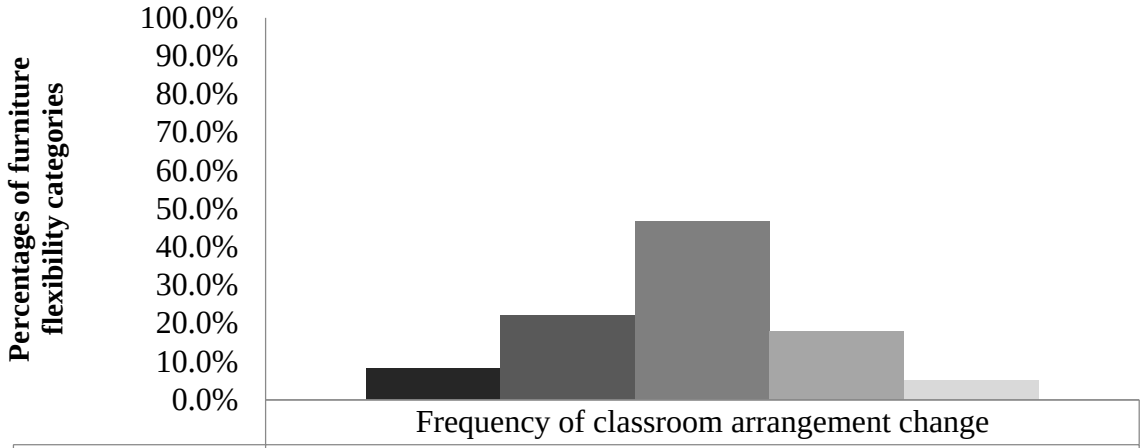
In terms of frequency of classroom arrangement change (or furniture movement), the mean of furniture movement among the teachers who have flexible/semi-flexible tables and chairs was found to be 2.89 (SD=0.96) which indicates low/moderate frequency (see Table 5-8 .

Table 5-8: Descriptive statistics for furniture movement

	N	Minimum	Maximum	Mean	Std. Deviation
Furniture movement	213	1.0	5.0	2.897	.9618

Among the teachers who had flexible furniture in their classrooms, 8.2% of the participants were found to never change their classroom arrangements whereas 22.2% of the participants reported that they rarely change their classroom arrangement. The majority (44.6%) of the participants reported that they “sometimes” change their classroom arrangements. Only 23%

of the participants reported that they frequently (17.9% most of the time and 5.1% always) change their classroom arrangement (see Figure 5-11).



	Frequency of classroom arrangement change
Never	8.2%
Rarely	22.2%
Sometimes	46.6%
Most of the time	17.9%
Always	5.1%

Figure 5-11: Frequency distributions of furniture movement categories

5.1.3.8 Practice of Using Technology and Factors in Decision to Use Technology in Classrooms

In terms of practice of using technology in classroom, nearly one fourth of the participants (22.7%) were found to be exclusively using technology and hands-on activities in their classes. Majority of the participants (63.7%) were found to be often using whole group presentations and sometimes hands-on activities in their classes. While 9.8% percent of participants indicated that they only exclusively use whole group presentations, only 3.8% of

the participants indicated that they seldomly use technology in their classrooms (see Figure 5-12).

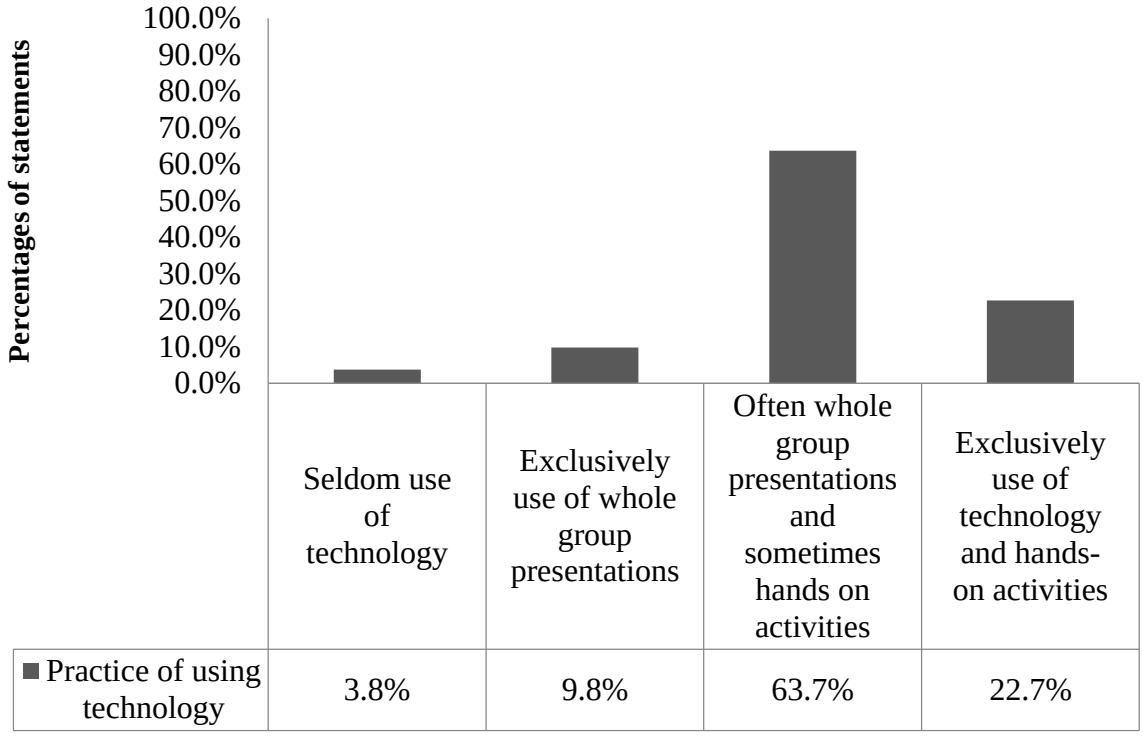


Figure 5-12: Frequency distributions of practice of using technology categories

According to the highest percentages among the factors using technology in classrooms, it was found that the most relevant reasoning for using technology was motivating and engaging learners (72.2%). The second major reasoning for using technology was found to be creating a more learner-centered classroom with students exploring their own questions and building their own knowledge (61.5%). Also, 22.6% of participants indicated that using scientifically-based research that suggests a particular technology application improves student learning was the most relevant factor. While 19.7% of participants indicated that

observing their colleagues successfully using technology to teach a concept was the most relevant factor, 19.2% of the participants indicated that implementing national, state or local technology standards (such as ISTE NETS, MEMO, etc.) was the most relevant factors for them to use technology in classroom (see Figure 5-13).

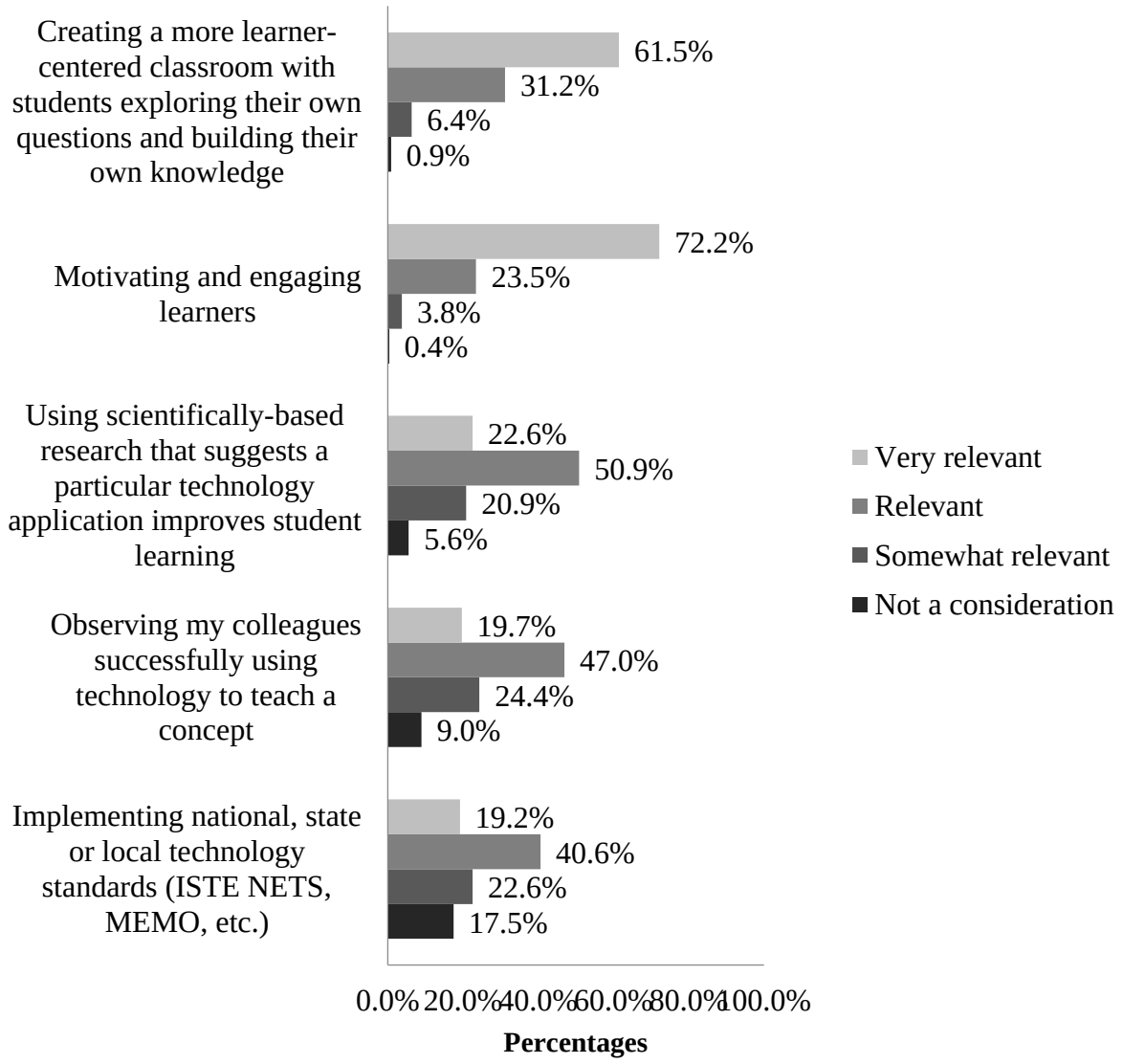


Figure 5-13: Frequency distributions of factors in decision to use technology in classroom

5.1.3.9 Instructional Areas and Effects of Course Materials on Classroom Arrangement Changes

In the survey, the teachers were asked to indicate their primary instructional area. Of the 234 participants, the majority of teachers' (52.6%) primary instructional area was science. While 11.1% of teachers were language teachers, percentages of social studies and math teachers were found to be equal (8.5%). While only 1.7% of the participants was PE/Health teachers, the percentages of music and art teachers were also found to be equal and low (2.6%). On the other hand, 9% of teachers indicated that their instructional area is "other" (see Figure 5-14).

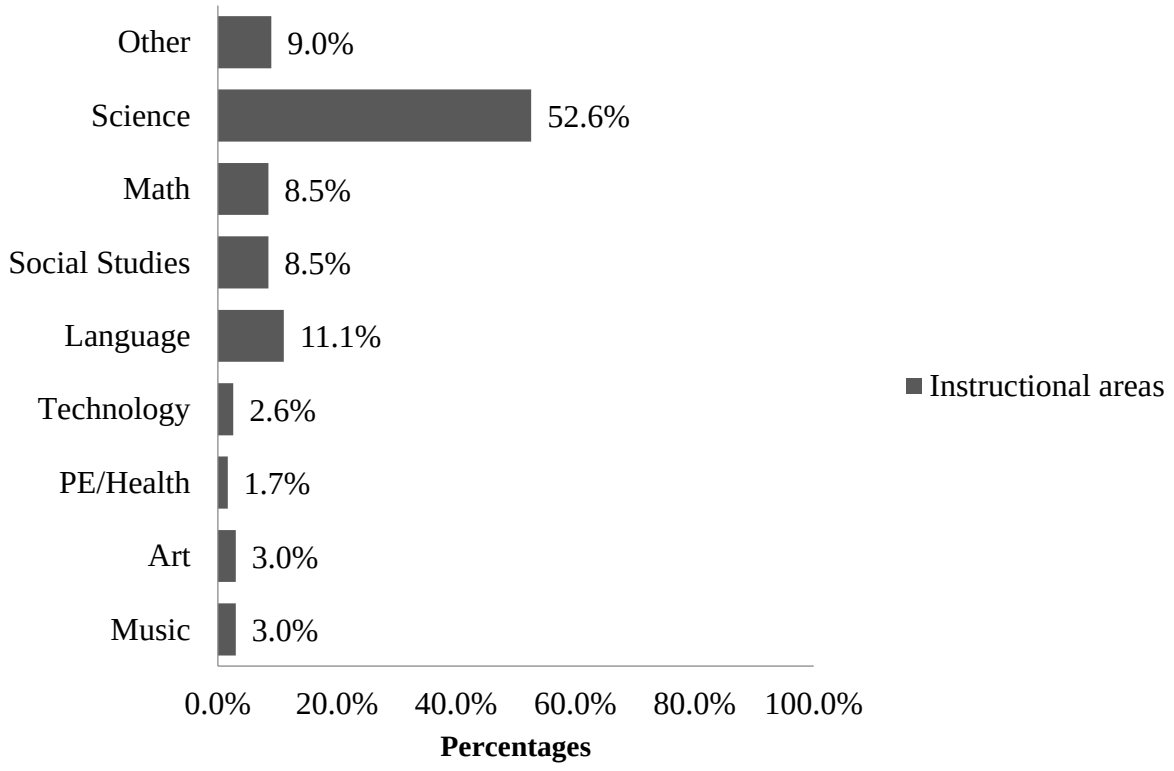


Figure 5-14: Frequency distributions of teachers' primary instructional areas

In relation to what teachers think about the effects of course materials on classroom arrangement change, 30% of the participants indicated that the course materials they use rarely / or never require changing the classroom arrangement. Majority of the participants (59%), on the other hand, indicated that the course materials they use sometimes require changing the classroom arrangement. Only 11.5% of the participants indicated that their course materials most of the time / always require changing the arrangement (see Figure 5-15).

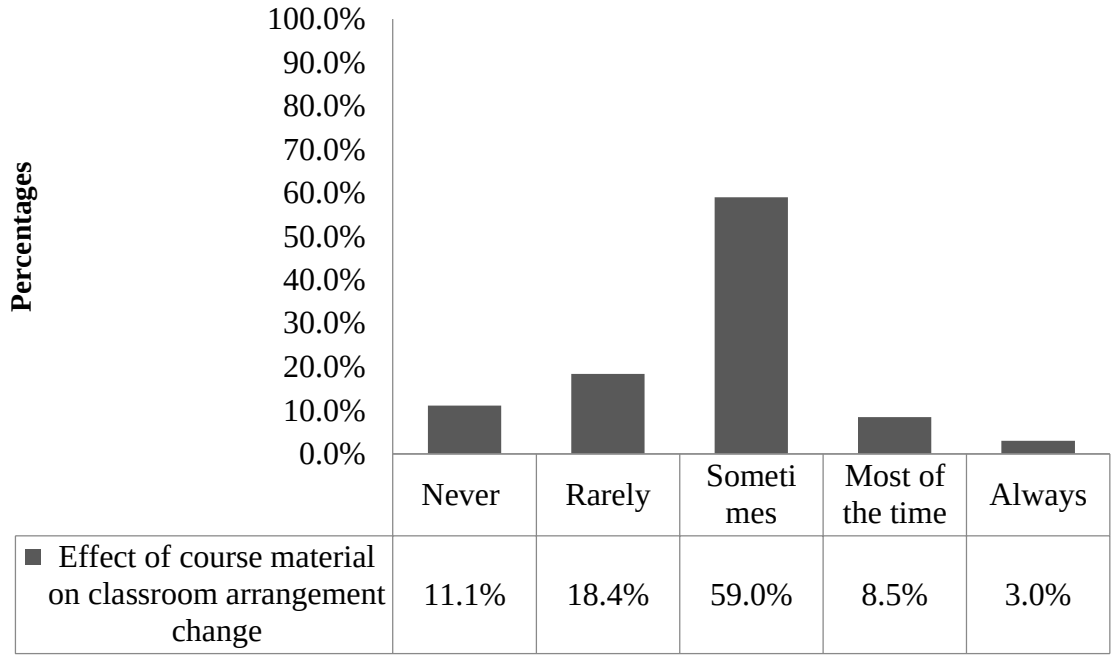


Figure 5-15: Frequency distributions of effects of course materials on classroom arrangement categories

5.1.3.10 Teaching Methods

In terms of most frequently used teaching methods, lectures was found to be the most frequently used teaching method (38.5%) among the other methods. Following lectures,

discussions (16.2%), small groups (14.1%), debates (11.1%) and tutorials (11.1%) were found to be the other most frequent teaching methods respectively. Class projects, on the other hand, were found to be least frequently used teaching method among the participants of the study (see Figure 5-16).

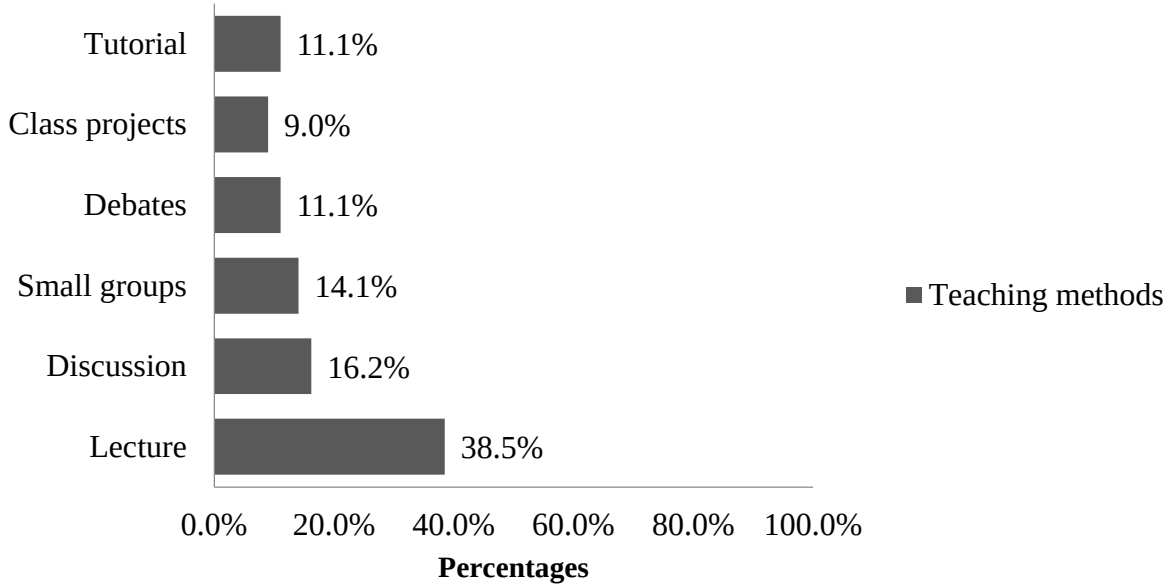


Figure 5-16: Frequency distributions of most frequently used teaching methods

5.1.4 Classroom Design Preferences

In the survey, teachers were given six different images that represent classroom designs, which were found to be innovative and alternative to traditional classrooms in the past. First, frequency distributions of classroom design preferences were analyzed individually. Figure 5-17 represents the descriptive statistics of teachers' classroom design preferences before they were coded and grouped based on what type of designs they are (expandable or variations of L-shape). According to the results of most preferred classroom designs, 27.4%

of participants were found to find the Layout 2, which was a variation of L-shape classroom designs, as the best classroom layout among the others. Following Layout 2, Layout 4 (23.8%), Layout 3 (18%), Layout 5 (13.80%), Layout 1 (8.80%), and Layout 6 (8.20%) were indicated as the best classroom alternatives respectively.

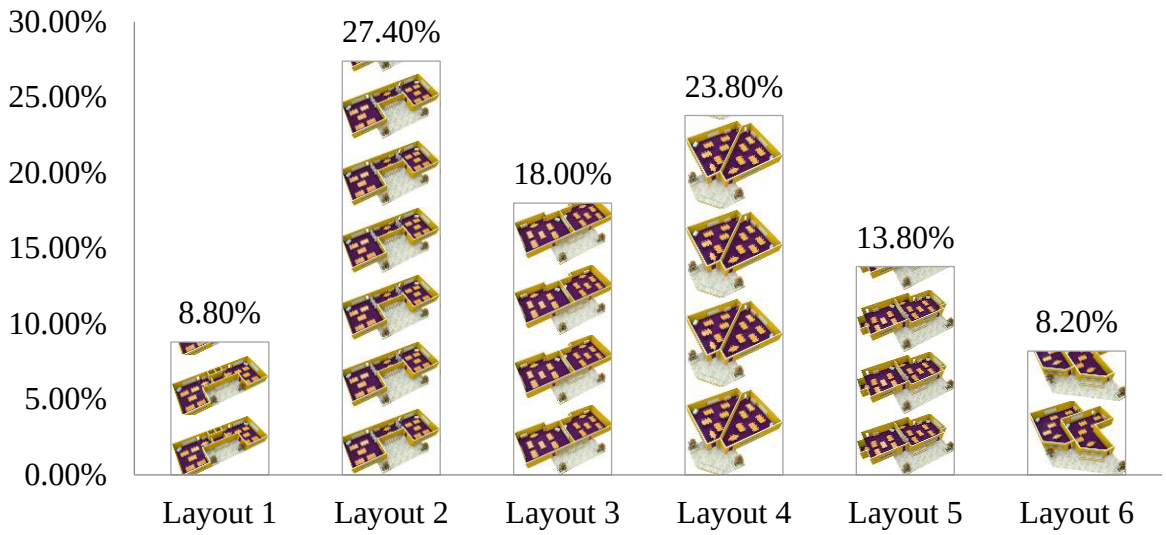
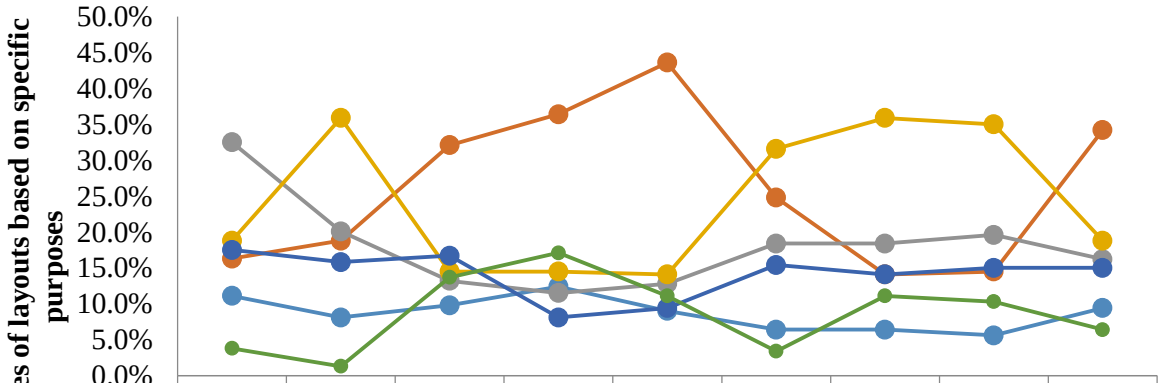


Figure 5-17: Frequency distributions of classroom layouts based on teachers' preferences

In the survey, teachers were also asked to choose the best classroom design for specific purposes and needs (such as best classroom layout for: lectures, class discussions, group studies, independent student activities, multiple teaching methods, interaction between students, teacher movement, circulation, and technology use). According to the frequency distributions of classroom layouts based on teachers' preferences for specific purposes: majority of participants (32.5%) were found to choose Layout 3 as the best classroom design for lecture purposes. 35.9% of the participants were found to choose Layout 4 as the best

classroom design for class discussions. Nearly half of the participants (43.6%) were found to choose Layout 2 as the best classroom design for multiple teaching methods. This classroom layout was also found to be the best classroom design by teachers for group studies (32.1%), independent student activities (36.4%), and technology use (34.2%). For interaction between students, teacher movement and circulation purposes, Layout 4 was found to be rated as the best classroom design (31.6%, 35.9%, and 35% respectively) by teachers. Layout 1, Layout 5, and Layout 6, on the other hand, were not chosen as best classroom design for any of the purposes (see Figure 5-18).



	Lectures	Class discussions	Group studies	Independent student activities	Multiple teaching methods	Interaction between students	Teacher movement	Circulation	Technology use
Layout 1	11.1%	8.1%	9.8%	12.4%	9.0%	6.4%	6.4%	5.6%	9.4%
Layout 2	16.3%	18.8%	32.1%	36.4%	43.6%	24.8%	14.1%	14.5%	34.2%
Layout 3	32.5%	20.1%	13.2%	11.5%	12.8%	18.4%	18.4%	19.6%	16.2%
Layout 4	18.8%	35.9%	14.5%	14.5%	14.1%	31.6%	35.9%	35.0%	18.8%
Layout 5	17.5%	15.8%	16.7%	8.1%	9.4%	15.4%	14.1%	15.0%	15.0%
Layout 6	3.8%	1.3%	13.7%	17.1%	11.1%	3.4%	11.1%	10.3%	6.4%

Figure 5-18: Profiles and frequency distributions of classroom layouts based on teachers' preferences for specific purposes

Second, frequency distributions of classroom design preferences were analyzed based on what type classroom designs they were (expandable or variations of L-shape classrooms). As can be seen in Figure 5-19, variations of L-shape classrooms were found to be preferred over expandable classrooms overall (with a percentage of 52.6%). Variations of L-shape classrooms were also found to be the best classroom designs for: group studies (55.6%); independent student activities (65.8%); multiple teaching methods (63.7%). The expandable classroom designs, on the other hand, were found to be chosen as best designs by teachers for: lectures (68.8%); class discussions (71.8%); interaction between students (65.4%); teacher movement (68.4%), and circulation (69.7%) purposes. For technology use, both expandable and variations of L-shape classroom designs were found to be preferred equal (50% and 50%).

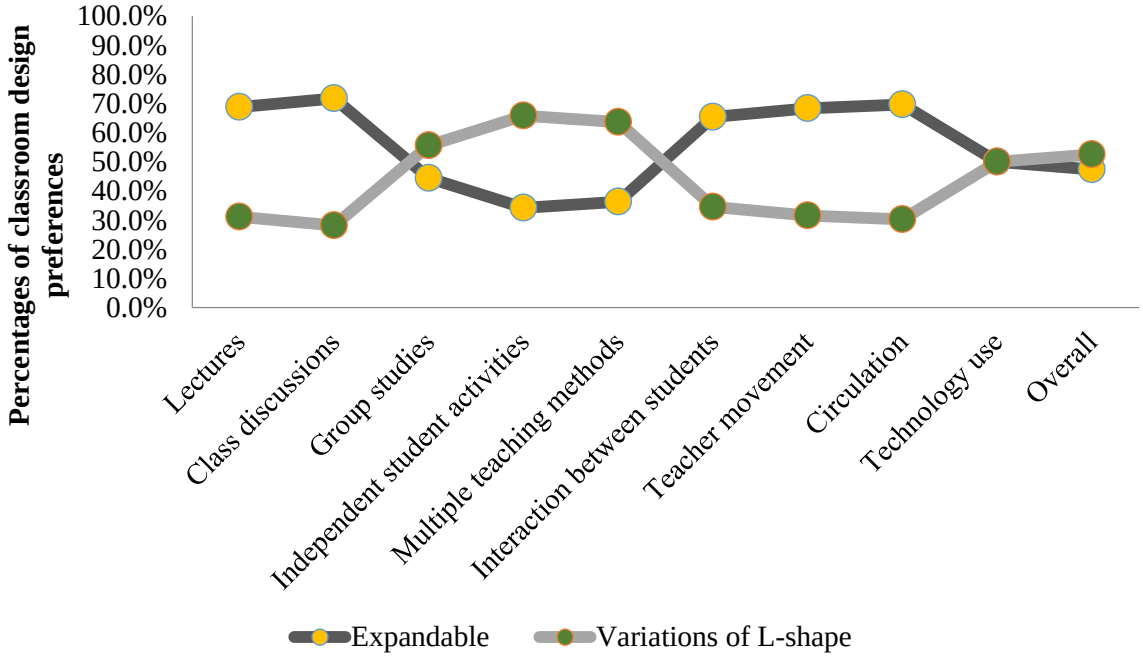


Figure 5-19: Profiles of expandable and variations of L-shape classroom layouts based on teachers' preferences for specific purposes

Table 5-9: Frequency distributions of expandable and variations of L-shape classroom layouts based on teachers' preferences for specific purposes

Design preference for:		Frequency	Percent
Lectures	Expandable classrooms	161	68.8
	Variations of L-shape	73	31.2
Class discussions	Expandable classrooms	168	71.8
	Variations of L-shape	66	28.2
Group studies	Expandable classrooms	104	44.4
	Variations of L-shape	130	55.6
Independent student activities	Expandable classrooms	80	34.2
	Variations of L-shape	154	65.8
Multiple teaching methods	Expandable classrooms	85	36.3
	Variations of L-shape	149	63.7
Interaction between students	Expandable classrooms	153	65.4
	Variations of L-shape	81	34.6
Teacher movement	Expandable classrooms	160	68.4
	Variations of L-shape	74	31.6
Circulation	Expandable classrooms	163	69.7
	Variations of L-shape	71	30.3
Technology use	Expandable classrooms	117	50.0
	Variations of L-shape	117	50.0
Overall	Expandable classrooms	111	47.4
	Variations of L-shape	123	52.6
	Total	234	100.0

5.2 Correlational Investigation

This section focuses on the relationships between the physical characteristics of classroom environment (teachers' current classroom arrangement and teachers' classroom design (layout/shape) preferences for both specific purposes and in general) and teachers' attitude and behavioral characteristics.

5.2.1 Teacher Motivation towards Education and Classroom Environment

In order to answer the first research question of this study (RQ1), a Pearson's Chi-square test of independence was performed to examine: the association between teachers' current classroom arrangement and their motivation level towards their education; and the association between teachers' classroom design preferences and their motivation level towards their education. This statistical procedure was viewed as the optimal statistical procedure to use because frequency data were present for both variables. As such, chi-squares are the statistical procedure of choice when both variables are categorical. In addition, with the large sample size, the available sample size per cell was more than five. (Agresti, 1990; Tang, He, & Tu, 2012). Therefore, the assumptions for utilizing a chi-square were met for answering these two questions.

RQ1a: Is there an association between teachers' current classroom arrangements and teacher motivation?

A Pearson's chi-square test of independence was performed to examine the relation between teachers' classroom design preferences and their motivation towards profession. There is no

significant evidence found of a relationship between teachers' current classroom arrangement and their motivation towards profession, Pearson X^2 (2, N=234) = 4.42, p = .110 (see Table 5-10)

Table 5-10: Pearson's Chi-Square test of dependence for teacher motivation towards education and classroom design preference

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.420[a]	2	.110
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

Therefore, as can be seen in Figure 5-20, the distributions of lowly and highly (high/moderate) motivated teachers within student and teacher centered classroom types were found to be similar. While the percentage of highly motivated teachers within teacher-centered classroom environments was 69.6%, the percentage of highly motivated teachers was 67.9% within student-centered classroom environments. Similarly, while the percentage of lowly motivated teachers was found to be 20.4% within teacher-centered classrooms, the percentage was found to be 32.1% within student-centered classroom environments.

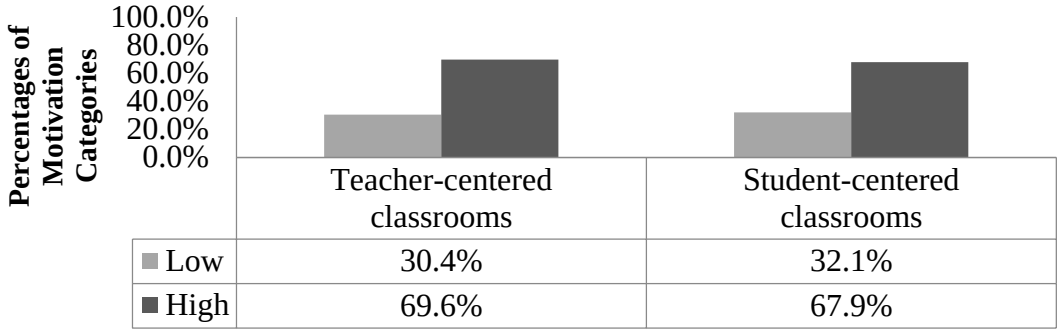


Figure 5-20: Frequency distributions of teachers' motivation levels in relation to teachers' current classroom types

RQ1b: Is there an association between teachers' classroom design preferences and teacher motivation towards education?

First, a Pearson's chi-square test of independence was performed to examine the relation between teachers' classroom design preferences (what they find best/prefer "overall") and their motivation towards education (see Table 5-11). The test between these variables was found to be statistically significant at the 0.05 significance level, Pearson X^2 (2, N=234) = 7.14, p = .028, with a moderate (Cramer's ϕ = .18) effect size according to Cohen's conventions for Cramer's V (Aron, Aron, & Coups, 2009).

Table 5-11: Pearson's Chi-Square test of dependence for teacher motivation and classroom design preferences

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.149[a]	2	**.028**
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

The frequency distribution of teacher motivation in relation to teachers' classroom design preferences show that teachers who have low teacher motivation towards their profession were found 15% more likely to prefer expandable classrooms over variations of L-shape classrooms. Similarly, looking within the classroom design groups, teachers who have higher (medium or high) motivation towards profession were found approximately 15% more likely to prefer variations of L-shape classrooms over expandable classrooms. Looking within the variations of L-shape classrooms group, we can also observe that teachers who prefer this classroom design group are 53% more likely to be highly motivated teachers (medium + high categories) than lowly motivated teachers (see Table 5-12).

Table 5-12: Frequency distribution of teacher motivation in relation to teachers' classroom design preference

			Teacher motivation categories			
			Low	Medium	High	Total
Classroom Design Preference	Expandable	Count	43	43	25	111
		% within Classroom Design Preference	38.7%	38.7%	22.5%	100.0%
	Variations of L-shapes	Count	29	66	28	123
		% within Classroom Design Preference	23.6%	53.7%	22.8%	100.0%
Total		Count	72	109	53	234
		% within Classroom Design Preference	30.8%	46.6%	22.6%	100.0%

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Pearson's chi-square test of independence was also performed to examine the relations between teacher motivation towards profession and teachers' preferences on classroom design for specific purposes. Table 5-13summarizes the results of the tests:

Table 5-13: Pearson's Chi-Square test of dependence for teacher motivation and classroom design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	13.669[a]	2	**.001**
Class discussions	6.554[a]	2	**.038**
Group studies	5.683[a]	2	.058
Independent studies	2.511[a]	2	.285
Multiple teaching methods	1.573[a]	2	.455
Interaction between students	2.422[a]	2	.298
Teacher movement	1.208[a]	2	.547
Circulation	5.335[a]	2	.069
Technology use	4.234[a]	2	.120
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

As Table 5-13indicates, the tests between teachers' motivation towards professions and classroom design preferences for lectures and class discussions variables were also found to be statistically significant at the 0.05 significance level:

- Lectures: Pearson X^2 (2, N=234) = 13.66, p = .001, with a moderate (Cramer's ϕ = .18) effect size.

- Class discussions: Pearson X^2 (2, N=234) = 6.55, p = .038, with a moderate (Cramer's ϕ = .17) effect size.

According to the frequency distributions of teacher motivation in relation to teachers' classroom design preferences for these two specific purposes, teachers who were found to be highly motivated (medium + high) were found 13% more likely to prefer expandable classroom designs over variations of L-shape classroom designs for "lecture" purposes. Similarly, teachers who were found to be highly motivated (medium + high) were found 12% more likely to prefer expandable classroom designs over variations of L-shape classroom designs for "class discussions" purposes (see Table 5-14).

Table 5-14: Frequency distributions of teacher motivation in relation to teachers' classroom design preferences for "lecture" and "class discussions" purposes

Design preference for:			Teacher motivation categories			
			Low	Medium	High	Total
Lectures	Expandable classrooms	Count	43	88	30	161
		% within Lectures	26.7%	54.7%	18.6%	100.0%
	Variations of L-shape	Count	29	21	23	73
		% within Lectures	39.7%	28.8%	31.5%	100.0%
Class discussions	Expandable classrooms	Count	46	87	35	168
		% within Class discussions	27.4%	51.8%	20.8%	100.0%
	Variations of L-shape	Count	26	22	18	66
		% within Class discussions	39.4%	33.3%	27.3%	100.0%

5.2.2 Teachers' Environmental Response and Classroom Environment

In order to answer the first research question of this study (RQ2), a Pearson's Chi-square test of independence was performed to examine: the association between teachers' current classroom arrangement and their environmental response; and the association between teachers' classroom design preferences and their environmental response. This statistical procedure was viewed as the optimal statistical procedure to use because frequency data were present for both variables. In addition, with the large sample size, the available sample size per cell was more than five. (Agresti, 1990; Tang, He, & Tu, 2012). Therefore, the assumptions for utilizing a chi-square were met for answering these two questions.

RQ2a: Is there an association between teachers' current classroom arrangements and teachers' environmental response and awareness?

First, a Pearson's chi-square test of independence was performed to examine the relation between teachers' current classroom arrangement and "Environmentally Inclusive" variable as an ER (Environmental Response) factor. There was no significant evidence found of a relationship between these two variables, Pearson X^2 (2, N=234) = .99, p = .609 (see Table 5-15).

Table 5-15: Pearson's Chi-Square test of dependence for teachers' current classroom environment and environmentally inclusive ERI factor

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.993[a]	2	.609
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

Accordingly, the distributions of lowly and highly (medium / high) environmentally inclusive teachers within student and teacher centered classroom types were also found to be similar. The percentages of highly environmentally inclusive teachers were 85.6% and 83.0% within teacher-centered and student-centered classroom environments respectively (see Figure 5-21).

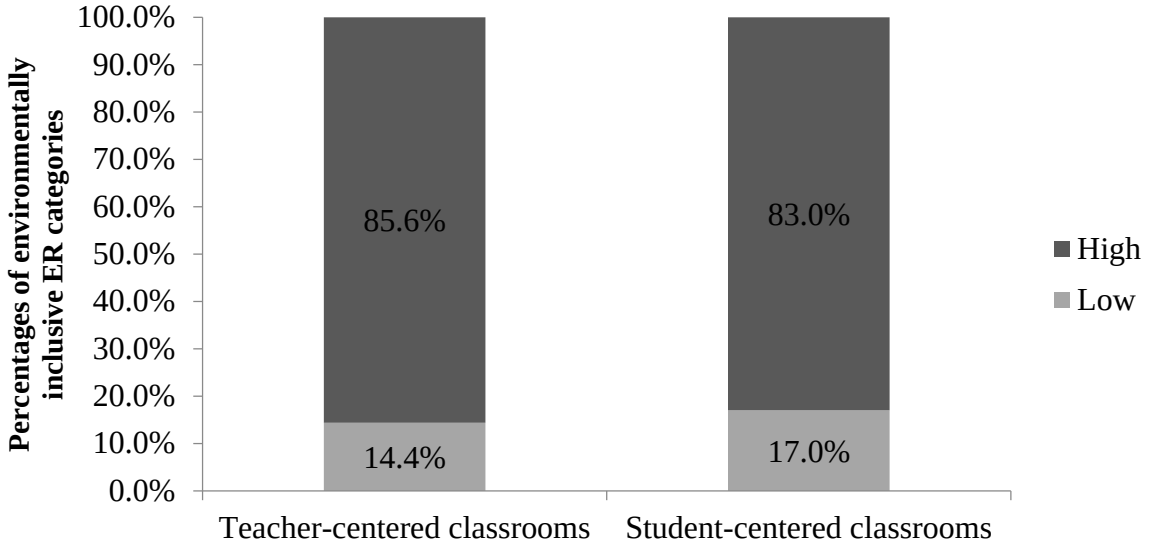


Figure 5-21: Frequency distributions of environmentally inclusive ER categories in relation to teachers' current classroom types

Second, a Pearson's chi-square test of independence was performed to examine the relation between teachers' current classroom arrangement and "Environmentally Exclusive" variable as an ER factor. There was no significant evidence found of a relationship between these two variables, Pearson X^2 (2, N=234) = .470, p = .791 (see Table 5-16).

Table 5-16: Pearson's Chi-Square test of dependence for teachers' current classroom environment and environmentally exclusive ER factor

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.470[a]	2	.791
N of Valid Cases	234		

a.1 cell (16.7%) have expected count less than 5.

Accordingly, the distributions of lowly and highly (medium + high) environmentally exclusive teachers within student and teacher centered classroom types were also found to be similar. The percentages of highly environmentally exclusive teachers were 74.0% and 77.4% within teacher-centered and student-centered classroom environments respectively (see Figure 5-22).

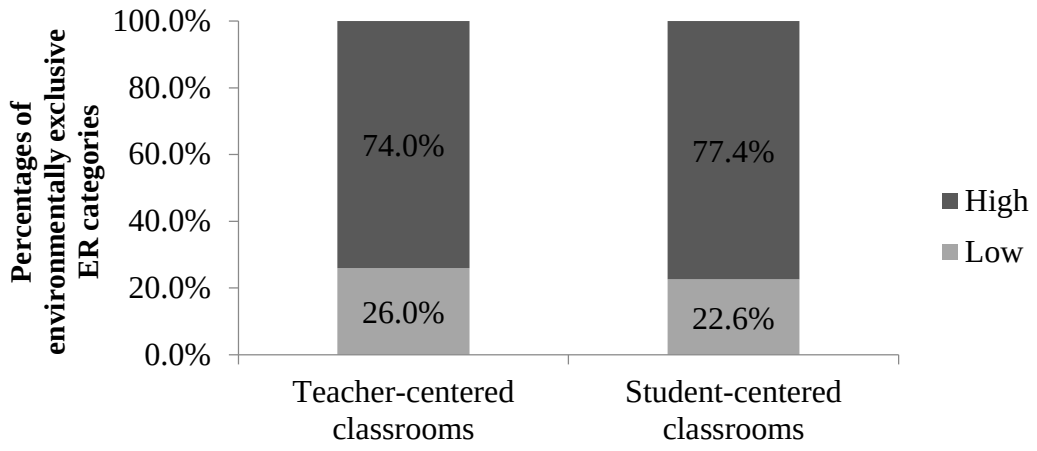


Figure 5-22: Frequency distributions of environmentally exclusive ER categories in relation to teachers' current classroom types

RQ2b: Is there an association between teachers' preferences on classroom design and teachers' environmental response and awareness?

First, a Pearson's chi-square test of independence was performed to examine the relation between what teachers prefer/find best "overall" on classroom design and "Environmentally Inclusive" variable as an ER (Environmental Response) factor. There was no significant evidence found of a relationship between these two variables, Pearson X^2 (2, N=234) = 3.584, p = .167 (see Table).

Table 5-17: Pearson's Chi-Square test of dependence for teachers' classroom design preferences (overall preference) and environmentally inclusive ER factor

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.584[a]	2	.167
N of Valid Cases	234		

a. 0 cells (.0%) have expected count less than 5.

Although there was no significant evidence found of a relationship between the two variables, teachers who prefer the variations of L-shape classrooms were 4.2% more likely to be highly motivated teachers than the teachers who prefer expandable classroom designs (see Figure 5-23).

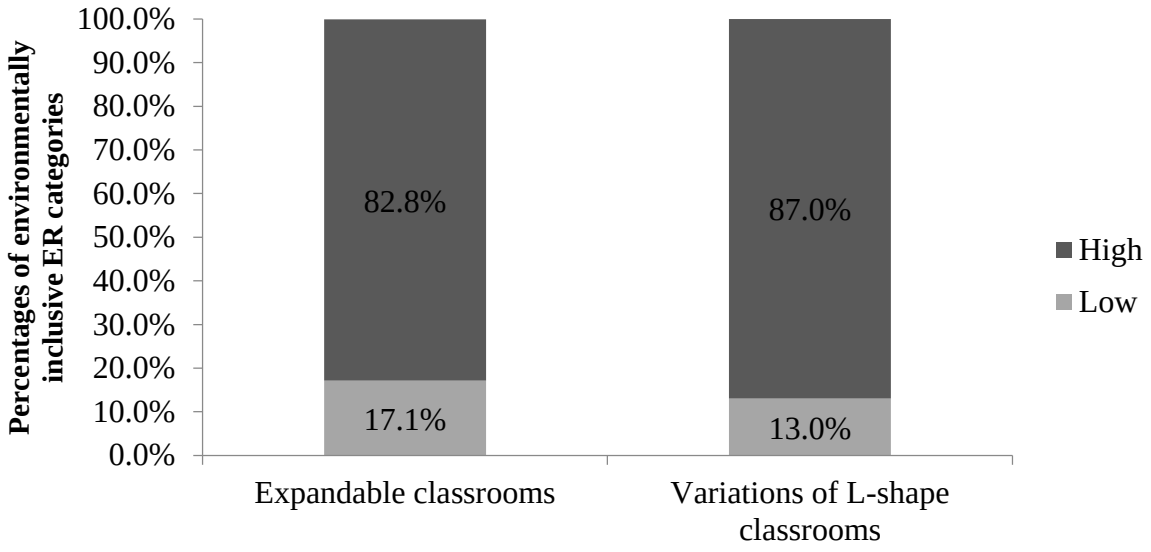


Figure 5-23: Frequency distributions of environmentally inclusive ER categories in relation to teachers' classroom design preferences.

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Pearson's chi-square test of independence was also performed to examine the relations between "Environmentally Inclusive" variable as an ER (Environmental Response) factor and teachers' preferences on classroom design for specific purposes. Table 5-18 summarizes the results of the tests:

Table 5-18: Pearson's Chi-Square test of dependence for environmentally inclusive ER factor and classroom design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	1.472[a]	2	0.479
Class discussions	4.138[a]	2	0.126
Group studies	9.295[a]	2	**0.010**
Independent studies	18.847[a]	2	**0.000**
Multiple teaching methods	2.093[a]	2	0.351
Interaction between students	2.518[a]	2	0.284
Teacher movement	4.041[a]	2	0.133
Circulation	.918[a]	2	0.632
Technology use	18.813[a]	2	**0.000**
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

As Table 5-18 indicates, the tests between environmentally inclusive ER factor and teachers' classroom design preferences variables were found to be statistically significant at the 0.05 significance level for the following purposes:

- Group studies: Pearson X^2 (2, N=234) = 9.29, p = .010, with a moderate (Cramer's ϕ = .20) effect size.
- Independent student activities: Pearson X^2 (2, N=234) = 18.84, p < .001, with a moderate (Cramer's ϕ = .29) effect size.

- Technology use: Pearson X^2 (2, N=234) = 18.81, $p < .001$, with a moderate (Cramer's $\phi = .29$) effect size.

According to the frequency distributions of environmentally inclusive ER factor in relation to teachers' classroom design preferences for "group studies", "independent student activities", and "technology use" purposes , teachers who prefer variations of L-shape classroom designs for "group studies" were found 5% more likely to be highly environmentally inclusive than teachers who prefer expandable classroom designs. Similarly, teachers who prefer variations of L-shape classroom designs for "independent student activities" were found 18% more likely to be highly environmentally inclusive than teachers who prefer expandable classroom designs. Lastly, teachers who prefer variations of L-shape classroom designs for "technology use" were also found 18% more likely to be highly environmentally inclusive than teachers who prefer expandable classroom designs. Therefore, for these three variables, teachers who prefer variations of L-shape classroom designs were found to be more environmentally inclusive than teachers who prefer expandable classroom designs (see Table 5-19).

Table 5-19: Frequency distributions of environmentally inclusive ER factor in relation to teachers' classroom design preferences for "group studies", "independent student activities", and "technology use" purposes

Design preference for:			Environmentally inclusive ER categories			Total
			Low	Medium	High	
Group studies	Expandable classrooms	Count	18	46	40	104
		% within Group studies	17.3%	44.2%	38.5%	100.0%
	Variations of L-shape	Count	17	83	30	130
		% within Group studies	13.1%	63.8%	23.1%	100.0%
Independent student activities	Expandable classrooms	Count	21	30	29	80
		% within Independent student activities	26.3%	37.5%	36.3%	100.0%
	Variations of L-shape	Count	14	99	41	154
		% within Independent student activities	9.1%	64.3%	26.6%	100.0%
Technology use	Expandable classrooms	Count	23	48	46	117
		% within Technology use	19.7%	41.0%	39.3%	100.0%
	Variations of L-shape	Count	12	81	24	117
		% within Technology use	10.3%	69.2%	20.5%	100.0%

5.2.3 Teacher Motivations for Creating a Better Classroom Environment

In order to answer the third research question of this study (RQ3), two sub-questions were established and analyzed.

RQ3a: What are the teachers' classroom design preferences?

In order to address what teachers prefer and find important for creating a better classroom environment (RQ3a), descriptive analysis was employed to understand what teachers prefer on classroom design overall and/or in order to meet certain needs and purposes. These classroom purposes were: lectures, class discussions, group studies, independent student activities, multiple teaching methods, interaction between students, teacher movement, circulation, technology use, and overall. As explained in Section 5.1.4 , nearly more than one third of participants rated Layout 2 as the best classroom design overall (for various purposes). Layout 2 was also found to be the best/most preferred classroom type by teachers for: group studies (32.5%); independent student activities (35.9), multiple teaching methods (43.6%), and technology use (34.2%). Nearly one third of participants rated Layout 3 as the best classroom design for lectures. Layout 4, on the other hand, was found to be the best classroom type for: class discussions (35.9%); interaction between students (31.6%); teacher movement (35.9%); and circulation (35%) purposes.

In summary, teachers were found 6% more likely to prefer variations of L-shape classroom designs over expandable classrooms designs. Teachers were also found to prefer variations of L-shape classrooms for the following class purposes:

- Group studies (12% more likely)
- Independent student activities (32% more likely)
- Multiple teaching methods (28% more likely)

On the other hand, teachers were also found to prefer expandable classroom designs over variations of L-shape classroom designs for the following class purposes:

- Lectures (38% more likely)
- Class discussions (44% more likely)
- Interaction between students (31% more likely)
- Teacher movement (37% more likely)
- Circulation (40% more likely)

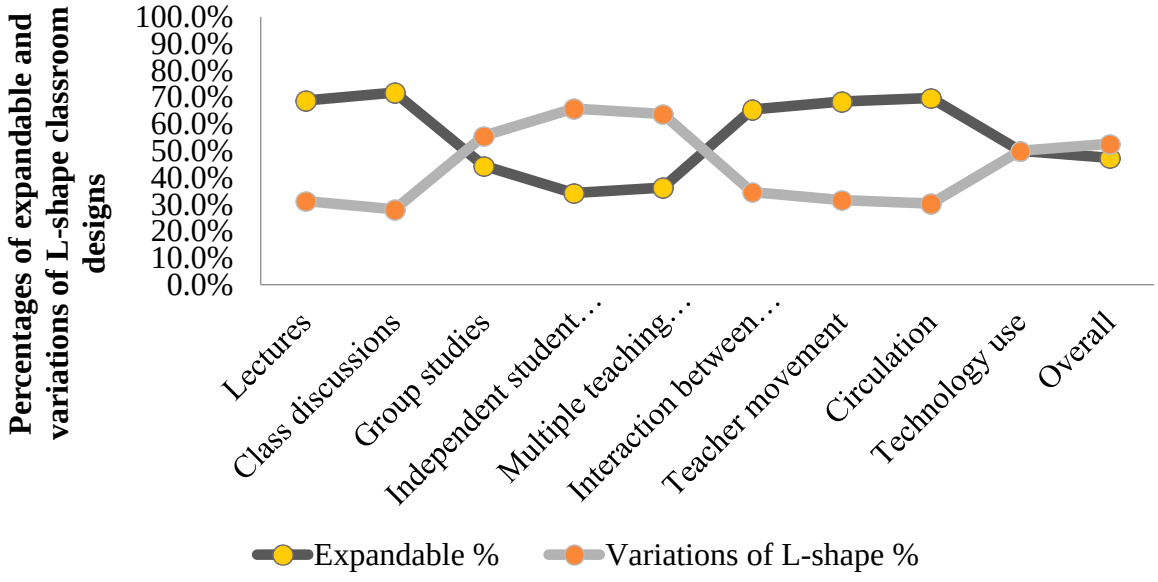


Figure 5-24: Frequency distributions of expandable and variations of L-shape classroom design preferences in relation to specific purposes in class

RQ3b: What are the issues that teachers define important for achieving a better classroom environment?

A ranking question was used to address what teachers find most important for achieving a better classroom environment through having participants prioritize the factors using 1-10 scale (1 mean most important and 10 means least important). The list included the following factors:

- Class size
- Indoor-outdoor connection
- Seating arrangement
- Flexibility of furniture
- Variability in furniture
- Variety of technology use
- Flexibility in furniture
- Flexibility of movement
- Interaction
- Aesthetic appeal
- Ability to control heat/ac
- Ability to control lighting (full or partial, in phased sequences)
- Windows
- Flooring finish
- Acoustics
- Available sink

As described in the Section 5.1 , the downloaded data set for this rank order question included a column for each item being ranked. In each column, the ranking each participant awarded that particular item was present. A mean score was calculated for each item on the list. The data then was transposed, so that the items on the list were rows and the mean ranks for each factor were columns. In this case, since respondents were asked to rank 1 as highest rank, a lower would mean score signify a higher rank. Therefore, class size (M = 3.70) was found to be the most important factor for achieving a better classroom environment. Following to class size, indoor-outdoor connection (M = 5.56), and flexibility of furniture (M = 6.21) were found to be the second and third most important factors respectively for achieving a better classroom environment (see Figure 5-25).

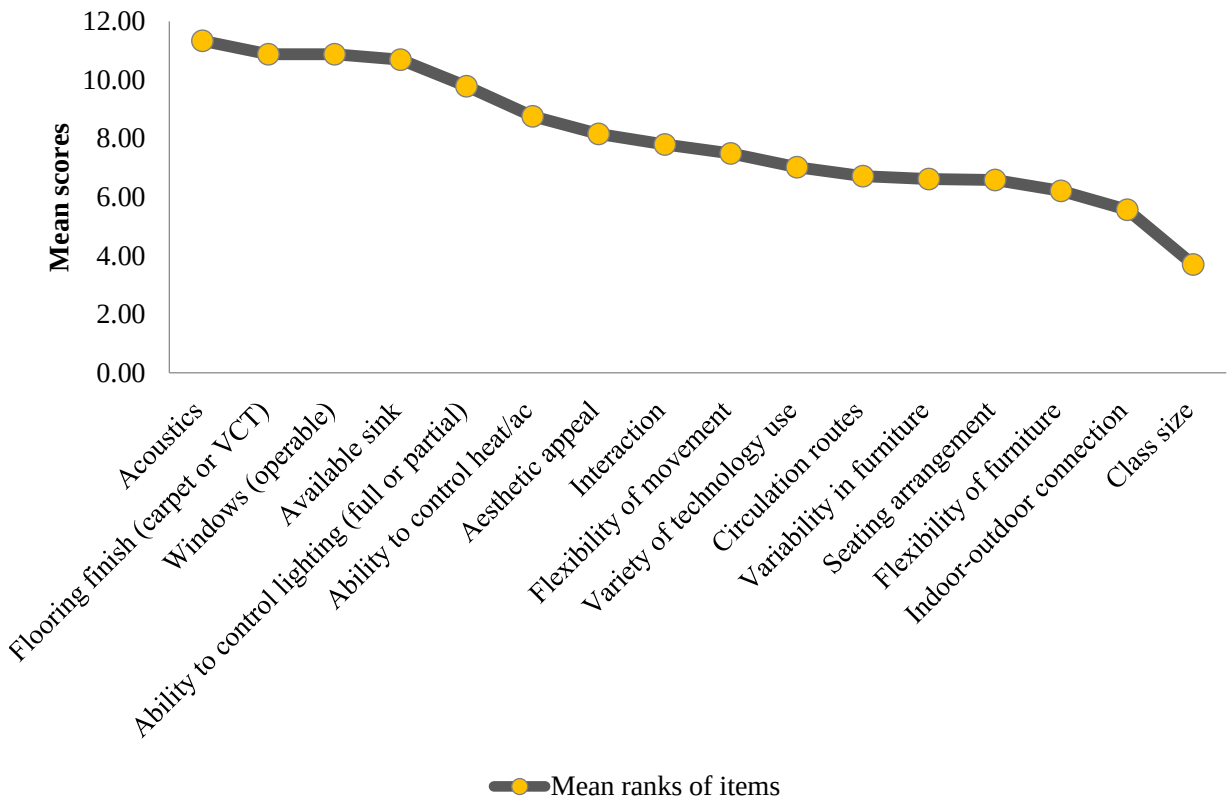


Figure 5-25: Mean ranks of factors for achieving a better classroom environment

5.2.4 Teachers' Attitude toward Education and Classroom Environment

In order to answer the fifth research question of this study (RQ5), a Pearson's Chi-square test of independence was performed when the available sample size per cell was more than five (Agresti, 1990; Tang, He, & Tu, 2012). In cases when this assumption was violated, a Likelihood ratio Chi-square test was performed as it does not require the value of the cell expecteds to be 5 or more in at least 80% of the cells (McHugh, 2013). Therefore, these two tests were used to examine the relationships between: teachers' current classroom arrangement and instructional content area; teachers' preferences on classroom design and instructional content area; teachers' current classroom arrangement and teaching methods;

and teachers' preferences on classroom design and teaching methods. These statistical procedures were viewed as the optimal statistical procedures to use because frequency data were present for both variables (categorical). Therefore, the assumptions for utilizing these chi-square tests were met for answering these four questions.

RQ5a: Is there an association between teachers' current classroom arrangement and instructional content area?

A likelihood ratio chi-square test was performed to examine the relation between teachers' current classroom arrangement and their instructional areas. As Table 5-20 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level, X^2 (8, N=234) = 21.77, p = .005, with a moderate (Cramer's ϕ = .28) effect size.

Table 5-20: Likelihood Chi-square test for teachers' current classroom environment and instructional area

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	21.772	8	**.005**
N of Valid Cases	234		

As Figure 5-26 indicates distributions of classroom types in relation to instructional areas, nearly three fourths (77.4%) of teachers who participated in study reported that they teach in a "teacher-centered classroom" environment, whereas nearly one third (22.6%) were found to teach in a "student-centered classroom" environment. Instructional areas that were found to be conducted in both teacher and student centered classroom environments were: art (42.9%

in student-centered classrooms); language (38.5% in student-centered classrooms); social studies (35.0% in student-centered classrooms); math (35.0% in student-centered classrooms); science (15.4% in student-centered classrooms); and other classes (22.6% in student-centered classrooms). On the other hand, instructional areas that were found to be conducted in teacher-centered classroom environments only were: music; PE/health; and technology (100% in teacher-centered classrooms) (see Table 5-21).

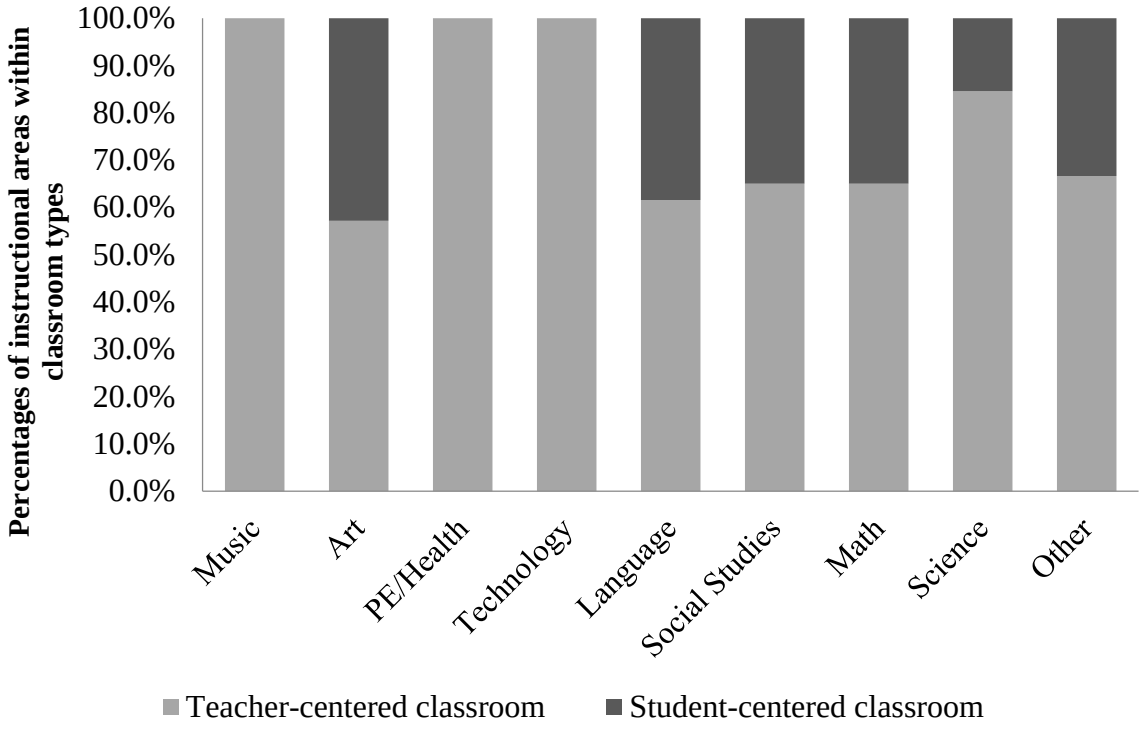


Figure 5-26: Frequency distributions of classroom types in relation to instructional areas

Table 5-21: Frequency distributions of instructional areas in relation to teachers' current classroom types

Instructional Area		Most frequent arrangement		Total
		Teacher-centered classroom	Student-centered classroom	
Music	Count	7	0	7
	% within Instructional Area	100.0%	0.0%	100.0%
Art	Count	4	3	7
	% within Instructional Area	57.1%	42.9%	100.0%
PE/Health	Count	4	0	4
	% within Instructional Area	100.0%	0.0%	100.0%
Technology	Count	6	0	6
	% within Instructional Area	100.0%	0.0%	100.0%
Language	Count	16	10	26
	% within Instructional Area	61.5%	38.5%	100.0%
Social Studies	Count	13	7	20
	% within Instructional Area	65.0%	35.0%	100.0%
Math	Count	13	7	20
	% within Instructional Area	65.0%	35.0%	100.0%
Science	Count	104	19	123
	% within Instructional Area	84.6%	15.4%	100.0%
Other	Count	14	7	21
	% within Instructional Area	66.7%	33.3%	100.0%
Total	Count	181	53	234
	% within Instructional Area	77.4%	22.6%	100.0%

RQ5b: Is there an association between teachers' classroom design preferences and instructional content area?

First, a likelihood ratio chi-square test was performed to examine the relation between what teachers prefer/find best "overall" on classroom design and their instructional areas. As Table 5-22 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level, X^2 (8, N=234) = 18.10, p = .020, with a moderate (Cramer's ϕ = .28) effect size.

Table 5-22: Likelihood ratio chi-Square test for teachers' classroom design preferences and instructional area

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	18.107	8	**.020**
N of Valid Cases	234		

As can be seen by the frequencies cross tabulated in Table 5-23, percentages of teachers who preferred expandable classrooms overall/for various purposes (47.4%) and variations of L-shape classrooms (52.6%) were found to be similar. Instructional areas in which teachers were found to prefer expandable classroom designs over variations of L-shape classroom designs were: music (85.7%), language (57.7%), social studies (60%), math (60%), and other (66.7%). Instructional areas in which teachers were found to prefer variations of L-shape classroom designs over expandable classroom designs were: art (57.1%), PE/Health (75%), and science (63.4%). In technology instructional area, on the other hand, the percentage of teachers who preferred expandable classroom designs and the percentage of teachers who

preferred variations of L-shape classroom designs were found to be equal (50% and 50%) (see also Figure 5-27).

Table 5-23: Frequency distributions of instructional areas in relation to teachers' classroom design preferences

Instructional area		Design preference (overall)		Total
		Expandable	Variations of L-shape	
Music	Count	6	1	7
	% within Instructional Area	85.70%	14.30%	100.00%
Art	Count	3	4	7
	% within Instructional Area	42.90%	57.10%	100.00%
PE/Health	Count	1	3	4
	% within Instructional Area	25.00%	75.00%	100.00%
Technology	Count	3	3	6
	% within Instructional Area	50.00%	50.00%	100.00%
Language	Count	15	11	26
	% within Instructional Area	57.70%	42.30%	100.00%
Social Studies	Count	12	8	20
	% within Instructional Area	60.00%	40.00%	100.00%
Math	Count	12	8	20
	% within Instructional Area	60.00%	40.00%	100.00%
Science	Count	45	78	123
	% within Instructional Area	36.60%	63.40%	100.00%
Other	Count	14	7	21
	% within Instructional Area	66.70%	33.30%	100.00%
Total	Count	111	123	234
	% within Instructional Area	47.40%	52.60%	100.00%

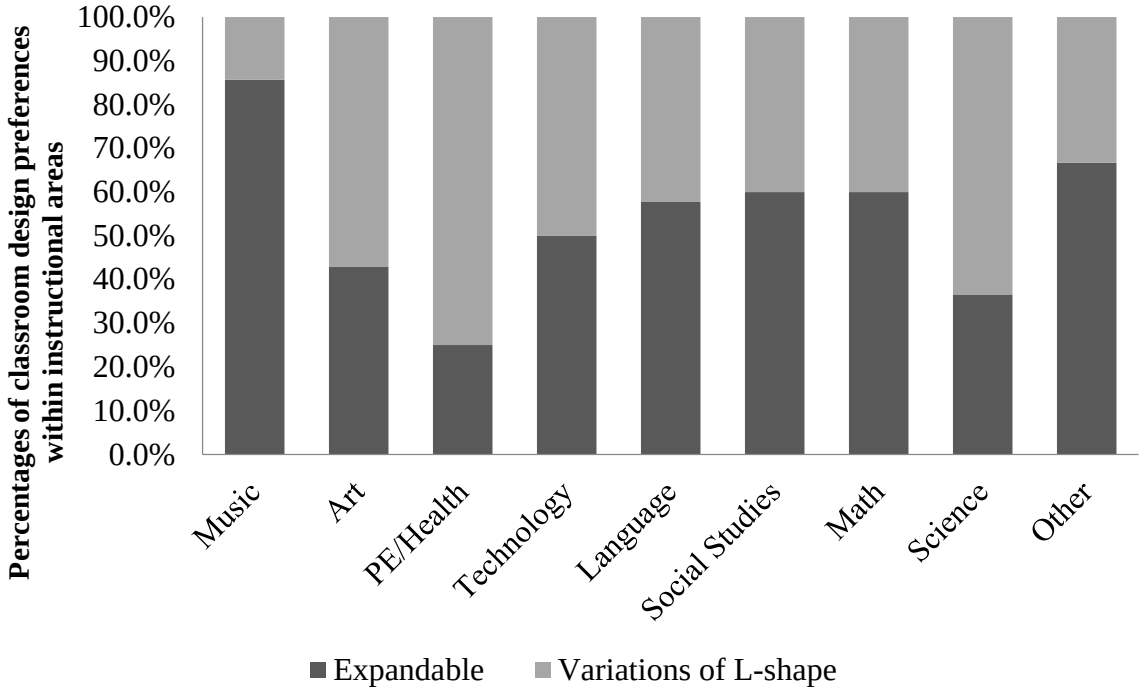


Figure 5-27: Frequency distributions of instructional areas in relation to teachers' classroom design preferences

Second, in addition to what teachers prefer/find best "overall" on classroom design, a likelihood ratio chi-square test was also performed to examine the relations between teachers' instructional areas and their classroom design preferences for specific purposes. Table 5-24 summarizes the results of the tests:

Table 5-24: Likelihood Chi-Square test for instructional areas and classroom design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	18.151	8	**.020**
Class discussions	12.228	8	.141
Group studies	15.361	8	.052
Independent student activities	7.295	8	.505
Multiple teaching methods	5.854	8	.664
Interaction between students	7.149	8	.521
Teacher movement	14.485	8	.070
Circulation	8.409	8	.395
Technology use	13.569	8	.094
N of Valid Cases	234		

As Table 5-24 indicates, the test between instructional area and teachers' classroom design preferences variables was also found to be statistically significant for lecture purposes at the 0.05 significance level, X^2 (8, N=234) = 18.15, p = .020, with a moderate (Cramer's ϕ = .29) effect size.

As can be seen by the frequencies cross tabulated in Table 5-25, the percentage of teachers who preferred expandable classrooms for lecture (68.8%) was found to be nearly more than double the percentage of teachers who preferred the variations of L-shape classrooms (31.2%).

Table 5-25: Frequency distributions of instructional areas in relation to teachers' classroom design preference for lectures

Instructional area		Design preference for Lectures		
		Expandable classrooms	Variations of L-shape	Total
Music	Count	5	2	7
	% within Instructional Area	71.4%	28.6%	100.0%
Art	Count	1	6	7
	% within Instructional Area	14.3%	85.7%	100.0%
PE/Health	Count	1	3	4
	% within Instructional Area	25.0%	75.0%	100.0%
Technology	Count	3	3	6
	% within Instructional Area	50.0%	50.0%	100.0%
Language	Count	20	6	26
	% within Instructional Area	76.9%	23.1%	100.0%
Social Studies	Count	14	6	20
	% within Instructional Area	70.0%	30.0%	100.0%
Math	Count	12	8	20
	% within Instructional Area	60.0%	40.0%	100.0%
Science	Count	87	36	123
	% within Instructional Area	70.7%	29.3%	100.0%
Other	Count	18	3	21
	% within Instructional Area	85.7%	14.3%	100.0%
Total	Count	161	73	234
	% within Instructional Area	68.8%	31.2%	100.0%

Instructional areas in which teachers were found to prefer expandable classroom designs over variations of L-shape classroom designs for lectures were: music (71.4%), language (76.9%), social studies (70%), math (60%), science (70.7%), and other (85.7%). Instructional areas in which teachers were found to prefer variations of L-shape classroom designs over expandable classroom designs were: art (85.7%) and PE/Health (75%). In technology instructional area, on the other hand, the percentage of teachers who preferred expandable classroom designs and the percentage of teachers who preferred variations of L-shape classroom designs for lecture purposes were also found to be equal (50%and 50%) (see Figure 5-28).

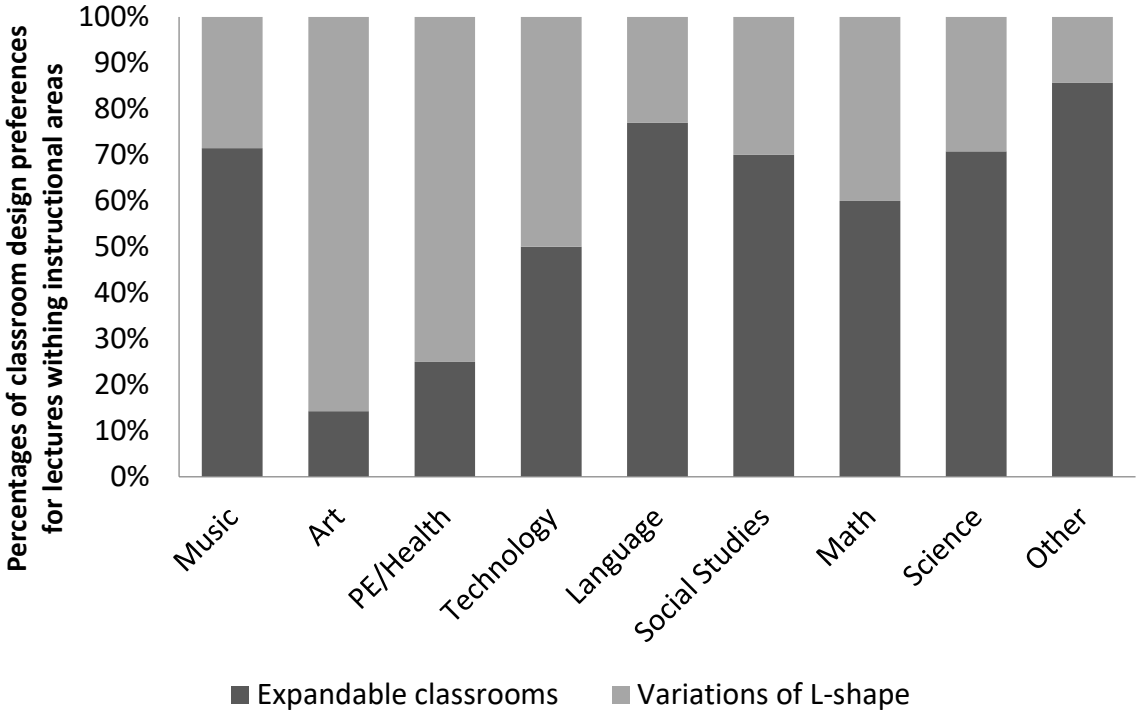


Figure 5-28: Frequency distributions of instructional areas in relation to teachers' classroom design preferences for lectures

As Table 5-26 indicates the changes in percentages of teachers' classroom design preferences in relation to purpose (overall vs. lecture), following trends were found in instructional areas when the purpose was" lecture" instead of "overall":

- Music: A 14.3% decrease was observed in teachers' preferences of expandable classroom designs.
- Art: A 28.6% increase was observed in teachers' preferences of variations of L-shape classroom designs.
- PE/Health: No change was observed in teachers' preferences of variations of L-shape classroom designs.
- Technology: No change was observed in teachers' preferences. Percentages of expandable classroom design preferences and variations' of L-shape classroom designs preferences were found to be equal (50%).
- Language: A 19.2% increase was observed in teachers' preferences of expandable classroom designs.
- Social studies: A 10% increase was observed in teachers' preferences of expandable classroom designs.
- Math: No change was observed in teachers' preferences. Percentages of expandable classroom design preferences and variations' of L-shape classroom designs preferences were found to be equal (60%).
- Science: A significant shift from preferring variations of L-shape classroom designs (with a 63.4%) to preferring expandable classroom designs (with a 70.7%) was observed.

- Other: A 19% increase was observed in teachers' preferences of expandable classroom designs.

Table 5-26: Frequency distributions of instructional areas in relation to teachers' classroom design preference for "overall" and "lecture" purposes

		Design preference for:			
		Overall		Lectures	
Instructional area		Expandable classrooms	Variations of L-shape	Expandable classrooms	Variations of L-shape
Music	% within Instructional Area	85.7%	14.3%	71.4%	28.6%
Art	% within Instructional Area	42.9%	57.1%	14.3%	85.7%
PE/Health	% within Instructional Area	25.0%	75.0%	25.0%	75.0%
Technology	% within Instructional Area	50.0%	50.0%	50.0%	50.0%
Language	% within Instructional Area	57.7%	42.3%	76.9%	23.1%
Social Studies	% within Instructional Area	60.0%	40.0%	70.0%	30.0%
Math	% within Instructional Area	60.0%	40.0%	60.0%	40.0%
Science	% within Instructional Area	36.6%	63.4%	70.7%	29.3%
Other	% within Instructional Area	66.7%	33.3%	85.7%	14.3%

RQ5c: Is there an association between teachers' current classroom arrangement and teaching methods?

A Pearson's chi-square test of independence was performed to examine the relation between teachers' current classroom arrangement and their teaching methods. As Table 5-27 indicates, the test between these variables was found to be statistically significant at the 0.05 significance level, Pearson X^2 (5, N=234) = 18.48, p = .002, with a moderate (Cramer's ϕ = .28) effect size.

Table 5-27: Pearson's Chi-Square test of dependence for teachers' current classroom arrangement and teaching methods

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	18.480[a]	5	**.002**
N of Valid Cases	234		

a. 1 cell (8.3%) has expected count less than 5.

As can be seen by the frequencies cross tabulated in Table 5-28, lectures and discussions as primary teaching methods were found to be used more in teacher-centered classrooms whereas small groups, class projects, and tutorials were found to be used more in student-centered classrooms. As Figure 5-29 indicates the differences between percentages of teaching methods within teacher and student centered classrooms visually, the following results were found:

- Compared to student-centered classroom environments, the percentage of using lectures as a primary teaching method was found to be nearly as double in teacher –

centered classrooms. 43.1% of teachers who currently teach in teacher-centered classroom environment were found to be using lectures as their primary teaching methods. In student-centered classroom environments, on the other hand, percentage of teachers who use lectures as primary teaching methods was found to be 22.6%.

- While18.8% of teachers who currently teach in teacher-centered classrooms were found to use discussions as their primary teaching method, 7.5% of teachers were found to use it as their primary teaching method in student-centered classrooms.
- Small groups as a primary teaching method, on the other hand, was found to be used 10% more in student-centered classrooms (22.6%) than teacher-centered classrooms (11.6%).
- Percentages of using debates as a primary teaching method in student-centered (13.2%) and teacher-centered classrooms (10.5%) were found to be similar. Student-centered classrooms were found to have slightly bigger percentage (2.7%).
- Class projects as a primary teaching method, was also found to be used 10.4% more in student-centered classroom s (17%) than they were found in teacher-centered classrooms (6.6%).
- Similarly, tutorials as a primary teaching method was also found to be used more in student-centered environments (17%) than they were found in teacher-centered environments (9.4%).

Table 5-28: Frequency distributions of teaching methods within teachers' most frequent classroom arrangement

Most frequent teaching method		Most frequent arrangement		
		Teacher-centered classroom	Student-centered classroom	Total
Lecture	Count	78	12	90
	% within Most frequent arrangement	43.1%	22.6%	38.5%
Discussion	Count	34	4	38
	% within Most frequent arrangement	18.8%	7.5%	16.2%
Small groups	Count	21	12	33
	% within Most frequent arrangement	11.6%	22.6%	14.1%
Debates	Count	19	7	26
	% within Most frequent arrangement	10.5%	13.2%	11.1%
Class projects	Count	12	9	21
	% within Most frequent arrangement	6.6%	17.0%	9.0%
Tutorial	Count	17	9	26
	% within Most frequent arrangement	9.4%	17.0%	11.1%
Total	Count	181	53	234
	% within Most frequent arrangement	100.0%	100.0%	100.0%

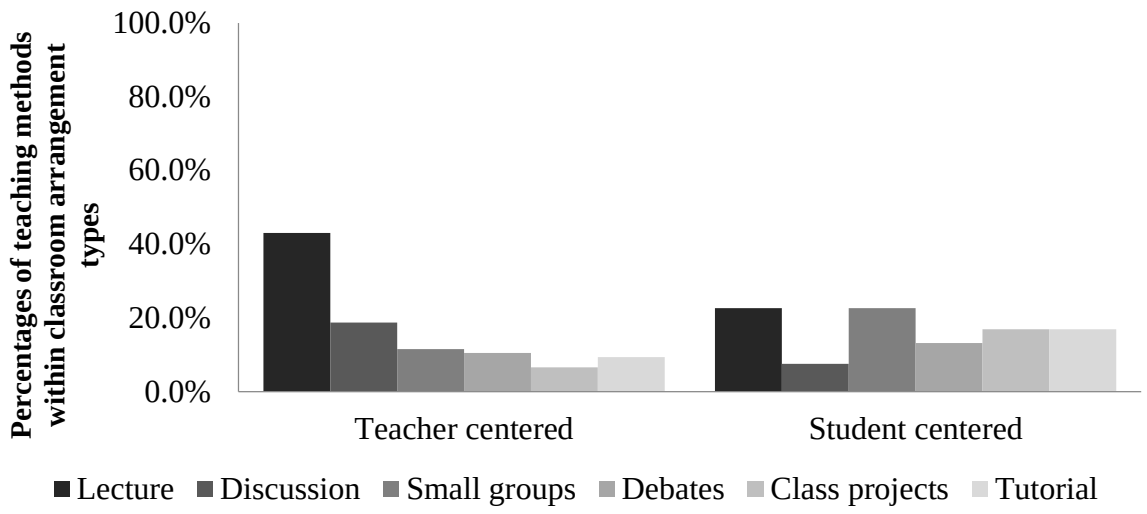


Figure 5-29: Frequency distributions of teaching methods in relation to teachers' current classroom arrangements

RQ5d: Is there an association between teachers' preferences on classroom design and teaching methods?

First, a Pearson's chi-square test of independence was performed to examine the relation between what teachers prefer/find best "overall" on classroom design and their primary teaching method. There is no significant evidence found of a relationship between these two variables, Pearson X^2 (5, N=234) = 4.67, p = .457 (see Table 5-29).

Table 5-29: Pearson's Chi-Square test of dependence for teachers' classroom design preferences (overall preference) and teaching method

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.677[a]	5	.457
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

Although no significant evidence found of a relationship between teaching methods and teachers' classroom design preference (overall), the distributions of teachers' primary teaching methods within expandable and variations of L-shape classroom design preferences show that teachers who prefer variations of L-shape classrooms (overall) were found to be using lectures as their primary teaching method more than teachers who prefer expandable classroom designs. While 32% of teachers' who find expandable classrooms best (overall) were found to be using lectures as their primary teaching methods, 44% of teachers' who find variations of L-shape classrooms best (overall) were found to be using lectures as their primary teaching method (see Figure 5-30).

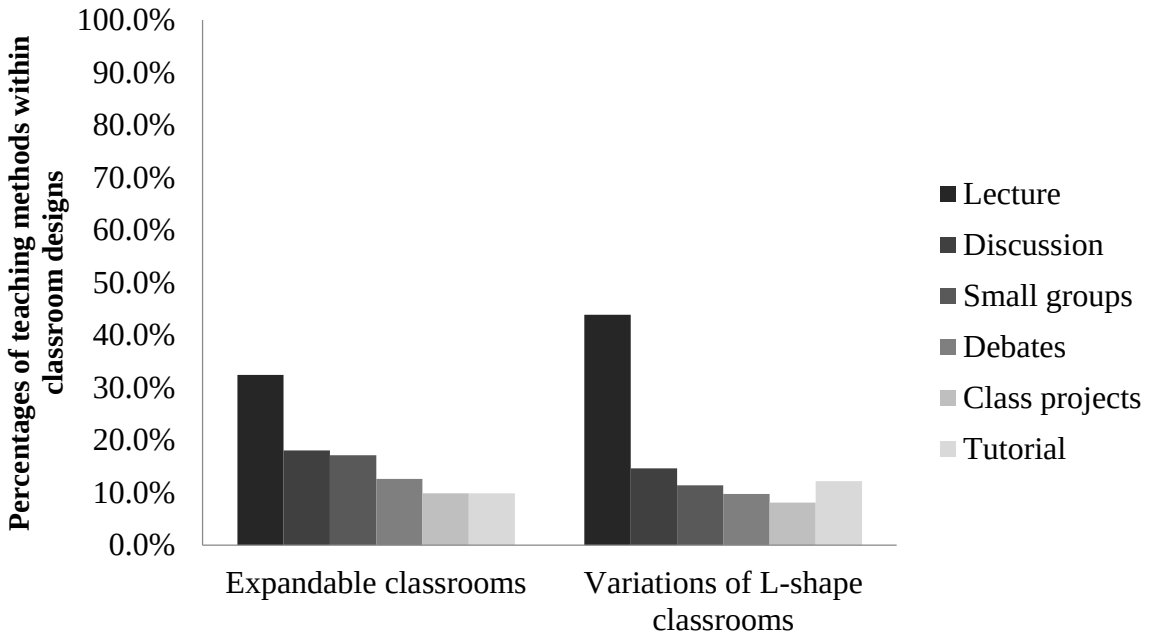


Figure 5-30: Frequency distributions of teaching methods in relation to teachers' overall classroom design preferences

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Pearson's chi-square test of independence was also performed to examine the relations between teaching methods and teachers' classroom design preferences for specific purposes. Table 5-30 summarizes the results of the tests:

Table 5-30: Pearson's Chi-Square test of dependence for teaching methods and classroom design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	13.034[a]	5	**.023**
Class discussions	10.525[a]	5	.062
Group studies	12.853[a]	5	**.025**
Independent student activities	6.926[a]	5	.226
Multiple teaching methods	12.012[a]	5	**.035**
Interaction between students	3.347[a]	5	.647
Teacher movement	11.022[a]	5	.051
Circulation	7.858[a]	5	.164
Technology use	17.098[a]	5	**.004**
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

As Table 5-30 indicates, the tests between teaching methods and teachers' classroom design preferences were found to be statistically significant at the 0.05 significance level for following purposes:

- Lectures: X^2 (5, N=234) = 13.03, p = .023, with a moderate (Cramer's ϕ = .23) effect size.
- Group studies: X^2 (5, N=234) = 12.85, p = .025, with a moderate (Cramer's ϕ = .23) effect size.
- Multiple teaching methods: X^2 (5, N=234) = 12.01, p = .035, with a moderate (Cramer's ϕ = .22) effect size.
- Technology use: X^2 (5, N=234) = 17.09, p = .004, with a moderate (Cramer's ϕ = .27) effect size.

As can be seen by the frequencies cross tabulated in Table 5-31, lectures was found to be the most frequently used teaching method within teachers' classroom design preferences for all four purposes. As Figure 5-31 visually indicates the differences between percentages of teaching methods within expandable and variations of L-shape classroom design preferences, the following results were found:

- According to design preferences for lectures: Lectures (44.7%) and tutorials (11.8%), as primary teaching methods, were found to be used more often within teachers who prefer expandable classroom designs. Discussions (19.2%), debates (17.8%), and class projects (13.7%) as primary teaching methods, on the other hand, were found to be used more often within teachers who prefer variations of L-shape classroom designs. Small groups as a primary teaching method was found to have respectively similar percentages within teachers who prefer expandable and variations of L-shape classroom design (13.7% and 15%).

- According to design preferences for group studies: Class projects (12.5%) and tutorials (17.3%), as primary teaching methods, were found to be used more often within teachers who prefer expandable classroom designs. Lectures (45.4%), on the other hand, were found to be used more often within teachers who prefer variations of L-shape classroom designs. Discussions, small groups, and debates were found to have similar percentages within teachers who prefer expandable and variations of L-shape classroom designs.
- According to design preferences for multiple teaching methods: Discussions (21.2%), small groups (18.8%), and class projects (12.9%) were found to be used more often within teachers who prefer expandable classroom designs. Lectures (45.6%), on the other hand, were found to be used more often within teachers who prefer variations of L-shape classroom designs. Debates and tutorials were found to have similar percentages within teachers who prefer expandable and variations of L-shape classroom designs.
- According to design preferences for technology use: Small groups (20.5%) and tutorials (14.5%) were found to be used more often within teachers who prefer expandable classroom designs. Lectures (49.6%), on the other hand, were found to be used more often within teachers who prefer variations of L-shape classroom designs. Discussions, debates, and class projects were found to have similar percentages within teachers who prefer expandable and variations of L-shape classroom designs.

Table 5-31: Frequency distributions of teaching methods within teachers' classroom design preferences for specific purposes

Design preference for:			Primary teaching methods						
			Lecture	Discussion	Small groups	Debates	Class projects	Tutorial	Total
Lectures	Expandable classrooms	Count	72	24	22	13	11	19	161
		% within Lectures	44.7%	14.9%	13.7%	8.1%	6.8%	11.8%	100.0%
	Variations of L-shape	Count	18	14	11	13	10	7	73
		% within Lectures	24.7%	19.2%	15.1%	17.8%	13.7%	9.6%	100.0%
Group studies	Expandable classrooms	Count	31	16	15	11	13	18	104
		% within Group studies	29.8%	15.4%	14.4%	10.6%	12.5%	17.3%	100.0%
	Variations of L-shape	Count	59	22	18	15	8	8	130
		% within Group studies	45.4%	16.9%	13.8%	11.5%	6.2%	6.2%	100.0%
Multiple teaching methods	Expandable classrooms	Count	22	18	16	9	11	9	85
		% within Multiple teaching methods	25.9%	21.2%	18.8%	10.6%	12.9%	10.6%	100.0%
	Variations of L-shape	Count	68	20	17	17	10	17	149
		% within Multiple teaching methods	45.6%	13.4%	11.4%	11.4%	6.7%	11.4%	100.0%
Technology use	Expandable classrooms	Count	32	20	24	14	10	17	117
		% within Technology use	27.4%	17.1%	20.5%	12.0%	8.5%	14.5%	100.0%
	Variations of L-shape	Count	58	18	9	12	11	9	117
		% within Technology use	49.6%	15.4%	7.7%	10.3%	9.4%	7.7%	100.0%

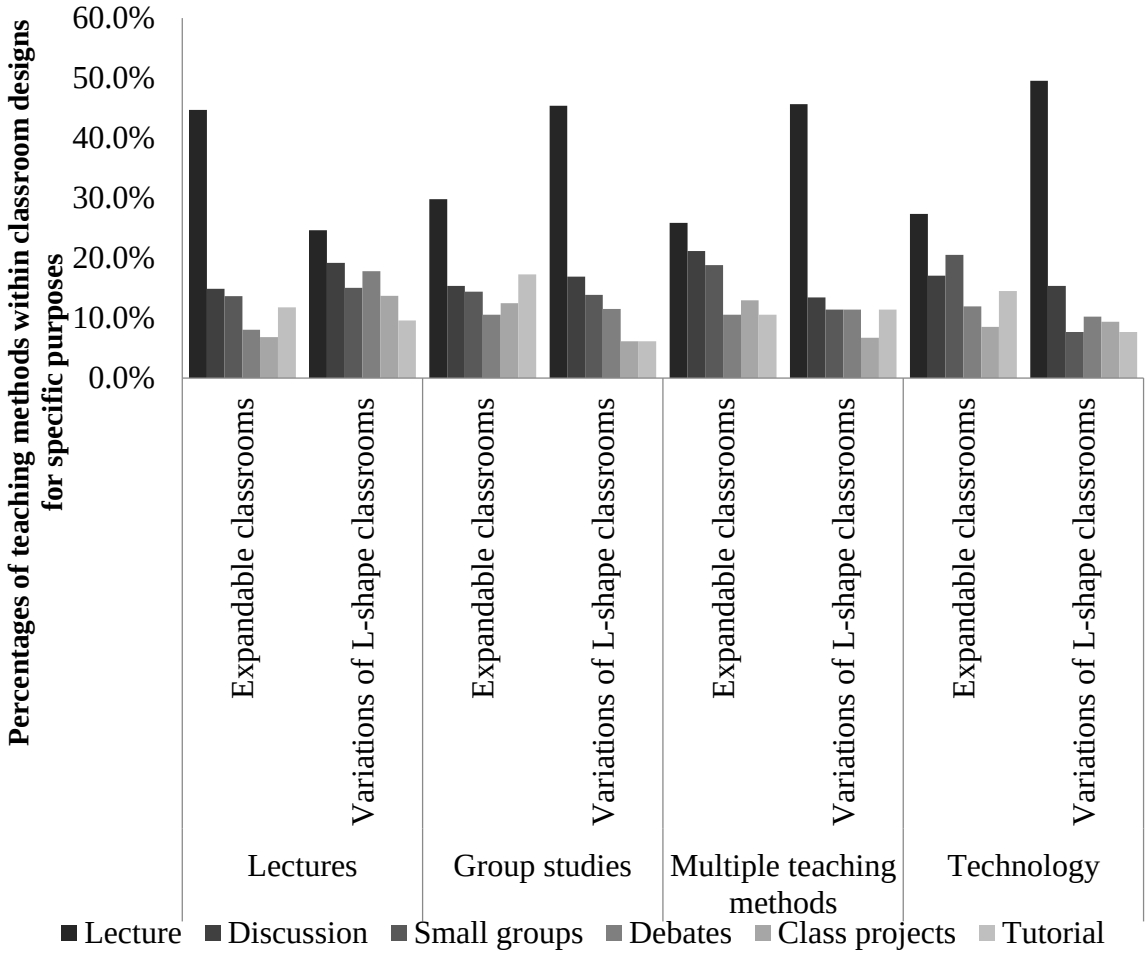


Figure 5-31: Percentages of teaching methods within teachers' design preferences for lectures, small groups, multiple teaching methods, and technology purposes

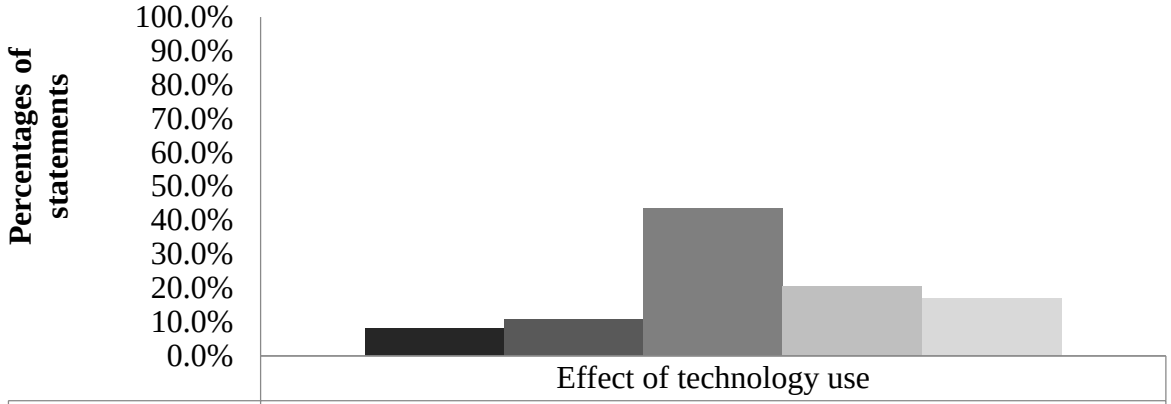
5.2.5 Technology Use and Classroom Environment

In order to address the sixth research question of this study (RQ6), three sub-questions were established and analyzed. In order to answer relational questions, a Pearson's Chi-square test of independence was performed when the available sample size per cell was more than five (Agresti, 1990; Tang, He, & Tu, 2012). In cases when this assumption was violated, a likelihood ratio chi-square test was performed as it does not require the value of the

cell expecteds to be 5 or more in at least 80% of the cells (McHugh, 2013). Therefore, these two tests were used to examine relationships between: teachers' practice of using technology in instruction, their classroom arrangements, and their classroom design preferences. These statistical procedures were viewed as the optimal statistical procedures to use because frequency data were present for both variables (categorical). Therefore, the assumptions for utilizing these chi-square tests were met for answering these four questions.

RQ6a: To what extend teachers' use of technology affect their current classroom arrangement?

Regarding the effect of technology use on physical arrangement, 37.6% of the participants indicated that their technology use in classroom always / most of the time effects their classroom arrangement. While almost half of the participants (43.6%) indicated that their technology use in classroom sometimes effects their classroom arrangement, only 18.8% of the participants were found to think that their technology use never / rarely effects their classroom arrangements (see Figure 5-32).



	Effect of technology use
Never	8.1%
Rarely	10.7%
Sometimes	43.6%
Most of the time	20.5%
Always	17.1%

Figure 5-32: Frequency distributions of effects of technology use on classroom arrangement categories

RQ6b: Is there an association between teachers' practice of using technology in instruction and their current classroom arrangement?

A Pearson's chi-square test of independence was performed to examine the relation between teachers' practice of using technology and their current classroom arrangement. There was no significant evidence found of a relationship between these two variables, Pearson X^2 (3, N=234) = 3.04, p = .384 (see Table 5-32).

Table 5-32: Pearson's Chi-Square test of dependence for teachers' practice of using technology and their current classroom arrangement

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.049[a]	3	.384
N of Valid Cases	234		

a. 1 cell (12.5%) has expected count less than 5.

Although no significant evidence found of a relationship between teachers' practice of using technology and their current classroom arrangement, the distributions of statements related to practice of using technology within teachers' current classroom arrangement types show that teachers who were in student-centered classroom environments were found to use 10% more exclusively use of technology and hands-on activities than teachers in student-centered classroom environments (see Figure 5-33).

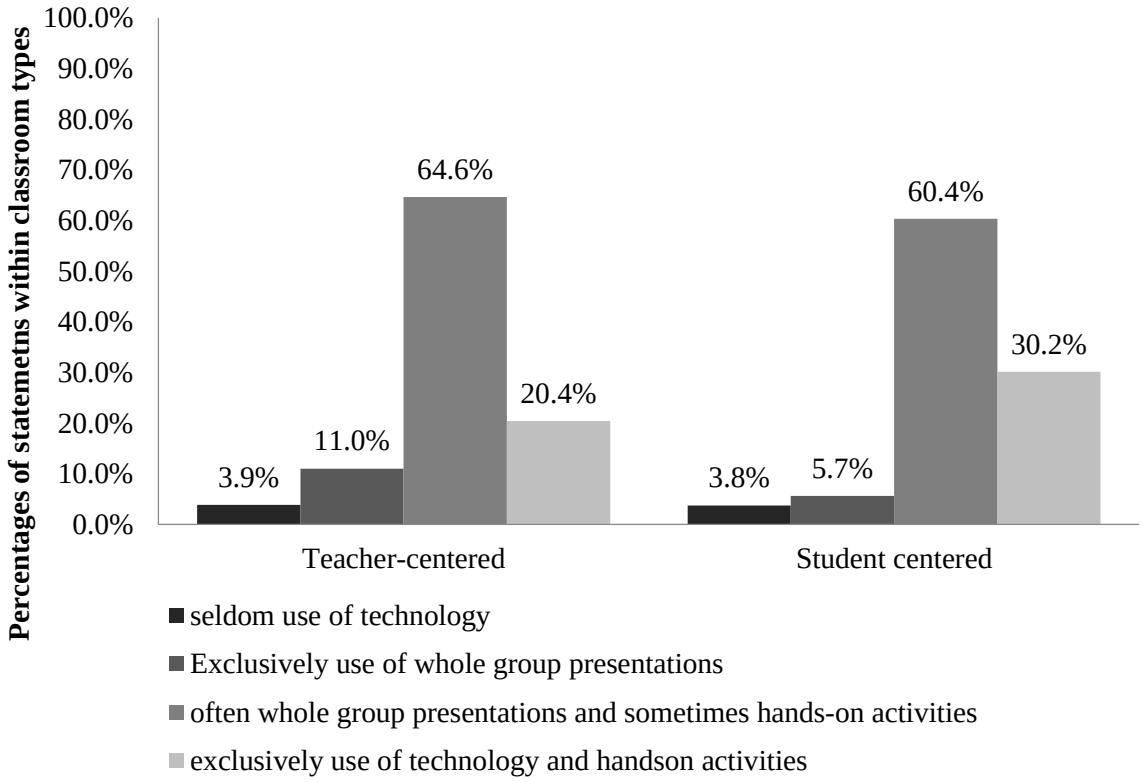


Figure 5-33: Percentages of statements related to practice of using technology in relation to current classroom arrangements

RQ6c: Is there an association between teachers' practice of using technology in instruction and their classroom design preference?

First, a Likelihood chi-square test was performed to examine the relation between what teachers prefer/find best "overall" on classroom design and their practice of using technology in instruction. There was no significant evidence found of a relationship between these two variables, X^2 (3, N=234) = 4.00, p = .261 (see Table 5-33).

Table 5-33: Likelihood Chi-Square test for teachers' practice of using technology in instruction and their classroom design preferences (overall)

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	4.009	3	.261
N of Valid Cases	234		

Although no significant evidence found of a relationship between teachers' practice of using technology and their overall classroom design preferences, the distributions of statements related to practice of using technology within design preferences show that teachers who prefer variations of L-shape classrooms were found to use nearly 6% more exclusively use of technology and hands-on activities than teachers who prefer expandable classrooms (see Figure 5-34).

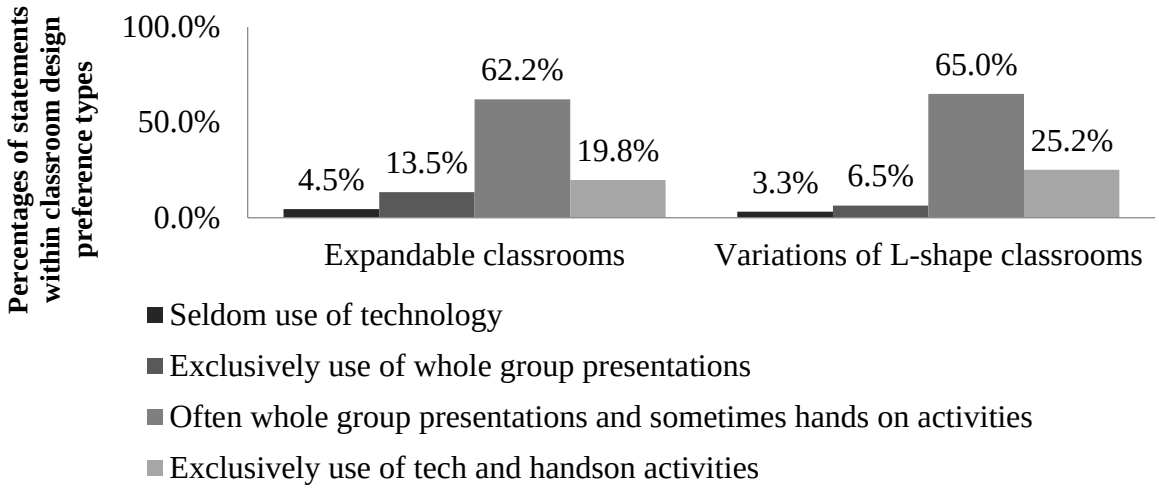


Figure 5-34: Percentages of statements related to practice of using technology in relation to classroom design preferences

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Pearson's chi-square test of independence was also performed to examine the relations between teachers' practice of using technology in classroom and their classroom design preferences for specific purposes. Table 5-34 summarizes the results of the tests:

Table 5-34: Pearson's Chi-Square test of dependence for teachers' practice of using technology in instruction and design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	6.168[a]	3	.104
Class discussions	2.540[a]	3	.468
Group studies	12.128[a]	3	**.007**
Independent student activities	4.319[a]	3	.229
Multiple teaching methods	1.515[a]	3	.679
Interaction between students	6.350[a]	3	.096
Teacher movement	9.204[a]	3	**.027**
Circulation	9.969[a]	3	**.019**
Technology use	2.955[a]	3	.399
N of Valid Cases	234		

As Table 5-34 indicates, the tests between teachers' practice of using technology in instruction and teachers' classroom design preferences were found to be statistically significant at the 0.05 significance level for following purposes:

- Group studies: X2 (3, N=234) = 12.12, p = .007, with a moderate (Cramer's ϕ = .23) effect size.
- Teacher movement: X^2 (3, N=234) = 9.20, p = .027, with a moderate (Cramer's ϕ = .20) effect size.
- Circulation: X^2 (3, N=234) = 9.96, p = .019, with a moderate (Cramer's ϕ = .21) effect size.

According to the differences between percentages of statements related to practice of using technology within expandable and variations of L-shape classroom design preferences, the following results were found (see Figure 5-35):

- According to design preferences for groups studies: Percentage of teachers who use exclusively use of technology and hands-on activities was found to be 13% more within teachers who prefer expandable classroom designs than teachers who prefer variations of L-shape classrooms.
- According to design preferences for teacher movement: Percentage of teachers who use exclusively use of technology and hands-on activities was found to be 17% more within teachers who prefer variations of L-shape classroom designs than teachers who prefer expandable classroom designs.
- According to design preferences for circulation: Percentage of teachers who use exclusively use of technology and hands-on activities was found to be 16% more

within teachers who prefer variations of L-shape classroom designs than teachers who prefer expandable classroom designs.

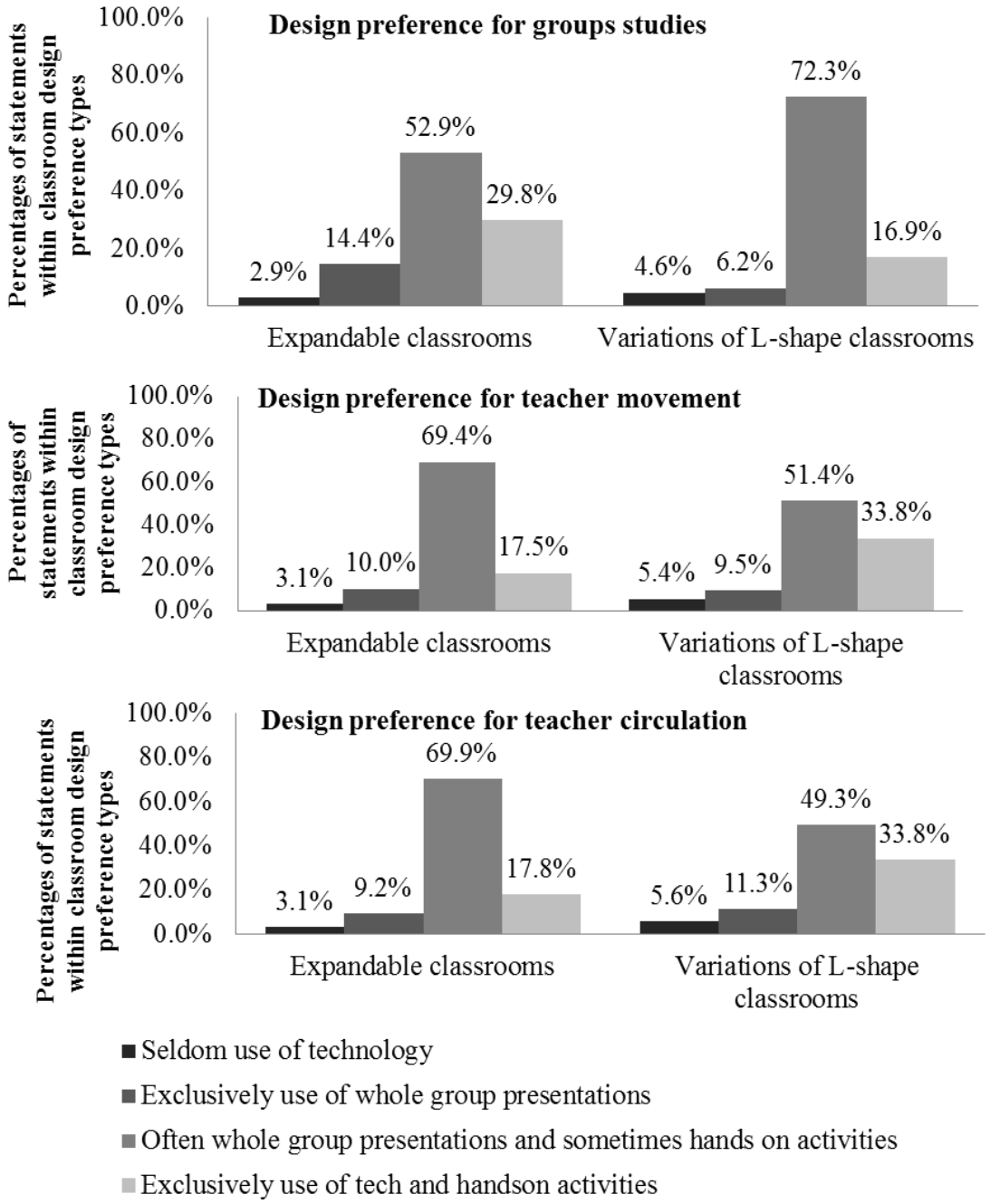


Figure 5-35: Practice of using technology rating percentages in relation to classroom design preferences for group studies, teacher movement, and circulation

5.2.6 Teachers' Motivational Strategies and Classroom Environment

In order to address the seventh research question of this study (RQ7), two sub-questions were established and analyzed. A Pearson's Chi-square test of independence was performed when the available sample size per cell was more than five (Agresti, 1990; Tang, He, & Tu, 2012). In cases when this assumption was violated, a likelihood ratio chi-square test was performed as it does not require the value of the cell expecteds to be 5 or more in at least 80% of the cells (McHugh, 2013). Therefore, these two tests were used to examine relationships between: teachers' motivational strategies in class, their classroom arrangements, and their classroom design preferences. These statistical procedures were viewed as the optimal statistical procedures to use because frequency data were present for both variables (categorical). Therefore, the assumptions for utilizing these chi-square tests were met for answering these four questions.

RQ7a: Is there an association between teachers' current classroom arrangement and their motivational strategies in classroom?

A Likelihood chi-square test was performed to examine the relation between teachers' current classroom arrangement and their motivational strategies used in classroom. Table 5-35 summarizes the results of the tests:

Table 5-35: Likelihood Chi-Square test for motivational strategies and teachers' current classroom arrangement

Statements	Value	df	Asymp. Sig. (2-sided)
Item 1	5.262	4	.261
Item 2	2.928	4	.570
Item 3	6.506	3	.089
Item 4	.982	4	.913
Item 5	7.913	3	**.048**
Item 6	6.320	4	.176
Item 7	7.986	3	**.046**
N of Valid Cases	234		

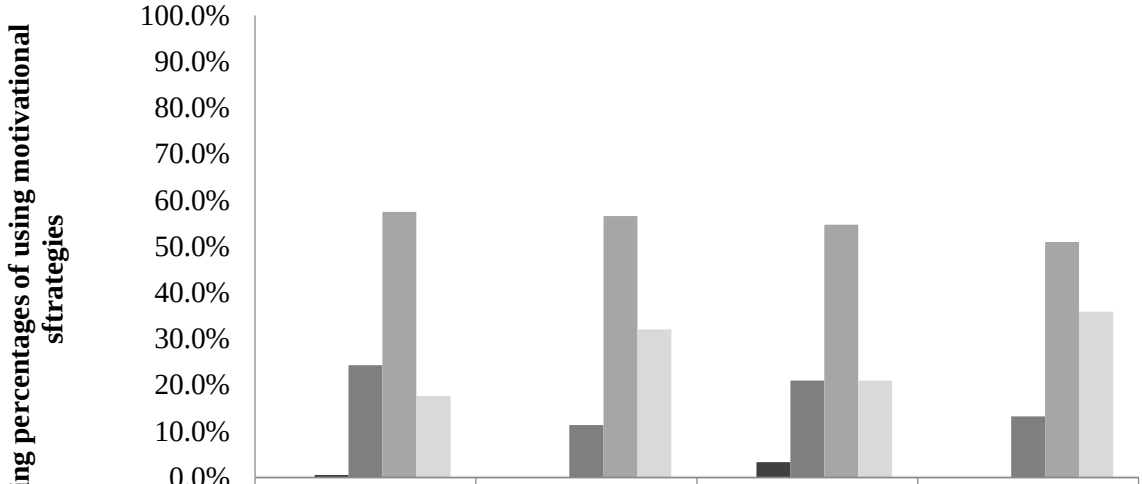
As Table 5-35 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level for the following motivational strategies/items:

- Item 5: I use tasks that allow my students to interact with each other, X^2 (3, N=234) = 7.91, p = .048, with a moderate (Cramer's ϕ = .18) effect size.
- Item 7: I encourage my students to learn from each other, X^2 (3, N=234) = 7.98, p = .046, with a moderate (Cramer's ϕ = .17) effect size.

Both of these motivational strategies are associated with cooperative learning through encouraging interaction between students in classrooms. This strategy aims to provide venues to hear, speak, and talk within instructional context (Pilegard & Fiorella, 2016). The importance of cooperative learning (or "group work") in classrooms that it allows teachers to

address both intellectual and social learning goals and improves students' academic skills through working together on a task that might otherwise be too complex for them to complete individually (Coates & Mayfield, 2009). As Figure 5-36 visually indicates the differences between rating percentages of statements related to motivational strategies within teacher-centered and classroom-centered classroom arrangements, following results were found:

- Item 5 - I use tasks that allow my students to interact with each other: Percentage of teachers who use this motivational strategy often (most of the time + always) was found to be 14% more within teachers who currently teach in student-centered classroom environments than teachers in teacher-centered classroom environments.
- Item 7 - I encourage my students to learn from each other: Percentage of teachers who use this motivational strategy often (most of the time + always) was found to be 11% more within teachers who currently teach in student-centered classroom environments than teachers in teacher-centered classroom environments.



	I use tasks that allow my students to interact with each other		I encourage my students to learn from each other	
	Teacher-centered	Student-centered	Teacher-centered	Student-centered
Never	0.0%	0.0%	0.0%	0.0%
Rarely	.6%	0.0%	3.3%	0.0%
Sometimes	24.3%	11.3%	21.0%	13.2%
Most of the Time	57.5%	56.6%	54.7%	50.9%
Always	17.7%	32.1%	21.0%	35.8%

Figure 5-36: Percentages of motivational strategies' ratings in relation to current classroom arrangements

RQ7b: Is there an association between teachers' classroom design preferences and their motivational strategies in classroom?

A likelihood ratio chi-square test was performed to examine the relation between what teachers prefer/find best "overall" on classroom design and their motivational strategies in classroom. Table 5-36 summarizes the results of the tests:

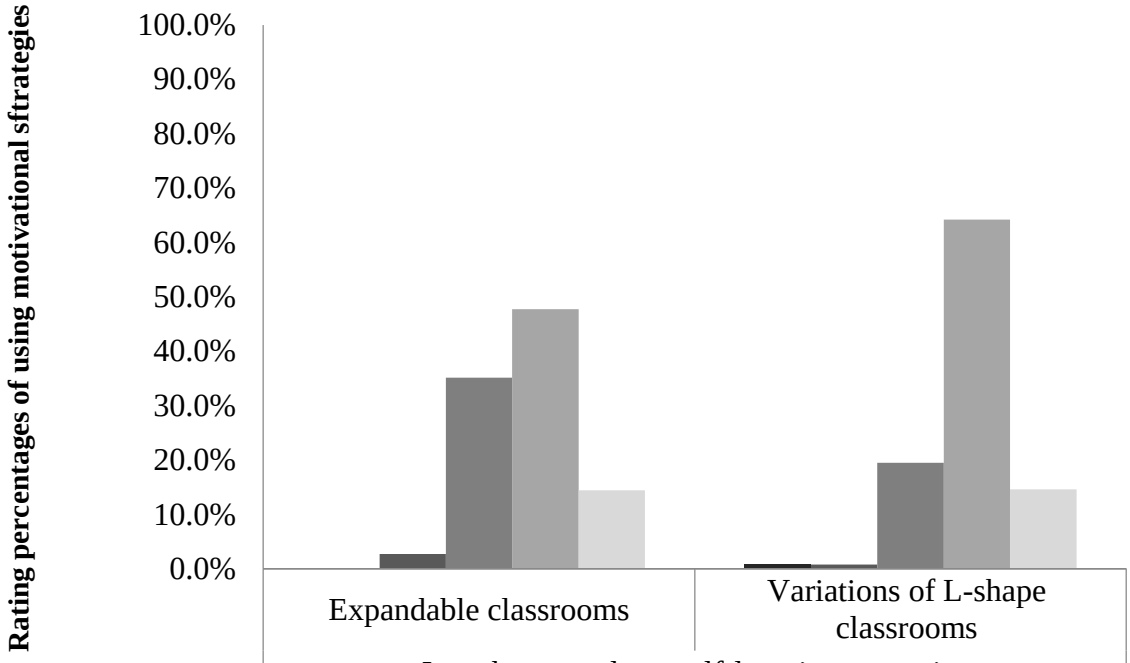
Table 5-36: Likelihood Chi-Square test for motivational strategies and classroom design preferences (overall)

Statements:	Value	df	Asymp. Sig. (2-sided)
Item 1	1.727	4	.786
Item 2	4.384	4	.357
Item 3	6.153	3	.104
Item 4	1.142	4	.888
Item 5	2.256	3	.521
Item 6	10.696	4	**.030**
Item 7	4.896	3	.180
N of Valid Cases	234		

As Table 5-36 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level for the following motivational strategy/item:

- Item 6: I teach my students self-learning strategies, X^2 (4, N=234) = 10.69, p = .030, with a moderate (Cramer's ϕ = .28) effect size.

This motivational strategy is associated with generative learning, which aims to enhance students' self-assessment through encouraging them to reflect on their learning experiences to make them self-regulated learners (Pilegard & Fiorella, 2016). As Figure 5-37 visually indicates the differences between rating percentages, percentage of teachers who use this motivational strategy often (most of the time + always) was found to be 17% more within teachers who prefer variations of L-shape classroom than teachers who prefer expandable classrooms.



	Expandable classrooms	Variations of L-shape classrooms
	I teach my students self-learning strategies	
Never	0.0%	.8%
Rarely	2.7%	.8%
Sometimes	35.1%	19.5%
Most of the Time	47.7%	64.2%
Always	14.4%	14.6%

Figure 5-37: Rating percentages of motivational strategy for generative learning in relation to teachers' classroom design preferences

5.2.7 Teacher Movement and Classroom Environment

In order to address the eight research question of this study (RQ8), two sub-questions were established and analyzed. A Likelihood Chi-square test was performed when the available sample size per cell was more than five (Agresti, 1990; Tang, He, & Tu, 2012). In cases when this assumption was violated, a likelihood ratio chi-square test was performed as it does not require the value of the cell expecteds to be 5 or more in at least 80% of the cells

(McHugh, 2013). Therefore, these two tests were used to examine relationships between: teacher movement, their classroom arrangements, and their classroom design preferences. These statistical procedures were viewed as the optimal statistical procedures to use because frequency data were present for both variables (categorical). Therefore, the assumptions for utilizing these chi-square tests were met for answering these four questions.

RQ8a: Is there an association between teachers' current classroom arrangement and teacher movement?

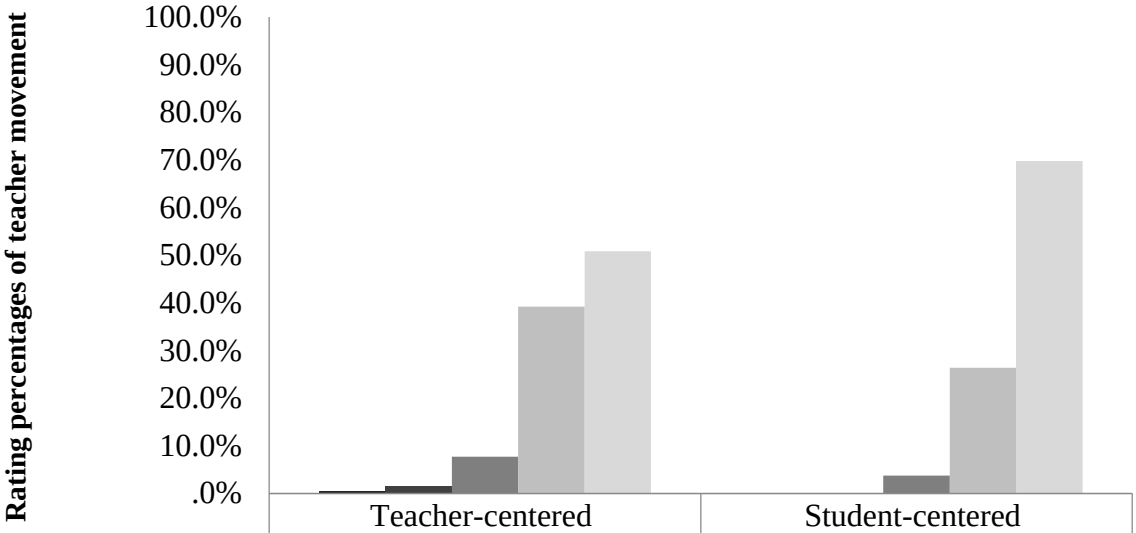
A Likelihood chi-square test was performed to examine the relation between teachers' current classroom environment and teacher movement variables. As Table 5-37 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level, X^2 (4, N=234) = 7.65, p = .013, with a strong (Cramer's ϕ = .37) effect size.

Table 5-37: Likelihood Chi-Square test for teachers' current classroom environment and teacher movement

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	7.656	4	**.013**
N of Valid Cases	234		

As Figure 5-38 visually indicates the differences between rating percentages, percentage of teachers who always move around to interact with students was found to be 19% more within

teachers who currently teach in a student-centered classroom arrangement than teachers who teach in teacher-centered classroom arrangements.



	Teacher-centered	Student-centered
Never	.6%	0.0%
Rarely	1.7%	0.0%
Sometimes	7.7%	3.8%
Most of the Time	39.2%	26.4%
Always	50.8%	69.8%

Figure 5-38: Rating percentages of teacher movement in relation to teachers' current classroom arrangements

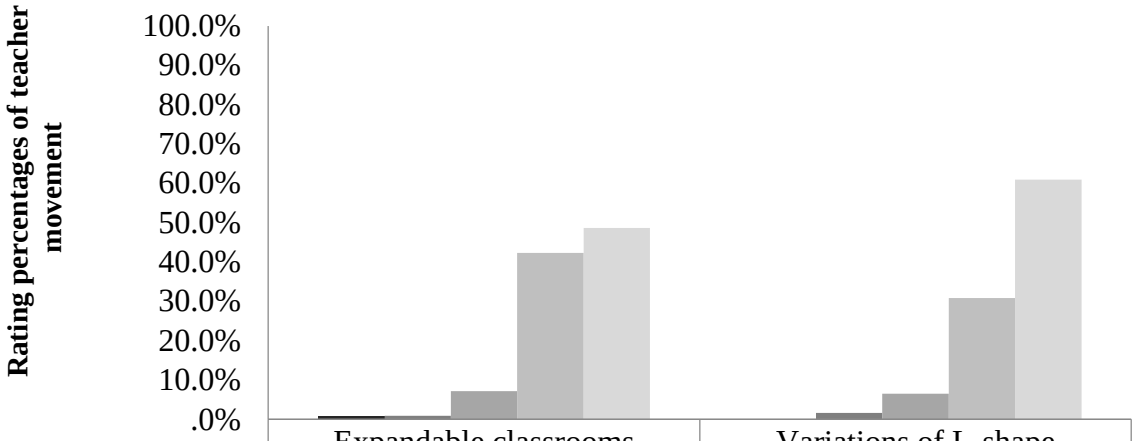
RQ8b: Is there an association between teachers' classroom design pereferences and teacher movement?

First, a Likelihood chi-square test was performed to examine the relation between teachers' classroom design preference "overall" and teacher movement in class. There was no significant evidence found of a relationship between these two variables, X^2 (3, N=234) = 4.00, p = .261 (see Table 5-38).

Table 5-38: Likelihood Chi-Square test for teacher movement and their classroom design preferences (overall)

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	5.499	4	.240
N of Valid Cases	234		

Although no significant evidence found of a relationship between teacher movement and teachers' overall classroom design preferences, the percentage of teachers who always move around to interact with students was found to be approximately13% more within teachers who prefer variations of L-shape classrooms (overall) than teachers who prefer expandable classroom designs (see Figure 5-39).



	Expandable classrooms	Variations of L-shape
Never	.9%	0.0%
Rarely	.9%	1.6%
Sometimes	7.2%	6.5%
Most of the Time	42.3%	30.9%
Always	48.6%	61.0%

Figure 5-39: Rating percentages of teacher movement in relation to teachers' overall classroom design preferences

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Likelihood chi-square test was also performed to examine the relations between teacher movement and their classroom design preferences for specific purposes. Table 5-39summarizes the results of the tests:

Table 5-39: Likelihood Chi-Square test for teacher movement and teachers' design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	14.394	4	**.006**
Class discussions	7.144	4	.128
Group studies	7.407	4	.116
Independent student activities	1.499	4	.827
Multiple teaching methods	4.773	4	.311
Interaction between students	7.420	4	.115
Teacher movement	13.142	4	**.011**
Circulation	11.940	4	**.018**
Technology use	7.852	4	.097
N of Valid Cases	234		

As Table 5-39 indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level for the following purposes:

- Lectures, X^2 (4, N=234) = 14.39, p = .006, with a moderate (Cramer's ϕ = .29) effect size.

- Teacher movement, X^2 (4, N=234) = 13.14, p = .011, with a strong (Cramer's ϕ = .38) effect size.
- Circulation, X^2 (4, N=234) = 13.14, p = .011, with a strong (Cramer's ϕ = .35) effect size.

According to the differences between percentages of statements related to teacher movement within expandable and variations of L-shape classroom design preferences, the following results were found (see Figure 5-40):

- According to design preferences for lectures: The percentage of teachers who always move around to interact with students was found to be 17% more within teachers who prefer expandable classroom designs than teachers who prefer variations of L-shape classrooms.
- According to design preferences for teacher movement: The percentage of teachers who always move around to interact with students was found to be 24% more within teachers who prefer expandable classroom designs than teachers who prefer variations of L-shape classrooms.
- According to design preferences for circulation: The percentage of teachers who always move around to interact with students was found to be 19% more within teachers who prefer expandable classroom designs than teachers who prefer variations of L-shape classrooms.

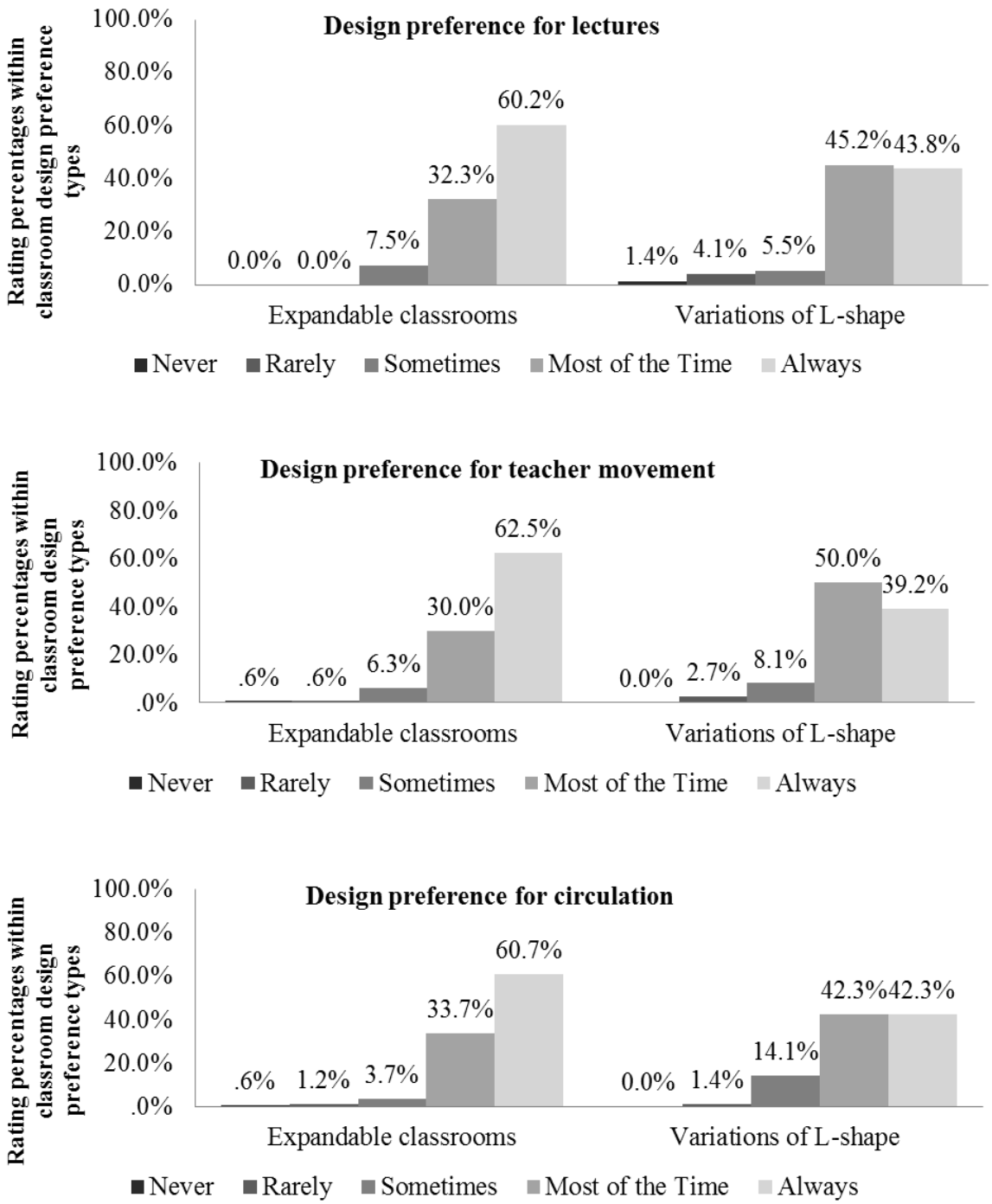


Figure 5-40: Teacher movement rating percentages in relation to classroom design preferences for lectures, teacher movement, and circulation

5.2.8 Satisfaction with Current Arrangement and Classroom Environment

In order to answer the ninth research question of this study (RQ9), a Chi-square test of independence was performed to examine the relationships between: teachers' current classroom arrangement; teachers' classroom design preferences; and teachers' satisfaction with their current classroom arrangement. These statistical procedures were viewed as the optimal statistical procedures to use because frequency data were present for both variables.

RQ9a: Is there an association between teachers' current classroom arrangement and their satisfaction with classroom arrangement?

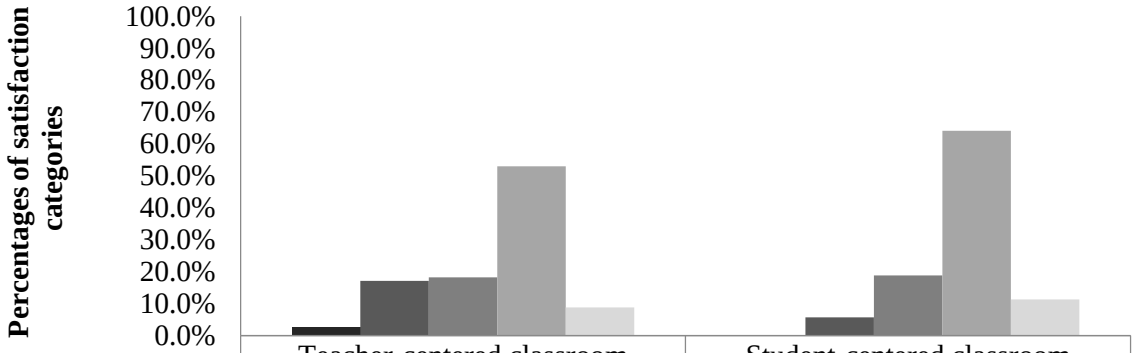
A Likelihood chi-square test was performed to examine the relation between teachers' current classroom arrangement and teacher satisfaction with classroom arrangement. There is no significant evidence found of a relationship between these two variables at the 0.05 significance level, Likelihood X^2 (4, N=234) = 8.25, p = .083 (see Table 5-40).

Table 5-40: The Chi-Square test for teachers' current classroom environment and teachers' satisfaction

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	8.25	4	.083
N of Valid Cases	234		

As Figure 5-41 visually indicates the differences between rating percentages, the percentage of teachers who were very satisfied / satisfied with their current classroom arrangements was found to be 14% more within teachers who currently teach in student-centered classroom

arrangements than teachers who teach in teacher-centered classroom arrangements. Correlatively, the percentage of teachers who were very dissatisfied / dissatisfied with their current classroom arrangements was found to be 14.2% more within teachers who currently teach in teacher-centered classroom arrangements than teachers who teach in student-centered classroom arrangements.



	Teacher-centered classroom	Student-centered classroom
Very dissatisfied	2.8%	0.0%
Dissatisfied	17.1%	5.7%
Neutral	18.2%	18.9%
Satisfied	53.0%	64.2%
Very satisfied	8.8%	11.3%

Figure 5-41: Teacher satisfaction rating percentages in relation to teachers' current classroom arrangements

RQ9b: Is there an association between teachers' preferences on classroom design and their satisfaction with classroom arrangement?

First, a Likelihood chi-square test was performed to examine the relation between teachers' classroom design preferences and satisfaction with their current classroom arrangement. There is no significant evidence found of a relationship between these two variables at the 0.05 significance level, X^2 (4, N=234) = 7.06, p = .132 (see Table 5-41).

Table 5-41: Likelihood Chi-Square test for teacher satisfaction and their classroom design preferences

	Value	df	Asymp. Sig. (2-sided)
Likelihood Ratio	7.068	4	.132
N of Valid Cases	234		

a. 2 cells (20.0%) have expected count less than 5.

Second, in addition to what teachers prefer/find best "overall" on classroom design, a Linear-by-linear Chi-Square test was also performed to examine the relations between teacher satisfaction with current classroom arrangement and their classroom design preferences for specific purposes. Table 5-42 summarizes the results of the tests:

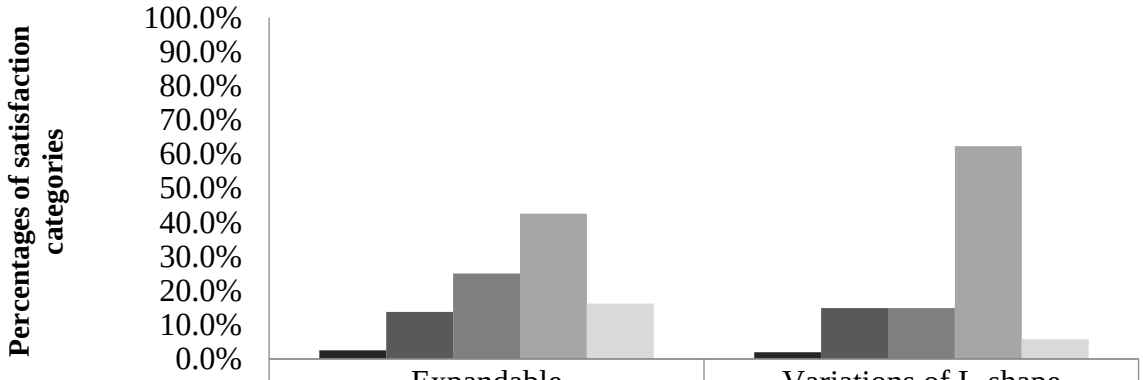
Table 5-42: Likelihood Chi-Square test for teacher satisfaction and teachers' design preferences for specific purposes

Design preference for:	Value	df	Asymp. Sig. (2-sided)
Lectures	4.84	4	.303
Class discussions	7.615	4	.107
Group studies	6.135	4	.189
Independent student activities	12.469	4	**.014**
Multiple teaching methods	14.232	4	**.007**
Interaction between students	8.475	4	.076
Teacher movement	3.010	4	.556
Circulation	5.233	4	.264
Technology use	8.538	4	.074
N of Valid Cases	234		

As Table indicates, the tests between these two variables were found to be statistically significant at the 0.05 significance level for the following purpose:

- Independent student activities: X^2 (4, N=234) = 12.46, p = .014, with a moderate (Cramer's ϕ = .24) effect size.
- Multiple teaching methods: X^2 (4, N=234) = 14.23, p = .007, with a moderate (Cramer's ϕ = .24) effect size.

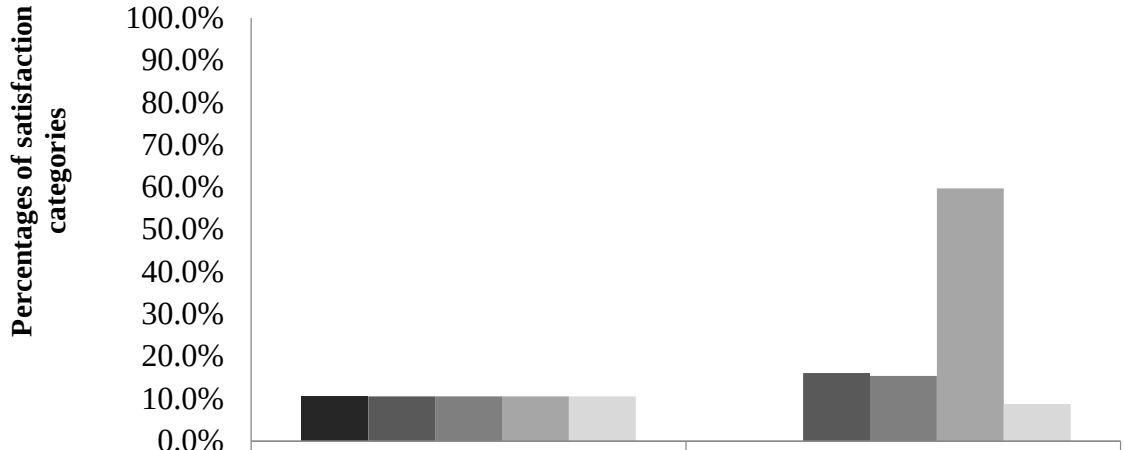
As Figure 5-42 visually indicates the differences between rating percentages, the percentage of teachers who were very satisfied / satisfied with their current classroom arrangements was found to be 10% more within teachers who prefer variations of L-shape classroom designs than teachers who prefer expandable classroom designs for independent student activities.



	Expandable	Variations of L-shape
Very dissatisfied	2.5%	1.9%
Dissatisfied	13.8%	14.9%
Neutral	25.0%	14.9%
Satisfied	42.5%	62.3%
Very satisfied	16.3%	5.8%

Figure 5-42: Teacher satisfaction rating percentages in relation to classroom design preferences for independent student activities

In terms of the relationship between teachers' classroom design preferences for multiple teaching methods and teachers' satisfaction, on the other hand, the percentage of teachers who were very satisfied / satisfied with their current classroom arrangements was found to be 47% more within teachers who prefer variations of L-shape classroom designs than teachers who prefer expandable classroom designs (see Figure).



	Expandable	Variations of L-shape
Very dissatisfied	10.6%	0.0%
Dissatisfied	10.6%	16.1%
Neutral	10.6%	15.4%
Satisfied	10.6%	59.7%
Very satisfied	10.6%	8.7%

Figure 5-43: Teacher satisfaction rating percentages in relation to classroom design preferences for multiple teaching methods

5.2.9 Furniture Movement and Classroom Environment

In order to answer the last research question of this study (RQ10), test of independence was performed to examine: the association between teachers' current classroom arrangement and

furniture movement; and the association between teachers' classroom design preferences and furniture movement.

RQ10a: Is there an association between teachers' frequency of furniture movement and their current classroom arrangement?

A Pearson's chi-square test of independence was performed to examine the relation between teachers' frequency of furniture movement and their current classroom arrangement. There was no significant evidence found of a relationship between teachers' current classroom arrangement and furniture movement, Pearson X^2 (4, N=42) = 2.58, p = .630 (see Table 5-43).

Table 5-43: Pearson's Chi-Square test of dependence for furniture movement and teachers' current classroom arrangement

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2.585[a]	4	0.630
N of Valid Cases	234		

a. 2 cells (20.0%) have expected count less than 5.

RQ10b: Is there an association between teachers' frequency of furniture movement and their classroom design preferences?

A chi-square test of independence was performed to examine the relation between teachers' frequency of furniture movement and their classroom design preferences. There was no significant evidence found of a relationship between teachers' classroom design preferences and furniture movement, Pearson X^2 (4, N=42) = 6.60, p = .158 (see Table 5-44).

Table 5-44: Pearson's Chi-Square test of dependence for furniture movement and teachers' classroom design preferences

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	6.609[a]	4	0.158
N of Valid Cases	234		

a. 0 cells (0.0%) have expected count less than 5.

5.2.10 Interaction between Independent Variables

The purpose of this analysis was to ascertain that there is no relationship between the two independent variables. A Chi-square test of independence was performed through a two-tailed Pearson correlation to examine the relation between the two nominal categorical variables (teachers' preferences on classroom design and their current classroom arrangement). This statistical procedure was viewed as the optimal statistical procedure to use because frequency data were present for both variables. As such, chi-squares are the statistical procedure of choice when both variables are categorical. In addition, with the large sample size, the available sample size per cell was more than five. Therefore, the assumptions for utilizing a chi-square were met. Table 5-45 summarizes the results of the tests:

Table 5-45: Pearson's Chi-Square tests for teachers' current classroom arrangement and teachers' design preferences

Test between current classroom arrangement and design preference for:	Value	df	Asymp. Sig. (2-sided)
Best Layout for Lectures	10.661	5	0.059
Best Layout for Class Discussions	4.201	5	0.521
Best Layout for Group Studies	2.974	5	0.704
Best Layout for Independent Student Activities	1.220	5	0.943
Best Layout for Multiple Teaching Methods	3.892	5	0.565
Best Layout for Interaction between Students	3.015	5	0.698
Best Layout for Teacher Movement	7.074	5	0.215
Best Layout for Circulation	5.247	5	0.387
Best Layout for Technology Use	7.664	5	0.176
Best Layout Overall	8.741	5	0.12

As Table 5-45 indicates, there is no significant evidence found of a relationship between teachers' current classroom arrangement and teachers' classroom design preferences, X^2 (5, N=234) = 8.74, p = .12. There is also no significant evidence found of a relationship between teachers' current classroom arrangement and teachers' classroom design preferences for specific purposes.

5.2.11 Interactions between the Individual Level Control Variables and Outcome Variables

The individual level control variables of the study were: gender; age; years of experience; and type of school setting. These control variables were not the focus in the study and were not included as a part of the research questions. However, since their existence might have influence over the dependent variables, they were included in the research model together with other independent variables and their relationships with the outcome variables were tested. There was no significant evidence found of a relationship between school setting and the outcome variables. However, there were significant evidences found of a relationship between:

- Years of experience and environmental response and awareness factors (environmentally inclusive and environmentally exclusive)
- Years of teaching experience and motivational strategies
- Age and motivational strategies

Since these demographic variables were not the focus in the study and were not included as a part of the research questions, and also as there were no evidences found of a relationship between these variables in the literature, these individual level control variables were treated as additional independent variables for testing purposes and considered as possible spurious (non-solution-related) correlations. These relationships were considered spurious correlations because their existence might be due to sampling, measurements or strategical methodologies and can be the result of some third set of events or set of processes that were not apparent (Lovett & Shah, 2007; Ward, 2013). Therefore, there may be a relationship, but they also

may not be meaningful in this study's framework. Therefore, these tests were conducted for descriptive purposes but the results were not taken into account within the tests for independence between the actual independent variables of the study (teachers' current classroom arrangement and their classroom design preferences) and dependent outcomes of this study. In other words, they were not controlled or treated as covariates. Following sections will focus on describing the tests in which significant evidences of a relationship were found.

5.2.11.1 Years of Teaching Experience and Environmental Response

In terms of the relationship between years of teaching experience and outcome variables, a linear-by-linear Chi square test was performed as both variables were ordinal categorical. There were significant evidences found of a relationship between years of experience and environmentally inclusive and environmentally exclusive ER factors (see Table 5-46). The results of the tests are:

- Environmentally inclusive ER factor: Linear-by-linear X^2 (1, N=234) = 8.29, p = .004, with a strong (Gamma γ = -.31) effect size.
- Environmentally exclusive ER factor: Linear-by-linear X^2 (1, N=234) = 14.06, p = .000, with a strong (Gamma γ = .46) effect size.

Table 5-46: Pearson's Chi-Square tests for teachers' years of experience and environmental response and awareness

ER factors:	Value	df	Asymp. Sig. (2-sided)
Environmentally inclusive	15.478	4	**0.016**
Environmentally exclusive	12.208	4	**0.004**
N of Valid Cases	234		

As can be seen in Table 5-47, the percentage of teachers who were highly/moderately environmentally inclusive teachers was found to be highest among teachers who had 1 to 5 years of teaching experience (93%) in comparison to the other age groups (6-10 years and 10 years and more of teaching experience). Accordingly, the percentage of teachers who were found to be lowly environmentally inclusive was found to be lowest among teachers who had 1-5 years of teaching experience (7%). Therefore, there was a negative association found between the two variables.

Table 5-47: Frequency distributions of environmentally inclusive factor categories within years of experience categories

			Environmentally inclusive			
			Low	Medium	High	Total
Years of teaching experience	1-5 years	Count	3	20	20	43
		% within Years of experience	7.0%	46.5%	46.5%	100.0%
	6-10 years	Count	6	12	12	30
		% within Years of experience	20.0%	40.0%	40.0%	100.0%
	10 years and more	Count	26	97	38	161
		% within Years of experience	16.1%	60.2%	23.6%	100.0%
Total		Count	35	129	70	234
		% within Years of experience	15.0%	55.1%	29.9%	100.0%

Table 5-48, on the other hand, indicates the frequency distributions of environmentally exclusive factor categories (as polar opposite of environmentally inclusive factor) within the

years of teaching experience categories. As can be seen in the table, the percentage of teachers who were highly/moderately environmentally exclusive teachers was found to be highest among teachers who had 10 years or more of teaching experience (82%) in comparison to the other age groups (1-5 years and 6-10 years of teaching experience).

Table 5-48: Frequency distributions of environmentally exclusive factor categories within years of experience categories

			Environmentally exclusive			
			Low	Medium	High	Total
Years of teaching experience	1-5 years	Count	19	23	1	43
		% within Years of experience	44.2%	53.5%	2.3%	100.0%
	6-10 years	Count	11	18	1	30
		% within Years of experience	36.7%	60.0%	3.3%	100.0%
	10 years and more	Count	29	120	12	161
		% within Years of experience	18.0%	74.5%	7.5%	100.0%
Total		Count	59	161	14	234
		% within Years of experience	25.2%	68.8%	6.0%	100.0%

5.2.11.2 Years of Teaching Experience and Motivational Strategies

In terms of the relationship between years of teaching experience and motivational strategies, there was significant evidence found of a relationship between the years of experience and one of the motivational strategies. This motivational strategy was:

- Motivational strategy for improving generative learning (Item 6): *I teach my students self-learning strategies*, Likelihood X^2 (8, N=234) = 22.56, p = .004, with a strong (Gamma γ = .31) effect size.

As can be seen in Table 5-49, the percentage of teachers who were using the motivational strategy for improving generative learning (Item 6) frequently (always/most of the time) in their classes (78.9%) was the highest among the teachers who had 10 years or more of teaching experience in comparison to the other age groups. As mentioned in previous sections, this motivational strategy aims to enhance students' self-assessment through encouraging them to reflect on their learning experiences to make them self-regulated learners (Pilegard & Fiorella, 2016).

Table 5-49: Frequency distributions of the strategy for improving generative learning within years of experience categories

			I teach my students self-learning strategies					Total
			Never	Rarely	Sometimes	Most of the Time	Always	
Years of experience	1-5 years	Count	1	0	18	17	7	43
		% within Years of experience	2.3%	0.0%	41.9%	39.5%	16.3%	100.0%
	6-10 years	Count	0	2	13	12	3	30
		% within Years of experience	0.0%	6.7%	43.3%	40.0%	10.0%	100.0%
	10 years and more	Count	0	2	32	103	24	161
		% within Years of experience	0.0%	1.2%	19.9%	64.0%	14.9%	100.0%
Total		Count	1	4	63	132	34	234
		% within Years of experience	0.4%	1.7%	26.9%	56.4%	14.5%	100.0%

5.2.11.3 Age and Motivational Strategies

In terms of the relationship between age and motivational strategies, there was significant evidence found of a relationship between age and one of the motivational strategies. This motivational strategy was:

- *I give immediate feedback to my students* (Item 3)*:* Likelihood X^2 (9, N=234) = 17.90, p = .036, with a moderate (Gamma γ = .12) effect size.

As can be seen in Table 5-50, the percentage of teachers who were using this motivational strategy (Item 3) frequently (always/most of the time) in their classes was the highest among the teachers who were 51 years or older (88.6%) in comparison to the other age groups. As age goes down, the percentages of teachers who were using this motivational strategy frequently were also observed to go down (83.6% for the age group of 41-50 years, 78.6% for the age group of 31-40 years, and 65.9% for the age group of 21-30 years).

Table 5-50: Frequency distributions of the strategy related to giving immediate feedback within years of experience categories

			I give immediate feedback to my students				Total
			Rarely	Sometimes	Most of the Time	Always	
Age	21-30 years	Count	0	14	17	10	41
		% within Age	0.00%	34.10%	41.50%	24.40%	100.00%
	31-40 years	Count	1	8	26	7	42
		% within Age	2.40%	19.00%	61.90%	16.70%	100.00%
	41-50 years	Count	0	9	38	8	55
		% within Age	0.00%	16.40%	69.10%	14.50%	100.00%
	51 years or older	Count	0	11	71	14	96
		% within Age	0.00%	11.50%	74.00%	14.60%	100.00%
Total		Count	1	42	152	39	234
		% within Age	0.40%	17.90%	65.00%	16.70%	100.00%

5.3 Content Analysis of Open-Ended Questions

This section focuses answering the open-ended questions of the study through interpreting from the content of the text data along with quantifying the qualitative information. In this analysis, the unit of analysis was words and frequencies of most used keywords were examined.

5.3.1 Teacher Motivations for Changing Classroom Arrangement

Open-ended questions of the study surveyed the participants' opinions and perspectives of motivations that make them change their classroom arrangements (furniture movement) and activities that they do in open areas in their classrooms. In order to address these two questions, content analysis technique was conducted through making interpretations and coding the textual material systematically and converting the qualitative data into quantitative data by using MAXQDA qualitative text analysis tool. The purpose of turning qualitative data into quantitative data was to use frequencies to understand how common these motivations among the participants. This approach can also allow the researcher to investigate relationships between qualitative data and other variables when further investigation is needed.

RQ4: What motivates teachers to change their classroom arrangements?

In total, there were 22 initial codes created. According to the initial codes that emerged, "discipline" (16.3%) was found to be the most important motivation/reason for teachers for changing the classroom arrangement. This code, discipline, was used to code teacher

statements related to classroom management and behavioral management. The second most important code that emerged from participants' answers was "projects/experiment/activities" (12.9%). This code, on the other hand, covered teacher statements related to science and lab works, experiments and activities. In addition to "projects/experiment/activities", "group work" was also found to be the second most important motivation for teachers to change their classroom arrangement (12.9%). This code was used to code teacher statements related to creating small group activities and organizations. The fourth most important motivation was found to be "assessment" (8.4%). This code emerged through teacher statements that were related to testing. The fifth most important motivation, on the other hand, was found to be "collaboration and communication" (7.9%). This code was used when words related to student interaction and collaboration were observed within statements. The other most important motivations were: learning style/needs (6.9%); instruction/teaching methods (6.4%); breaking monotony (5.9%); visual or hearing problems of students (4%); fostering teacher movement and circulation (3%); student movement (2.5%); class size (2%); technology use (1.5%); concentration and focus (1.5%); and creating open space (1%) respectively (see Figure 5-44).

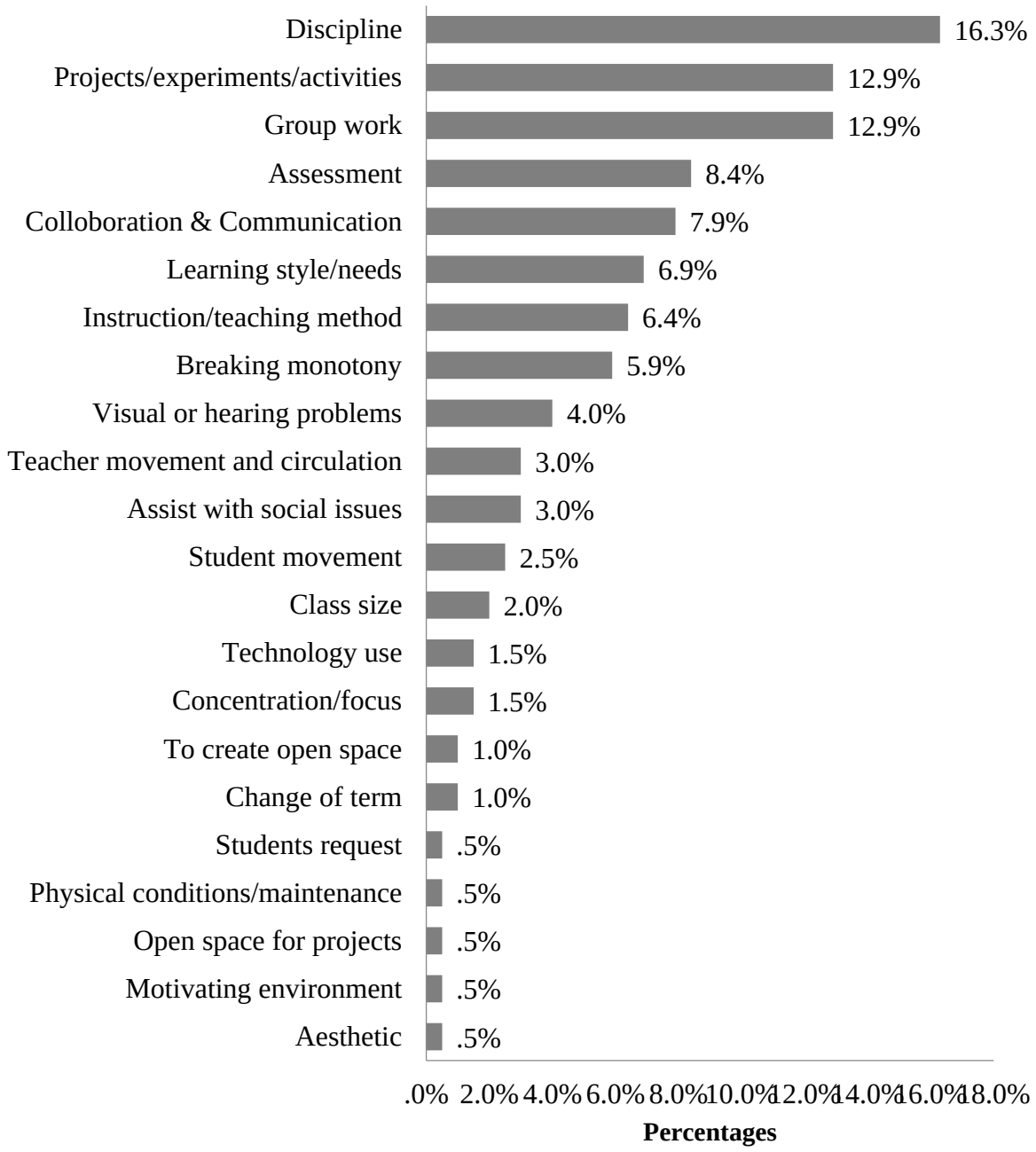


Figure 5-44: The initial codes emerged from teacher motivations for changing classroom arrangement

In the second phase of data analysis, codes were categorized into meta-codes based on the themes that were found to be related and could fall under the same higher category/construct to bring more clarification to interpretation. The number of codes/categories was reduced from 23 to 13 through this process (see Figure 5-45).

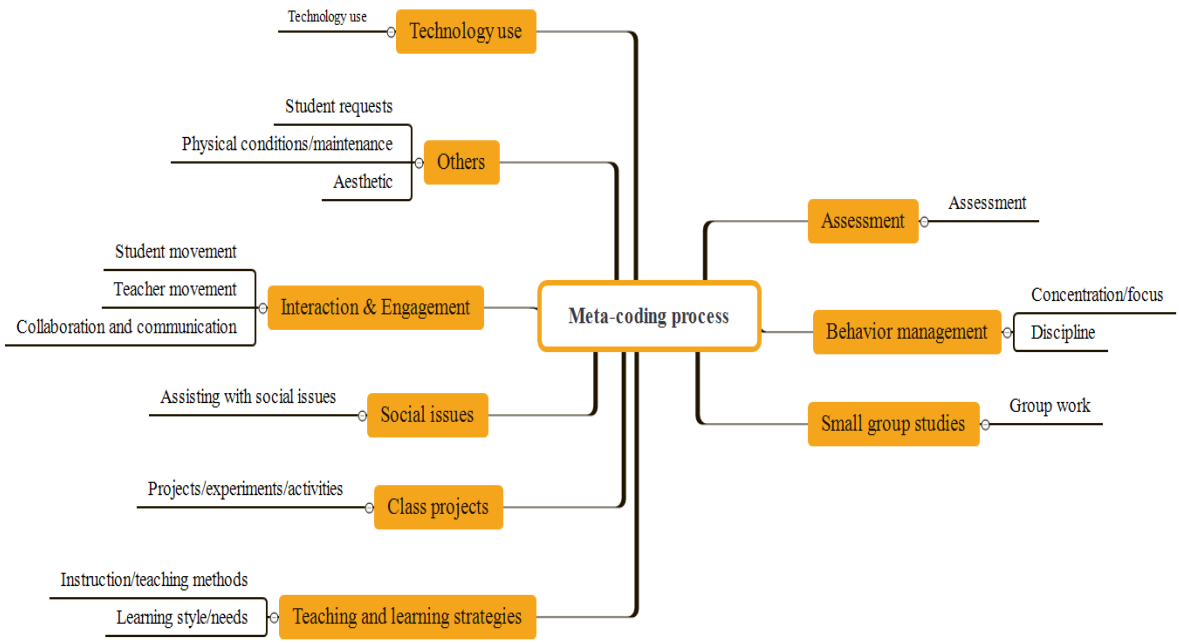


Figure 5-45: Meta-coding scheme for teacher motivations for changing classroom arrangement

As Figure 5-46 indicates, the most important motivation for teachers for changing their classroom arrangement was found to be issues related to “behavior management” (18.3%), in which statements related to concentration & focus problems of students and disciplinary reasons were grouped. The second most important motivation was found to be “teaching and learning strategies” (13.4%), which addresses the statements related to instruction, teaching

methods, learning styles and needs. Interaction and engagement (13.4%), on the other hand, was also found to be the second most important motivation for teacher for changing the arrangement. This meta-code was used to group the initial codes that were related to teacher movement, student movement, and collaboration and communication.

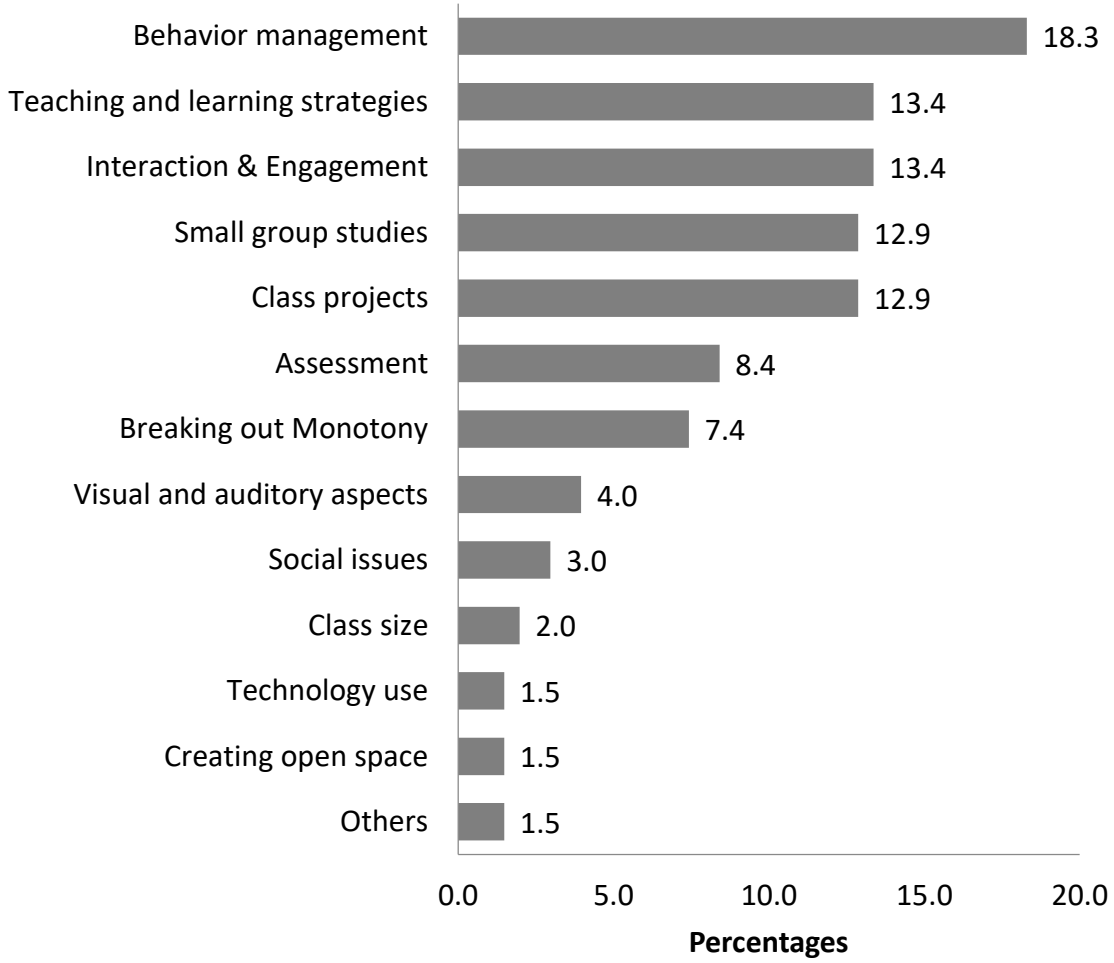


Figure 5-46: The meta-codes emerged from teacher motivations for changing classroom arrangement

RQ4a: What type of activities do teachers use in open areas?

The purpose of this question was to address the needs of teachers for open spaces, including both indoor and outdoor open spaces. Most teachers mentioned that they do not have any open space in their classrooms for spreading out the furniture when they need to. Some teachers mentioned that they go outside as there was no extra space in their classrooms to accommodate different types of activities even when they change the arrangement and space out the furniture.

As can be seen in Figure 5-47, “group studies” was found to be the most frequently mentioned activity that teachers use in open areas (21.9%). Following group studies, “labs and experiments” (21.3%); “class projects” (13.6%); “demonstrations and simulations” (7.1%), “environmental observations” (6.5%); activities that require “better student and/or teacher movement” (5.9%); “play/games” (5.1%); “class discussions” (3.6%); “reading” (3%); and “Physical Education (PE) activities” were the other most frequently mentioned activities.

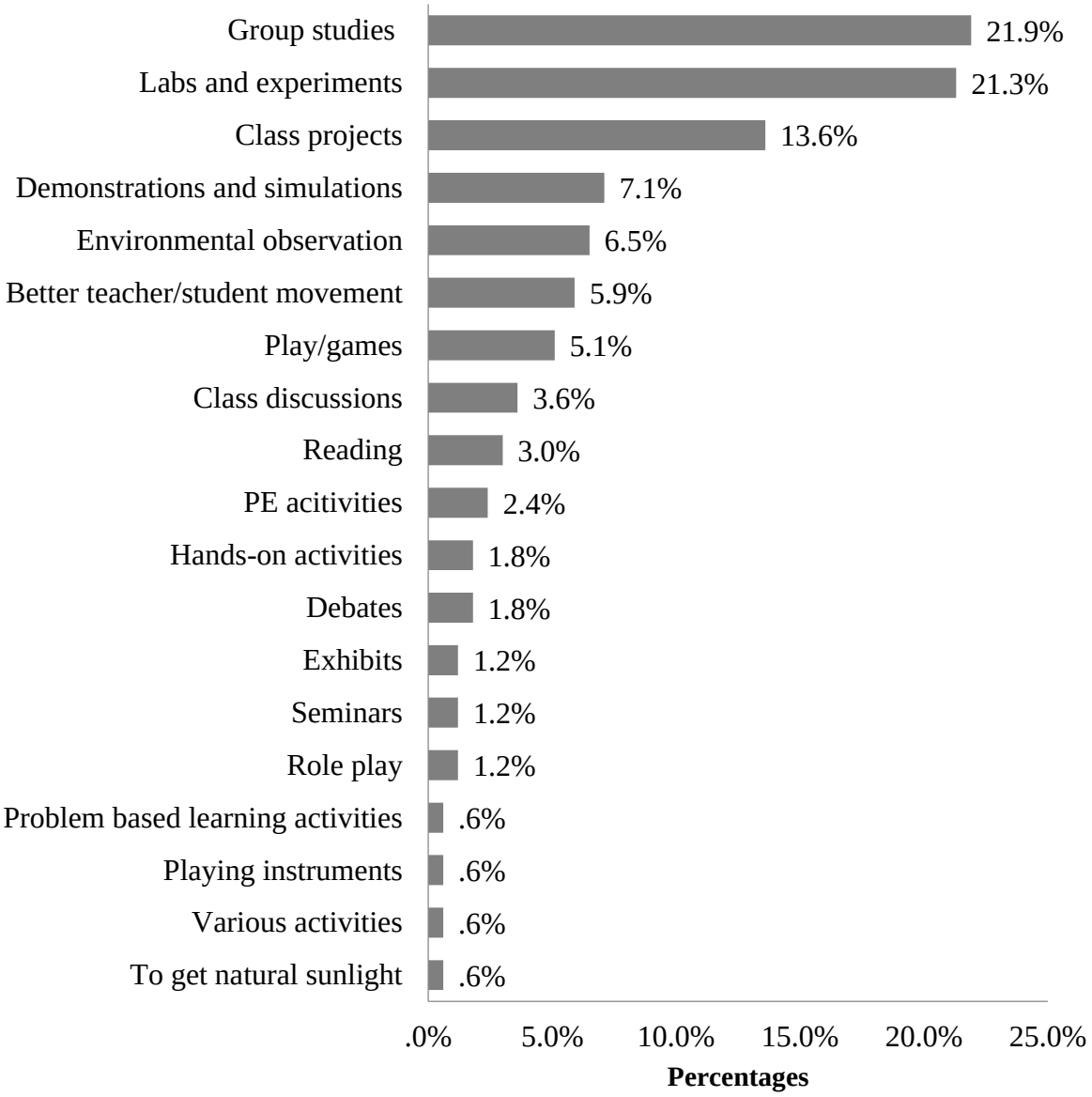


Figure 5-47: The meta-codes emerged from activities teachers use in open areas

CHAPTER 6 DISCUSSIONS

This chapter aims to provide a summary of the results and discusses the results in non-statistical terms and answers each research question posed to explain what they mean and/or indicate; a discussion on how the results support or differ from the extant theoretical positions and relevant literature findings; a summary of limitations that are related to sampling, methodology and analysis; and recommendations for future research studies.

6.1 Summary

This study conceptualized classrooms as "teacher-designed" environments and investigated the associations between teachers' current classroom arrangements, their classroom design preferences, and teachers' attitudes and behavioral outcomes. First, teachers' current classroom design characteristics, teachers' attitudes and behavioral characteristics, and teachers' classroom design preferences were studied in order to identify the design and behavioral differences among the study's participants. Second, associations between student-centered and teacher-centered classrooms and teachers' attitudes and behavioral outcomes were investigated and compared individually. Following this phase, associations between teachers' classroom design preferences and teachers' attitudes and behavioral outcomes were examined separately. This phase compared variations of expandable classroom designs with variations of L-shape classroom designs as two different classroom layouts found to be innovative and alternative to traditional classrooms in the literature. Third, teachers' motivations for changing the classroom arrangement and reasons/necessities for creating

extra open space through either changing the classroom arrangement or completely changing the environment in classrooms were also studied through a quantified qualitative approach. The followings briefly summaries the key findings:

- In response to the first research question of the study (teachers' motivation and classroom environment), analysis of this study did not indicate any association between teachers' current classroom arrangement and their motivation towards education. In other words, whether being in a student-centered or a teacher-centered classroom environment was not found to be associated with teachers' motivation towards education. Teachers' classroom design preferences, on the other hand, were found to be associated with teachers' motivation towards education. According to teachers' overall classroom design preferences, teachers who were found to be highly motivated prefer the variations of L-shape classroom designs over expandable designs. One interesting finding from this investigation was that design preferences of teachers who were highly motivated differ based on the teaching purposes. In other words, preferences change depending on what the classroom is aimed to be served for. For instance, although the analysis showed that teachers who were highly motivated preferred variations of L-shape classrooms when they were asked what they prefer "overall", these teachers were found to prefer expandable classroom designs when the classroom is to serve for "lecture" and "class discussions" purposes.

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In response to the second research question of the study (relationship between teachers' environmental response and classroom environment), comparison of student-centered and teacher-centered classroom environments did not reveal a significant difference in teachers' environmental dispositions. In other words, this result suggests that whether teachers were in a student-centered or teacher-centered environment, the ways they comprehended and made the use of the environment did not differ. However, the analysis of the study indicated a significant association between teachers' classroom design preferences and their environmental response. As for teachers' classroom design preferences for "group studies", "independent student activities", and "technology use", teachers who preferred the variations of L-shape classroom designs were more likely to be highly environmentally inclusive than teachers who preferred expandable classroom designs. Therefore, considering the meaning of being environmentally inclusive, being pro-urbanist and responsive to urban aesthetics, variations of L-shape classrooms can be considered of a primary design alternative for group studies, independent student activities, and technology use.

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In terms of the third research question of the study, (teachers' classroom design preferences and factors for achieving a better classroom environment) descriptive analysis indicated that teachers in general prefer the variations of L-shape classroom designs. When teachers' classroom design preferences for specific purposes were studied individually, teachers were found to prefer the variations of L-shape classroom designs for group studies; independent

student activities; and multiple teaching methods. The expandable classroom designs, on the other hand, were found to be preferred for lectures; class discussions; interaction between students; teacher movement; and circulation purposes. Overlapping these design preferences with the previous section's findings, it can be concluded that the variations of L-shape classroom designs can be considered as a primary design alternative when a classroom for group studies and independent student activities is to be designed. The underlying logic behind this finding can be explained through the fact that both group studies and independent student activities require teachers to organize the students in separated small group spaces. Therefore, the legs of the variations of L-shape classroom designs can become very useful for these purposes.

As it has been previously mentioned, the third research question of the study involved a sub-question in which teachers were asked to rank the importance of factors for achieving a better classroom environment. The analysis indicated that the class size is the most important factor for teachers for creating a better classroom environment. This finding was found to be supporting the existing findings from literature. One of the most comprehensive studies in the related research field, which was commissioned by the US Department of Education, found that the only objective factor that was found to be correlated with higher student achievement was the class size after controlling for many other factors (McLaughlin & Drori, 2000). Additional studies also show correlation between smaller class size and significantly higher student achievement in both middle schools and high schools (Akerhielm, 1995; Ehrenberg, Brewer, Gamoran, & Willms, 2001; Deutsch, 2003). In literature, class size was also found to

be associated with spatial density, meaning the amount of space per student (Maxwell, 2003). These findings from relevant research studies reveal the impact of reduced space on classroom activities, the attitudes, social relationships of students and attainment. These findings indicate that a crowded setting is likely to be noisier and more difficult to ventilate, problems which can interfere with learning (Woolner et al, 2007; Woolner & Hall, 2010).

According to the findings of this study, the other two most important factors for teachers for achieving a better classroom environment were found to be indoor-outdoor connections and flexibility of furniture respectively. In the literature, indoor-outdoor connection has been found to have a positive impact on cognitive, social, emotional, and physical development of students and its implementation in design can particularly be observed in Montessori education. In this education system, as one most successful educational approaches in the history, outdoor classrooms are considered an integral part of the curriculum and activities (Lillard, 2013). Also, comparing this finding with the findings from teachers' motivations for changing the classroom arrangement "to create extra space", it can be concluded that indoor-outdoor connection is not only an important factor for students' learning and development, but also an important source of space for teachers to conduct different activities and teaching styles. Furniture flexibility, on the other hand, is a major factor and necessity to allow teachers to change the classroom arrangement when they need to. Therefore, these three factors together should be considered as primary considerations when designing classrooms for middle schools.

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Referring back to the fourth research question of the study (teacher motivations for changing their classroom arrangements), on the other hand, behavior management was found to be the most important factor for teachers to change their classroom arrangement. This finding was found to be supporting the arguments and findings from past empirical research studies. In literature, several studies have found that classroom arrangement has the potential to help prevent problem behaviors before they occur through controlling student attention during instruction. It can be used to encourage desirable behavior or contribute to students' misbehavior (Prohansky & Wolfe, 1975; White, 1979; Riwlin & Winstein, 1984; Gump, 1987; MacAulay, 1990; Walker & Walker, 1991; Daniels, 1998; Walker, Colvin, & Ramsey, 1995; Wannarka & Ruhl, 2008). It has also been found that since proximity and orientation can influence communication, it is also possible that classroom arrangement and different furniture configurations can have influence on the nature and extent of student interaction (Wannarka & Ruhl, 2008). Therefore, it can be concluded that unlike the other factors that also have impacts on behavior (such as individual student characteristics, social dynamics), seating arrangement is one factor that is under teacher control that can be a powerful tool to manage behavioral problems in classroom. This was found to be the most important motivation for teachers to change classroom arrangement in this study. As for the second and third most important factors, "teaching and learning strategies" and "interaction and engagement" were found to be other factors respectively that motivate teachers to change their classroom arrangements. Combining these results (which were obtained from teachers'

opinions and perspectives) with other empirical research findings from the literature (Weinstein, 1992; Savage, 1999; Brekelmans, Wubbels & Brok, 2002; Martin, 2002; Oblinger, 2006; Durán-Narucki, 2008; Kumar, O'Malley, & Johnston, 2008) , it can be concluded that classroom arrangement can be used as a useful tool to regulate behavioral outcomes; support teaching and learning strategies; and stimulate interaction and engagement between students and teachers.

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In terms of the results of the fourth research question of the study (teachers' attitude towards education and classroom environment) the findings revealed associations between teachers instructional areas and both teachers current classroom arrangement and their classroom design preferences. The results indicated that the instructional areas that were found to be conducted in teacher-centered classroom environments only were: music; technology; and PE/health. The other instructional areas (art, language, social studies, math, and science) were found to be conducted in both types of classroom arrangements.

Association between instructional area and teachers' classroom design preferences in general, on the other hand, indicated that instructional areas in which teachers were found to prefer the expandable classroom designs were: music; language; social studies; and math. On the other hand, instructional areas in which teachers were found to prefer variations of L-shape classroom designs included: art; science; and PE/Health. When teachers were asked to indicate their classroom design preferences for specific purposes, it was also found that

music, language, social studies, math and science teachers prefer expandable classroom designs for lecture purposes. Therefore, a significant shift was observed among the science teachers' classroom design preferences from preferring the variations of L-shape classroom designs to preferring expandable classroom designs when their preferences were asked for "lecture" purposes rather than "overall". This finding suggests that the purpose (such as preference for lecture, class discussions, group studies, better teacher movement etc.) can affect teachers' classroom design preferences. Therefore, understanding teachers' attitudes and methods toward education should play an important role during the design process of classrooms.

In terms of teaching methods and classroom environment, the results also indicated that lectures and discussions (as primary teaching methods) were found to be used more frequently in teacher-centered classrooms whereas small groups, class projects, and tutorials were found to be used more frequently in student-centered classrooms. When teachers' classroom design preferences were asked for specific purposes, the findings also indicated that the relationship between teachers' teaching methods and their classroom design preferences change. Therefore, similar to the relationship between classroom design and instructional area, purpose of the teacher can play an important role on teachers' classroom design preferences.

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In terms of teachers' technology use, teachers' self-reports indicated that technology is an important aspect effecting teachers' classroom arrangement whether they are in a student-centered or teacher-centered classroom environment. Considering the fact that there has been

an increase in technology integration in classroom and technology related teaching reforms, flexibility and adaptability of the classroom to accommodate diverse options become an important issue to address through design. In response to the relationship between teachers' practice of using technology in instruction and teachers' classroom design preferences, teachers who prefer variations of L-shape classrooms were also found to be using technology exclusively. Therefore, variations of L-shape classrooms can be considered as a primary layout alternative when classrooms are designed specifically for technology integration.

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In response to the sixth research question of the study (teachers' motivational strategies and classroom environment), the findings indicated that the motivational strategies related to cooperative learning were found to be conducting more often in student-centered classroom environments. Since the nature of cooperative learning aims to stimulate interaction and engagement among student and teacher, observing these motivational strategies more frequently in student-centered classroom environment was not unpredictable. As previous research studies (Martin, 2002; Moores, & Moores 2007) show that student-centered classrooms foster interaction as typically students in these classrooms are seated in clusters and classroom is arranged in a way to create a physical arrangement to support that the focus of the activity is on pupils working either individually or in groups.

In terms of teachers' motivational strategies and their classroom design preferences, on the other hand, motivational strategy towards improving generative learning was found to be

associated with classroom design preferences. Teachers' who use this motivational strategy (which aims to enhance students' self-assessment through encouraging them to reflect on their learning experiences) often were found to prefer variations of L-shape classroom designs over expandable classroom designs. Therefore, depending on the learning style that is aimed to be fostered by teachers, different classroom arrangements and layout types can be considered as primary alternatives.

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In terms of teacher movement and classroom environment, the findings of this study indicated that teachers move around more frequently in student-centered classroom environments. Unfortunately, teacher movement and its relation with classroom arrangement is one of the overlooked issues in classroom design research. However, this finding (positive association between student-centered classrooms and teacher movement) was found to be in line with Martin's (2002) study as the most related example from the related literature. Through observing 61 lessons in 12 different schools, she found that where teachers address the whole class (teacher-centered classrooms), they are less mobile and where teachers address groups or individual students (student-centered classrooms), they are more mobile with a positive correlation. Therefore, it can be concluded that student-centered classroom arrangements can foster better teacher movement, which can mediate better student-teacher interaction and accordingly better academic, behavioral, and social outcomes.

In terms of teachers' class design preferences for lectures, the findings also indicated that teachers who frequently move in classroom prefer expandable classroom designs. According to teachers' classroom design preferences for better teacher movement, teachers who frequently move around once more were found to prefer expandable classroom designs. And lastly, according to teachers' classroom design preferences for better circulation, teachers who frequently move around were again found to prefer expandable classrooms. Therefore, it can be concluded that expandable classroom layouts can be considered as a primary design alternative when teacher movement and circulation are priorities within the design process.

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In terms of the relationship between teachers' satisfaction with their current classroom arrangement and their classroom design preferences, teachers prefer variations of L-shape classroom designs for multiple teaching methods and independent student activities were found to be more satisfied with their classroom arrangements than teacher who prefer expandable classroom designs.

6.1.1 Design Implications of Findings

Although design implications of the major findings were briefly discussed in the previous section, Table 6-1 provides a summary of the correlational findings and their design implications through explaining in what circumstances these classroom environment characteristics can become a primary classroom arrangement and design (layout) alternative. These implications might be concerns of designers, educators, and school principals who aim

to create better functioning classrooms in which the physical characteristics of the classroom environment support the following concerns and/or priorities:

Table 6-1: Design implications of the correlational findings

	Correlational Findings	Design Implications
Student-centered classroom arrangements	Associated with art, language, social studies, math, and science instructional areas.	Can be considered as primary arrangement alternative when: these specific instructional areas and teaching methods; cooperative learning strategies; and better teacher movement are concerns/priorities within the design process.
	Associated with small groups, class projects, and tutorial teaching methods.	
	Associated with motivational strategies toward improving cooperative learning.	
	Associated with more frequent teacher movement.	
Teacher-centered classroom arrangements	Associated with music, technology, PE/health, art, language, social studies, math, and science instructional areas.	Can be considered as primary arrangement alternative when: these instructional areas and teaching methods are concerns/priorities within the design process.
	Associated with lecture and discussion primary teaching methods.	
Variations of L-shape classroom designs	Associated with higher teacher motivation towards education.	Can be considered as primary design (layout) alternative when: teacher motivation; environmental response; these specific instructional areas; technology use in instruction; generative learning; and teacher satisfaction are concerns/priorities within the design process.
	Associated with higher environmental response and awareness towards urban aesthetics (environmentally inclusive ER factor).	
	Associated with art, science, and PE/Health instructional areas.	
	Associated with exclusively use of technology in instruction.	
	Associated with motivational strategies toward improving generative learning.	
	Associated with higher teacher satisfaction.	
Expandable classroom designs	Associated with music, language, social studies, and math instructional areas.	Can be considered as primary design (layout) alternative when: these specific instructional areas and teacher movement are concerns/priorities within the design process.
	Associated with science instructional area for lecture purposes only.	
	Associated with more frequent teacher movement.	

In addition to the correlational findings and their design implications, teachers were also found to prefer the variations of L-shape classroom designs for: group studies; independent student activities; and multiple teaching methods. The expandable classroom designs, on the other hand, were found to be preferred for lectures; class discussions; interaction between students; teacher movement; and circulation purposes. Overlapping these design preferences with the previous section's findings, it can be concluded that the variations of L-shape classroom designs can be considered as a primary design alternative when a classroom for group studies and independent student activities is to be designed.

Table 6-2: Design implications of the descriptive findings on classroom layout types

	Descriptive Findings	Design Implications
Variations of L-shape classroom designs	Primary preference for group studies	Can be considered as primary classroom layout alternative when small group studies and activities, and addressing multiple teaching methods in one classroom are primary concerns/ priorities within the design process.
	Primary preference for independent student activities	
	Primary preference for multiple teaching methods	
Expandable classroom designs	Primary preference for lectures	Can be considered as primary layout alternative when interaction between students, teacher movement and circulation, and addressing lecture purpose only are primary concerns/priorities. Since this layout allows teachers to combine classrooms together, it can provide better movement and interaction when two classrooms need to be combined.
	Primary preference for interaction between students	
	Primary preference for teacher movement and circulations	

Following table summarizes the design implications of the descriptive findings on the three most important benefits of classroom arrangement when organized properly:

Table 6-3: Design implications of the descriptive findings on benefits of classroom arrangement

	Descriptive Findings	Design Implications
Classroom arrangement	As a means for controlling behavior management.	Classroom arrangement can be used a useful tool to: regulate behavioral outcomes; support teaching and learning strategies; and stimulate interaction and engagement between students and teacher as teachers were found to find them as the most important factors.
	As a means for supporting teaching and learning strategies.	
	As a means for supporting interaction and engagement.	

In terms of the aspects for creating a better learning environment, Table 6-4summarizes the three most important items that need to be considered in classroom design:

Table 6-4: Design implications of the descriptive findings on important classroom aspects

	Descriptive Findings	Design Implications
Most Important Classroom Aspects	Class size	These factors should be taken into consideration as primary concerns for all type of classroom designs as they can either positively or negatively affect attitudes, social relationships of students and attainment through spatial density (amount of space per student).
	Indoor-outdoor connection	
	Flexibility of furniture	

6.2 Conclusions

In conclusion, we can assume that design and architecture has a great potential to support teaching practice and can improve learning because the physical characteristics of classroom environments were found to have effects on teacher and student behavior, attitudes and practices and therefore learning outcomes. However, only a small handful of studies have analyzed classroom designs and arrangements from teachers' perspectives as the classroom design literature have mainly focused on the relationships between physical environment and students' academic and behavioral outcomes.

Findings and design implications of this study illustrated some of the potential primary classroom design and arrangement alternatives depending on the circumstances that need to be met essentially. These findings and implications together also indicate that there is not one single classroom design or arrangement type that can meet the requirements and/or needs of all types of teaching methods, instructional areas, learning styles, and so on. However, it is important that designing classrooms as specialized learning environments and meeting teachers' needs and characteristics as much as possible can increase the potential of the physical environment to support both educational and behavioral outcomes. It is important that teachers are aware of the influences of physical environment on their practice, so that they can have control over their classrooms and accommodate the features that can meet their needs. As Martin (2002) suggests, making the case for the importance of environmental response and awareness in the training and retraining process of teachers is very important. As this study has also indicated associations between teachers 'environmental response and

classroom design, teachers' environmental competence becomes an important constituent of classroom function. If the teacher is not aware of the influences of the physical environment on his/her behavior, then providing the appropriate design features will become ineffectual.

In summary, classrooms should be flexible enough so that they can support not only traditional instructions, but also small groups, individual learnings, multipurpose activities and teaching/learning styles. Therefore, furniture in classroom should allow teachers to make changes when they need to through being flexible and easy to move and rearrange. But most importantly, class size and spatial density (amount of space per student) should be adequate enough to allow teachers to make these changes when they need to. Connection between classes and indoor-outdoor can also provide teachers the flexibility when they need to combine classes or need additional/extra space for different types of activities.

One important approach to address primary concerns/needs and overcome problems before they occur and identify the priorities and address the appropriate needs of teachers is including teachers in the design process. Sanoff (2001) argues that in each stage of school design projects it is essential to directly involve teachers and students in order to maximize the performance of spaces for learning. Since teachers are the "decision makers" and classrooms are "teacher-designed" environments, they are directly associated with the potential outcomes of the classroom environment and involving them in the design process can implement significant values to the creation and planning process. As this study provided

evidences on the relationship between classroom environment (both layout and arrangement) and: the teaching methods; instructional areas; learning styles; and class room design, investigating and comprehending these teacher characteristics beforehand will improve the quality of the decision-making mechanism during the design process. When such questions and needs addressed properly, we can increase the potential of the physical environment for adequately supporting education through design.

6.3 Limitations of the Study

The following sections will discuss the three main limitations of the study that are related to sampling, methodology, and statistical analysis tools.

6.3.1 Sampling Strategy Limitations

One of the main limitations of the study is the sampling strategy. In this study, 8 middle schools that are under the WCPSS and teachers who pursue doctoral studies at North Carolina State University, College of Education participated. According to the website of Wake County Public School System, there are 33 middle schools under the Wake County Public School System. Accordingly, since there are approximately 40 teachers in middle schools, the approximate population size was calculated to be 1320. The minimum sample size estimation was conducted through using Cohen's (1992) sample size estimation with 95% confidence level. The minimum required sample size number was calculated 234. In total there were 284 middle school teachers participated in the study. When missing data was

removed, the total sample size was 234. Therefore, meeting with the minimum required sample size was not a limitation of the study.

However, although an invitation to participate in the study was sent to all the middle schools under WCPSS, only the schools who volunteered to participate took part in the study. Volunteer sampling is a form of purposive/ non-random sampling for all such reasons ("Volunteer Sampling", 2006). Therefore, although all middle schools were invited, the main limitation is that there is no evidence that this sample is representative of the wider population to make generalizations about due to self-selection bias.

6.3.2 Methodological Limitations

One other limitation of the study is using self-reports (survey) to gather data through asking participants about their attitudes, opinions, behaviors and so on. In this study, survey data was used to obtain both attitudes and behavioral outcomes of teachers and classroom environment characteristics. Due to surveys' convenience for implementing to larger sample size, time and cost concerns, and being able to account for all the research questions and variables of the study with one tool, survey method (self-reports) was preferred to examine the associations between variables of interest. However, the most important issue related to using survey for gathering attitude and behavioral data is that the respondents may not provide honest answers and accordingly may not reflect their actual behaviors and attitudes as observational studies would do.

6.3.3 Statistical Limitations

In this study, all independent variables were nominal categorical variables whereas the dependent variables were both ordinal categorical and nominal categorical variables. The ordinal categorical variables of the study were likert-scales. In literature, there are different opinions and ways about how to treat likert-scales. Some researchers prefer to treat them as continuous, some prefer ordinal, and some prefer categorical approach. In this study, treating likert-scales as ordinal categorical variable was the final decision after considering all the possible scenarios and outcomes due to mainly two reasons: the nature of the data; and the nature of the research questions. First of all, when the likert-scales were treated continuous, repeated values emerged in data and creating a meaningful regression model became difficult due to overlapping values. In order words, the data acted as categorical rather than an interval data because a likert scale item is in fact a set of ordered categories. The second reason why the likert scales were not treated continuous was because the nature of the research questions of the study required examining associations between independent and dependent variables, rather than predicting the outcome variables. Therefore, after examining the data with three different statistician consultants and considering the nature of research questions, treating all the variables as categorical was the final decision and using Chi square tests were the preferred method.

Ideally, the Kruskal-Wallis H test, as a rank-based nonparametric test, is the ideal method for testing the associations between nominal and ordinal categorical variables. However, due to the failure to meet the fourth assumption of Kruskal-Wallis, which requires the distributions in

each group (i.e., the distribution of scores for each group of the independent variable) to have the same shape (which also means the same variability) this test could not be computed. Therefore, depending on the availability to meet the required assumptions, Pearson's and Likelihood Chi square tests were used to test for independence between both nominal- nominal and nominal-ordinal categorical variables of the study. And since these tests do not account for ordinal information in variables, some loss of information might have occurred.

6.4 Recommendations for Future Research

First of all, this study focused on two characteristics of classroom environment: arrangement and layout. And within these characteristics, two sub-categories were taken into consideration: student and teacher centered classroom arrangements; and expandable and variations of L-shape classroom design (layouts) because they were the interest of research. Therefore, during the analysis and interpretation processes, number of classroom aspects that were examined and found to be associated with the dependent variables was limited due to focusing on these characteristics only. Accordingly, further interpretation into teachers' choices and preferences and identifying underlying reasons were limited. For instance, the findings of this study indicated that variations of L-shape classrooms are associated with motivational strategies toward improving generative learning. But we do not know why exactly these classroom designs were found to be supporting this learning style. Some explanations can be generated through interpretations, but further details (variables) needed to explain these relationships empirically. Therefore, based on the relational findings of this study, further studies can focus on one these classroom types individually and obtain more in

depth information regarding their individual characteristics influencing teachers' outcomes. Secondly, as discussed in section 6.3.2 addressing research questions relevant to this study's through conducting observations and behavior mapping methods might provide more accurate and useful data for these kind of behavioral type of research studies. Also, although this study did not compare groups (middle teachers who currently teach at middle schools and middle school teachers who were previously teachers and currently pursuing doctoral studies at NC State) of teachers due to such comparison was not a part of the research questions, a future study can choose to distinguish between groups to see whether pursuing a higher education distinguishes any difference between teachers' responses.

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APPENDICES

APPENDIX A: IRB Approved One Page Invitation to Participate in the Study

North Carolina State University is a land-grant university and a constituent institution of The University of North Carolina

College of Design

NC STATE UNIVERSITY

INFORMATION LETTER FOR CLASSROOM DESIGN SURVEY

Dear Middle School Teachers,

I am proposing to conduct a study about the importance of classroom arrangements. A survey questionnaire was developed to identify the issues that teachers believe are important for improving student performance. The survey questionnaire would take about 15 minutes to complete.

Your input is an essential part of this study, and I would appreciate your response and time. Your responses will be used only for research purposes, and your answers will be completely anonymous and will remain confidential. There are no correct or incorrect answers; I am only interested in your opinions.

If you have any questions about the study or this survey, please contact Ece Altinbasak at ealtinb@ncsu.edu.

Sincerely,

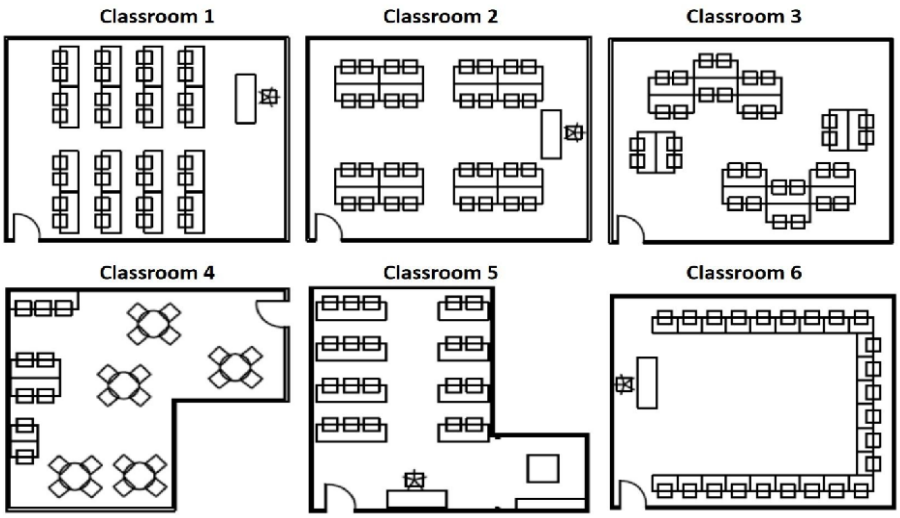
Ms. Ece Altinbasak
PhD Candidate, North Carolina State Universityo College of Design
Fulbright Grantee
Phone: (413) 320o 8408
Eo mail: ealtinb@ncsu.edu

APPENDIX B: IRB and WCPSS Approved Survey

CLASSROOM DESIGN SURVEY | College of Design NC STATE UNIVERSITY

The following questions below relate to your current classroom arrangement and features. Please answer all the questions.

1 Which of the following classrooms represent the arrangement you use most frequently



	Classroom 1	Classroom 2	Classroom 3	Classroom 4	Classroom 5	Classroom 6
1st most frequent	❍	❍	❍	❍	❍	❍
2nd most frequent	❍	❍	❍	❍	❍	❍

2 Are the tables and chairs fixed or flexible in your classroom?

- ❑ Fixed
- ❑ Semi flexible (movable but heavy)
- ❑ Flexible

3 How often do you change your classroom arrangement?

- ❑ Never
- ❑ Rarely
- ❑ Sometimes
- ❑ Most of the Time
- ❑ Always

4 Are there policy restrictions about changing the classroom arrangement in your school?

- ❑ Yes
- ❑ No

5 When you change your classroom arrangement, what are the main reasons to make changes?

1st reason

2nd reason

6 Does your current classroom have a direct connection to the outdoors?

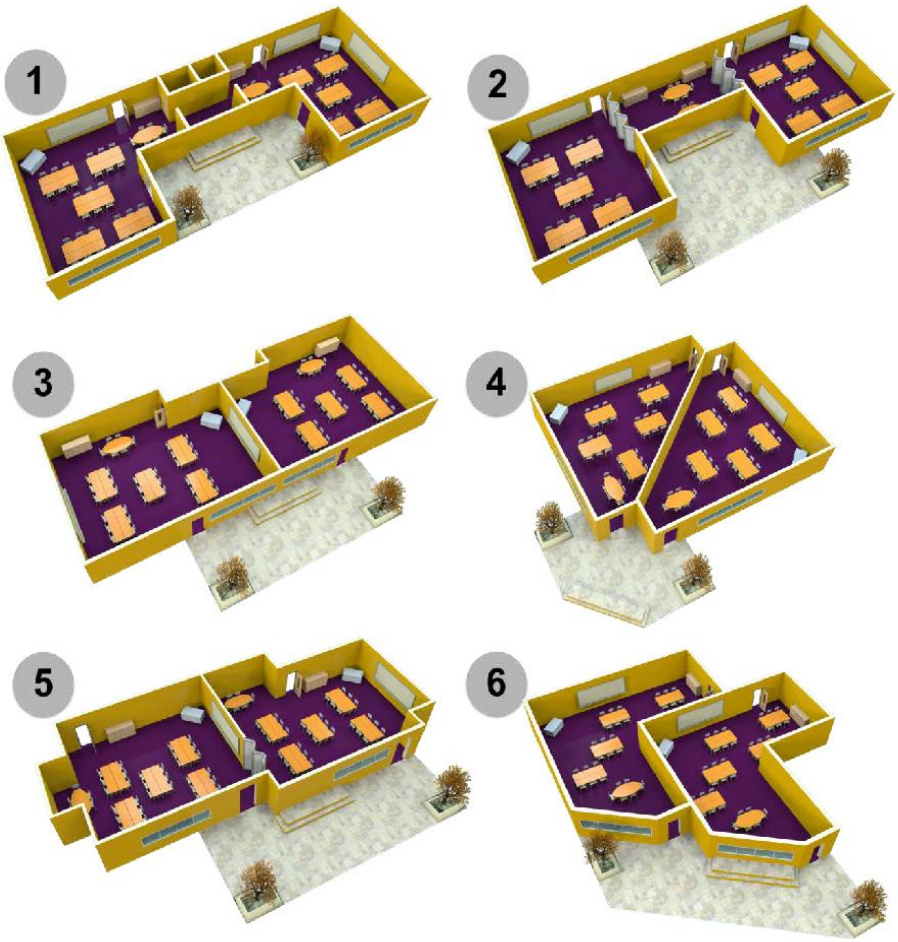
- ❑ Yes
- ❑ No

7 What types of activities do you use in the open area?

8 Please rank the following items below from most to least important for achieving a better classroom environment where 1 is most important and 16 is least important.

_____ Class size
_____ Indoor-outdoor connection
_____ Seating arrangement
_____ Flexibility of furniture
_____ Variability in furniture
_____ Variety of technology use
_____ Circulation routes
_____ Flexibility of movement
_____ Interaction
_____ Aesthetic appeal
_____ Ability to control heat/ac
_____ Ability to control lighting (full or partial, in phased sequences)
_____ Windows (operable)
_____ Flooring finish (carpet or VCT)
_____ Acoustics
_____ Available sink

9 There are six classrooms arrangements below, which have been selected from different innovative schools. Each pair of classrooms contain similar furniture, table arrangements and they all have direct connection to outdoor spaces. Please select the best CLASSROOM LAYOUT (SHAPE) that would satisfy each of the statements below.



	Layout 1	Layout 2	Layout 3	Layout 4	Layout 5	Layout 6
Best layout for **lectures**	❍	❍	❍	❍	❍	❍
Best layout for class **discussions**	❍	❍	❍	❍	❍	❍
Best layout for **group studies**	❍	❍	❍	❍	❍	❍
Best layout for **independent student activities**	❍	❍	❍	❍	❍	❍
Best layout for **multiple teaching methods**	❍	❍	❍	❍	❍	❍
Best layout for **interaction between students**	❍	❍	❍	❍	❍	❍
Best layout for **teacher movement**	❍	❍	❍	❍	❍	❍
Best layout for **circulation**	❍	❍	❍	❍	❍	❍
Best layout for **technology use**	❍	❍	❍	❍	❍	❍
Best layout **overall**	❍	❍	❍	❍	❍	❍

11 The following statements below relate to factors that may affect your personal motivation as a teacher. There are no correct or incorrect answers, please just indicate how much you agree or disagree with each statement by clicking on the appropriate option.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I set goals for myself and achieve them.	❍	❍	❍	❍	❍
I spend some of my free time on self-improvement on teaching by reading articles, attending workshops and meetings, etc.	❍	❍	❍	❍	❍
I know my teaching is effective in helping students to learn	❍	❍	❍	❍	❍
I am satisfied with my current job	❍	❍	❍	❍	❍
I would like my students to learn more	❍	❍	❍	❍	❍
I like to spend a lot of energy to make my classes interesting	❍	❍	❍	❍	❍
I am personally responsible for part of the education of every student I teach	❍	❍	❍	❍	❍

12 Please indicate how often do you use the following motivational strategies in your class, by clicking the most appropriate answer for each statement.

	Never	Rarely	Sometimes	Most of the Time	Always
I set class rules myself rather than allowing my students to do so	❍	❍	❍	❍	❍
I encourage my students to give suggestions for improving the course	❍	❍	❍	❍	❍
I give immediate feedback to my students	❍	❍	❍	❍	❍
I start all my lessons with the same presentation technique	❍	❍	❍	❍	❍
I use tasks that allow my students to interact with each other	❍	❍	❍	❍	❍
I teach my students self-learning strategies	❍	❍	❍	❍	❍
I encourage my students to learn from each other	❍	❍	❍	❍	❍
I move around frequently to interact with students	❍	❍	❍	❍	❍

13 Overall, how satisfied are you with your classroom arrangement?

- ❑ Very Dissatisfied
- ❑ Dissatisfied
- ❑ Neutral
- ❑ Satisfied
- ❑ Very Satisfied

14 What best describes your current practice of using technology in instruction? (Please choose only one of the following)

- ❑ I seldom use technology to deliver instruction.
- ❑ I almost exclusively use whole group presentation style either using an interactive whiteboard, PowerPoint or other instructional software to explain or demonstrate concepts or instructions.
- ❑ I often use whole group presentation style, but sometimes facilitate students in their use of a variety of information resources and hands-on activities.
- ❑ I almost exclusively facilitate student learning by encouraging students to use information resources and hands-on activities.

15 Please rate the relevance of the following factors in your decision to use technology in instruction.

	Very relevant	Relevant	Somewhat relevant	Not a consideration
Implementing national, state or local technology standards (ISTE NETS, MEMO, etc.)	❍	❍	❍	❍
Observing my colleagues successfully using technology to teach a concept	❍	❍	❍	❍
Using scientifically-based research that suggests a particular technology application improves student learning	❍	❍	❍	❍
Motivating and engaging learners	❍	❍	❍	❍
Creating a more learner-centered classroom with students exploring their own questions and building their own knowledge	❍	❍	❍	❍

16 Does your use of technology affect your current classroom arrangement?

- ❑ Never
- ❑ Rarely
- ❑ Sometimes
- ❑ Most of the Time
- ❑ Always

17 Please indicate your primary instructional content area.

- ❑ Music
- ❑ Art
- ❑ PE / Health
- ❑ Technology
- ❑ Language
- ❑ Social studies
- ❑ Math
- ❑ Science
- ❑ Other

18 Does the course material you use require changing the classroom arrangement?

- ❑ Never
- ❑ Rarely
- ❑ Sometimes
- ❑ Most of the Time
- ❑ Always

19 Please rank the following teaching methods in order of frequency of usage in your classes where 1 is most frequent 1 and 6 is least frequent.

_____ Lecture
_____ Discussion
_____ Small groups
_____ Debates
_____ Class projects
_____ Tutorial

20 Which of the following best describes your current school location?

- ❑ Urban
- ❑ Suburban
- ❑ Rural

21 What is your gender?

- ❑ Male
- ❑ Female

22 What is your age?

- ❑ 21-30 years
- ❑ 31-40 years
- ❑ 41-50years
- ❑ 51 years or older

23 Including the current year, how many years of teaching experience do you have?

- ❑ 1-5 years
- ❑ 6-10 years
- ❑ 10 years and more

24 Please enter your school name.

10 The following statements below relate to environmental attitudes regarding some of the environmental premises. Please select the most appropriate answer for each statement.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I often feel that I am a part of the environment around me	❍	❍	❍	❍	❍
I often have strong emotional reactions to buildings	❍	❍	❍	❍	❍
Building projects which disrupt the ecology should be abandoned and the land returned to its natural state	❍	❍	❍	❍	❍
I often feel uneasy in a large crowd of people	❍	❍	❍	❍	❍
I find street noise very distracting	❍	❍	❍	❍	❍
I do not like the variety of stimulation one finds in the city	❍	❍	❍	❍	❍
Cities contain the least desirable aspects of modern life	❍	❍	❍	❍	❍

APPENDIX C: Correlation Index

1. Classroom design preferences and teacher motivation towards education

X^2 (2, N=234) = 7.14, p = .028
Cramer's ϕ = .18

2. Classroom design preferences for lectures and motivation towards education

X^2 (2, N=234) = 13.66, p = .001
Cramer's ϕ = .18

3. Classroom design preferences for class discussions and motivation towards education

X^2 (2, N=234) = 6.55, p = .038
Cramer's ϕ = .17

4. Classroom design preference for group studies and environmentally inclusive ER factor

X^2 (2, N=234) = 9.29, p = .010
Cramer's ϕ = .20

5. Classroom design preference for independent studies and environmentally inclusive ER factor

X^2 (2, N=234) = 18.84, p < .001
Cramer's ϕ = .29

6. Classroom design preference for technology use and environmentally inclusive ER factor

X^2 (2, N=234) = 18.81, p < .001
Cramer's ϕ = .29

7. Current classroom arrangement and instructional content area

X^2 (8, N=234) = 21.77, p = .005

Cramer's ϕ = .28

8. Classroom design preferences and instructional content area

X^2 (8, N=234) = 18.10, p = .020
Cramer's ϕ = .28

9. Classroom design preference for lectures and instructional content area

X^2 (8, N=234) = 18.15, p = .020
Cramer's ϕ = .28

10. Current classroom arrangement and teaching methods

X^2 (5, N=234) = 18.48, p = .002
Cramer's ϕ = .28

11. Classroom design preference for lectures and teaching methods

X^2 (5, N=234) = 13.03, p = .023
Cramer's ϕ = .23

12. Classroom design preference for group studies and teaching methods

X^2 (5, N=234) = 12.85, p = .025
Cramer's ϕ = .23

13. Classroom design preference for multiple teaching methods and teaching methods

X^2 (5, N=234) = 12.01, p = .035
Cramer's ϕ = .22

14. Classroom design preference for technology use and teaching methods

X^2 (5, N=234) = 17.09, p = .004
Cramer's ϕ = .27

15. Classroom design preference for group studies and practice of using technology in instruction

X^2 (3, N=234) = 12.12, p = .007
Cramer's ϕ = .23

16. Classroom design preference for teacher movement and practice of using technology in instruction

X^2 (3, N=234) = 9.20, p = .027
Cramer's ϕ = .20

17. Classroom design preference for circulation and practice of using technology in instruction

X^2 (3, N=234) = 9.96, p = .019
Cramer's ϕ = .21

18. Current classroom arrangement and motivational strategy for cooperative learning (Item 5)

X^2 (3, N=234) = 7.91, p = .048
Cramer's ϕ = .18

19. Current classroom arrangement and motivational strategy for cooperative learning (Item 7)

X^2 (3, N=234) = 7.98, p = .046
Cramer's ϕ = .17

20. Classroom design preference and motivational strategy for generative learning (Item 6)

X^2 (4, N=234) = 10.69, p = .030.
Cramer's ϕ = .20

21. Current arrangement and teacher movement

X^2 (4, N=234) = 7.65, p = .013
Cramer's ϕ = .37

22. Classroom design preference for lectures and teacher movement

X^2 (4, N=234) = 14.39, p = .006
Cramer's ϕ = .29

23. Classroom design preference for teacher movement and teacher movement

X^2 (4, N=234) = 13.14, p = .011
Cramer's ϕ = .38

24. Classroom design preference for circulation and teacher movement

X^2 (4, N=234) = 13.14, p = .011
Cramer's ϕ = .35

25. Current classroom arrangement and satisfaction

X^2 (1, N=234) = 5.22, p = .022
Cramer's ϕ = .27

26. Classroom design preference for group studies and satisfaction

X^2 (1, N=234) = 4.40, p = .036
Cramer's ϕ = .22

27. Years of teaching experience and environmentally inclusive ER factor

X^2 (4, N=234) = 12.20, p = .016,

Gamma $\gamma = .28$

28. Years of teaching experience and environmentally exclusive ER factor

X^2 (4, N=234) = 15.47, p = .004
Gamma $\gamma = .46$

29. Years of teaching experience and strategy for generative learning (Item 6)

X^2 (8, N=234) = 22.56, p = .004
Gamma $\gamma = .31$

30. Age and strategy for motivational strategy for giving immediate feedback (Item 3)

X^2 (9, N=234) = 17.90, p = .036
Gamma $\gamma = .12$