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EVIDENCE FOR "TAILORING" IN THE MATCHING OF INTEGRATED SERVICES TO STUDENTS' DEVELOPMENTAL NEEDS IN CITY CONNECTS SCHOOLS USING PATTERN ANALYSIS AND LATENT CLASS ANALYSIS

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Evidence for "Tailoring" in the Matching of Integrated Services to Students' Developmental Needs in City Connects Schools Using Pattern Analysis and Latent Class Analysis

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With an increase in emphasis on individual uniqueness and multi-contextual influences, developmental and intervention/prevention science along with similar fields of research (e.g., personalized medicine, personalized learning, health communication, business marketing) have promoted the design and implementation of interventions that would tailor responses and strategies to optimize targeted outcomes based on individual needs and variability (Joyner & Paneth, 2019; Kreuter et al., 1999; Vesanen, 2007). However, in spite of the effort and resources invested in personalization in the past decades, evidence for the realization and utility of tailored interventions have been more anecdotal than quantitatively empirical. The majority of person-centered studies have been qualitative (Lerner et al., 2019). While there is little agreement on what "tailoring" means across the different fields of study, there is a consensus that the term "tailoring" and tailoring-related terms (e.g., personalization, individualization, differentiation, and customization) lack a common and feasible theoretical foundation. Consequently, this semantic crisis has made the construct increasingly difficult to conceptualize and operationalize (e.g. Economist Group, 2021; Shemshack & Spector, 2020).

Drawing on insights from the Specificity Principle, Orthogenetic Principle, and Developmental Contextualism in developmental science, this dissertation proposed a provisional definition of "tailoring": *the process of matching unique patterns of services based on each student's cumulative strengths and needs and the availability of services* (e.g., Bornstein, 2015; Lerner et al., 1998; Walsh et al., 2002; Werner & Kaplan, 1956). Guided by this definition, this

dissertation sought to find evidence of "tailoring" in one "whole-child," school-based/evidence-based Integrated Student Support (ISS): City Connects. City Connects partners with school personnel and multiple community agencies to systematically and cost-effectively allocate services/resources to students and their families from low-income communities in order to promote strengths, address needs, and mitigate risks (Moore & Emig, 2014; Dearing et al. 2016; Walsh & Theodorakakis, 2017).

After establishing a theoretically-informed basis for "tailoring" as an operationalizable construct, this dissertation employed a comprehensive, three-dimensional approach to data analysis: nomothetic (for finding general/ "universal" trends), differential (for finding differences between groups), and idiographic (for finding differences between individuals) (e.g., Lerner et al., 2019; Overton, 2015; Salvatore & Valsiner, 2010). This was to magnify the descriptive power of the data and findings. In order to accomplish this, the two exploratory substudies in this dissertation employed 1) descriptive analysis, 2) a novel approach for comparing the service patterns matched to each student's unique sets of strengths and needs, and 3) Latent Class Analysis (LCA). The major findings suggest that "tailoring" in City Connects schools is occurring in five ways: 1) *students with higher needs receive more support than students with fewer needs; 2) City Connects is adaptive in responding to the emerging needs of individuals as circumstances change in the course of time; 3) there are unique patterns of services that are either shared (two more students have the same combination of services/types of services) or unshared (only one student has a particular service pattern); 4) service patterns are related to students' developmental needs (i.e., higher risk level->higher percentages of individualized service patterns); and 5) service pattern matching is purposeful and does not occur randomly.* The implications that these findings have on theory, research, and practice are discussed.

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AMDG

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Chapter 1: Introduction

Sir Isaiah Berlin, philosopher and political and social theorist, wrote: "To understand is to perceive patterns. . . . To make intelligible is to reveal the basic pattern" (Berlin, 1997, p. 129). Thus, pattern analysis is critical to organizing and understanding data. For philosophers and scientists, perceiving congruence and incongruence, similarity and difference, uniformity and variability, unity and diversity, parts and whole is foundational to understanding both the simple and complex, interrelated networks and relationships that form and shape reality. Psychologists in particular study patterns of growth and development, patterns of thoughts, emotions, and behaviors, as well as how individuals, groups, and systems influence and transform one another.

This dissertation is a study of patterns within one Integrated Student Support (ISS) program: City Connects. City Connects has through the years developed and implemented an effective system and culture of "whole child" student support that responds to the complex needs of underserved communities in over a hundred schools in the United States and ten schools in Ireland. This dissertation examines the patterns of services tailored to individual students to combat inequality related to poverty and address its impact on children's development across multiple domains: Academic, Social/Emotional/Behavioral, Health, and Family. By examining these patterns of "tailoring" along nomothetic, differential, and idiographic dimensions, this study seeks 1) to contribute to the understanding of how an intervention like City Connects systematically customizes comprehensive services and 2) to provide a novel approach to evaluate systems of student support.

Poverty's Impact on Child Development

Poverty's detrimental effects on child development pose a critical challenge for intervention and prevention science (American Academy of Pediatrics 2016; Dearing, 2008; Walker, 2004; Walsh & Theodorakakis, 2017). Poverty is multifaceted and exposes children to risk factors that negatively impact multiple outcomes (e.g., family stability, academic performance, physical and mental health, and psychosocial wellbeing) simultaneously (Kraemer et al., 1997; Meaney, 2001; Reardon, 2011). Left unaddressed, the various risk factors become more prevalent and complex and have been shown to widen the opportunity gap and increase academic and developmental disparities (Masten & Cicchetti, 2010; Masten & Labella, 2016). For this reason, educational and public health researchers have emphasized the need for early and comprehensive assessment and intervention in order to mitigate the risks associated with childhood poverty and capitalize on the strengths and potentials that are already present in children and their families (e.g., Cates et al., 2016; Deming, 2009; Evans & Schamberg, 2009; Masten & Labella, 2016; Moore et al., 2017; Parry, 1992; President's Commission on Excellence in Special Education, 2002; Reynolds et al., 2010).

Since children spend a large portion of their lives in school, responsive and adaptive or "malleable" school-based interventions that provide critical resources to meet students' complex developmental and contextual needs are indispensable (Masten & Labella, 2016; National Center on Education and Economy [NCEE], 2005; Walsh & Murphy 2003). While two-thirds of the achievement gap is associated with out-of-school factors, many school-based interventions in the past have focused primarily on improving academic achievement and in-school behavioral problems (Reardon, 2011). Moving away from this parochial approach to intervention science, schools have within the past two decades implemented various evidence-based programs that

attempt to address students' needs and promote students' strengths holistically across multiple Developmental Domains (e.g., Academic, Social/Emotional/Behavioral, Health, and Family) (Fisher & Fisher, 2018; Jackson et al., 2016; Walker, 2004). However, these interventions tend to lack a cohesive and systematic approach for assessing each student's unique sets of strengths and needs and allocating limited resources in a cost-effective and efficient manner (Higgins-Averill & Rinaldi, 2013; Castillo et al., 2010; Eagle et. al, 2015; Freeman et al., 2015; Schiller et al., 2020). In other words, the discrepancy between research and practice further exacerbate the barriers between students and the opportunities to succeed and thrive.

Theoretical Bases

This section presents the theoretical frameworks underpinning this current study. Issues of optimizing description of human development by integrating nomothetic, differential, and idiographic information will be discussed. Further, three complementary developmental theories (Specificity Principle, Orthogenetic Principle, and Developmental Contextualism) presented below provide guidance for observing and conceptualizing the complexities of development from different theoretical perspectives. Contemplating development from the perspective of the particular, general/universal, and contextual constructs a comprehensive and holistic vision of human strengths, needs, and flourishing. This vision provides an end goal or raison d'être for research and practice in developmental and intervention/prevention science.

Integrating the Nomothetic, Differential, and Idiographic in Research

Developmental and intervention/prevention science in the past decades have emphasized the importance of taking into account multiple contextual factors and between-individual differences in research and practice (Lerner et al., 2019; Overton, 2015; Salvatore & Valsiner, 2010; Walsh et al., 2002). Theoretically, it has been established that complex needs require

holistic and dynamic systems of support that can readily handle complexity and tailor their responses to those needs. However, developmental and intervention research have been dominated by the nomothetic approaches that focus on general outcomes, differential approaches (e.g., comparing subgroups on statistical group mean differences or other quantitative and qualitative differences), and predictive models (e.g., regression models) (Beltz et al., 2016; Hill, 2021; Lerner, 2018; Lerner et al., 2019; Salvatore & Valsiner, 2010). Consequently, idiographic information, or details about particular individuals and experiences, is often eclipsed by general research findings to be applied universally.

In order to optimize explanations and descriptions of human development and improve intervention design and implementation, researchers in the past decade have emphasized the need for more quantitative approaches to idiographic research (Hill, 2021; Lerner et al., 2019; Salvatore and Valsiner, 2010). Qualitative studies make up the majority of idiographic research in the social sciences (Lerner et al., 2019; Salvatore and Valsiner, 2010). Salvatore and Valsiner (2010) assert that all science is after all idiographic, and since science is always guided by theoretical assumptions, it is also essentially nomothetic. In a sense, differential is also nomothetic and relies on data at the individual level in order to make subgroup studies possible. Integrating quantitative idiographic studies with nomothetic and qualitative studies facilitates mutual enrichment of different sources of information and increases the generalizability of research findings (Hill, 2021; Lerner, 2018; Lerner et al., 2019).

Iterative Movement between the Specific, General, and Contextual Aspects of Development

Three complementary developmental theories guide this current study: Specificity Principle, Orthogenetic Principle, and Developmental Contextualism.

As articulated by Bornstein, the Specificity Principle starts with the assumption that every individual has qualities specific to that individual alone (Bornstein, 2015, 2017; Bornstein, et al., 2017; Lerner et al., 2019). Consequently, no one's developmental trajectory is exactly the same as another's trajectory, though they may be similar (Beauchaine et al., 2009; Cicchetti, & Sroufe, 2000; Lerner et al, 2019; Meany, 2001). While the differences between individuals (groups, families, relationships, etc.) might appear small from a statistical and observational standpoints, the apparently small differences can have a big impact on an individual's life.

Whereas the Specificity Principle emphasizes the importance of specific experiences at specific times while also recognizing the importance of general and universal trends in development, Werner's Orthogenetic Principle (OP) takes a broad and universal approach without losing sight of the specific and particular. The OP provides a universally applicable description of development: it is a movement from a state of globality to increasing differentiation (Werner, 1948, 1957; Werner & Kaplan, 1956). The OP is a framework that can be used to understand biological, physiological, psychological, and behavioral changes. The process of development involves an increase in the complexity of former states and parts that need to be integrated in a way that is conducive to adaptation. A failure to integrate is an indication of poor development. In other words, development is determined more by the degree of integration rather than by physiological markers of growth through time (e.g., age, height, size, etc.) (e.g., Raeff, 2016).

Finally, Developmental Contextualism integrates ecological, lifespan, contextual, and relational developmental theories and situates the individual within multiple levels of influence (Lerner, 1991, 1995a, 1995b; Lerner et al., 1998; Walsh et al., 2002). Within this framework, individuals are active agents, or co-agents, of change within their environment. While

individuals may share a similar context, the "co-action" between individual and context (e.g., environment and relationships) is also unique to specific individuals at specific moments in time (e.g., Bronfenbrenner, 1974; Cicchetti & Sroufe, 2000; Lerner, 1995; Lerner, 2018; Lerner et al., 2019; Walsh et al., 2002). Developmental Contextualism provides a framework that takes into account general contextual factors and between individual differences.

Bridging Theory and Practice

Taken together, the relationship between nomothetic, differential, and idiographic data along with the Specificity Principle, Orthogenetic Principle, and Developmental Contextualism serve as theoretical foundations that ground the intervention that is the focus of this study (i.e., City Connects). Developmentally informed interventions and research aim to integrate the general and the particular, the simple and the complex, and the contextual and the individual. Taking a multidimensional approach to the study of development, it becomes apparent that there are aspects in the course of development that are constant and those that are in flux across time. For this reason, intervention science is tasked with a double mission of systematically maintaining order and stability or uniformity and allowing flexibility that promotes the emergence of variability or diversity that is both adaptive and healthy. Thus, based on these theoretical understandings, researchers have proposed that a holistic or "whole child" integrative approach to school-based intervention that exemplifies four essential tenets for effective practice in developmental science: comprehensive, customized, coordinated, and continuous (e.g., Moore et al., 2017; Walsh et al., 2002; Wasser Gish, 2019). An environment that meets these tenets increases a child's opportunity to thrive and succeed.

The following sections will describe the framework (Integrated Student Supports) of an exemplary approach (City Connects) to school-based intervention that is rooted in developmental science.

Integrated Student Supports (ISS)

Beyond the availability and accessibility of funding and other resources, developmentally sound approaches to intervention aim to 1) address both in and out-of-school barriers to academic performance and overall well being (comprehensive), 2) allocate resources according to each child's unique and contextualized strengths and challenges (customized), 3) have a systematic implementation strategy that fosters collaboration of stakeholders (coordinated), and 4) is data-informed to monitor student progress (Center for Optimized Student Support, 2019; Moore et al., 2017; Wasser Gish, 2019). Within this context, Integrated Student Supports (ISS) emerged as a viable system for creating an environment and culture of organized and strategic collaboration and support.

Different models of ISS (e.g., Comer Process, Community in Schools, and City Connects, Beacon Initiative, Children's Aid Society Community Schools, etc.) vary in their approaches to "whole child" support but share to some extent the four characteristics of effective practice derived from developmental theories and research (Moore et al., 2017; Wasser Gish, 2019). Nevertheless, through the years, several different ISS models have been shown to improve students' academic outcomes in a cost-effective manner. For example, in 2014 Child Trends reviewed the evaluations of three exemplary models of ISS known for their rigorous research methodologies and positive impact: Comer Process, Community in Schools, and City Connects. Of the 11 evaluations, 4 were randomized-controlled trials (RCTs) and 7 were quasi-experimental studies (QEDs) (Moore & Emig, 2014). The QEDs showed significant

improvement in academic achievement and school attendance. The RCTs results were mixed and inconsistent. In 2017, eight more rigorous evaluations were reviewed, and the results confirmed that the overall impact of ISS interventions were either positive or null. Results that showed negative effects were rare (Moore et al., 2017).

ISS Mechanism of "Tailoring"

Research continues to confirm that developmentally-sound and empirically-based models of ISS are both efficacious and cost-effective. However, there is a lack of research on the mechanisms that contribute to the success of ISS models and school-based interventions in general. In other words, the question "Does it work?" often eclipses the more fundamental question of "Why/How it works?" (McMaster et al., 2005; Walker, 2004). As Walker (2004) wrote: "the first generation of scientific studies of interventions has had a dual focus on outcomes and proving that they work and the next generation of studies will illustrate how and why interventions work" (p. 402). Educational and clinical research is often aimed at finding statistical associations between different variables and predicting outcomes for universal application. However, there are few studies that seek to elucidate the changes and variability that the bi-directional exchanges between individuals and interventions might entail.

One mechanism that ISS models attribute to their effectiveness is the "tailoring" or customization of support plans and services according to students' needs. For example, in 2012, the Community in Schools (CIS) chairperson and president stated: "[CIS coodinators] assess school and students' needs and tailor services to respond to those needs" (Community in Schools, 2012, p. 3). Johnston et al. (2017) stated: "A successful community school has a clearly defined strategy for properly identifying the needs of its students and school community and a plan for securing the resources and tailored services to meet those identified needs" (p.10). James

Comer, psychiatrist and professor at Yale School of Medicine and founder of the Comer Process, said: "The Comer Process...encourages a flexible, and almost custom-tailored approach to each child" (Marriott, 1990, as cited in Rosenberg, 2013). Wasser Gish and Walsh (2017) of City Connects asserted that "integrated student support drives the right set of school- and community-based resources to the right child at the right time, over time" (p. 2). While a school's general needs also shape ISS's decision making and response, the "tailoring" process of needs assessment and service matching is primarily child-centered.

"Tailoring" and "Tiering"

Based on over two decades of practice and experience informed by developmental science, ISS models have identified "tailoring" as a critical mechanism of change (City Connects, 2020; Emmons & Comer, 2009; Johnston et al., 2017; Parise et al., 2017; Wasser Gish, 2019). Of the four developmental tenets for effective practice, "customized" can be used interchangeably with "tailored." The basic assumption behind this concept is that since each individual is unique, each individual requires a unique or distinct, customized adaptation of a particular intervention (e.g., Bornstein, 2015, 2017; Chan & Ginsburg, 2011; Hill, 2021; Kreuter et al., 2000; Lerner et al., 2019). In other words, one size does not fit all. However, "tailoring" is a challenging construct to operationalize (e.g., Blackwell & Rosetti, 2014; Hawkins et al., 2008; Ivey & Broaddus, 2000; Reber et al., 2018; Rotter, 2014; Shemshack & Spector, 2020; Zmuda, 2015). Across different areas of study in intervention science (e.g., health messaging, personalized medicine, education) and business marketing (e.g., advertisement), there is little agreement on how to define and measure "tailoring" (Chan & Ginsburg, 2011; Hawkins et al., 2008; Joyner & Paneth, 2019; Kreuter et al., 1999; Schumann et al., 2007; Vesanen, 2007). Its use and effectiveness are for the most part anecdotal rather than empirically demonstrable.

Unlike the other three developmental tenets for effective practice (comprehensive, coordinated, and continuous), "customized" or "tailored" is most elusive. Currently there are no studies that have examined "tailoring" both as a construct and an active ISS mechanism.

Many school-based interventions including models of ISS use the Multi-tiered System of Support (MTSS) (Batsche, et al., 2005; Benner et al., 2013; Institute of Medicine, 1994; Walker, et al., 1996). Using this three-tier public health framework, schools categorize services based on their level of intensity or degree of individualization (i.e., the more individualized, the more intense; Tier 1 = universal programs, Tier 2 = targeted/group intervention, Tier 3 = intense/individualized). Within the MTSS framework, all students receive Tier 1 services, and Tier 2 and Tier 3 services are utilized for students who need further support beyond enrichment. However, MTSS focuses primarily on academic and behavioral interventions and varies significantly in its implementation across schools (Batsche, et al., 2005; Bender, 2009). Such inconsistency makes it difficult to discern a characterizable and cohesive pattern in needs assessment and service matching (Higgins-Averill & Rinaldi, 2013; Castillo et al., 2010; Eagle et. al, 2015; Freeman et al., 2015; Petagourakis, 2021; Schiller et al., 2020). Further, the needs of every child are typically not assessed but only children who present significant needs. Rather than taking a preventive approach, MTSS responds to needs as they arise.

ISS models provide the structure and organization to optimize the use of the MTSS framework (Moore et al., 2017). The categorization of services according to their intensity is coupled with a systematic and thorough approach to needs assessment, service delivery, and progress monitoring along with a strategic plan for collaboration among stakeholders. ISS' "whole child" approach responds to needs holistically across multiple Developmental Domains to mitigate the accumulation of risks that could lead to more complex and challenging needs

(e.g., Cicchetti & Sroufe, 2000; McIntosh & Goodman, 2016; Moore et al., 2017; Shogren et al., 2016; Walsh et al., 2002). Thus, ISS creates an environment that facilitates the customization of support plans for individual students in a way that MTSS alone could not.

City Connects

An exemplary ISS model that has significantly fine tuned the "whole-child" approach to school-based intervention over the past two decades is City Connects. City Connects schools have consistently scored higher on standardized tests, have higher report card grades, have lower grade retention, have lower probability of absenteeism and dropping out than comparison schools (City Connects, 2016, 2018, 2020; Lee-St.John et al., 2018; Walsh et al., 2014). English Language Learners (ELL) in City Connects schools attain an equivalent level of literary proficiency as their native English-speaking peers by third grade (City Connects, 2010; Dearing et al., 2014).

Besides adapting the levels corresponding to those in the MTSS framework to tiering services based on their intensity, City Connects is currently the only ISS model that assigns a provisional "Tier of Strengths/Risks" (1 = minimal risk; 2a = mild risk; 2b = moderate risk; 3 = high risk) to each individual child based on their cumulative sets of strengths and needs. Though most students are matched with the intensity of the services that mirrors the intensity of their needs, the services that each child receives are not constrained neither by the Tier of Services nor the Tier of Strengths/Risks. For example, a student assigned to Tier 1 might be receiving a Tier 3 service due to specific family needs at a specific moment in time, but overall the student has strengths that appear to support his academic performance. A Tier 2b student might benefit from Tier 1 enrichment services that could decrease the likelihood of that student from moving from Tier 2b to Tier 3. Both the assignment of provisional student "Tier of Strengths/Risks" along

with the flexibility of matching Tier of Services with Tier of Strengths/Risks is preliminary indication that every single child is being assessed and monitored and that the between individual differences are being taken into account in the process of tailoring plans of support.

Working Definition of "Tailoring"

Drawing from developmental theories, research on school-based interventions and other fields in prevention and intervention science (i.e., health communication and personalized medicine), as well as implementation science, the following provisional definition/description of "tailoring" will guide this study: "Tailoring" is the process of matching unique patterns of services on the basis of each student's unique, cumulative strengths and needs, taking into account the local availability of services. While this definition can be applied to multiple level of contexts (e.g., schools, districts, etc.), this study is student centered and will focus on the needs, strengths, and contexts of individual students. It should be noted that with regards to service patterns, "unique" refers to combinations of services that are distinct from one another. A "unique pattern" can refer to both a pattern shared by multiple individuals and a pattern assigned to only one individual. Whether shared (more than one student has the same combination of services) or unshared (only one student has a particular combination of services), a pattern is unique if it is distinct from all the other patterns.

Current Study

This study consists of two related substudies that seek to examine the practice of matching the right services and supports to each student's cumulative strengths and needs at a specific moment in time. City Connects, a developmentally-sound and empirically well-established ISS model, is chosen for this study. Since City Connects 1) has over 20 years of experience in intervention design and implementation, 2) has consistently shown through

rigorous research methods positive immediate and long-term impact on multiple student outcomes, 3) can demonstrate through fidelity of implementation measures that each individual child's needs are assessed across multiple Developmental Domains, and 4) monitors student progress regularly, City Connects in particular, among various ISS models, is an excellent example for this study (e.g., City Connects, 2010, 2012, 2014, 2016, 2018, 2020).

Integrating quantitative nomothetic, differential, and idiographic information on the matching of in- and out-of-school services according to each students' cumulative strengths and needs, this study fills in the gap in the literature regarding a critical mechanism in school-based interventions: the "tailoring" or customization of support plans and services to each individual student's needs. Expounding on this construct would fill the conceptual gap between needs assessment and service matching. Moving beyond the question of overall effectiveness of the intervention, understanding how and to what extent City Connects matches "the right services to the right child at the right time" would inform ways to improve needs assessment and efficiency in allocating limited resources. Furthermore, the elucidation of the current practice of tailoring in City Connects, a research-informed practice, will further inform research for future practice.

This study seeks to answer the following overarching research question:

What is the evidence that services and supports are being tailored to each individual student in City Connects schools?

Specifically, using relatively small data sets, the first substudy (Study 1), a preliminary exploratory study, will aim to answer the following questions:

1) What is the evidence for tailoring based on the aggregate descriptive information?
    a) What is the relationship between Students Tiers of Strengths/Risks and the Tiers/Categories of Services received?

i) What is the distribution of students across Tiers of Strengths/Risks (i.e., number/percentage of students in Tier 1, Tier 2a, Tier 2b, and Tier 3)?

ii) What is the mean number of services received per student in each Tier of Strengths/Risks?

iii) Across Tiers of Services (Tier 1, Tier 2, and Tier 3), what is the distribution of Student Tiers of Strengths/Risks (e.g., What percentage of Tier 1 students received at least one Tier 3 service)? Across Student Tiers of Strengths/Risks, what is the distribution of Tiers of Services (e.g., Of the services Tier 1 students received, what percentage was Tier 3 services)?

2) What evidence is there for tailoring in City Connects based on the analysis of patterns/combinations of services?

i) Overall, how many unique patterns/combinations of services are there within a classroom? Following most of the same students within the current classroom back two years, how many unique patterns/combinations of services are there within a cohort (mostly same students, different classrooms)?

ii) Are there unique patterns/combinations of services among students within the same Tier of Strengths/Risks?

iii) How different are the patterns/combinations of services? (i.e., Do they differ by one or two services or are there dramatic differences?)

iv) For the same students across three years, do the students who did not share a pattern and the students who did share a pattern continue to do so in subsequent years?

Building on Study 1, using a larger data set, the second substudy (Study 2) seeks to replicate the findings in Study 1 and expands the investigation of the construct and practice of tailoring comprehensive services to individual students. Similar to Study 1, Study 2 will answer the following research questions:

1) What is the evidence for tailoring based on the aggregate descriptive information?

    i) What is the distribution of students across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3)?

    ii) What is the mean number of services received per student in each Tier of Strengths/Risks?

    iii) Across Tiers of Services (Tier 1, Tier 2, and Tier 3), what is the distribution of Student Tiers of Strengths/Risks (e.g., What percentage of Tier 1 students received at least one Tier 3 service)? What is the distribution of Tiers of Services across Tiers of Strengths/Risks (i.e., number/percentage of students in Tier 1, Tier 2a, Tier 2b, and Tier 3 receiving Tier 1 Services, Tier 2 Services, Tier 3 Services)?

    iv) Across Student Tiers of Strengths/Risks, what is the distribution of Tiers of Services (e.g., Of the services Tier 1 students received, what percentage was Tier 3 services?)

2) What evidence is there for tailoring in City Connects based on the analysis of patterns/combinations of services?

    i) Overall, how many unique patterns/combinations of services are there across the district?

ii) Are there unique patterns/combinations of services among students within the same Tier of Strengths/Risks?

iii) Are there different patterns/combinations between and among students within a sample of classrooms within the same school? How unique are the patterns/combinations of services? (i.e., Do they differ by one or two services or are there dramatic differences?)

3) Are there discernible latent patterns of service delivery in the district?

a) Across Tiers

b) Given the following covariates:

i) Demographics: grade. school, gender, race, English Language Learner (ELL), immigrant status, Special Education status (SPED), and low income flag/indicator

ii) Dosage (i.e., the number of years receiving City Connects intervention)

Chapter 2: Literature Review

This chapter situates the current study within the existing literature on the "tailoring" or customization of critical services in school-based student support initiatives. A discussion on nomothetic, differential, and idiographic approaches to research along with a presentation of person-centered, organismic, and probabilistic epigenetic developmental theories provide a framework for understanding the contexts and mechanisms that make for effective practice. Specifically, Integrated Student Supports (ISS) has been identified as one exemplary model that systematically allocates limited resources to meet the complex needs of students from under-resourced communities. ISS' effectiveness has been attributed to the mechanism of "tailoring" unique support plans for each individual student with unique sets of strengths and needs. However, this attribution is more anecdotal than quantitatively empirical. On the one hand, there is a lack of agreement on the construct of "tailoring" in school-based interventions. On the other hand, the research on the operationalization of the construct is practically non-existent. To address this gap, this study uses a highly regarded and well-established ISS, City Connects, to explore further the construct and mechanism of "tailoring."

This review of the literature is structured as follows: presentation of the theoretical frameworks that elucidate the need for the integration of the nomothetic and idiographic in both research and practice; overview of poverty's impact on children and the dilemma of allocated limited resources; introduction to Integrated Student Supports (ISS) as an exemplary model for school-based intervention; the challenges of operationalizing "tailoring" and its relationship to a prevalent approach to intervention science: "tiering"; overview of City Connects to show why it is a most appropriate candidate for the exploration and understanding of "tailoring."

Poverty's Impact on Children and Allocation of Limited Resources

Poverty contributes to in- and out-of-school barriers to students' success and wellbeing (American Academy of Pediatrics 2016; Dearing, 2008; Walker, 2004; Walsh & Theodorakakis, 2017). It is well established that poverty and out of school factors contribute to two-thirds of the academic achievement gap (Reardon, 2011). Furthermore, limited access to basic resources has been shown to increase the likelihood of poor health and developmental delays in young children (Walsh & Theodorakakis, 2017). Family income, for example, has been shown to be strongly associated with students' educational outcomes especially if the onset of poverty occurred during early childhood (Brooks-Gunn & Duncan, 1997). Such negative outcomes widen the opportunity gap and increase academic and developmental disparities. Educational and public health policies have recommended early identification of risks and timely intervention to address these complex needs (e.g., Cates, et al., 2016; Deming, 2009; Evans & Schamberg, 2009; Masten & Labella, 2016; Reynolds, Temple, & Ou, 2010; President's Commission on Excellence in Special Education, 2002; Moore et al., 2017).

Designing evidence-based interventions that deliver critical and "wrap-around" services to students and families given the limited resources and unlimited needs has been particularly challenging for the field of prevention and intervention science (Walker, 2004). With the No Child Left Behind Act (NCLB) in 2001 and Every Student Succeeds Act (ESSA) in 2015, more effort was directed toward identifying schools in high-poverty communities and directing funds toward resources (e.g., evidence-based programs, assessment, progress monitoring) that promoted student success. However, having more resources did not guarantee better outcomes. A study that looked at the relationship between school spending and academic outcomes in Michigan showed no significant correlations (DeGrow & Hoang, 2016). The National Assessment of Educational Progress (NAEP) also found no correlation between public school

spending and student achievement (National Center for Education Statistics, 2020). While there is no doubt that availability and accessibility of resources are indispensable in improving the conditions of communities in extreme poverty, having a systematic and theory-driven approach to allocating those resources is just as crucial (Fisher & Fisher, 2018; Jackson et al., 2016; Walker, 2004).

Theoretical Frameworks in Developmental Research and Practice

This section provides the theoretical frameworks that support this study's exploration of the construct of "tailoring." This section will begin with a discussion on the need to integrate nomothetic, differential, and idiographic approaches to research with an emphasis on quantitative idiographic research. Then, a presentation of the Specificity Principle will highlight the importance of person-centered research and its implications for practice in an age dominated by variable-centered research and prediction modeling. Finally, Orthogenetic Principle and Developmental Contextualism provide the overarching or "big-picture" frameworks for understanding and explaining, rather than predicting, the dynamics and direction of development in general.

Nomothetic, Differential and Idiographic Tension in Research

A perennial tension has characterized philosophical inquiry through the ages: the tension between the universal and the particular, the one and the many (Clarke, 2001; Overton, 2015). Inductive generalizations and laws of nature based on patterns and trends in the real world continue to face the challenges of accounting for the myriads of anomalies present in the unique experiences of individuals and across groups. At the same time, according to Aristotle, though particulars are what truly exists, "[t]he acquisition of scientific knowledge is impossible without universals" (Aristotle & Lawson-Tancred, 1999, p. 425). Without guiding universals or

commonalities shared among particulars, scientific inquiry would be restricted to each particular, isolated—albeit real—experience, and the comparison of the multitude of unique experiences would be impossible. Commenting on this paradox, the late Jesuit Father W. Norris Clarke (2001), a leading 21st century Thomistic scholar, wrote: "I am compelled to affirm that every single real being, compared to every other, is at once similar to every other, because each one is, exists, is real; and yet dissimilar to every other, because each one is precisely this being and not that one" (p. 73). Critical inquiry that moves between the universal and particular—one and many, commonality and diversity, part and whole—elucidates the understanding of reality.

Specifically, in the social sciences, the perplexing relationship between the nomothetic (general trends and the laws that govern them) and idiographic (particular and unique manifestation of a phenomenon) has posed a challenge to the search for comprehensive knowledge of human development and behavior (Salvatore & Valsiner, 2010). Adding to the tension and complexity between the nomothetic and idiographic, social scientists also take into account a third source of information: the differential (grouping individuals based on shared attributes) (Lerner, 2018; Lerner et al., 2019; Overton, 2015). In a sense, differential is also nomothetic and relies on data at the individual level in order to make subgroup studies possible. While there is a general consensus that nomothetic, differential, and idiographic information are essentially interdependent, there is less agreement on where to place the emphasis in both research and practice (Lamiell, 1998, 2003; Lerner, 2018; Lerner & Lerner, 2019; Lerner et al., 2019; Salvatore & Valsiner, 2010).

Clinical and developmental research in the last century has tended to emphasize the nomothetic and differential at the expense of the idiographic (Lerner, 2018; Lerner et al, 2019; Salvatore & Valsiner, 2010). However, generalized or scientific knowledge ultimately relies on

the integration of the particular and universal (Beltz et al., 2016; Salvatore & Valsiner, 2010). While patterns and trends at the inter-individual level lay the foundation for generalizations, general patterns and trends do not necessarily confirm definitively the universality or generalizability of a particular phenomenon occurring within a specific context (Lamiell, 1998, 2003; Salvatore & Valsiner, 2010). Human development at the group-mean level does not always coincide with development at the individual level (Bornstein et al., 2017; Hill, 2021; Lerner, 2018). Understanding development requires interpreting the group-mean level in the context of the individual level, and vice versa. Thus, an iterative process of moving between the nomothetic, differential, and idiographic is a prerequisite of epistemological integration.

Researchers in recent years have advocated for idiographic or person-centered (inter- and intra-individual) analysis that would further enrich generalized knowledge (Beltz et al, 2016; Gayles & Molenaar, 2013; Hill, 2021; Lerner & Lerner, 2019; Molenaar & Nesselroade, 2012; Rose, 2016). Hill (2021) observed: "The field of developmental science has focused implicitly and explicitly on disaggregating lived experience into discrete variables and constructs and then demonstrating co-relations among the variables" (p. 3). Though there is a proliferation of qualitative studies (e.g., Community-based Participatory Action Research) in the past decades, there is also a "relative absence of rigorous quantitative methods useful for understanding the role of person-specific variation within the integrated (nomothetic-differential-idiographic) system" (Lerner et al., 2019, p. 496). Advancing quantitative idiographic approaches to take into account the diversity of developmental pathways among individuals across diverse groups contributes to "finding the specific ways needed to enhance the specific lives of specific individuals at specific times in specific places" (Lerner & Lerner, 2019, p. 36).

Specificity Principle

To understand further the need for an emphasis on idiographic research and its implication for practice, the Specificity Principle elaborates on how person-specific differences require person-specific interventions. Considering the discrepancies in the literature on parenting practices, Bornstein (2015) formulated the Specificity Principle in the following way: "The *specificity principle* states that specific cognitions and practices on the part of specific parents at specific times exert specific effects over specific children in specific ways" (p. 77). In other words, it is not overall parenting that impacts overall developmental outcomes in children, but rather specific actions targeted at specific deficiencies/strengths in a specific context within a specific relationship at a specific time are most impactful. The Specificity Principle provides a framework for accounting for anomalies among and discrepancies between particularities that developmental stage theories (e.g., Erickson, 1950; Freud, 1949; Kohlberg, 1984; Piaget,1970; Selman, 1980) and categorical approaches to human behavior have subjected to the universal (Bornstein, 2015, 2017; Jensen et al., 2006; Lerner & Lerner, 2019; Lerner et al., 2019; Rose, 2016; Walsh et al., 2002).

Every person has a unique developmental trajectory (Beauchaine et al., 2009; Cicchetti, & Sroufe, 2000; Learner et al., 2019; Meany, 2001). Often, the person-specific variations might be negligible from a statistical group-mean or nomothetic standpoint, but from the perspective of an individual (or family, relationship, school, community, culture, etc.), small differences can make a big impact (Bornstein, 2017; Hill, 2021; Lerner et al., 2019). In terms of developmental research, Hill (2021) averred: "In considering research design, the Specificity Principle challenges us to consider the whole person and as such an integration of the important constructs into the lived experiences of individuals and families" (p. 3). This approach is meant to be a corrective to the dominant research designs overly focused on between-group means and on

analysis of variables to establish causation and predict outcomes (Bornstein, 2017; Hill, 2021). Studying the "whole person" requires methodologies that are able to integrate person-centered and variable-centered types of analyses (Hill, 2021).

In terms of practice, given that most variations between individuals are small, it is unnecessary to design an entirely separate or radically modified intervention for each individual person. Doing so lacks theoretical justification and would be costly, which would then further create barriers to availability and accessibility of resources (e.g., Chan & Ginsburg, 2011; Evers et al., 2012). Following the Specificity Principle, slight modifications—or idiographic adaptations—made within a well-designed, well-implemented, and empirically established intervention in response to person-specific, idiographic differences could be enough in most cases to produce the desired outcomes for individuals (e.g., Bornstein, 2017; Ghate, 2015; Hill, 2021). Contrary to the opinion that development meant an increase in variability, Jaan Valsiner & van Dijk (2000) argued: "A more adequate claim would be that development entails constant modification of the range of variability of the phenomena that the developing organism can display at any next moment - inventing new versions of conduct and 'dropping off' others" (p.25). Thus, a critical feature of an effective intervention is its flexibility and efficiency in responding to specific modifications at specific moments in the course of development.

Rather than competing with nomothetic approaches to research, the Specificity Principle complements them (Bornstein, 2017; Hill, 2021). General trends make apparent the inconsistencies and discrepancies at the idiographic level. Without universals, every phenomenon would be completely random and unrelated. The world is generally experienced as a unity. However, moving beyond a "one size fits all" approach increases explanatory power and optimizes intervention efforts (Bornstein, 2017; Hill, 2021; Lerner et al., 2019; Rose,

2016). Thus, the Specificity Principle offers a framework for integrating the nomothetic, differential, and idiographic.

Orthogenetic Principle (OP)

Whereas the Specificity Principle emphasizes the importance of specific experiences at specific times while recognizing the importance of general and universal trends in development, Heinz Werner's Orthogenetic Principle (OP) takes a broad and universal approach without losing sight of the specific and particular. Werner conceptualized the "Orthogenetic Principle" (OP), a foundational framework for developmental psychopathology and developmental psychology in general. This universally applicable principle based on organismic theories states: "[W]herever development occurs it proceeds from a state of relative globality and lack of differentiation to a state of increasing differentiation, articulation, and hierarchic integration" (Werner, 1957, p.126). An earlier version of the principle also included the idea that the later evolved higher forms/states coexist with the older, lower forms/states (Werner & Kaplan, 1956). In other words, traces of the old always remain in the new. Development occurs when complex structures or functions (e.g., physiological, linguistic, cognitive, affective, behavioral, cultural, etc.) emerge from less complex structures and are organized into a coherent, *integrated* whole (e.g., Valsiner, 2000; Werner, 1948). Integration is "hierarchic" because previous structures and functions are not eliminated to make way for newly evolved ones but ordered for adaptation, unity, and stability amid changes and the instability they may entail (Raeff, 2016).

The OP offers a flexible framework for organizing and synthesizing findings in developmental research. It provides a guiding direction for thinking about the processes and end goal of development. Unlike stage theories of development, the OP is not specific about concrete outcomes and benchmarks (Raeff, 2016). Further, similar to other organismic and probabilistic

epigenetic frameworks of development, the Orthogenetic Principle is not a predictive model (e.g., Gottlieb, 1991; Raeff, 2016; Werner, 1957). However, it provides an integrative explanatory framework for grappling with multidimensional and complex dynamics of development that are often treated as fragmented and solitary processes in developmental science (Raeff, 2016; Walsh et al., 2016). The value of the Orthogenetic Principle lies within its power to explain and describe rather than predict specific outcomes. As Raeff (2016) emphasized: "It is thus critical not to conflate predicting with either explaining or understanding…. We do not have to be able to predict future events in order to understand and/or explain current or past ones" (p. 69).

Developmental Contextualism

Finally, Developmental Contextualism is a broad framework that integrates multiple factors across multiple levels of ecological systems (e.g., microsystem, mesosystem, exosystem, and macrosystem) that are in continuous, dynamic relationships with individuals (Lerner, 1995a, 1995b; Walsh et al., 2002). While multiple levels of contextual influence dictate certain aspects of human development, within a contextual developmental framework, outcomes are to a certain extent probabilistic rather than predetermined, and individuals are agents of change (Lerner, 1995a, 1995b). In the bidirectional exchange between individuals and environment, individuals can affect the trajectory of their own development, the trajectory of others' development, and the environment or ecological systems they are in (Lerner, 1991, 1995a, 1995b).

There are aspects of an individual's life course that are constant (continuity) and there are aspects that are subject to change (discontinuity), but constancy and change are to a certain extent not predetermined and are relative to each individual and their contextual conditions. At the same time, the general process of development that gives individuals their individuality is

also paradoxically an aspect of development that is common and constant. Studying diverse patterns of interactions across diverse contexts through time provides clues as to why certain processes or functions remain constant and why others change and why there are variations between individuals and groups (Lerner, 1995b).

Bridging Theory and Practice

As shown above, the Specificity Principle is essentially contextual, but its emphasis is on individual variations given specific experiences, at specific moments within specific contextual conditions (Bornstein, 2017). However, the degree of specificity also depends on the co-actions or transactions between multiple factors at the individual, social, and environmental levels across lifespan (e.g., Lerner, 1995a, 1995b; Lerner et al., 2021; Cicchetti & Sroufe, 2000; Walsh et al., 2002). Developmental Contextualism's emphasis is on the multiple contexts that influence the general direction of developmental pathways without losing sight of person-specific differences. Considering the relationship between specificity and context, individuality and commonality, in research and practice will unlikely generate statistical models that predict outcomes but will likely provide an integrative description of human development (Hill, 2021; Lerner & Lerner, 2019; Lerner et al., 2019).

Taken together, the relationship between nomothetic and idiographic data along with the Specificity Principle, Orthogenetic Principle, and Developmental Contextualism serve as theoretical foundations that ground the intervention that is the focus of this study (i.e., City Connects). Developmentally informed interventions and research aim to integrate the general and the particular, the simple and the complex, and the contextual and the individual. Based on these theoretical understandings, researchers have proposed that a holistic or "whole child" integrative approach to school-based intervention exemplifies four essential tenets for effective practice in

developmental science: comprehensive, customized, coordinated, and continuous (e.g., Center for Optimized Student Support, 2019; Moore et al., 2017; Walsh et al., 2002; Wasser Gish, 2019).

The following sections will describe the framework (Integrated Student Supports, ISS) of an exemplary approach (City Connects) to school-based intervention that is rooted in developmental science. The challenges of operationalizing the ISS mechanism of "tailoring" will be presented. A discussion on the relationship between "tailoring" and "tiering," a more familiar and tangible construct, will help further elucidate the construct of "tailoring" and its role in an ISS model.

Integrated Student Supports (ISS)

In the past decades, schools have proven to be propitious centers for implementing evidence-based student support systems that reduce the detrimental effects of risk factors and promote children's development and learning especially in under-resourced communities (Coltoff, 2005; Dryfoos, 1999; Walsh & Wieneke, 2009). Applied intervention and prevention science has generated many strengths-based K-12 school-based programs that show promise in improving students' psychosocial, emotional, and educational outcomes (Borman et al., 2017). Among the many approaches to school-based intervention, there is one exemplary approach to meeting students' in- and out-of-school needs: Integrated Students Supports (ISS) (Moore et al., 2017).

Integrated Student Supports (ISS) are developmentally-informed and evidence-based interventions that target students' in- and out-of-school needs (Moore & Emig, 2014). Though there are variations in the design and implementation of different ISS models, ISS in general are "whole-child" approaches to intervention. In contrast to previous approaches to school-based

interventions (e.g., those focused primarily on either academic achievement or behavioral problems), ISS aspires to deliver "customized, comprehensive, coordinated, and continuous" resources and services to students and their families (Wasser Gish, 2019). In other words, the specific needs of every child are considered across multiple domains (e.g., school, health, family, social-emotional), and doing so involves the collaboration of multiple stakeholders and institutions/programs within and beyond the school. ISS' systematic allocation of resources have been shown to significantly improve students' academic performance and social-emotional well being (Moore & Emig, 2014; Moore et al., 2017; Dearing et al. 2016; Walsh et al., 2014). Regular monitoring of outcomes and fidelity of intervention implementation through rigorous data collection and analysis guide improvement efforts (City Connects, 2016, 2020; Moore et al., 2017).

In the past two decades, several ISS have proven to be effective in improving outcomes across Developmental Domains (i.e.., Academic, Social/Emotional/Behavioral, Health, and Family) for students from under-resourced communities (Moore & Emig, 2014; Gish, 2019). Among these ISS are programs/interventions such as the Comer Process (CP), Community in Schools (CIS), and City Connects (CC). The common elements these ISS share include universal needs/risk assessment, collaborative effort within and beyond the school to match services to students/school needs, addressing both in and out-of-school needs, and data-driven decision making and evaluation (Dearing et al. 2016; Emmons & Comer, 2009; Parise et al., 2017). These exemplary ISS models have been shown to effectively mitigate the achievement and opportunity gaps. ISS models foster an organized, dynamic, and collaborative environment that optimizes student success.

Most of the studies carried out to confirm the effectiveness of these interventions are quasi-experimental rather than randomized-controlled trials (RCT). This is understandable since random assignment is not always possible or ethical when it comes to withholding certain necessary services to students (City Connects, 2016). While the majority of the research on ISS has been focused on their overall effectiveness of interventions, few studies have looked at the mechanisms that contribute to their effectiveness. Community in Schools (CIS), for example, conducted a rare study involving a randomized control trial to test the effect of one aspect of CIS: case management for students with high risk of dropping out of school (Parise, 2017). Results showed positive effects for non-academic factors (e.g., perception of school and home climate, quality of relationships, etc.) but no effects for academic factors (e.g., absenteeism, grades, suspensions, etc.). City Connects has used rigorous statistical methods (e.g., difference-in-difference, hierarchical linear regression, longitudinal growth models, propensity score adjustment, etc.) to confirm robust, positive effects on student outcomes, but have conducted few studies to examine the core mechanisms contributing to the intervention's overall effectiveness.

What is "Tailoring"?

One mechanism to which many of the ISS models attribute their effectiveness is that of "tailoring" in- and out-of-school services to the needs of each individual student (e.g., City Connects, 2020; Emmons & Comer, 2009; Johnston et al., 2017). Tailoring or customization of an intervention to the specific needs of individuals has been the topic of discussion and debate in several fields of research including communication, medicine, and education (Altendorf et al., 2020; Joyner & Paneth, 2019; Zmuda, 2015). The underlying rationale for tailoring is that

individuals are unique with specific sets of needs and strengths. Consequently, treatment or intervention has to be altered to some degree to address those between-individual differences.

Theoretically and practically, tailoring interventions to the specific needs of each child is logical and commonsensical, but also proven difficult to articulate and operationalize. "What is tailoring?" and "How do we know it's happening?" are perplexing but foundational questions that have not been adequately addressed in the literature. Often in the field of prevention science, researchers seek to prove that an intervention works rather than examining a more fundamental question of why and how it works (Ghate, 2015; McMaster et al., 2005; Walker, 2004). This section explores in depth the evidence that points to the mechanism of "tailoring." First, the problem of articulating what "tailoring" is will be presented. Then, "tiering" (i.e., Multi-Tier Systems of Support, MTSS), a concept closely related to "tailoring," will be examined. Finally, it will be shown how Integrated Student Supports (ISS) serves as a bridge between "tailoring" and "tiering."

The Challenge of Defining and Operationalizing "Tailoring"

Similar to the literature on tailoring across different fields of intervention and prevention science, literature on school-based interventions such as ISS models describe processes that are related to tailoring (i.e., assessing, tiering, matching, etc.), but there is a lack of a common definition or description of the construct. Furthermore, many "tailored" interventions tend to focus on either academic or behavioral outcomes rather than holistic and integrated "whole-child" supports. For example, Reber et al. (2018) identified three types of "personalization"—context, choice, and active—to increase student classroom interest. Similarly, Zmuda (2015) used the term "personalization" to mean making learning material explicitly relevant to the students to increase engagement. Ivey & Broaddus (2000) used the term "tailoring" to refer to

increasing student choice and autonomy by adjusting reading lessons based on regular student-teacher interactions. Another term related to tailoring is "individualization," and it is often associated with the Individualized Education Plan (IEP) for children with learning disabilities (Blackwell & Rossetti, 2014; Rotter, 2014). Finally, the term "differentiation" refers to an approach of grouping or "differentiating" students within the same classroom according to their learning pace (Levy, 2008). Instruction is "tiered" based on the level of difficulty to meet each group's strengths and needs.

While some researchers have indicated that there is a lack of reliable and validated criteria or assessment tools for the personalization, individualization, and differentiation of students, others question the validity of the constructs themselves (e.g., McMaster, et al. 2015; Stedeke, 2017). What distinguishes these tailoring-related terms (e.g., personalization, individualization, and differentiation) from another is not always apparent and attempts to operationalize them for quantitative analysis are lacking. For example, in one systematic review of the different terms for "personalized learning" (e.g., adaptive learning, individualized instruction, customized learning, etc.), Shemshack & Spector (2020) argued that a major obstacle to the personalized learning movement in the past decades is a lack of agreement on what personalized learning is in the first place. With the hope in technology to transform education reignited during the Covid-19 pandemic, a relatively recent report echoes the call to find a solution to this semantic crisis that has made personalized learning as a philosophical ideal difficult to operationalize (Economist Group, 2021). Further, since it has become apparent that the use of technology with the aim to facilitate learning, though helpful, cannot replace the teacher-student relationship and feedback loop, the report warns about conflating personalization with technologization (Economist Group, 2021; Stillson & Nag, 2009).

Of the different fields of intervention and prevention science (e.g., school-based intervention, personalized medicine, etc.), health communication or messaging has made notable efforts to quantify "tailoring" based on theoretical frameworks (e.g., cognitive processing theories). The number of unique messages or unique combinations/patterns of messages used for behavioral intervention (e.g., smoking cessation, weight loss) have been calculated and the effects of such tailoring on desired outcomes were tested (Hawkins et al., 2008; Kreuter et al., 1999; Kreuter et al., 2000; Strickland et al., 2015). The effects of messages tailored according to the attributes of individuals and groups have shown mixed results. Nevertheless, health communication provides a model for operationalizing and measuring the construct of "tailoring" based on theoretical foundations and assessment of individuals' contexts and needs.

Relationship between Tailoring and Tiering. Closely related to the construct of "tailoring" is "tiering." In the literature, descriptions of tailoring are more elusive than those of tiering, and having a clear understanding of tiering could elucidate what is often meant by tailoring. Tailoring is often conceptualized as a process of matching needs and strengths to the right services and supports (e.g., City Connects, 2020; Ivey & Broaddus, 2000; Johnston et al., 2017; Walsh & Theodorakakis, 2017; Walsh et al., 2016). Tiering is referred to as a way of ranking or organizing services according to their level of intensity (e.g., Eagle et al., 2015; Institute of Medicine, 1994; Walker, et al., 1996). The literature does not elaborate on the relationship between tailoring and tiering services. This section will introduce one highly regarded tiering system of support, Multi-Tier System of Supports (MTSS), and will elaborate on how Integrated Students Supports (ISS), which utilizes the MTSS framework, elucidates the relationship between tailoring and tiering.

Multi-tier System of Supports (MTSS). Many schools and districts employ a three-tiered public health framework for early screening of risks, intervention, and progress monitoring (Batsche, et al., 2005; Institute of Medicine, 1994; Walker, et al., 1996). Services and programs are ranked according to their level of intensity. For example, Tier 1 services are school-wide or universal (e.g., core curriculum and behavioral supports). Tier 2 (targeted/group intervention) and Tier 3 (intensive/individualized) services are for students with moderate to severe needs and are unresponsive to universal interventions. All students receive Tier 1, and few receive Tier 2 and Tier 3 services. Interventions become more individualized and intensive (e.g., crisis management, counseling, etc.) as needs become more severe.

While the three-tiered framework highlighted the multidimensional aspect of intervention and prevention science, researchers were critical of the three-tiered approach for school-based interventions (i.e., Response to Intervention and Positive Behavior Intervention and Supports). For one, research showed that the delineation of intensity or levels (Tiers 1, 2, 3) of services seemed arbitrary and that in real-world settings, services tend to overlap in order to respond more effectively to the complex needs of students (Center for Mental Health in Schools, 2011). Herman et al. (2012) observed that in a three-tier model of assessment and prevention, Tier 2 is the most ambiguous since students receiving Tier 2 services tend to have needs that range from moderate to intensive. Some students who were originally assigned to receive Tier 2 services eventually moved on to receive Tier 3 services as more intense needs manifest themselves with the passing of time. Furthermore, the lack of a systematic approach or organizational constituent to unify the "laundry list" of fragmented services across the three tiers also posed a barrier to cost-effective and efficient use of limited resources (Center for Mental Health in Schools, 2011; Eagle et al., 2015; Walsh et al., 2016).

In response to the critiques of the three-tiered models of intervention, Multi-tier System of Supports (MTSS) emerged as an attempt to address students' multidimensional and complex developmental needs (Higgins-Averill & Rinaldi, 2013; Eagle et al., 2015; Sugai, 2009). This approach allowed for flexibility in responding to complex needs of students especially from under-resourced communities. MTSS was the product of the integration of two other tiered system of supports frameworks: Response to Intervention (RtI), which focused exclusively on academic achievement, and Positive Behavior Intervention and Supports (PBIS), which focused exclusively on behavioral problems (Batsche, et al., 2005; Bender, 2009). MTSS organizes academic and behavioral supports according to their level of intensity. MTSS received formal endorsement in 2015 from the Every Student Succeeds Act (ESSA) as a viable approach to ensuring equitable access to educational opportunities and resources for all students, especially those with disadvantaged backgrounds (Moore et al., 2017).

While MTSS is an improvement over the previous tiered frameworks, there are several notable limitations. MTSS tend to be poorly implemented due to a lack of agreement on the roles of leaders and stakeholders and consistent implementation strategies, and as a result, services and programs continue to be fragmented rather than cohesive and comprehensive (Higgins-Averill & Rinaldi, 2013; Castillo et al., 2010; Center for Mental Health in Schools, 2011; Eagle et. al, 2015; Freeman et al., 2015; Petagourakis, 2021; Schiller et al., 2020; Walsh et al., 2016). Without systematic and strategic implementation, a well-designed intervention could be less effective than a poorly designed intervention (Ghate, 2015; Lipsey, Howell, Kelly, Chapman, & Carver, 2010). Further, within the MTSS framework, the primary purpose of screening and assessing students is to identify academic and behavioral problems. In doing so, MTSS leaves out many out-of-school factors that could have significant effects on other Developmental

Domains (i.e., Academic, Social/Emotional/Behavioral, Health, and Family). Consequently, a lack of cohesive and consistent implementation strategies puts into question the process and criteria of matching students to services based on their needs.

ISS and the Relationship between Tailoring and Tiering. Many exemplary Integrated Student Supports (ISS) interventions employ the MTSS model. ISS models vary across different school-based interventions, but they all share the following common key elements: needs assessment, partnerships with stakeholders, collaboration with school and community-based support systems, and data monitoring (Moore & Emig, 2014). Unlike MTSS alone, ISS provides attentive and responsive support to every individual student, including those with no apparently severe needs (Moore et al., 2017). ISS provides not only thorough assessment of students' strengths and needs, it also serves as an organizational component within schools that provides cohesion to the process of identifying and matching limited resources to students and their families. A responsive intervention that consists of comprehensive needs assessments, cohesive implementation strategies, and a systematic approach to coordinating the delivery of limited resources provides the bedrock for the "tailoring" of individualized support plans (Wasser Gish, 2019).

ISS conceives "whole child" intervention in terms of a continuum of needs that cuts across multiple contexts and Developmental Domains (e.g., Cicchetti & Sroufe, 2000; Walsh et al., 2002). In keeping with its developmental tenet of supporting the "whole child," ISS theoretically tailors individualized plans of support for each student (McIntosh & Goodman, 2016; Moore et al., 2017; Shogren et al., 2016). Practically, different ISS models vary in the extent to which they individualize their support. Most ISS models share the common conviction that students receiving the right services at the right time regardless of the acuity of their overall

needs is more important than the specific tier of services they are receiving (Bowden, 2017; Johnston et al., 2017; City Connects, 2020).

The conceptual bridge between tiering services and matching services lacks clear articulation in both the MTSS and ISS literature. However, within the ISS framework, the idea of matching or "tailoring" services to students' needs is more concrete and compelling than in the MTSS framework alone. Though ISS utilizes the MTSS framework to organize services according to their intensity or degree of individualization, it is ISS' "whole child" approach to assessment and intervention that guides the process of tailoring or matching services to the unique needs of each student.

Indeed, comprehensive assessment of student needs and a strategic process of allocating limited resources have to precede the questions: "What is tailoring?" and "How do we know it's occurring?" Categorizing or tiering services according to their level of intensity is limited if the assessment of students' needs target primarily academic and behavior problems. Bracketing the questions related to tailoring, it is clear that ISS interventions make use of the MTSS framework in an organized, efficient, and cost-effective manner (e.g., Bowden et al., 2015; Bowden et al., 2017; DeNike & Ohlson, 2013; Moore et al., 2017).

City Connects

The tiering of services' according to their level of intensity in the context of ISS provides clues to the phenomenon of tailoring as a critical mechanism of change. An in-depth study of a well-established ISS could further shed light on this confounding construct. City Connects, a well-established and highly regarded ISS, can aid in concretizing the construct of "tailoring" (Bowden et al., 2015; Bowden et al., 2017 Fisher & Fisher, 2018; Moore et al., 2017). This section will present the evidence for City Connects' positive effects on students' outcomes;

present City Connects' unique approach to assessing strengths and needs; and show how City Connects as an exemplary model of ISS provide an exceptional opportunity to study the construct of "tailoring."

Robust Empirical Evidence of City Connects' Effectiveness

Over the past two decades, City Connects has been implemented in over 150 U.S. schools across 7 states, providing comprehensive services that have contributed to the mitigation of the achievement and opportunity gaps for students ranging from pre-kindergarten through grade 12 (City Connects, 2010, 2020; Dearing et al., 2014; Moore et al., 2017; Walsh et al. 2014). Overall, students in City Connects schools have consistently scored higher on standardized tests, have higher report grades, have lower grade retention, have lower probability of absenteeism and dropping out than comparison schools (City Connects, 2010, 2012, 2014, 2016, 2018, 2020). English Language Learners (ELL) in City Connects schools attain an equivalent level of literary proficiency as their native English-speaking peers by third grade (City Connects, 2010; Dearing et al., 2014). Furthermore, a rigorous benefit-cost analysis conducted by Bowden et al. (2015) from Teacher's College, Columbia University, showed that for every $1 invested in City Connects, society receives a return of $3. Thus, City Connects is not only an effective but also a cost-effective evidence-based practice.

City Connects' Unique "Whole-child" Tiering and Tailoring Process

City Connects attributes its effectiveness to its systematic tiering and tailoring process. City Connects coordinators (either a licensed counselor or social worker) are tasked with assessing and monitoring students' needs and tailoring services accordingly. Coordinators serve as a unifying link between school personnel, families, and community agencies that facilitate collaboration and brings about a cohesive process of matching and delivering services

to students and families. Twice a year, coordinators administer a "Whole-Class Review" in order to evaluate the strengths and needs of each student with their teachers (City Connects, 2018, 2020). Coordinators then use a three-tier model, as with many ISS models, to match the severity of needs to the intensity of services (1=low intensity/prevention/enrichment services, 2 = moderate intensity/early intervention services, 3 = high intensity/intensive/crisis intervention services). Each student receives an individualized plan for support from multiple programs within and outside the school. Students with more intensive needs receive an "Individual Student Review" and are matched with additional supports.

City Connects offers a flexible and holistic approach to assessment and intervention that is responsive rather than reactive. Unlike many ISS models, City Connects also assigns students to a provisional "tier of strengths/risks" based on their cumulative strengths and needs (1 = minimal risk; 2a = mild risk; 2b = moderate risk; 3 = high risk). This tiering system is unique to City Connects. One advantage of assigning students to tiers of strengths/risks rather than only tiering services according to their intensity is that the assignment of tiers facilitates the tracking of student progress holistically (Fisher & Fisher, 2018; City Connects, 2020). Indeed, most City Connects students receive the level of services that match with their provisional tier of strengths/risks (e.g., Tier 1 student receiving Tier 1 Services, Tier 3 Students receiving Tier 3 services) (City Connects, 2010, 2012, 2014, 2016, 2018, 2020). However, many students also receive services that do not match their tier of strengths/risks. For example, a student tiered as "minimal risk" ("Tier 1 Student") might have many strengths, but life circumstances could call for one or more Tier 3 services (e.g., crisis counseling) in addition to Tier 1 and 2 services (e.g., tutoring, after school enrichment programs, etc.) that other Tier 1 Students are also receiving. Almost all students receive Tier 1 services, and many Tier 1 students receive Tier 2

services. Thus, the relationship between tier of services has to be constantly monitored and re-evaluated in light of each student's changing circumstances and overall strengths and needs.

In other ISS models such as Comer Process and Community in Schools, all students theoretically receive Tier 1 "universal services " (e.g., school-wide social/emotional, academic, and behavioral curriculum), but within these models not every child receives comprehensive assessment and a tailored set of services. Such individualized attention and care is often reserved for students with apparently intensive needs. In contrast, true to developmental theories of risk and promotive factors (e.g., Adelman & Taylor, 2011; Cicchetti, 2006; Masten & Cicchetti, 2010; Masten & Labella, 2016; Rutter & Sroufe, 2000), City Connects provides early and comprehensive assessment and intervention for each individual child regardless of the intensity of needs (Walsh et al., 2014). In this sense, City Connects is both a preventive and interventive ISS model with strong empirical evidence of program effectiveness.

City Connects and Research on Tailoring

City Connects' approach to "whole child" intervention is based on four core tenets of developmental science for effective practice: customized, comprehensive, coordinated, and continuous (Center for Optimized Student Support, 2019; City Connects, 2020; Wasser Gish, 2019). That is to say, City Connects aspires to 1) be responsive to each unique child's needs in their specific context at a specific moment in time by tailoring unique plans of support for each child (customized); 2) provide services that encompasses multiple Developmental Domains (i.e., Academic, Social/Emotional/Behavioral, Health, and Family) regardless of apparent risk factors (comprehensive); 3) have a systematic approach to implement the intervention with fidelity by fostering collaboration among stakeholders (coordinated); 4) and offer stability and continuity by

rigorously monitoring progress, evaluating outcomes, and modifying practice as needed (continuous).

In addition to providing the evidence for its overall positive impacts on student outcomes, City Connects has also been able to provide evidence for its actualization of the three of the four developmental tenets--comprehensive, coordinated, and continuous (City Connects, 2010, 2012, 2014, 2016, 2018, 2020). However, the research on the tenet of providing "customized" or "tailored" supports and services remains lacking and the concept remains elusive. While this is not a unique conundrum for City Connects, because City Connects has strong evidence for overall effectiveness and can demonstrate that its approach is comprehensive, coordinated, and continuous, City Connects is also ripe for further research on the critical component of "customized" or tailored" supports.

Literature Summary

Poverty poses a significant barrier to the availability and accessibility of critical services and supports that children need to develop and thrive. Developmental science has shown that out-of-school barriers significantly impact students' in-school performance. Efforts in the past decades have been made to identify schools struggling with the effects of poverty in order to invest more evidence-based programs and other resources into those schools. However, the focus of these interventive efforts has generally been on in-school problems (i.e., academic and behavior). Further, while financially investing more into poor schools and districts is a first step in the right direction, without a systematic and efficient approach to assessing needs and coordinating the distribution of resources, the cost may not outweigh the benefit.

Developmental science and theories of development support the practice of providing unique plans of support ("tailoring") and call for quantitative research methods that integrate

idiographic, differential, and nomothetic information. Specifically, the Specificity Principle, Developmental Contextualism, and Orthogenetic Principle affirm each individual's unique developmental trajectory and the influence of multilevel contextual factors. These theories propose an iterative movement between particular experiences and general or universal trends to optimize description of development and effectiveness of interventions.

Research has shown that comprehensive "whole child" approaches to early assessment and intervention can buffer the detrimental effects of poverty on children's academic achievement and overall well being. School-based models of Integrated Student Supports (ISS) are exemplary approaches to caring for the "whole child." ISS models vary in practice and emphasis but share a number of common elements. In general, ISS provides a dynamic and organized structure that promotes the collaboration of school personnel, families, and community partners in order to systematically coordinate the allocation of limited resources according to students' needs. ISS also monitors students' progress continuously through data collection and analysis.

Drawing from developmental science and practice-based evidence, ISS models attribute their effectiveness to a key mechanism: the "tailoring" of unique plans of supports according to each child's unique sets of strengths and needs. The approach is theoretically sound and practically intuitive. However, operationalizing the construct of "tailoring" has been a challenge in the field of prevention science in general and in school-based intervention research in particular. What is "tailoring" and how do we know it's happening?

A construct closely related to "tailoring" is "tiering" (ordering services and supports according to their intensity or level of individualization). ISS models use the Multi-Tiered System of Supports (MTSS) framework to match students to services. On its own, MTSS lacks

the organizational structure for effective implementation. MTSS' focus is primarily on academic and behavior problems and left many of students' out-of-school needs unaddressed. ISS' holistic and comprehensive approach to needs assessment and support optimizes the use of the MTSS framework. As a result, within the context of ISS, "tailoring" of student support becomes more concrete and compelling as a construct and process.

Finally, in order to explore this construct of "tailoring" further, City Connects, a highly regarded and well-researched ISS model, was chosen for examination. Since City Connects not only tier services according to the MTSS framework but also provide a provisional "tier of strengths/risks" for each individual student, City Connects is an ideal candidate for this study. The "tiering of risk" for each student provides the foundational evidence that each child is receiving attention and care. No other ISS models have this level of comprehensive and individualized care in their approach to needs assessment and service matching. Thus, City Connects is ripe for further research on "tailoring," a critical mechanism of ISS models and school-based interventions in general. City Connects' pattern of matching services to each individual student could provide the key to validating and operationalizing quantitatively the construct of "tailoring."

Current Study

This proposed non-experimental study aims to explore the construct of "tailoring" as a mechanism within one well-established Integrated Student Supports (ISS) system: City Connects. City Connects, like other ISS models, operates from four core tenets of developmental science for effective practice: comprehensive, customized, coordinated, and continuous (Center for Optimized Student Support, 2019; City Connects, 2020). Tailoring falls under the tenet of "customized." Based on the premise that every unique child's response to specific conditions and

environment forges a unique trajectory of development, tailoring services and supports that align with each child's unique sets of strengths and needs is a critical component of any intervention. However, currently, there are no studies that have operationalized quantitatively "tailoring" in school-based interventions. "What is tailoring?" and "How do we know it is occurring?" continue to be confounding yet foundational questions.

Working Definition of "Tailoring"

Based on the literature on nomothetic and idiographic research and developmental theories, a provisional definition/description of tailoring was formulated: *Tailoring is the process of matching unique patterns of services based on each student's cumulative strengths and needs and the availability of services*. This description provides a way to conceptualize the student-intervention reciprocal or dynamic co-action that calls for continuous and systematic adjustment and modification based on specific individuals' needs in specific conditions at specific moments in time.

Research Questions

Guided by the above working definition of tailoring and the tenets of developmental science, this study will seek to answer the following overarching research question:

What is the evidence that services and supports are being tailored to each individual student in City Connects schools?

Specifically, using relatively small data sets, the first substudy (Study 1), a preliminary exploratory study, will aim to answer the following questions:

1) What is the evidence for tailoring based on the aggregate descriptive information?

    a) What is the relationship between Students Tiers of Strengths/Risks and the Tiers/Categories of Services received?

i) What is the distribution of students across Tiers of Strengths/Risks (i.e., number/percentage of students in Tier 1, Tier 2a, Tier 2b, and Tier 3)?

ii) What is the mean number of services received per student in each Tier of Strengths/Risks?

iii) Across Tiers of Services (Tier 1, Tier 2, and Tier 3), what is the distribution of Student Tiers of Strengths/Risks (e.g., What percentage of Tier 1 students received at least one Tier 3 service)? Across Student Tiers of Strengths/Risks, what is the distribution of Tiers of Services (e.g., Of the services Tier 1 students received, what percentage was Tier 3 services)?

2) What evidence is there for tailoring in City Connects based on the analysis of patterns/combinations of services.

i) Overall, how many unique patterns/combinations of services are there within a classroom? Following most of the same students within the current classroom back two years, how many unique patterns/combinations of services are there within a cohort (mostly same students, different classrooms)?

ii) Are there unique patterns/combinations of services among students within the same Tier of Strengths/Risks?

iii) How different are the patterns/combinations of services? (i.e., Do they differ by one or two services or are there dramatic differences?)

iv) For the same students across three years, do the students who did not share a pattern and the students who did share a pattern continue to do so in subsequent years?

While this study is exploratory in nature rather than hypothesis testing, given the findings in City Connects annual evaluation reports and guided by developmental theories, a few preliminary hypotheses can be made:

1. Most students will receive Tier 1 and Tier 2 Services, and few students will receive Tier 3 Services. Higher risk level will show higher mean number of services.
2. Student Tiers of Strength/Risk will mostly align with Tier of Services received.
3. Unique, unshared service patterns are present and the percentage of students with unique unshared service patterns will be over 50%.
4. Percentage of individualized patterns will increase as grade level increases.
5. Percentage of individualized patterns will increase as student risk increases.

Building on Study 1, using a larger data set, the second substudy (Study 2) seeks to replicate the findings in Study 1 and expand the investigation of the construct and practice of tailoring comprehensive services to individual students. Similar to Study 1, Study 2 will answer the following research questions:

1) What is the evidence for tailoring based on the aggregate descriptive information?

   i) What is the distribution of students across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3)?

   ii) What is the mean number of services received per student in each Tier of Strengths/Risks?

   iii) Across Tiers of Services (Tier 1, Tier 2, and Tier 3), what is the distribution of Student Tiers of Strengths/Risks (e.g., What percentage of Tier 1 students received at least one Tier 3 service)? What is the distribution of Tiers of Services across Tiers of Strengths/Risks (i.e., number/percentage of students in

Tier 1, Tier 2a, Tier 2b, and Tier 3 receiving Tier 1 Services, Tier 2 Services, Tier 3 Services)?

iv) Across Student Tiers of Strengths/Risks, what is the distribution of Tiers of Services (e.g., Of the services Tier 1 students received, what percentage was Tier 3 services?)

2) What evidence is there for tailoring in City Connects based on the analysis of patterns/combinations of services?

i) Overall, how many unique patterns/combinations of services are there across the district?

ii) Are there unique patterns/combinations of services among students within the same Tier of Strengths/Risks?

iii) Are there different patterns/combinations between and among students within a sample of classrooms within the same school? How unique are the patterns/combinations of services? (i.e., Do they differ by one or two services or are there dramatic differences?)

3) Are there discernible latent patterns of service delivery in the district?

a) Across Tiers

b) Given the following covariates:

i) Demographics: grade. school, gender, race, English Language Learner (ELL), immigrant status, Special Education status (SPED), and low income flag/indicator

ii) Dosage (i.e., the number of years receiving City Connects intervention)

For Study 2, the same preliminary hypotheses can be made with an additional hypothesis:

1) Most students will receive Tier 1 and Tier 2 Services, and few students will receive Tier Services. Higher risk level will show higher mean number of services.
2) Student Tiers of Strength/Risk will mostly align with Tier of Services received.
3) Unique, unshared service patterns are present and the percentage of students with unique unshared service patterns will be over 50%.
4) Percentage of individualized patterns will increase as grade level increases.
5) Percentage of individualized patterns will increase as student risk increases.
6) Services are not randomly assigned.

Chapter 3: Method

This study consists of two substudies that seek to explore the observable and latent patterns in the matching of supports and services (Tiers of Service; 1 = prevention/enrichment; 2 = early intervention; 3 = intensive/crisis intervention) to individual students based on their cumulative strengths and needs (Tiers of Strengths/Risks; 1 =minimal risk; 2a = mild risk; 2b = moderate risk; 3 = intensive risk) in City Connects schools. Using two randomly selected classrooms of students from two different schools from the same district, the preliminary study (Study 1) will use descriptive and pattern analyses to provide the initial evidence of tailoring. Using a larger and more comprehensive data set from a school district different from the two in the preliminary study, the second, more detailed study (Study 2) will use descriptive, pattern, and latent class analyses to further confirm evidence for tailoring. These analytic techniques seek to bring together nomothetic, differential, and idiographic information to optimize the description and explanation of the construct of tailoring in light of developmental science (e.g., Hill, 2021; Lerner et al., 2019).

While there are advanced analytic techniques (e.g., Mulilevel Modeling, MLM; Hierarchical Linear Modeling, HLM; Group Iterative Multiple Model Estimation, GIMME) that to a certain extent have effectively bridged the nomothetic and idiographic dimensions of data analysis, the goals of these techniques do not align with the goals of this current study. GIMME for example sought to improve previous approaches such as MLM to better account for individual variance in the overall statistical model that seeks to find associations between predictor and outcome variables (e.g., Beltz et al., 2016; Beltz & Gates, 2017). However, this study is primarily descriptive rather than predictive. Rather than studying the relationship

between the "tailoring" of service patterns and certain outcomes, this study aims to establish the construct of "tailoring" by describing what is already present in the data.

Research Design

Study 1

To address the first research question for Study 1, descriptive statistics will be used to examine the relationship between Student Tiers of Strengths/Risks, Tiers of Services, and service type for relatively small data sets. To address the second question, pattern analysis will be employed to explore the observable patterns in the matching of services and supports to students' Tiers of Strengths/Risks. Descriptive statistics generated through Stata software (version 17) will show the trends in service delivery based on the services' level of intensity and according to each student's level of risk. Service matching pattern analysis (i.e., comparing the set of services delivered to each student to identify unique combinations of services) using Google Sheets will show the variability between individual students in the type of services and intensity level of services delivered. This is not an established method in clinical and educational science, but pattern analysis has been used in health communication to determine how the number of unique messages tailored to each individual or group affects cognitive and behavioral changes (e.g., Kreuter et al., 1999; Sahin et al, 2019).

Study 2

A larger and more comprehensive data set (n = 5849) will be used for Study 2. As in Study 1, in order to address the first research question for Study 2, descriptive statistics will show the relationship between Student Tiers of Strengths/Risks, Tiers of Services, and service type. To address the second question, pattern analysis will be employed to explore the observable patterns in the matching of supports and services to students' Tiers of Strengths/Risks.

Descriptive statistics generated through Stata software (version 17) will show the trends in service delivery based on the services' level of intensity and according to each student's level of risk. Service matching pattern analysis (i.e., comparing the set of services delivered to each student to identify unique combinations of services) using Stata (version 17) will show to what extent do sets of services vary between individual students. Finally, in order to have a sense of how unique patterns are, service profiles of three students from the same grades and in the same Tiers of Strengths/Risks will be selected from two different schools for comparison.

To address the third research question in Study 2, students will be separated into Student Tiers of Strengths/Risks, and Latent Class Analysis (LCA) through Latent Gold software (version 6.0) will be used to identify the presence of any discernible, discrete patterns within each Student Tier based on categories/types of services (e.g., health screening: vision, family engagement, academic: individual tutoring, social/emotional/behavior: crisis counseling), also referred to as "service labels" LCA is used for cross-sectional studies with multiple indicators (Goodman, 2002; McCutcheon, 1987). Study 2 will focus on service delivery patterns at one specific point in time across different student grade levels (i.e., K-9). The reason for performing LCA for groups of students based on Student Tier of Strengths/Risks is in part due to the fact that students are assigned provisional Tiers of Strengths/Risks before they receive any services. Instead of inputting Student Tier as a covariate, this approach seeks to explore what kinds of latent patterns, if any, are present among individual students within each pre-assigned Student Tier.

In contrast to a variable-centered procedure (e.g., factor analysis, correlation analysis, and multiple regression), Latent Class Analysis (LCA) is a person-centered classification approach that assigns individuals to latent classes based on patterns of shared, observable characteristics or

responses (Goodman, 2002). In more technical terms, LCA detects variances in samples and identifies latent subgroups according to similar patterns across sets of indicator variables (Weller et al., 2020). Person-centered approaches such as LCA are suitable for describing similarities between individuals and differences between groups of individuals rather than describing the variability of a particular variable in the course of development (Lanza, 2016).

Participants

Study 1

The sample for this initial study includes students from two different classrooms/cohorts within two different urban public schools in the northeastern region of the United States across three academic years–2018-2019, 2019-2020, 2020-2021–when the students were in 3rd, 4th, and 5th grade respectively. The students were in the same class in the 5th grade. This study follows the pattern of services these students received in the 4th and 3rd grade. Not all the students present in the current 5th grade class were present in the previous grades. While this is not a longitudinal study per se, it seeks to carry out a preliminary exploration of the potential variability in patterns of services that could be associated with students' grade level.

In Class A, there were n = 23 students in the current 5th grade; in their 4th grade year, there were n= 21 students; and in their 3rd grade year, there were n = 17 students. In Class B, there were n = 21 students in the current 5th grade; in their 4th grade year there were n= 17 students; and in their 3rd grade year, there were n =15 students.

Study 2

The sample for this study includes n = 5,849 of students from 21 schools in an urban public school district in the northeastern region of the United States. The participants were in K to 9th grades during the 2017-2018 academic year, two years before the COVID-19 pandemic

broke out. The original data set contained n = 7,381 students. This latter data set did not include Pre-K because City Connects' assessment and treatment of students in this grade level differ significantly from those of the other grade level. Students with missing Student Tier and students who did not receive at least one full year of City Connects treatment were excluded from the n=7,381 participant data set. In the original data set (without Pre-K), there were 237 students who were not assigned a Student Tier of Strengths/Risks for reasons unknown. Given student mobility is frequent among low-income families, it is possible that these students moved to another district before being assigned a provisional Tier level (e.g., Barton, 2003; Rumberger, 2003). After applying the inclusion/exclusion criteria (i.e., having had at least one full year of City Connects treatment and having been assigned a Student Tier), n=5,849 participants remained.

Measures

The data is retrieved from two proprietary electronic data management systems, MyConnects and Student Support Information System (SSIS), which City Connects uses to securely record students' demographic information, strengths and needs assessment, service referrals, and progress. In 2019, City Connects moved from using SSIS to MyConnects. The data is collected by City Connects' school coordinators from students, teachers, schools, and school districts and is maintained by City Connects administrators and staff at the central headquarter at Boston College (e.g., City Connects, 2014, 2020). School coordinators are members of City Connects' staff and are either licensed social workers or school/mental health counselors. Study 1 used data from both management systems (MyConnects and SSIS), and Study 2 used data from SSIS.

Demographics

Study 1. The first substudy (Study 1), as a preliminary, exploratory study, will include only student ID (de-identified), grade, school/class (de-identified), gender, and race/ethnicity. Student demographics for Study 1 are provided in Table 1. For Class A, the majority of the students across all grade levels are males and Hispanic. For Class B, the majority of the students across all grade levels are males and White. Black students make up the second largest group in both Class A and Class B and across all grade levels.

Table 1

Student Demographics for Study 1 (Class A and Class B)

	Class A						Class B					
Grade (n)	**3rd (n=17)**	**%**	**4th (n=21)**	**%**	**5th (n=23)**	**%**	**3rd (n=15)**	**%**	**4th (n=17)**	**%**	**5th (n=21)**	**%**
Gender												
Male	9	53	11	52	14	61	11	73	13	76	13	62
Female	8	47	10	48	9	39	4	27	4	24	8	38
Race/Ethnicity												
Black	2	12	4	19	4	17	5	33	5	29	6	29
White	0	0	0	0	0	0	7	47	8	47	9	43
Asian	1	6	1	5	1	4	0	0	0	0	0	0
Hispanic	13	76	15	71	17	74	3	20	4	24	6	29
Other	1	6	1	5	1	4	0	0	0	0	0	0

Note. [a] Students are currently in the same 5th grade class but were not necessarily in the same class in 3rd and 4th grades. The same students in the 3rd grade were also in the 4th grade, and the same students in the 4th grade were also in the 5th grade.
[b]Race/Ethnicity information missing for the student labeled as "Other" in Class A.

Study 2. Table 2 below provides the student demographics and background information. The following information will be included as covariates for the latent class analysis: grade,

school, gender, race, English Language Learner (ELL), immigrant status, Special Education status (SPED), and low income indicator.

Among the participants, there are slightly more males than females with the majority identifying as either “Black” or “Hispanic.” There are significantly more elementary school students than middle and high school students. Across the 21 schools, the number of students ranged from 161 to 397 students. Schools with PreK-5 grades far exceeded the number of schools with 6th to 12th graders.

Table 2

Student Demographics and Background Information for Study 2 (n =5,849)

	Students	
	n = 5,849	%
Gender		
Female	2,827	48
Male	3,022	52
Race		
Black	1122	19.
White	539	9
Asian	95	2
Hispanic	2964	68
Other	129	2
Grade		
K	782	13
1	1,019	17
2	1,079	18
3	1,084	19

4	829	17
5	425	7
6	115	2
7	271	5
8	84	1
9	161	3

School ID (Grades)	Students	
n = 21	n = 5,849	%
1 (PreK-5)	310	5
2 (K-5)	275	5
3 (PreK-5)	243	4
4 (PreK-5)	308	5
5 (PreK-5)	161	3
6 (9-12)	218	4
7 (K-5)	174	3
8 (6-12)	397	7
9 (PreK-5)	329	6
10 (K-5)	217	4
11 (PreK-5)	356	6
12 (K-5)	340	6
13 (PreK-5)	313	5
14 (PreK-5)	181	3
15 (K-5)	256	4
16 (K-5)	310	5
17 (6-8)	316	5
18 (K-5)	200	3
19 (PK-5)	252	4
20 (K-5)	342	6
21 (PreK-8)	351	6

Further, as shown in Table 3, the majority of the students did not receive Special Education (SPED), were not English Language Learners (ELL), and were not immigrants. However, the majority of the students were from low-income families.

Table 3

Student Background Information (cont.) (n=5,849)

Indicators	Students (n)	%
Special Ed (SPED)		
No SPED	4682	80
SPED	1167	20
Income Indicator		
Not Low	875	15
Low	4974	85
ELL		
Not ELL	4817	82
ELL	1032	18
Immigrant Status		
Not Immigrant	5724	98
Immigrant	125	2

Coding for these demographics/background variables are described as follows:

Grade

Grade was coded as 1 = Kindergarten, 2 = 1st Grade, 3 = 2nd Grade, 4 = 3rd Grade, 5 = 4th Grade, 6 = 5th grade, 7 = 6th Grade, 8 = 7th Grade, 9 = 8th Grade, and 10 = 9th Grade.

School

In order to de-identify the 21 schools within the district, the schools were arranged in alphabetical order and were assigned a number from 1 to 21.

Gender

Gender was coded as female = 0 and male = 1.

Race/Ethnicity

Race/ethnicity were coded as 1 = Black, 2 = White, 3 = Asian, 4 = Hispanic, 5 = Other.

Low Income Flag

Students from low-income families were coded 1 and students not from low-income families were coded as 0.

English-Language Learner (ELL)

English-Language Learners were coded as 1. Those who did not qualify as ELL students, were coded as 0.

Immigrant Status

Immigrant status was coded as 1 = Immigrant and 0 = Not immigrant.

Dosage

Along with demographic information, dosage will also be a covariate in Study 2. Dosage refers to the number of years a student received the City Connects intervention. Especially in high-poverty communities, students change schools frequently due to instability of financial situation and family life (e.g., Barton, 2003; Rumberger, 2003). It has been shown that in general a higher dosage or more number of years at a City Connects school is positively associated with higher academic outcomes (i.e., report card grades and standardized test scores) (Walsh et al., 2014).

Students in this study received between 1 to 7 full years of City Connects. Dosage was coded categorically (1 to 7). Coding this way will facilitate reporting the descriptive findings of

the potential clusters generated from the latent class analysis. Table 4 provides the distribution of students across dosage years.

Table 4

Distribution of Students across Dosage Years

Dosage Years	Students (n=5849)	%
1	2859	45
2	1606	27
3	658	11
4	340	6
5	193	3
6	121	2
7	72	1

Student Tiers of Strengths/Risks

City Connects site coordinators administer a Whole Class Review (WCR) at the beginning of each academic year. This process involves reviewing with the teachers of every class each student's apparent strengths and needs across multiple Developmental Domains: Academic, Social/Emotional/Behavioral (SEB), Health, and Family domains. Coordinators then assign each student a provisional Student Tier of Strengths/Risks (1 =Minimal Risk; 2a = Mild Risk; 2b = Moderate Risk; 3 = Intensive Risk) based on the number and type of strengths and needs identified (e.g., City Connects, 2016, 2018, 2020; Sibley et al., 2017). Students receive services based on their cumulative strengths and needs and students are re-tiered in the following year based on their progress. Table 5 provides the distribution of students across Student Tiers of Strengths/Risks for Study 2.

Table 5

Distribution of Students (n=5,849) across Student Tiers of Strengths/Risks

Student Tier	n	%
1	1788	31
2a	1899	32
2b	1389	24
3	773	13
Total	5849	100

Student Tiers of Strengths/Risks. Strengths were originally coded as 1 = No Tier Assigned; 2 = (1) Minimal Risk; 3 = (2b) Mild Risk; 4 = (2b) Moderate Risk; 5 = Intensive Risk. (As stated above, in the original data set, there were 237 students who were not assigned a Student Tier of Strengths/Risks for reasons unknown. These students were removed for the current study.)

Service Labels and Tiers/Intensity

The services and supports are categorized by their Tiers of Service/level of intensity (1 = prevention/enrichment; 2 = early intervention; 3 = intensive/crisis intervention). In general, more individualized and less universal services (e.g., after school sports programs vs. individual counseling) are considered higher in intensity. Each service is made available by a specific provider (e.g., Boys & Girls Club of America, American Red Cross, etc.) either within the school/district or from a community partner. Each service is categorized according to a service label/type (e.g., family donation, health screening, academic support), indicating the target of the intervention. Students might receive different services for similar needs depending on the students' specific circumstances and the availability of certain providers at specific geographical locations at specific moments in time.

Study 1. The services the students received were categorized and coded according to service label/type, provider, and intensity (see Appendix A, Tables A1 and A2). For the 2019-2020 and 2020-2021 academic years, both service labels (e.g., Donations) and the specific service providers (Donations: City Connects Coordinator; Donations: Cradles to Crayons) under those labels were easily accessible in MyConnects, the relatively new proprietary electronic data management systems City Connects uses to securely store student data. Thus, service providers were used for pattern analysis for these two academic years. However, for the 2018-2019 academic year, data was retrieved from an older proprietary electronic data management system, Student Support Information System (SSIS). Service providers were not easily accessible, and as a result, general service labels or categories were used for the 2018-2019 academic year in the pattern analysis. One potential drawback is that the number of unique patterns might be reduced if only general service labels were used.

Study 2. Service labels (n=77) served as Latent Class Analysis (LCA) indicator variables (for a detailed list see Appendix B, Table B1). Across the 77 service labels, students who received a label were coded as 1 and those who did not receive a service label were coded as 0. For the sake of interpretability, this exploratory study did not use specific service provider names as indicator variables, which exceeded the number of service labels.

Validity and Reliability of City Connects' Tiering System

City Connects coordinators follow structured and consistent protocols with high implementation fidelity across schools (City Connects, 2012, 2014). Students' strengths and needs are quantified following these protocols. At the same time, coordinators ultimately rely on

clinical judgment when assigning students to a tier of strengths/risks and matching services according to students' strengths and needs. Ideally, both statistical or actuarial judgment and clinical or subjective judgment are to be used in a complimentary fashion with a strong emphasis on statistical approaches in order to optimize decision making (e.g., Dawes, Faust, Meehl, 1989; Trull & Prinstein, 2005). However, the empirically validated tools are not always available or appropriate for certain problems and populations (Helms, 2006; Trull & Prinstein, 2005). City Connects coordinators are nevertheless licensed clinicians trained to use both objective and subjective measures.

While there has been no validity and reliability study of City Connects' assessment tools/process, as Petsagourakis (2021) noted, there are indications of validity and reliability from City Connects' annual reports. For example, during the 2018-2019 academic year, of the 25,952 students in 82 City Connects schools across nine school districts, 36% were assigned to Tier 1 (minimal risk), 32% to Tier 2a (mild risk), 21% to Tier 2b (moderate risk), and 11% to Tier 3 (intensive risk) (City Connects, 2020). Furthermore, in the same year, Tier 1 students received an average of 9.5 services; Tier 2a students received an average of 9.8 services; Tier 2b students received an average of 10.7; and Tier 3 students received an average of 11.6 services. That is to say, students with a higher risk level received more services (City Connects, 2020). The services came after and confirmed the initial provisional tiering. Because these trends have been fairly consistent in the past decade, this could be the first indication of validity and reliability of City Connects' assessment tools/process (City Connects, 2010, 2012, 2018, 2020; Petsagourakis, 2021).

Analytic Plan

Study 1

Descriptives of Aggregate Data. In order to answer the questions under Research Question 1, summary statistics will provide a general overview of the data from *two sets of three classroom/cohorts* (Class A and Class B) of students from two different schools within the same district, across three years. As noted above, in each class, the current 5th graders are in the same classroom, but they were not necessarily in the same classrooms in the 4th and 3rd grade. However, they will be placed in the same cohort for the purpose of this analysis. This would allow for observations of changes to service profile patterns for students who were in the school for all of those two or three years.

Specifically, summary statistics will include the following: the distribution of students across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3); the distribution of Tiers of Services across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3 receiving Tier 1 Services, Tier 2 Services, Tier 3 Services); mean number of services received per student in each Student Tier of Strengths/Risk, the percentage of students receiving at least one service from each each level of service, and the distribution of services across Student Tiers of Strengths/Risks.

Pattern analysis

In order to answer the questions under Research Question 2, analysis of service patterns/combinations will be carried out in Google Sheets. Starting with the current 5th grade for Class A, the ID for each de-identified student from the class will be listed in the first row. Under each ID number, the code (for Service Label/Provider/Type Code and Service Tier level) for each service students received for that academic year will be listed. Across the columns of student ID numbers, the same codes will share the same row. Each column of services will be color-coded. Columns that are not color-coded (remained white) indicate that the

patterns/combinations of services are not shared by any other student. The same patterns/combinations of services will be coded with the same colors to indicate that those sets of services are shared between two or more students. The percentage of unique shared and unshared patterns will be calculated. (Note: The data for 3rd graders had pre-assigned numeric codes from the older management system. Those codes were listed out for each student in a column and were compared for differences first in the number of services and then the specific services.)

This pattern analysis will be carried out for (mostly the same) students when they were in the 4th and 3rd grade. Since an aim of this preliminary substudy is to see if there are marked variability in patterns between grades, rather than to make longitudinal inferences, the students in the 5th grade who were not in the 4th and 3rd grade cohorts, and the students in the 4th grade who were not in the 3rd grade cohort were left in the data set for analysis. This procedure will be repeated for Class B.

It should be noted again that the data for the 5th grade (2020-2021) and 4th grade (2019-2020) were taken from a different management system (MyConnects) than the 3rd grade (2018-2019; SSIS). At the time of the initial analysis, service types/providers were made available in MyConnects but not for SSIS. For this reason, service labels were used for the 2018-2019 analysis. The detailed list of Service Labels/Providers/Types and Codes are in Appendix A, Tables A.1 and A.2 for MyConnects data, and A.3, and A.4. for SSIS data.

Study 2

Descriptives of Aggregate Data. In order to answer the questions under Research Question 1, summary statistics will provide a general overview of the data from *one school district* different from the one in Study 1. Specifically, summary statistics will include the

following: the distribution of students across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3); the distribution of Tiers of Services across Tiers of Strengths/Risks (i.e., number of students in Tier 1, Tier 2a, Tier 2b, and Tier 3 receiving Tier 1 Services, Tier 2 Services, Tier 3 Services); mean number of services received per student in each Student Tier of Strengths/Risks; the percentage of students receiving at least one service from each Tier of Service; and the total number/percentage of services delivered to students by Tiers of Service.

Pattern analysis. In order to answer the questions i and ii under Research Question 2, analysis of service patterns/combinations for the entire district will be carried out in Stata (version 17). The ID for each de-identified student from the district will be listed in the first column. At the top of every subsequent column will be a code for a service label (e.g., family assistance and support, tutoring, health screening-vision) the students received. For each student, "1" will indicate that the student received a specific service and "0" will indicate that they did not receive that service. Stata (version 17) will be commanded to group the same patterns/combinations of services together. The number of unique patterns of services will be calculated. Patterns can be either shared (more than one student has this combination of services) or unshared (only one student has this combination of services). "Unique" patterns can be either shared or unshared, and total unique patterns is the sum of both shared and unshared patterns. The percentage of unique, unshared patterns will be calculated.

Further, using Google Sheets, to answer question iii of Research Question 2, pattern analysis will be applied to a relatively small sample (n = 6) from the larger dataset (n=5,849) to see how the service patterns of students in the same grades, from the same schools, and with the same Tiers of Strengths/Risks differ from one another.

It should be noted that the main analysis will use the reduced data set of n = 5,849 students extracted from the original data set of n = 7,381 students. However, pattern analysis will also be carried out using the original data set and results will be provided as well. This is because the inclusion/exclusion criteria (i.e. Student Tier assignment is available and one full year of City Connects treatment) could affect the number of "true patterns" potentially present in the data set. For example, in the original data set, 100 students might share one pattern of services, but by imposing the exclusion criteria, that number might be reduced to 30 students sharing that one particular pattern of services. Thus, results of the pattern analysis for both data sets will be provided for comparison.

Once patterns have been identified as either unshared (a service patterns that is completely unique, not shared but any other student) or shared (a service pattern that two or more students share), the students with shared patterns will be removed from the data set, and the students with completely unique, unshared patterns of services will remain for Latent Class Analysis. Given that each student in the unshared group has their own distinct pattern, LCA could confirm whether these service assignments are completely random or if there is some kind of underlying, latent pattern that exists. For this exploratory study, the group with shared patterns will not be analyzed. Theoretically, it is difficult to know what the analysis and results would confirm at this time.

Latent Class Analysis (LCA). In order to answer the third research question, Latent Class Analysis (LCA) will be used to determine whether there are discernible pattern(s) in the alignment of student characteristics and service profile. In other words, at this point, tailoring is assumed to be an existing phenomenon based on City Connects' theoretical framework and an initial pattern analysis from a selected subsample from the data set used for this study. LCA

explores discrete patterns in the matching of services. For LCA, Collins and Wugalter (1992) recommended a sample size of at least $n = 300$, and Finch and Bronk (2011) suggest that $n = 500$ is ideal. Wurpts and Geiser's (2014) study suggested that having more high-quality indicators even when the sample size increased accuracy in defining discrete classes and "improved convergence rates and led to reduced class proportion and low probability CRP bias" (p. 10).

Students in the "unshared" group will be divided according to their Tiers of Strengths/Risks, and LCA will be carried out for each group of students. The indicators will be the service labels/types of services. The service labels will be arranged according to the Developmental Domains (i.e., Academic, Social/Emotional/Behavioral, Health, and Family) to facilitate interpretability of results. Covariates include grade, school, gender, race, English Language Learner (ELL), immigrant status, Special Education status (SPED), low income indicator, and dosage.

A three-step approach was carried out using the software Latent GOLD 6.0 (Bakk et al, 2013; Bakk & Vermunt, 2015, 2016; Vermunt & Magidson, 2016). Step 1 involves the selection of the number of classes/clusters before covariates are added. This is carried by building a sequence of models–stepwise, one model at a time–until it meets certain statistical criteria (Weller et al., 2020). Researchers continue to debate over the "best criteria" for a LCA model, but generally, it is often based on fit statistics (e.g., Bayesian information criterion, BIC; Alkaike information criterion, AIC), model specification (e.g., identified vs. not identified), and theoretical interpretability (e.g., Muthén & Muthén, 2000; Nylund et al., 2007; Vermunt, 2002; Weller et al., 2020).

The second and third steps involve adding covariates into the model. In Step 2, the posterior classification probabilities are saved after re-running the final model. In Step 3, there is

the option of inputting covariates either as “active” or “inactive” covariates (Vermunt & Magidson, 2005). This study will use the “inactive covariates” approach. This means that the effects of the covariates are fixed so that the resulting parameters remain unchanged from the original final model (Step 1), which did not have covariates added to it. This approach provides the conditional probability of belonging without changing the original model. Some researchers prefer the one-step method of inputting all the covariates at the beginning and allowing the covariates to determine the number of classes (Vermunt & Magidson, 2005). However, in an exploratory study such as this, the main objective is to report the characteristics or descriptive findings regarding each class/cluster rather than trying to make predictive inferences based on certain outcomes. Latent GOLD 6.0 was used to run latent class regression models that also provided the statistical significance for each covariate, but it effects was nevertheless fixed.

Chapter 4: Results

The results of the data analysis are provided below for Study 1 (sample of two classrooms/cohorts across three academic years) and Study 2 (students from 21 schools across one public school district within one academic year). Summary and interpretation of findings will follow description of the results. Further discussion of results/findings will be provided in Chapter 5.

Study 1

As a preliminary investigation of the construct of "tailoring," Study 1 examines relatively small samples of students within the same classroom/cohort (Class A and Class B) across three years. The provisional description/definition of "tailoring" established in the previous chapters, based on developmental theories, research, and real-world applications, guides the search for the evidence of tailoring given the quantitative data. As previously defined, tailoring is *the process of matching unique patterns of services based on each student's cumulative strengths and needs and the availability of services*.

To summarize the research questions presented in the previous chapters, the first research aim of Study 1 is to look for evidence of tailoring at the *nomothetic and differential* levels. 1) In other words, from the overall aggregate descriptive information, what can be inferred from the potential patterns about the matching of services and supports according to students' Tiers of Strengths/Risks? The second aim is to look for evidence of tailoring at the *nomothetic, differential, and idiographic* levels. 2) In other words, from the patterns of services across classrooms/cohorts and between individuals, what can be inferred about tailoring?

Class A

Preliminary Descriptive Analysis. It should be noted again that the 5th grade (n=23) students in this sample were currently from the same classroom. They were not necessarily in the same classroom in the 4th (n=21) and 3rd grade (n=17), and not all of the students in the current 5th grade were attending the school in their 4th grade and 3rd grade years. This might be due to the fact that families within this population tend to move often to different schools (e.g., Barton,

2003; Rumberger, 2003). The same 14 students were present in all three grade levels, and the same 21 students in the 4th grade were also in the 5th grade.

As shown in Table 6, consistent with City Connects' previous findings, within each grade level there are a higher percentage of students assigned to Tier 1 (minimal risk) and Tier 2a (mild risk) combined than Tier 2b (moderate risk) and Tier 3 (high risk) combined. It is interesting to note that in this sample, for the 3rd grade class/cohort, Tier 2a and Tier 3 have the same percentages of students. In general, most students have more apparent strengths than needs and few have less apparent strengths than needs.

Table 6

Class A Distribution of Student Tiers Across Grades

Tier	Grade					
	3rd		4th		5th	
	n	%	n	%	n	%
Tier 1	9	52	11	52	9	39
Tier 2a	2	12	4	19	6	26
Tier 2b	4	24	3	14	4	17
Tier 3	2	12	3	14	4	17
Total	17	100	21	100	23	100

Further, as shown in Table 7, while most students across all three grade levels received Tier 1 and Tier 2 Services, not all students received Tier 1 Services. Additionally, not all Tier 3 Students received Tier 3 Services, and in some cases there was a higher percentage of Tier 1 and Tier 2a Students than Tier 3 Students who received Tier 3 Services. Therefore, within this sample, Tiers of Services are not tied to students' risk level. In other words, there is no perfect one-to-one correspondence between risk tier and tier of student.

Further examination of the data reveals that of the Tier 1 Students who received Tier 3 Services: one 5th grader received Family Assistance (C3); of the five 4th graders, there was one with Family Assistance (C3) and Crisis Intervention (E3), one with Crisis Intervention (E3), and three other with only Family Assistance (C3). Among the 3rd graders there was only one student in Tier 2b receiving a Tier 3 Service (247, IEP:Physical Therapy). These findings show that the Tier 3 Services that Tier 1 Students received are primarily family services. In other words, a student might be identified as having many strengths, but at times their family might need extra supports. Occasionally, some unexpected emergency (e.g., death in the family or a broken arm) not unique to Tier 3 Students might arise and require other intensive services (e.g., crisis intervention, physical therapy).

Table 7

Distribution of Class A Students Receiving at Least One Service within a Service Tier for All Three Grade Levels

		Service Tiers					
Grade	**Student Tier**	**Tier 1**		**Tier 2**		**Tier 3**	
		n	**%**	**n**	**%**	**n**	**%**
3rd							
	Tier 1 (n=9)	9	100	9	100	0	0

Tier 2a (n=2)	2	100	2	100	1	50
Tier 2b (n=4)	4	100	4	100	0	0
Tier 3 (n=2)	2	100	2	100	0	0
Total = 17						
4th						
Tier 1 (n= 11)	10	91	11	100	5	45
Tier 2a (n=4)	3	75	4	100	2	50.
Tier 2b (n=3)	3	100	3	100	2	67
Tier 3 (n=3)	3	100	3	100	2	67
Total = 21						
5th						
Tier 1 (n =9)	9	100	9	100	1	11
Tier 2a (n=6)	6	100	6	100	0	0
Tier 2b (n=4)	4	100	4	100	0	0
Tier 3 (n=4)	4	100	4	100	1	25
Total = 23						

Note. This table includes students in grades 3-5 who received at least one service with a Service Tier. For example, among 3rd graders in Tier 2a, 100% of the students received at least one Tier 1 Service, 100% received at least one Tier 2 Service, and 50% received at least one Tier 3 Service.

In terms of services received, as shown in Table 8, for all three years, Tier 1 (low intensity/prevention/enrichment) and Tier 2 Services (moderate intensity/early intervention services) make up the majority of the services that students received across all Student Tiers. Additionally, the mean number of services decreased with an increase in grade level. Students required a higher mean number of services when they were younger than when they were older. Consistent with previous findings, the mean number of services generally increased with an increase in student tier/risk. Even though there are fewer students with intensive needs (Tier 3 Students), these students on average had a higher mean number of services than students with less intensive needs. It is interesting to note that in this sample, as shown in Table 8, the

percentage of Tier 3 Services (intensive/crisis intervention) across student tiers of strengths/risks increased from 3rd grade to 4th grade and decreased from 4th grade to 5th.

Table 8

Distribution of Number/Percentage of Services Received across Student Tiers of Strengths/Risks and Tiers of Services in Class A for All Three Grades

		Service Tiers								
Grade	**Student Tier**	**Tier 1**		**Tier 2**		**Tier 3**		**Total**		**Mean # of Services**
		n	%	n	%	n	%	n	%	
3rd (n=17)										

Tier 1 (n=9)	21	28	55	72	0	0	76	100	8.44
Tier 2a (n=2)	4	25	11	69	1	6	16	100	8.00
Tier 2b (n=4)	21	51	20	47	0	0	41	100	10.25
Tier 3 (n=2)	8	42.	11	58	0	0	19	100	9.50
Total	54	36	97	4	1	1	152	100	
4th (n=21)									
Tier 1 (n= 11)	24	39	31	51	6	10	61	100	5.55
Tier 2a (n=4)	6	32	10	53	3	16	19	100	4.75
Tier 2b (n=3)	7	33	10	48	4	19	21	100	7.00
Tier 3 (n=3)	7	30	12	52	4	17	23	100	7.67
Total	44	35	63	51	17	14	124	100	
5th (n=23)									
Tier 1 (n =9)	29	66	14	32	1	2	44	100	4.89
Tier 2a (n=6)	24	75	8	25	0	0	32	100	5.33
Tier 2b (n=4)	11	73	4	26	0	0	15	100	3.75
Tier 3 (n=4)	14	64	7	32	1	5	22	100	5.50
Total	78	70	33	2	2	2	113	100	

Pattern Analysis of Services Received. In this analysis, students were assigned an alphabet letter in place of their student ID (see Figures 1, 2, and 3). A letter corresponds with the same student across all three years if they attended the school for all three years. Student Tiers are provided in the following row. In the subsequent rows, services were coded and the same services were inputted into the same rows. For a detailed list of the services corresponding to these codes, see Appendix A, Tables A.1 and A3. (Note: Some service provider names were de-

identified because they included the name of the students' school and district.) Columns with the same color indicate that students corresponding to those columns share the same pattern of services. Columns corresponding to students who had a pattern that no other students shared were not filled with any color. Patterns need to differ from other patterns by at least one service to be considered unique. "Unique pattern" can refer to both "unshared" and "shared" patterns. One unique pattern, for example, can be shared by multiple students. That is to say, the total number of unique or distinct patterns is the sum of both unshared and shared patterns.

Service patterns among all students within classroom/cohort. As shown in Figure 1, students in the 5th grade had 14 students (61%) who had unshared patterns of services. In other words, these patterns were not shared by any other students in this classroom/cohort. One pattern was shared by 6 students and one pattern was shared by 3 students. In total, there were 16 unique patterns.

As shown in Figure 2, students in the 4th grade (n=21) had 12 students (57 %) who had unshared patterns of services. There was one pattern shared by 3 students and one pattern shared by 2 students. In total, there were 14 unique patterns.

As shown in Figure 3, students in the 3rd grade (n=17) also had 12 students (70%) who had unshared patterns of services. There was one service shared by 3 students and one pattern shared by 2 students. In total, there were 14 unique patterns.

Patterns differed by one service or by more than one service. For example, among the 5th graders, Student C differs from Student E by 3 services, but Student C differs from Student Q by 5 services, and Student E differs from Student Q by 2 services. As another example, among the 4th graders who were in the same school and Tier level (2a), Student H and I differed by 2

services; Student H and Student P differed by 6 services. Student I and Student P differed by 4 services.

Among the same participants (n=14) who were present for all three years, there were students (e.g., Student B and Student O) who had unshared patterns for all three years, students (e.g., Student C and Student G) who had shared patterns for all three years, students (e.g., Student D and E) who had one unshared pattern for only one of the three years, and students (e.g., Student T and Student U) who had unshared patterns for two of the three years. Of the 15 students who were in all three academic years, 5 (33%) had unshared patterns for all three years.

In summary, the percentage of students with unique patterns unshared with any other students decreased significantly from 3rd grade to 4th grade and increased slightly from 4th grade to 5th grade (70%→57%→61%). In this sample, the percentages of unshared service patterns suggest that individualization of service patterns might not correspond perfectly with grade level. Since development is not necessarily linear , individualization/tailoring does not depend entirely on a student's age/grade level. At the same time, findings also suggest that more individualization of services at an early age might reduce the need for more individualization of services later on. Additionally, a sampling from within the sample showed that service patterns for students from the same grade and Student Tier differed from between 2 to 6 services, confirming that developmental needs vary even among individuals who share similar characteristics (e.g., age, grade, school, classroom) and apparently similar overall risks/strengths.

Figure 1

Pattern Analysis of Coded Services for all Student Tiers in Class A, 2020-2021 Academic Year (5th grade, n=23)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Z	AA
Tier	1	2b	1	3	1	2a	3	1	1	1	2b	1	2b	3	2b	2a	3	2a	2a	2a	1	2a	1		
2020-2021 (n=23)	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2		B2	B2	B2	B2	B2	B2	B2	B2	B2	B2		
																					D2				
														E3									E3		
	H2											H2					H2								
	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1	R1			
	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1		
	K1			T1			T1			T1	T1	T1				T1		T1					T1		
				K1	K1					K1		K1	K1			K1		K1	K1			K1			
				K1	K1					K1		K1				K1		K1	K1			K1			
							U2						U2					U2			U2		U2		
	Q1													Q1	Q1	Q1	Q1					Q1	Q1		
																	V2								
																Z2									

Note. 14 students had unshared patterns (white columns); 6 students shared the same pattern (yellow columns); 3 students shared the same pattern (green columns)

Figure 2

Pattern Analysis of Coded Services for all Student Tiers in Class A, 2019-2020 Academic Year (4th grade, n=21)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Z	AA
Tier	1	1	1	2b	1	1	2a	2a	1	1	3	2b	2b	1	2a	1	3	1	2a	1	3				
2019-2020 (n=21)	A2	A2		A2	A2	A2	A2	A2			A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2				
	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2				
	C3											C3			C3	C3	C3	C3	C3	C3	C3				
	D2												D2												
	E3											E3	E3	E3	E3		E3				E3				
	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1			F1	F1	F1	F1	F1	F1				
	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1	F1			F1	F1	F1	F1	F1	F1				
	G2				G2		G2			G2		G2		G2			G2				G2				
	H2											H2					H2				H2				
			I1						I1												I1				
							J2						J2					J2			J2				
										K1		K1													
													L3												
														M2				M2							
														N2											
														O2				O2			O2				
	P1																								

Note. 14 students had unshared patterns (white columns); 5 students shared the same pattern (turquoise columns); 2 students shared the same pattern (orange columns)

Figure 3

Pattern Analysis of Coded Services for all Student Tiers in Class A, 2018-2019 academic year (3rd grade, n=17)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Z	AA
Tier	1	1	1	2b		1	2	2b	1	2a				2b		1		2a	1	1	2b			1	3
2018-2019 (n = 17)	266(2)	266(2)	223(2)	266(2)		266(2)	202(1)	201(1)	266(2)	266(2)				202(1)		266(2)		247(3)	266(2)	266(2)	230(2)			266(2)	211(1)
	266(2)	266(2)	266(2)	266(2)		266(2)	266(2)	202(1)	266(2)	266(2)				240(2)		266(2)		266(2)	266(2)	266(2)	266(2)			266(2)	264(1)
	266(2)	223(2)	266(2)	305(2)		266(2)	266(2)	204(1)	223(2)	266(2)				264(1)		266(2)		266(2)	312(1)	266(2)	266(2)			305(2)	266(2)
	267(2)	312(1)	266(2)	312(1)		268(2)	266(2)	209(1)	312(1)	268(2)				264(1)		268(2)		266(2)	310(1)	268(2)	223(2)			349(2)	266(2)
	268(2)	310(1)	268(2)	310(1)		305(2)	268(2)	307(1)	310(1)	305(2)				264(1)		305(2)		267(2)	268(2)	310(1)	296(2)			312(1)	266(2)
	296(2)	268(2)	305(2)	268(2)		310(1)	305(2)	310(1)	268(2)	310(1)				266(2)		310(1)		268(2)	266(2)	312(1)	329(1)			310(1)	268(2)
	305(2)	266(2)	310(1)	264(1)		312(1)	310(1)	310(1)	266(2)	312(1)				266(2)		312(1)		305(2)	266(2)		312(1)			268(2)	305(2)
	310(1)		312(1)	266(2)			312(1)	312(1)						266(2)				310(1)	266(2)		310(1)			296(2)	310(1)
	312(1)													268(2)				312(1)	223(2)		268(2)			266(2)	312(1)
	349(2)													305(2)					305(2)		266(2)			264(1)	346(1)
														310(1)					312(1)		264(1)				349(2)
														312(1)					310(1)						
														349(2)					268(2)						
														349(2)					266(2)						

Note. 12 students had unshared patterns (white columns); 3 students shared the same pattern (turquoise columns); 2 students shared the same pattern (green columns)

Service patterns within each Student Tier of Strengths/Risks. As shown in Figure 4, among 5th graders (n=23), Tier 1 (n=9) had 6 students (67%) with unshared patterns and there was one pattern shared by 3 students, with a total of 7 unique patterns. Tier 2a (n=6) had 4 students (67%) with unshared patterns and there was one pattern shared by 2 students, with a total of 5 unique patterns. All of the students (100%) in both Tier 2b (n=4) and Tier 3 (n=4) had unshared patterns.

As shown in Figure 5, among 4th graders (n=21), Tier 1 (n=11) had 7 students (64%) with unshared patterns, one pattern shared by 2 students, and another pattern shared by 2 students, with a total of 9 unique patterns. All of the students (100 %) in Tier 2a (n=4), Tier 2b (n=3), and Tier 3 (n=3) had unshared patterns.

As shown in Figure 6, among 3rd graders (n=17), Tier 1 (n=9) had 5 students (56%) with unshared patterns, one pattern shared by 2 students, and another pattern also shared by 2 students, with a total of 7 unique patterns. All of the students (100 %) in Tier 2a (n=2), Tier 2b (n=4), and Tier 3 (n=2) had unshared patterns.

Figure 4

Pattern Analysis of Coded Services Ordered by Student Tiers in Class A, 2020-2021 Academic Year (5th grade, n=23)

ID	B	D	F	I	J	K	M	V	X	G	Q	S	T	U	W	C	L	N	P	E	H	O	R
Tier	1	1	1	1	1	1	1	1	1	2a	2a	2a	2a	2a	2a	2b	2b	2b	2b	3	3	3	3
2020-2021 (n=23)	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2		B2	B2	B2	B2	B2
								D2															
									E3													E3	
	H2						H2																H2
	R1	R1	R1	R1	R1	R1	R1	R1		R1	R1	R1	R1	R1	R1	R1	R1	R1		R1	R1	R1	R1
	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1	S1
	K1					T1	T1		T1		T1	T1					T1			T1	T1		
			K1			K1	K1				K1	K1	K1		K1			K1		K1			
			K1			K1	K1				K1	K1	K1		K1					K1			
								U2	U2			U2						U2			U2		
	Q1								Q1		Q1				Q1				Q1			Q1	Q1
																							V2
											Z2												

Note. **Tier 1 Students (n=9):** 6 students had unshared patterns (5 white columns and 1 green column), 3 students shared the same pattern (3 yellow columns); **Tier 2a Students (n=6):** 4 students had unshared patterns (3 white columns and 1 green column), 2 students shared the same pattern (2 yellow columns); **Tier 2b Students (n=4):** 4 students had unshared patterns (2 white columns and 1 yellow column); **Tier 3 Students (n=4):** 4 students had unshared patterns (3 white columns and 1 green column).

Figure 5

Pattern Analysis of Coded Services Ordered by Student Tiers in Class A, 2019-2020 Academic Year (4th grade, n=21)

ID	B	C	D	F	G	J	K	O	Q	S	U	H	I	P	T	E	M	N	L	R	V
Tier	1	1	1	1	1	1	1	1	1	1	1	2a	2a	2a	2a	2b	2b	2b	3	3	3
2019-2020 (n=21)	A2	A2		A2	A2			A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2
	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2	B2
	C3								C3	C3	C3			C3	C3		C3			C3	C3
	D2																	D2			
	E3							E3						E3			E3	E3		E3	E3
	F1	F1	F1	F1	F1	F1	F1		F1	F1	F1	F1	F1		F1	F1	F1	F1	F1	F1	F1
	F1	F1	F1	F1	F1	F1	F1		F1	F1	F1	F1	F1		F1	F1	F1	F1	F1	F1	F1
	G2			G2			G2	G2				G2					G2			G2	G2
	H2																H2			H2	H2
			I1			I1															I1
										J2		J2						J2			J2
							K1										K1				
																		L3			
								M2		M2											
								N2													
								O2		O2											O2
	P1																				

Note. **Tier 1 Students (n=11):** 7 students had unshared patterns (7 white columns and 1 green column), 2 students shared the same pattern (2 orange columns); **Tier 2a Students (n=4):** 4 students had unshared patterns (3 white columns and 1 turquoise column), 2 students shared the same pattern (2 yellow columns); **Tier 2b Students (n=3):** 3 students had unshared patterns (2 white columns and 1 turquoise column); **Tier 3 Students (n=3):** 3 students had unshared patterns (2 white columns and 1 turquoise column).

Figure 6

Pattern Analysis of Coded Services Ordered by Student Tiers in Class A, 2018-2019 academic year (3rd grade, n=17)

ID	B	C	D	G	Q	T	U	J	Z	K	S	E	I	O	V	H	AA
Tier	1	1	1	1	1	1	1	1	1	2a	2a	2b	2b	2b	2b	3	3
2018-2019 (n = 17)	266(2)	266(2)	223(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	247(3)	266(2)	201(1)	202(1)	230(2)	202(1)	211(1)
	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	266(2)	202(1)	240(2)	266(2)	266(2)	264(1)
	266(2)	223(2)	266(2)	266(2)	266(2)	312(1)	266(2)	223(2)	305(2)	266(2)	266(2)	305(2)	204(1)	264(1)	266(2)	266(2)	266(2)
	267(2)	312(1)	266(2)	268(2)	268(2)	310(1)	268(2)	312(1)	349(2)	268(2)	266(2)	312(1)	209(1)	264(1)	223(2)	266(2)	266(2)
	268(2)	310(1)	268(2)	305(2)	305(2)	268(2)	310(1)	310(1)	312(1)	305(2)	267(2)	310(1)	307(1)	264(1)	296(2)	268(2)	266(2)
	296(2)	268(2)	305(2)	310(1)	310(1)	266(2)	312(1)	268(2)	310(1)	310(1)	268(2)	268(2)	310(1)	266(2)	329(1)	305(2)	268(2)
	305(2)	266(2)	310(1)	312(1)	312(1)	266(2)		266(2)	268(2)	312(1)	305(2)	264(1)	310(1)	266(2)	312(1)	310(1)	305(2)
	310(1)		312(1)			266(2)			296(2)		310(1)	266(2)	312(1)	266(2)	310(1)	312(1)	310(1)
	312(1)					223(2)			266(2)		312(1)			268(2)	268(2)		312(1)
	349(2)					305(2)			264(1)					305(2)	266(2)		346(1)
						312(1)								310(1)	264(1)		349(2)
						310(1)								312(1)			
						268(2)								349(2)			
						266(2)								349(2)			

Note. **Tier 1 Students (n=9):** 5 students had unshared patterns (5 white columns and 1 green column), 2 students shared the same pattern (2 green columns), 2 students shared the same pattern (2 turquoise columns ; **Tier 2a Students (n=2):** 2 students had unshared patterns (1 white column and 1 turquoise column); **Tier 2b Students (n=4):** 4 students had unshared patterns (3 white columns and 1 orange column); **Tier 3 Students (n=2):** 2 students had unshared patterns (2 white columns).

In summary, percentages of the number of patterns that are unshared increased with an increase in risks (Student Tiers of Strengths/Risks). It is interesting to note that for 3rd and 4th graders, students from Tier 2a to Tier 3 all had unshared patterns, and for 5th graders, Tier 2b and Tier 3 students all had unshared patterns. This suggests that higher levels of risks require more individualization/tailoring of services.

Class B

Preliminary Descriptive Analysis. The same procedures and analysis was applied to another class/cohort of students (Class B) from a different school in a different school district in order to confirm the results from the examination of Class A. As noted before, the 5th grade (n=21) students in this sample were currently from the same classroom. They were not necessarily in the same classroom in the 4th (n=17) and 3rd grade (n=14), and not all of the students in the current 5th grade were attending the school in their 4th grade and 3rd grade years. This might be due to the fact that families within this population tend to move often to different

schools (e.g., Barton, 2003; Rumberger, 2003). The same 15 students were present in all three grade levels, and the same 17 students in the 4th grade were also in the 5th grade.

As shown in Table 9, as with Class A, within each grade level there are a higher percentage of students assigned to Tier 1 (minimal risk) and Tier 2a (mild risk) combined than Tier 2b (moderate risk) and Tier 3 (high risk) combined. Of note, unlike Class A, for the 3rd grade class/cohort, none of the students in the sample was assigned to Tier 2b, and while the percentage of students assigned to Tier 3 increased as grade level increased in Class A, for Class B the percentage of students assigned to Tier 3 decreased from 3rd grade to 4th and decreased from 4th to 5th. This suggests potential variability in the pattern of student tier assignment. Interestingly, no 3rd grade students were assigned to Tier 2b in this sample.

Table 9

Class B Distribution of Student Tiers Across Grades

Student Tiers	Grade					
	3rd		4th		5th	
	n	%	n	%	n	%
Tier 1	5	33	7	41	8	38
Tier 2a	7	47	4	23	6	29
Tier 2b	0	0	4	23	4	19
Tier 3	3	20	2	12	3	14.
Total	15	100	17	100	21	100

Further, as shown in Table 10 and consistent with the findings in Class A, while most students across all three grade levels received Tier 1 and Tier 2 Services, not all students

received Tier 1 Services. Additionally, as with Class A, not all Tier 3 Students received Tier 3 Services, and in some cases there was a higher percentage of Tier 1 and Tier 2a Students than Tier 3 Students who received Tier 3 Services. Therefore, in this sample, Tiers of Services are also not tied to students' risk level. In other words, there is no perfect one-to-one correspondence between risk tier and tier of student. Further examination of the data reveals that of the Tier 1 Students who received Tier 3 Services: four 4th grade students received Accommodations and Adaptation (Family) (A3e); two 3rd grade students received IEP: Speech and Language (248), one received IEP: Speech and Language (248) and IEP Occupational Therapy (246), and one received Health/Medical (community-provided) 233.

Table 10

Distribution of Number/Percentage of Class B Students Receiving at Least One Service within a Tier of Service for All Three Grade Levels

		Service Tiers					
Grade	**Student Tier**	**Tier 1**		**Tier 2**		**Tier 3**	
		n	**%**	**n**	**%**	**n**	**%**
3rd							
	Tier 1 (n=5)	5	100	5	100	4	80
	Tier 2a (n=7)	7	100	7	100	2	29
	Tier 2b (n=0)	0	0	0	0	0	0
	Tier 3 (n=3)	3	100	23	100	0	0
	Total = 15						
4th							

	Tier 1 (n= 7)	7	100	7	100	4	57
	Tier 2a (n=4)	4	100	4	100	1	25
	Tier 2b (n=4)	4	100	4	100	0	0
	Tier 3 (n=2)	2	100	2	100	0	0
	Total = 17						
5th							
	Tier 1 (n =8)	8	100	8	100	0	0
	Tier 2a (n=6)	6	100	6	100	2	33
	Tier 2b (n=4)	4	100	4	100	0	0
	Tier 3 (n=3)	2	67	3	100	1	33
	Total = 21						

Note. For example, among 3rd graders in Tier 2a, 100% of the students received at least one Tier 1 Service, 100% received at least one Tier 2 Service, and 28% received at least one Tier 3 Service.

In terms of services received, as shown in Table 11, for all three years, Tier 1 (low intensity/prevention/enrichment) and Tier 2 Services (moderate intensity/early intervention services) make up the majority of the services that students received across all Student Tiers. Additionally, the mean number of services decreased with an increase in grade level. Students required a higher mean number of services when they were younger than when they were older. The mean number of services generally increased with an increase in student tier/risk. Even though there are fewer students with intensive needs (Tier 3 Students), these students on average had a higher mean number of services than students with less intensive needs. These findings are consistent with those in the examination of Class A. It is interesting to note that in this sample, for both 3rd and 5th grades, the mean number of services were higher for Tier 2b Students than Tier 3 Students.

Table 11

Distribution of Number/Percentage of Services Received across Student Tiers of Strengths/Risks and Tiers of Services in Class B for All Three Grades

		Service Tiers								
Grade	**Student Tier**	**1**		**2**		**3**		**Total**		**Mean # of Services**
3rd (n=15)										
	1 (n=5)	25	53	16	34	6	13	47	100	9.40
	2a (n=7)	39	56	28	40	3	4	70	100	10.00
	2b (n=0)	0	0	0	0	0	0	0	100	0.00
	3 (n=3)	13	52	12	48	0	0	25	100	8.33
	Total	77	54	56	39	9	6	142	100	
4th (n=17)										
	1 (n= 7)	51	80	9	14	4	6	64	100	9.17
	2a (n=4)	6	76	8	22	1	3	37	100	9.25
	2b (n=4)	7	73	11	28	0	0	40	100	10.00
	3 (n=2)	7	70	6	30	0	0	20	100	10.00
	Total	122	76	34	21	5	14	161	100	
5th (n=21)		n	%	n	%	n	%	n	%	
	1 (n =8)	19	52	17	50	1	3	37	100	4.63
	2a (n=6)	14	40	17	49	4	11	35	100	5.83
	2b (n=4)	10	50	10	50	0	0.	20	100	5.00
	3 (n=3)	6	43	7	50	1	7	14	100	4.67

Pattern Analysis of Services Received. As with the pattern analysis of Class A, students in Class B (from a different school) were assigned an alphabet letter in place of their student ID (see Figures 7, 8, and 9). A letter corresponds with the same student across all three years, if they

attended the school for all three years. Student Tiers are provided in the following row. In the subsequent rows, services were coded and the same services were inputted into the same rows. For a detailed list of the services corresponding to these codes see Appendix A, Table A.2 and A.4. (Some service provider names were de-identified because they included the name of the students' school or specific geographical location.) Columns with the same color indicate that students corresponding to those columns share the same pattern of services. Columns corresponding to students who had a pattern that no other students shared were not filled with any color. Patterns need to differ from other patterns by at least one service to be considered unique. As mentioned previously, "unique pattern" can refer to both "unshared" and "shared" patterns.

Service patterns among all students within classroom/cohort. As shown in Figure 7, students in the 5th grade (n=21) had 10 students (48%) who had unshared patterns of services. One pattern was shared by 9 students and one pattern was shared by 2 students. In total, there were 12 unique patterns. (Note: Student V, a Tier 3 Student, only had one service. The reason for this is not known, but Student V was nevertheless kept in the study.)

As shown in Figure 8, students in the 4th grade (n=17) also had 11 students (65%) who had unshared patterns of services. There were 3 patterns each shared by 3 students. In total, there were 14 unique patterns.

As shown in Figure 9, students in the 3rd grade (n=15) had 13 students (87%) who had unshared patterns of services. There was one service shared by 2 students. In total, there were 14 unique patterns among 3rd graders.

Patterns differed by one service or by more than one service. For example, among the 4th graders, Student K differs from Student L by 4 services, but Student K differs from Student O by

5 services, and Student L differs from Student O by 2 services. As another example, among the 3rd graders from the same Student Tier (Tier 3), Student B differed from Student N by 6 services; Student B differed from Student T by 2 services; and Student N differed from Student T also by 6 services.

Among the same n=15 participants who were present for all three years, there were students (e.g., Student I and Student T) who had unshared patterns for all three years, students (e.g., Student R and Student U) who had shared patterns for all three years, and students (e.g., Student B and Student S) who had unshared patterns for two of the three years. In this sample, no student had one unshared pattern for only one of the three years. Similar to Class A, of the n=15 students whose service profiles were available for all three academic years, 5 (33%) had unshared patterns for all three years.

In summary, the percentage of students with unique patterns unshared with any other students decreased as grade level increased (3rd:87%→4th:65%→5th:48%). (In Class A, the percentage of unshared patterns increased slightly between 4th and 5th grade [3rd:70%→4th:57%→5th:61%].) Findings suggest that more individualization of services at an early age might reduce the need for more individualization of services later on. Additionally, a sampling taken from within the sample showed that service patterns differed from between 2 to 6 services for students within the same grade and same Student Tier, confirming that development varies even among individuals who share similar characteristics (e.g., age, grade, school, classroom) and apparently similar needs (i.e., overall risks/strengths). These findings replicate the findings in the study of Class A.

Figure 7

Pattern Analysis of Coded Services for all Student Tiers in Class B, 2020-2021 academic year

(5th grade, n=21)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
Tier	2b	2b	2a	1	1	2a	2a	2a	3	2b	1	3	1	1	2a	1	1	1	2b	2a	3
2020-2021 n = 21	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	
	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	
		A2b				A2b		A2b	A2b			A2b							A2b		
						A3c		A3c				A3c									
						A3d		A3d													
											A3e										
															A2f						
																			A1g		
	B1	B1	B1	B1	B1	B1	B1	B1	B1		B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	
			B2a								B2a										
										B1b				B1b							
	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	
								D2													
																					E2
			F1								F1	F1							F1		
											F1										
			F1a									F1a									

Note. 10 students had unshared patterns (white columns); 9 students shared the same pattern (green columns); 2 students shared the same pattern (turquoise columns)

Figure 8

Pattern Analysis of Coded Services for all Student Tiers in Class B, 2019-2020 academic year

(4th grade, n=17)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
Tier	2b	2b				2a	2a	3	2b	1	1	2b	1	1	1	1	1	2a	3	2a	
2019-2020						A2b		A2b				A2b									
n=17							A3e			A3e			A3e		A3e	A3e					
	A1h	A1h				A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	
	A1h	A1h					A1h	A1h	A1h	A1h	A1h		A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	
	A1i	A1i				A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	Ai	Ai	A1i	A1i	A1i	
		A1j				A1j				A1j											
						A1k				A1k											
								A2l				A2l									
	D2							D2				D2									
								F1a	F1a			F1a									
	G2	G2				G2				G2	G2	G2						G2		G2	
	G2a	G2a				G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	
	H1	H1				H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	
	I1	I1				I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	
	I1	I1				I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	
		J1					J1		J1	J1	J1	J1		J1	J1	J1	J1			J1	
								K2													
										L1			L1			L1			L1		
																		M1			

Note. 11 students had unshared patterns (white columns); 2 students shared the same pattern (yellow columns); 2 students shared the same pattern (green columns)

Figure 9

Pattern Analysis of Coded Services for all Student Tiers in Class B, 2018-2019 academic year (3rd grade, n= 15)

ID	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
Tier	T3	T1				T1		T1		T1	T1	2a	T3	T2a	T2a	T2a	T2a	T2a	T3	T2a	
2018-2019	200(2)	200(2)				200(2)		200(2)		200(2)	200(2)	200(2)	200(2)	200(1)	200(2)	200(2)	200(2)	200(2)	200(2)	200(2)	
(n =15)	269(1)	248(3)				248(3)		248(3)		269(1)	269(1)	248(3)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	
	209(2)	269(1)				269(1)		269(1)		209(2)	218(1)	269(1)	203(1)	235(2)	230(3)	203(1)	209(2)	218(1)	209(2)	209(2)	
	312(1)	218(1)				218(1)		246(3)		263(1)	209(2)	209(2)	269(1)	209(2)	203(1)	269(1)	312(1)	235(2)	312(1)	312(1)	
	310(1)	209(2)				209(2)		209(2)		312(1)	263(1)	312(1)	209(2)	263(1)	269(1)	201(1)	310(1)	209(2)	310(1)	310(1)	
	295(2)	312(1)				312(1)		312(1)		310(1)	312(1)	310(1)	263(1)	312(1)	209(2)	209(2)	295(2)	263(1)	295(2)	295(2)	
	321(1)	310(1)				310(1)		310(1)		295(2)	310(1)	233(3)	312(1)	310(1)	312(1)	263(1)		312(1)	216(2)		
	264(2)	295(2)				266(1)		233(3)		268(1)	233(3)	295(2)	310(1)	295(2)	310(1)	312(1)		310(1)			
	216(2)	268(1)				295(2)		295(2)			295(2)	321(1)	295(2)		295(2)	310(1)		295(2)			
						267(1)		321(1)							200(2)	264(2)		268(1)			
						264(2)									269(1)	295(2)		267(1)			
															235(2)	267(1)					
															209(2)	264(2)					
															263(1)						
															312(1)						
															310(1)						
															295(2)						

Note. 13 students had unshared patterns (white columns); 2 students shared the same pattern (turquoise columns)

Service patterns within each Student Tier of Strengths/Risks. As shown in Figure 10, among 5th graders (n=21), Tier 1 (n=8) had 2 students (25%) with unshared patterns and there

was one pattern shared by 6 students, with a total of 3 unique patterns. Tier 2a (n=6) had 4 students (67%) with unshared patterns and there was one pattern shared by 2 students, with a total of 5 unique patterns. All of the students (100%) in both Tier 2b (n=4) and Tier 3 (n=3) had unshared patterns.

As shown in Figure 11, among 4th graders (n=17), Tier 1 (n=7) had 5 students (71%) with unshared patterns, one pattern shared by 2 students, with a total of 6 unique patterns. All of the students (100 %) in Tier 2a (n=4), Tier 2b (n=4), and Tier 3 (n=2) had unshared patterns.

As shown in Figure 12, among 3rd graders (n=15), all students (100%) in Tier 1 (n=5) and Tier 3 (n=3) had unshared patterns. Tier 2a (n=7) had 5 (71%) unshared patterns, and one pattern shared by 2 students. This totals to 13 unique patterns. (As previously mentioned, no student was assigned to Tier 2b in this sample.)

Figure 10

Pattern Analysis of Coded Services Ordered by Student Tiers in Class B, 2020-2021 Academic Year (5th grade, n=21)

ID	E	F	L	N	O	Q	R	S	D	G	H	I	P	U	B	C	K	T	J	M	V
Tier	1	1	1	1	1	1	1	1	2a	2a	2a	2a	2a	2a	2b	2b	2b	2b	3	3	3
2020-2021 n = 21	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	A2	
	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	A1a	
										A2b		A2b				A2b		A2b	A2b	A2b	
										A3c		A3c								A3c	
										A3d		A3d									
			A3e																		
													A2f								
																		A1g			
	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1	B1		B1	B1	B1	
			B2a						B2a												
					B1b												B1b				
	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	C2	
												D2									
																					E2
			F1						F1									F1		F1	
			F1																		
									F1a											F1a	

Note. **Tier 1 Students (n=8):** 2 students had unshared patterns (2 white columns), 6 students shared the same pattern (6 green columns); **Tier 2a Students (n=6):** 4 students had unshared patterns (4 white columns), 2 students shared the same pattern (2 green columns); **Tier 2b**

Students (n=4): 4 students had unshared patterns (2 white columns, 1 turquoise column, and 1 green column); **Tier 3 Students (n=3):** 3 students had unshared patterns (2 white columns and 1 turquoise column).

Figure 11

Pattern Analysis of Coded Services Ordered by Student Tiers in Class B, 2019-2020 Academic Year (4th grade, n=17)

ID	K	L	N	O	P	Q	R	G	H	S	U	B	C	J	M	I	T
Tier	1	1	1	1	1	1	1	2a	2a	2a	2a	2b	2b	2b	2b	3	3
2019-2020 (n = 17)								A2b							A2b	A2b	
	A3e		A3e		A3e	A3e			A3e								
	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h	A1h
	A1h	A1h	A1h	A1h	A1h	A1h	A1h		A1h	A1h	A1h	A1h	A1h	A1h		A1h	A1h
	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i	A1i
	A1j							A1j					A1j				
	A1k							A1k									
															A2l	A2l	
												D2			D2	D2	
														F1a	F1a	F1a	
	G2	G2						G2		G2	G2	G2	G2		G2		
	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a	G2a
	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1	H1
	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1	I1
	J1	J1		J1	J1	J1	J1		J1		J1		J1	J1	J1		
																K2	
	L1		L1			L1											L1
										M1							

Note. **Tier 1 Students (n=7):** 5 students had unshared patterns (3 white columns, 1 yellow column), 2 students shared the same pattern (2 turquoise columns); **Tier 2a Students (n=4):** 4 students had unshared patterns (2 white columns, 1 yellow column, and 1 green column); **Tier 2b Students (n=4):** 4 students had unshared patterns (4 white columns); **Tier 3 Students (n=2):** 2 students had unshared patterns (2 white columns).

Figure 12

Pattern Analysis of Coded Services Ordered by Student Tiers in Class B, 2018-2019 Academic Year (3rd grade, n=15)

ID	C	G	I	K	L	M	O	P	Q	R	S	U	B	N	T
Tier 2018-2019 (n =15)	T1	T1	T1	T1	T1	2a	T2a	T2a	T2a	T2a	T2a	T2a	T3	T3	T3
	200(2)	200(2)	200(2)	200(2)	200(2)	200(2)	200(1)	200(2)	200(2)	200(2)	200(2)	200(2)	200(2)	200(2)	200(2)
	248(3)	248(3)	248(3)	269(1)	269(1)	248(3)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)	269(1)
	269(1)	269(1)	269(1)	209(2)	218(1)	269(1)	235(2)	230(3)	203(1)	209(2)	218(1)	209(2)	209(2)	203(1)	209(2)
	218(1)	218(1)	246(3)	263(1)	209(2)	209(2)	209(2)	203(1)	269(1)	312(1)	235(2)	312(1)	312(1)	269(1)	312(1)
	209(2)	209(2)	209(2)	312(1)	263(1)	312(1)	263(1)	269(1)	201(1)	310(1)	209(2)	310(1)	310(1)	209(2)	310(1)
	312(1)	312(1)	312(1)	310(1)	312(1)	310(1)	312(1)	209(2)	209(2)	295(2)	263(1)	295(2)	295(2)	263(1)	295(2)
	310(1)	310(1)	310(1)	295(2)	310(1)	233(3)	310(1)	312(1)	263(1)		312(1)		321(1)	312(1)	216(2)
	295(2)	266(1)	233(3)	268(1)	233(3)	295(2)	295(2)	310(1)	312(1)		310(1)		264(2)	310(1)	
	268(1)	295(2)	295(2)		295(2)	321(1)		295(2)	310(1)		295(2)		216(2)	295(2)	
		267(1)	321(1)					200(2)	264(2)		268(1)				
		264(2)						269(1)	295(2)		267(1)				
								235(2)	267(1)						
								209(2)	264(2)						
								263(1)							
								312(1)							
								310(1)							
								295(2)							

Note. **Tier 1 Students (n=5):** 5 students had unshared patterns (5 white columns); **Tier 2a Students (n=7):** 7 students had unshared patterns (6 white columns and 1 turquoise column); **Tier 2b Students (n=0)**; **Tier 3 Students (n=3):** 3 students had unshared patterns (3 white columns).

In summary, similar to the findings in the study of Class A, the percentages of the number of patterns that are unshared increased with an increase in risks (Student Tiers of Strengths/Risks), the percentages of the number of patterns that are unshared generally increased with an increase in risks (Student Tiers of Strengths/Risks). This again suggests that higher levels of risks require more individualization/tailoring of services.

Study 2

Using a dataset larger than in Study 1 with participants from a different school district, Study 2 seeks to confirm the findings/patterns found in Study 1. The preliminary objectives of Study 2 are similar to Study 1: To look for evidence of tailoring at the *nomothetic and differential* levels. 1) In other words, from the overall aggregate descriptive information, what can be inferred from the potential patterns about the matching of services and supports according

to students' Tiers of Strengths/Risks? The second aim is to look for evidence of tailoring at the *nomothetic and idiographic* levels. 2) In other words, from the patterns of services across classrooms/cohorts and between individuals, what can be inferred about tailoring?

Additionally, similar to a *post-hoc* analysis, Study 2 takes the analysis a step further and aims to see if there are discernible, latent patterns in service delivery among students with unique, unshared patterns of services. In other words, 3) Is service delivery/matching completely random, or is there evidence of order underlying the apparent randomness?

Preliminary Descriptive Analysis

As shown in Table 12, on average, the percentage of students decreased as the level of risk (Tier of Strengths/Risks) increased. In other words the students that experienced more intensive risk (i.e., Tier 2b and Tier 3 Students) are fewer than the students that experienced less intensive risk (i.e., Tier 1 and Tier 2a). Interestingly, the largest percentage of students fell within the level of "mild risk" (Tier 2a). Further, as Student Tier/risk level increased, the mean number (and the maximum number) of services also increased. This suggests higher needs require more services.

Table 12

Distribution of Number/Percentage of Students and Services across Student Tiers of Strengths/Risks

Student Tier	Students n	%	Services n	%	Service Mean	SD	Min Number of Services	Max Number of Services

1	1788	31	12436	28	6.96	2.78	1	16
2a	1899	32	13885	31	7.31	2.97	1	18
2b	1389	24	10950	25	7.88	3.22	1	19
3	773	13	6943	16	8.98	3.12	1	22
Total	5849	100	44214	100				

Further, as shown in Table 13, across all Student Tiers of Strengths/Risks, more students received Tier 1 than Tier 2 Services, and more students received Tier 1 and Tier 2 Services than Tier 3 Services. This confirm the above findings that most students require low intensity interventions and while many students received intensive services regardless of their overall level of risks, more students with the highest levels of risks (Tier 2b and Tier 3 Students) receive more intensive services than students with lower levels of risks (Tier 1 and Tier 2b Students).

Table 13

Distribution of Number/Percentage of Students Receiving at Least One Service within a Tier of Service for All Grade Levels

Student Tier	**Service Tiers**					
	1		**2**		**3**	
	n	%	n	%	n	%
1 (n=1788)	1776	99	1521	85	1234	69
2a (n=1899)	1875	99	1655	87	1486	78
2b (n=1389)	1372	98	1237	89	1389	80
3 (n=773)	761	98	724	94	678	88
Total = 5849						

Note. For example, among Tier 3 Students, 98.45% of the students received at least one Tier 1 Service, 93.66% received at least one Tier 2 Service, and 87.71% received at least one Tier 3 Service.

Expanding on the above results, in terms of service distribution across Student Tiers of Strengths/Risks and Tiers of Services, Table 14 provides the number/percentage of services both within each Student Tiers of Strengths/Risks (1, 2a, 2b, 3) across Tiers of Services (1, 2, 3) and within each Tier of Service across Student Tiers of Strengths/Risks. Results show that of all the services received, the majority of the services were Tier 1 Services (low intensity/prevention/enrichment services), and the next highest number of services were Tier Services (moderate intensity/early intervention services), followed by Tier 3 Services (high intensity/intensive/crisis intervention services). Tier 2 and Tier 3 Services increased as student risks increased, and Tier 3 has the highest percentage of Tier 3 Services. In other words, higher risks require more intensive services.

Table 14

Distribution of Number/Percentage of Services Received across Student Tiers of Strengths/Risks

Student Tier	**Service Tiers**						**Total Services**	
	1		**2**		**3**			
	n	%	n	%	n	%	n	%
1 (n =1788)	6825	55	4075	33	1536	12	12436	100
2a (n=1899)	7249	52	4484	32	2152	16	13885	100
2b (n=1389)	5372	49	3757	34	1821	17	10950	100
3 (n=773)	3018	43	2569	37	1356	20	6943	100
Total (n=5849)	22464	51	14885	34	6865	16	44214	100

Pattern Analysis of Services Received

As mentioned before, when a pattern is "unshared," only one student has this pattern. When a pattern is "shared," two or more students have the same service pattern or combination

of services. Patterns can differ by one or more than one service. Total "unique patterns" mean the sum of both shared and unshared patterns.

After the application of the inclusion/exclusion criteria (i.e., remove if designation of Student Tiers is missing and remove if student did not receive a full year of City Connects) to the original data set (without pre-K) of n=7,381 participants was reduced to n=5,849 participants. Pattern analysis will focus on the reduced data set, but analysis and results using the original data set will be provided in Appendix C, Tables C1 and C2, for comparison. As mentioned in the previous chapter, a pattern might be considered "unshared" in the reduced data set but might be shared with one or more students in the original data set. For this reason, pattern analysis was carried out on the original data set as well to show the "true patterns" (shared and unshared) within the data set.

Service Patterns among All Students across the District. Results of initial analysis presented in Table 15 show that of the n=5,849 students, 1,931 students (33 %) had a pattern not shared with any other student. As sensitivity analysis was carried out by comparing the percentage of unshared patterns in the reduced data set (after the imposition of the inclusion/exclusion criteria) to the original data set. In the original data set, of the n=7,381 students, 2,522 (35%) students had a pattern not shared with any other student. Thus, the results differ minutely between the two data sets. Using the original data set to calculate the number of "true" shared patterns, results show that there are 839 patterns total shared by 4,829 students. Thus, there are a total of (unshared patterns + shared patterns = 2552 + 839) 3391 unique patterns. To provide an idea of the range of the number of shared patterns, patterns are shared at least by 2 students and at most by 86 students. There are 708 students who share a pattern with only one other student. This means that there are 354 total patterns, each of which is shared by 2

students. For the full list of the number of shared patterns, see Appendix D, Table D1. The reduced data set will be used for the rest of the analysis in this study.

Table 15

Sensitivity Analysis Comparing Number/Percentage of Unique Service Patterns in Two Data Sets

	Data set				
	Reduced			Original	
	n	%		n	%
Unshared	1931	33	**Unshared**	2552	35
Shared	3918	67	**Shared**	4829	65
Total	5849	100	**Total**	7381	100

Since it has been established that about one-third of the students in this data set have a unique pattern of service not shared with any other student, the next step is to see how the percentage of unshared patterns compared to shared patterns across grade levels. As shown in Table 16, on average, as grade level increased, the percentage of unshared service patterns also increased. This suggests that as students grow older their needs become more complex and require more individualized/tailored patterns of services. At the same time, similar with the results in Study 1, grade level does not perfectly correspond with the percentage of unshared patterns from 4th grade onward with the most notable drop between 6th and 7th grade. It is likely that since differentiation of personality, temperament, and needs become more pronounced as children grow, development becomes less linear and predictable. It is also possible that the small sample size for the upper grade levels could be related to the fluctuation in percentages.

Table 16

Distribution of Students by Shared and Unshared Service Patterns across Grade Levels (n=5,849)

Pattern Type	Grade																			
	K		1		2		3		4		5		6		7		8		9	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Unshared (n=1931)	138	18	253	25	337	31	417	38	326	39	167	39	67	58	97	36	46	55	83	52
Shared (n=3918)	644	82.	766	75	742	69	667	62	50	61	258	61	48	42	174	64.	38	48	78	48
Total	782	13	1019	17	1079	18	1084	19	829	14	425	7	115	2	271	5	84	1	161	2

Service patterns within each Student Tier of Strengths/Risks. In Table 17, students (n=5,849) are grouped according to their provisional Tiers of Strengths/Risks. Tier 1 (n=1,788) had 363 students (67%) with unshared patterns. Tier 2a (n=1,899) had 566 students (30%) with unshared patterns. Tier 2b (n=1,389) had 574 students (41%) with unshared patterns. Finally, Tier 3 (n=773) had 428 students (55 %) students with unshared patterns. In summary, as Tiers of Strengths/Risks increased (in order words, as risks increase), the percentage of unshared patterns within each tier also increased. Results suggest that an increase in risk level requires more individualized/tailored sets of services.

Table 17

Distribution of Students by Shared and Unshared Service Patterns across Student Tiers (n=5,849)

Pattern Type	Student Tier							
	Tier 1		Tier 2a		Tier 2b		Tier 3	
	n	%	n	%	n	%	n	%
Unshared	363	20	566	30	574	41	428	55

Shared	1425	80	1333	70	815	59	345	45
Total	1788	31	1899	32	1389	24	773	13

Extent of Uniqueness between Individuals. In order to have a sense of how unique or distinct the patterns are between students, three students from two different schools were chosen (from the n=5,849 data set) based on their grade levels and assigned tiers. Since Study 1 sampled participants from 3rd, 4th, and 5th grades, the sample below included 2nd and 6th graders.

Three Tier 2b students in the 2nd grade and from the same school (School 13, see Table 2) were sampled for analysis. As shown in Figure 13, Student A and Student B differ by 9 services; Student A and Student C differ by 3 services; and Student B and Student C differ by 8 services, though these students had the same Tier of Strengths/Risks and were in the same grade and from the same school.

Another set of three students was sampled from a different school (School 17, see Table 2). These students were Tier 1 Students in the 6th grade. Figure 14 shows Student C and Student D differ by 2 services, Student C and Student E differ by 5 services; Student D and E differ by 7 services, though these three students had the same Tier of Strengths/Risks, were in the same grade and from the same school.

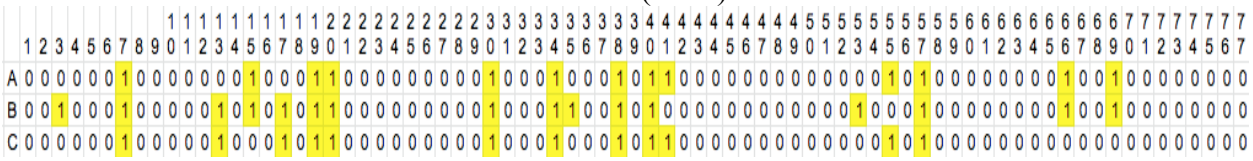
In summary, though students were from the same school and in the same grade level and Tier of Strengths/Risks, their service patterns differed by 3 to 9 services among 2nd graders and 2 to 7 services among the 6th graders. That is to say, similar demographic characteristics (e.g., age, grade, school) and needs that are apparently similar (e.g., overall risk level) do not predetermine the sets of services and supports each individual student needs. Differentiating students based on similar traits and apparent risks/strengths is a convenient way of assessing

needs and allocating resources but it is insufficient. The above results suggest that individual uniqueness requires individualized attention and care.

Figure 13

Comparison of Service Patterns of Three Tier 2b Students (n=3) in 2nd Grade from the Same School (#13)

Services (n=77)

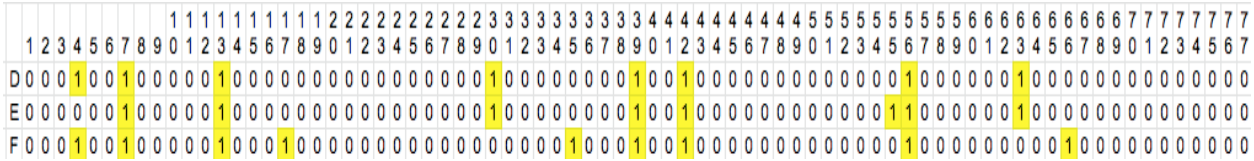


Note. Students were de-identified as Student A, B, and C. Highlighted number "1" indicates that of the 77 services, a student received that service. "0" indicates that the service was not received.

Figure 14

Comparison of Service Patterns of Three Tier 1 Students (n=3) in 6th Grade from the Same School (#17)

Services (n=77)



Note. Students were de-identified as Student D, E, and F. Highlighted number "1" indicates that of the 77 services, a student received that service. "0" indicates that the service was not received.

Latent Class Analysis (LCA)

LCA results were analyzed both broadly (e.g., across clusters, Developmental Domains, and tiers) and narrowly (e.g., within each cluster, based on each service indicator and student demographics). The goal of analysis is to see how the clusters and Student Tiers of Strengths/Risks (Tier 1, Tier 2a, Tier 2b, Tier 3) differentiate. Discernible, distinct patterns could indicate that the tailoring of unique sets of services to students' unique sets of strengths and risks (as indicated by Student Tier assignment) is not completely random.

Preliminary Descriptive Analysis. This section provides the descriptive statistics for the n=1,931 students (out of n=5,849) who had an unshared service pattern, that is, one not shared by any other student in the data set.

Descriptives for Students with Unshared Patterns. As shown in Table 18, the demographics of the students with unshared service patterns resemble the general demographics of all the students (see Tables 2 and 3). However, there is one exception. In this sample (n=1,931), there is a noticeably *larger percentage of students receiving Special Education (SPED)* than in the combined data set (n=5,849). In the unshared sample (n=1,931), 31% are SPED students, while in the larger data set, 20% are SPED students.

Based on Student Tiers of Strengths/Risks, the percentage of male students increased as Student Tier level increased. For White and Asian students and students identified as "Other," the percentage of students decreased as Student Tier level increased. For Black and Hispanic students, the percentage of students increased as Student Tier level increased. The percentage of

SPED, Low Income, and ELL students generally increased as Student Tier level increased. However, the percentage of students with Immigrant Status decreased as the Student Tier increased.

Table 18

Background Information of Student with Unique, Unshared Service Patterns (n=1,931)

Tier	Gender				Race/Ethnicity										Special Ed		Low Income		ELL		Immigrant	
	n	%	Female	%	Black	%	White	%	Asian n	%	Hispanic	%	Other	%	n	%	n	%	n	%	n	%
1	363	19	210	60	70	19	42	12	8	2	234	64	9	2	51	14	287	79	47	13	12	3
2a	566	29	269	48	99	17	61	11	8	1	389	69	0	0	429	76	498	88	112	20	9	2
2b	574	30	217	40	115	20	45	8	2	0	398	69	14	2	364	63	501	87	121	21	9	2
3	428	22.	137	32	96	22	33	8	3	1	292	68	4	1	234	55	391	92	69	16	6	1
Total	1931		833	43	380	20	181	9	18	1	1313	68	39	0	592	31	1678	87	349	18	36	2

Selection of Class Solution. For each Student Tier of Strengths/Risks (Tier 1, Tier 2a, Tier 2b, Tier 3), latent class modeling consisted of testing one cluster/class at a time. Given the exploratory nature of the study, there was no theoretical rationale to hypothesize the potential number of latent classes. Covariates were added only after a final model had been selected and

posterior classification probabilities saved. This approach prevents covariates from determining class membership ahead of time. This (3-Step) approach is more fitting for a descriptive study such as this in which the focus is on class characteristics rather than prediction of class membership (Vermunt, 2010).

In selecting a class solution (number of classes/clusters in a model), fit statistics were examined to determine which model (the number of clusters/classes) best fit the data (see Table 19). The most common and reliable fit statistics are the Bayes Information Criterion (BIC) and the Akake Information Criterion (AIC) (e.g., Schreiber, 2017; Vermunt & Magidson, 2013). The L-squared (L^2) value is also another indicator of goodness-of-fit. The lower the BIC, AIC, and L^2 values are, the better the fit the model is. In addition to the fit statistics, the Log Likelihood (LL) and *p*-value indicate whether one model is able to predict the data better than the other. The lower the LL and *p*-value, the better the model predicts the data. Further, non-zero degrees of freedom (df) is an indication that the model is likely identified. Outputs also provide the number of parameters (Npar) estimated, which is helpful to evaluate the model if *p*-values > 0.05, and the Classification error (Class. Err.). The closer to zero the Class. Err. is, the less likely the model is misspecified (Vermunt & Magidson, 2013).

Given the above criteria, a 5-class model was selected for Tier 1 and Tier 3 Students and a 7-class model for Tier 2a and Tier 2b Students (see Table 20). For Tier 2a, the BIC was lower for the 5-class model than the 6-class model, but for Tiers 1, 2b, and 3, the models were selected in part based on non-zero degrees of freedom. Specifically, for Tiers 1 and 3, beyond a 5-class model resulted in negative degrees of freedom, and for Tiers 2b, beyond a 7-class model also resulted in negative degrees of freedom. In the final models for all four Student Tiers of

Strengths/Risks, $p < 0.001$ and Class. Err. < 0.02. Potentials for interpretability were also considered in deciding on the final models for each Student Tier.

Table 19

Latent Class Analysis Model Fit Information across Student Tiers

	Fit Statistics							
Tier 1 (n=363)	**LL**	**BIC(LL)**	**AIC(LL)**	**Npar**	**L^2**	**df**	**p-value**	**Class.Err.**
1-Cluster	-6786.539	13973.8974	13709.078	68	9313.1497	295	0.00E+00	0
2-Cluster	-6390.6519	13588.837	13055.3038	137	8521.3755	226	0.00E+00	0.0072
3-Cluster	-6007.0313	13228.3095	12426.0626	206	7754.1342	157	0.00E+00	0.0052
4-Cluster	-5767.9421	13156.845	12085.8842	275	7275.9559	88	0.00E+00	0.0034
5-Cluster	-5481.8202	12991.3149	11651.6403	344	6703.712	19	0.00E+00	0.0259
Tier 2a (n=566)	**LL**	**BIC(LL)**	**AIC(LL)**	**Npar**	**L^2**	**df**	**p-value**	**Class.Err.**
1-Cluster	-11008.4755	22447.9753	22152.9509	68	14847.2076	498	0.00E+00	0
2-Cluster	-10454.9815	21778.3504	21183.963	137	13740.2197	429	0.00E+00	0.0147
3-Cluster	-10015.1202	21335.9909	20442.2405	206	12860.4972	360	0.00E+00	0.0205

4-Cluster	-9610.5318	20964.1769	19771.0635	275	12051.3202	291	0.00E+00	0.0208
5-Cluster	-9281.0676	20742.6116	19250.1352	344	11392.3919	222	0.00E+00	0.0247
6-Cluster	-8867.8376	20353.5145	18561.6751	413	10565.9318	153	0.00E+00	0.0046
7-Cluster	-8524.9421	20105.0866	18013.8842	482	9880.1409	84	0.00E+00	0.0081

Tier 2b (n=574)	**LL**	**BIC(LL)**	**AIC(LL)**	**Npar**	**L^2**	**df**	**p-value**	**Class.Err.**
1-Cluster	-11569.5032	23596.3956	23283.0063	72	15868.3685	502	0.00E+00	0
2-Cluster	-11042.2095	23005.5503	22374.4191	145	14813.7812	429	0.00E+00	0.0144
3-Cluster	-10541.6322	22468.1376	21519.2644	218	13812.6266	356	0.00E+00	0.006
4-Cluster	-10191.1975	22231.0102	20964.3951	291	13111.7572	283	0.00E+00	0.0114
5-Cluster	-9855.6356	22023.6282	20439.2711	364	12440.6333	210	0.00E+00	0.0114
6-Cluster	-9475.3649	21726.8289	19824.7299	437	11680.092	137	0.00E+00	0.0144
7-Cluster	-9210.3826	21660.6062	19440.7653	510	11150.1274	64	0.00E+00	0.0113

Tier 3 (n=428)	**LL**	**BIC(LL)**	**AIC(LL)**	**Npar**	**L^2**	**df**	**p-value**	**Class.Err.**
1-Cluster	-8992.3718	18414.9413	18126.7435	71	12800.9067	357	0.00E+00	0
2-Cluster	-8439.2275	17744.9096	17164.455	143	11694.6181	285	0.00E+00	0.0005
3-Cluster	-8094.8314	17492.3744	16619.6629	215	11005.826	213	0.00E+00	0.0032
4-Cluster	-7723.1489	17185.2661	16020.2978	287	10262.4609	141	0.00E+00	0.016
5-Cluster	-7462.7248	17100.6748	15643.4496	359	9741.6127	69	0.00E+00	0.0041

Note. L-squared = L2, Log Likelihood = LL, Bayes Information Criterion = BIC, Akake Information Criterion = AIC, Number of Parameters =Npar, Degrees of Freedom =df, Classification error = Class. Err.

Indicators (Service Labels). Of the 77 indicators/service labels, as listed in Appendix B, Table B.1, Tier 1 Students with unshared patterns did not receive 9 of the services (counseling_student_school, crisis_intervention_school, iep_behavioral_therapy, iep_hearing, intensive_care_coordination, mentoring_peer, staff_mentoring, student_family_tran_assistance, and summer_programming_enrichment_c). Tier 2a Students also did not receive 9 of the

services (behavioral_social, counseling_family, iep_behavioral_therapy, intensive_care_coordination, mentoring_peer, psychiatric_services, student_family_tran_assistance, summer_programming_enrichment_c, and therapeutic_mentoring). Tier 2b Students did not receive 4 of the services (counseling_family, iep_behavioral_therapy, iep_vision, mentoring_peer, and summer_programming_enrichment_s). Tier 3 Students did not receive 6 of the services (afterschool_program_academic, before_school_program_academic_c, iep_vision, student_family_tran_assistance, summer_programming_enrichment_c, and summer_programming_enrichment_s).

LCA results indicated whether an indicator was statistically significant. An indicator that is statistically significant ($p < 0.05$) contributes to the determination of class membership. For each Student Tier of Strengths/Risks, Figure 15 lists all of indicators that were statistically significant and grouped the services based on the Developmental Domains they address (Academic, Social/Emotional/Behavioral, Health, and Family) and color-coded the services according to their intensity (Tier 1 Service = Green; Tier 2 Service = Yellow; Tier 3 Service = Red). (Note: Under Tier 1, before_school_program_community and before_school_program_school were listed at the bottom because it was not known to which Developmental Domains they belonged. Further, under Tier 3, special_education_evaluation was slighted over $p = 0.05$, but was included in the list.)

Figure 15

Statistically Significant Indicators Grouped by Student Tiers, Developmental Domains, and Service Tier

Tier 1 (n=363)		Tier 2a (n=566)		Tier 2b (n=574)		Tier 3 (n=428)	
before_school_program_academic_s	***	before_school_program_academic_s	*	before_school_program_academic_s	**	enrichment_academic	**
enrichment_academic	***	enrichment_academic	***	summer_programming_academic_s	**	college_career_assistance_s	***
college_career_assistance_c	***	college_career_assistance_c	***	college_career_assistance_s	***	academic_classroom_support	***
enrichment_arts_community	***	college_career_assistance_s	***	enrichment_academic	***	literacy_intervention	***
enrichment_arts_school	***	enrichment_arts_community	*	enrichment_arts_community	***	math_intervention	***
academic_classroom_support	***	enrichment_arts_school	***	enrichment_arts_school	***	attendance_support	***
academic_support	*	academic_classroom_support	***	academic_classroom_support	***	iep_accommodations_adaptatio	***
literacy_intervention	***	individual_tutoring_school	**	individual_tutoring_school	**	iep_speech_language	**
math_intervention	***	literacy_intervention	***	literacy_intervention	***	special_education_evaluation	
attendance_support	***	math_intervention	***	math_intervention	***	enrichment_youth_dev_commur	***
enrichment_youth_dev_community	***	iep_accommodations_adaptations	***	iep_accommodations_adaptations	***	behavioral_support_ccnx	**
enrichment_youth_dev_school	***	iep_occupational_therapy	*	iep_speech_language	***	behavioral_support_district	***
mentoring	***	iep_speech_language	***	i504_plan_school_provided	***	classroom_based_social_in	***
behavioral_support_ccnx	*	i504_plan_school_provided	**	attendance_support	***	classroom_group_social_int	*
behavioral_support_district	***	attendance_support	***	enrichment_youth_dev_community	***	mentoring	***
classroom_based_social_in	***	enrichment_youth_dev_community	***	mentoring	***	psycho_social_group	**
classroom_group_social_int	**	enrichment_youth_dev_school	**	behavioral_support_ccnx	***	staff_mentoring	***
psycho_social_group	**	mentoring	**	behavioral_support_district	***	checkin_ccnx_site_coordinator	***
ccnx_healthy_life_skills_cls	***	behavioral_support_ccnx	***	classroom_based_social_in	***	counseling_student_school	*
health_screening_vision	**	behavioral_support_district	***	psycho_social_group	***	health_screening_hearing	***
health_medical_community	***	classroom_based_social_in	***	checkin_ccnx_site_coordinator	*	health_screening_post_sco	***
sports_physical_activity_c	***	classroom_group_social_int	*	ccnx_healthy_life_skills_cls	**	health_screening_vision	***
sports_physical_activity_s	***	psycho_social_group	***	health_screening_bmi	***	sports_physical_activity_s	***
ccnx_healthy_life_skills_small_g	**	checkin_ccnx_site_coordinator	***	health_screening_hearing	***	classroom_group_health_int	***
classroom_based_health_int	**	health_screening_bmi	***	health_screening_post_sco	***	health_medical_school	***
classroom_group_health_int	***	health_screening_hearing	***	health_screening_vision	***	informal_screening_diagnostic	***
esl_parent_family	***	health_screening_post_sco	***	sports_physical_activity_c	***	parent_family_engagement	***
parent_family_engagement	**	health_screening_vision	***	sports_physical_activity_s	***	family_assistance	***
family_conference_meeting	***	sports_physical_activity_c	***	classroom_based_health_int	***	family_conference_meeting	***
parent_family_don_early_int_c	*	sports_physical_activity_s	***	classroom_group_health_int	***	parent_family_don_early_int_s	**
parent_family_don_early_int_s	*	classroom_based_health_int	***	informal_screening_diagnostic	*		
afterschool_program_school	*	classroom_group_health_int	***	esl_parent_family	**		
before_school_program_community	**	esl_parent_family	**	parent_family_engagement	***		
before_school_program_school	***	parent_family_engagement	***	family_assistance	***		
		family_assistance	**	parent_family_don_early_int_c	***		
		family_conference_meeting	***	parent_family_don_early_int_s	***		
		parent_family_don_early_int_c	***	afterschool_program_community	**		
		parent_family_don_early_int_s	**	afterschool_program_school	**		

Note.

[a] $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

[b] Green = Tier 1 Services; Yellow = Tier 2 Services; Red = Tier 3 Services

[c] It was not clear to which Developmental Domain after_school_program_school, before_school_program_community and before_school_program_school belonged, but they were included here at the end of the list for Tier 1 and Tier 2b.

Differentiation of Classes for Interpretability. Given the vast number of indicators/service labels, latent profile plots were not easily interpreted and the distinctiveness of each cluster based on the indicators was difficult to decipher. For this reason, in order to better highlight the distinctiveness of each cluster within each Student Tiers of Strengths/Risks and facilitate interpretability, the *number of (statistically significant) services* received within a particular Developmental Domain based on the *proportion of students* receiving those services

were considered. In order to do this, 1) *LCA results were organized based on the four Developmental Domains* (Academic, Social/Emotional/Behavioral [SEB], Health, and Family) the services sought to address. 2) *Service indicators/labels are then highlighted according to the intensity of the service* (green = Tier 1 (T1) Service/enrichment; yellow = Tier 2 (T2) Service/early intervention; red = Tier 3 (T3) Service/intensive and crisis intervention).

And, 3) *the proportion or percentage probability of the number of students receiving a service within a cluster were assigned to a five categories scale* (1% or less = very low proportion of students; between 1% and 25% = low proportion of students; between 25% and 50% = moderate proportion of students; between 50% and 75% = high proportion of students; between 75% and 100% = very high proportion of students) and color-coded (see Appendix E, Tables E.1, E.2, E.3, E.4, for full results and legend). 25%, 50%, and 75% would be considered borderline and will be labeled as low/moderate, moderate/high, and high/very high, respectively. Other cutoff percentages (e.g., <33.33=low; between 33.33 to 66.66=moderate; and between 66.66 and 100.00=high support) were tested, but the distinctiveness of each cluster was neither apparent nor easy to interpret. There were many services in which less than 1% of students within a cluster were receiving those services. There were also many services in which less than 25% of the students were receiving those services. Dividing the proportions/percentages into the five categories scale mentioned above strikes a balance between having too few, broad categories, which highlight similarities rather than distinctiveness, and having too many, specific categories, which render interpretability of the data tedious.

The results presented below were organized according to Student Tier and Developmental Domain. *Across the latent classes/clusters*, if a *moderate to very high proportion* of students received a particular service, it was recorded in the table (left column). Additionally,

within a latent class/cluster, if a service had the *highest proportion of students* receiving a particular service, that service was also recorded (right column) to specify further what makes the cluster distinctive, since the same services within the range of moderate to very high proportion of students could be shared by several clusters. At times, the service with the highest within-cluster proportion of students receiving that service might not necessarily fall in the range of moderate to very high proportion of students receiving services because none of the clusters fell within that range for that specific service.

To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier. The same categories used to distinguish the proportion of students receiving services were also used to distinguish the degree of support need/received: 1% or less = very low support; between 1% and 25% = low support; between 25% and 50% = moderate support; between 50% and 75% = high support; between 75% and 100% = very high support. 25%, 50%, and 75% would be considered borderline and will be labeled as low/moderate, moderate/high, and high/very high, respectively. The steps used to differentiate class/clusters for the sake of interpretability are outlined in Table 20.

Table 20

Outline of Steps for Highlighting the Distinctiveness of LCA Clusters/Classes

1) Organize indicators/service labels according to Development Domain (Academic,

Social/Emotional/Behavior, Health, and Family)
2) Color-code *Proportions of Students* receiving services. (1% or less = very low proportion of students; between 1% and 25% = low proportion of students; between 25% and 50% = moderate proportion of students; between 50% and 75% = high proportion of students; between 75% and 100% = very high proportion of students)
3) For each Developmental Domain, record all services (and intensity level) that had a moderate to very high proportion of students receiving those services for each class/cluster.
4) If a class/cluster has a service with the highest within-cluster proportion of students receiving that service, as compared to the other clusters, record that service (and intensity level).
5) To determine the *Level of Support*, take the number of services with a moderate to very high *Proportion of Students* receiving those services within a Developmental Domain and divide that number by the total number of services that students received within that domain. [Use the same cutoff values as in #2. Borderline values at 25%, 50%, 75%, use both descriptors, e.g., at 75% use "Moderate/High."]
6) Use the Tier of Service/Service Intensity level (T1, T2, T3) of the services with the highest within-cluster proportion of students as compared to the other clusters to specify further the distinctiveness of a given cluster. Label "unspecified" if none of the services within a class/cluster had the highest within-cluster proportion of students receiving services.

A brief demonstration of how this differentiation process was applied to the Academic domain for Tier 1 Students is provided here using Table 21. The legend for the color codes is below the table. (For the complete, detailed tables for all tier levels and Developmental Domains, see Appendix E., Tables E.1, E.2, E.3, and E.4.) As shown in Table 16, most services fell within the very low to low proportion of students receiving Academic support. Across clusters/classes, the variability of the services with a moderate to very high proportion of students receiving services is relatively apparent. Cluster 1 has 5 services, Cluster 2 has two services, Cluster 3 has 6 services, Cluster 4 has 5 services, and Cluster 5 has 3 services falling within this range of moderate to very high proportion of students receiving services. Going across clusters for the first service (before_school_program_academic_s), Cluster 4 has the highest within-cluster proportion of students receiving this service. The service academic_support is an example of how a cluster might have the highest proportion of students receiving a particular service but that

service did not fall within the range of moderate to very high proportion of students receiving services. In this case, for academic_support, Cluster 2 had the highest within-cluster proportion of students, compared to the other within-portion proportions.

Table 21

Sample of Statistically Significant Service Labels/Indicators with Proportion of Tier 1 Students (with Unshared Patterns) across Five Clusters/Classes Receiving Academic Services

		Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
T1 N=363 Cluster size		0.5394	0.1635	0.1311	0.0967	0.0692
before_school_program_academic_s	***	0.0102	0.0507	0.0002	0.2559	0.0003
enrichment_academic	***	0.4843	0.2713	0.9222	0.0026	0.3607
college_career_assistance_c	***	0.0255	0.0002	0.2725	0.0003	0.0004
enrichment_arts_community	***	0.0766	0.0003	0.3349	0.0005	0.0007
enrichment_arts_school	***	0.0722	0.0174	0.4585	0.0009	0.9537
academic_classroom_support	***	0.3672	0.0685	0.0632	0.712	0.5581
academic_support	*	0.0215	0.1178	0.0167	0.0002	0.0003
literacy_intervention	***	0.5339	0.2416	0.021	0.2882	0.1617
math_intervention	***	0.4743	0.2364	0.0207	0.0017	0.0421
attendance_support	***	0.6598	0.9779	0.4747	0.9982	0.0848
enrichment_youth_dev_community	***	0.0289	0.1354	0.9936	0.9958	0.0021
enrichment_youth_dev_school	***	0.0255	0.2354	0.0002	0.0003	0.1195

Note. Legend for color codes:

Very Low	Less than 1%
Low	Between 1% and 25%
Moderate	Between 25% and 50%
High	Between 50% and 75%
Very High	Between 75% and 100%

After applying these steps for differentiation to all Student Tiers, the consolidated results/findings are presented in Table 22. Three initial, general observations can be made: 1) Tier 1 and Tier 3 have the same number of clusters and Tier 2a and Tier 2b have the same number of cluster; 2) Tier 1 and Tier 3 have fewer number of clusters than Tier 2a and Tier 2b; 3) given that the distinctiveness of each cluster within each Student Tier was highlighted based

on a) the level of need (i.e., moderate to high proportion of students requiring services within a Developmental Domain) and b) the specification of needs (the Tier of Service with the highest within-cluster proportion of students receiving that service), the combination of a) the level of need (low, moderate, and high) and b) the specification for the type of service with the highest within-cluster proportion of students receiving those services were unique for each cluster.

A few preliminary conclusions can be drawn from these rich LCA results and the analysis of cluster distinctiveness:

1. Even though in this sample every student within each Student Tier had an unique, unshared pattern/set of services, the data converged and assigned students to distinct clusters. This suggests that the assignment or tailoring of services is purposeful rather than random. In other words, there are ordered, latent patterns in the service matching process. It should be noted that previous results showed that as grade level and risk level increased, the percentage of individualized sets of services also increased, providing preliminary evidence that service assignments are purposeful. The LCA results give further support for this conclusion.
2. It is curious that students with the lowest risks (Tier 1 Students) and the highest risks (Tier 3 Students) were assigned to the least number of clusters, and the students whose risks were in the mild and moderate range (Tier 2 and Tier 2b Students), had more number of clusters based on latent patterns of service assignments. One reason could be that strengths are more apparent for children with few risks (Tier 1) and for children with many risks (Tier 3). Identifiable strengths facilitate the matching of services. Less identifiable strengths might require more effort, flexibility, and variability in service tailoring.

3. Findings confirm that Student Tier or student overall risks/strengths do not necessarily correspond with level (e.g., low, moderate, high) and dominant type (e.g., T1, T2, T3) of student needs. Within each Student Tier, patterns (level of overall needs + dominant type of needs) for each cluster never repeated. Across Student Tiers and across Developmental Domains, every level of overall needs and dominant/specific type of needs is present. This suggests that even though students are assigned provisional tiers of strengths/risks, students are still receiving individualized attention and care rather than being bound to those tier assignments.
4. Finally, the results raise the question of how similar students assigned to different tiers of strengths/risks are in terms of strengths and needs. Take for example, as shown in Table 23, students in Tier 1/Cluster 4, Tier 2a/Cluster 2, and Tier 2b Cluster 6. Though these students were assigned to different tiers of strengths/risks, the intensity level of needs for all of these clusters was "Moderate" (coded yellow) across all Developmental Domains. Two conclusions could be made: 1) the tiering system might misidentify certain students, or 2) while these students are indeed very similar in terms of overall strengths and needs, it is the specificity of needs (e.g., most students needed only T2 services, most students needed a combination of T1, T2, and T3 services) that further differentiated the students.

Table 22

Consolidation of LCA Results Color-Coded by Intensity Level for All Student Tiers Based on Proportion of Students Receiving Services

Tier 1					Tier 3				
CL	Academic	SEB	Health	Family	CL	Academic	SEB	Health	Family
1	Moderate (T2)	Low (Unspecified)	Low (Unspecified)	Low (Unspecified)	1	High (T2, T3)	Moderate (T2)	Moderate (T1)	Moderate/High (Unspecified)
2	Low (T2)	Moderate (T1, T2)	High (T1, T2)	Low (Unspecified)	2	High (T2, T3)	Moderate (Unspecified)	Moderate (T1)	Moderate/High (T1)
3	Moderate (T1)	Moderate (T1)	Low (T2)	Low (T1, T2)	3	High (T1)	Moderate (T1)	Moderate (T1)	Very Low (Unspecified)
4	Moderate (T1, T2, T3)	Moderate (T2)	Moderate (T1)	Moderate (T1,T2)	4	Moderate (T2, T3)	Moderate (T2, T3)	Moderate (T3)	Moderate/High (T2)
5	Moderate (T1)	Moderate (T2)	Low (T1)	High (T1, T2)	5	Low (Unspecified)	Moderate/High (T2, T3)	Very High (T2, T3)	Moderate/High (T2)
Tier 2a					**Tier 2b**				
CL	Academic	SEB	Health	Family	CL	Academic	SEB	Health	Family
1	Low (Unspecified)	Low (Unspecified)	Moderate (Unspecified)	Very Low (Unspecified)	1	Moderate (Unspecified)	Moderate (T1)	Moderate (T1)	Very Low (Unspecified)
2	Moderate (T2, T3)	Moderate (Unspecified)	Moderate (T1)	Moderate (T1)	2	Moderate (T2)	High (T1, T3)	Moderate/High (T1, T3)	Low (Unspecified)
3	Moderate (T1, T3)	Moderate (Unspecified)	Moderate/High (T1)	Moderate (T2)	3	Moderate (T2)	Moderate (T1)	Low (T1)	Very Low (Unspecified)
4	Low (Unspecified)	High (T1, T2, T3)	Moderate/High (T1)	Low (Unspecified)	4	Moderate (T2, T3)	High (T1, T2)	Moderate/High (T1)	Moderate/High (T1, T2)
5	Low (T1, T3)	Low (T2)	Moderate/High (T1)	Very Low (Unspecified)	5	Moderate/High (T2)	Low (T1)	Moderate/High (T1, T2)	Moderate (Unspecified)
6	Low (T1)	Moderate (T1)	Moderate (T1)	Moderate (T2)	6	Moderate (T1, T2)	Moderate (T1)	Moderate (T1)	Moderate (T2)
7	Low (T3)	Moderate (T2)	High (T1)	Moderate (T1, T2)	7	Low (T2)	Moderate (T1)	Moderate/High (T2)	Very Low (Unspecified)

Note.
[a]Green = Low or Very Low, Yellow = Moderate, Pink = Moderate/High, Red = High.
[b]See Table 21 and Tables F.1 to F.21 in Appendix F for how this table was generated.

Introduction of Covariates in LCA Models

The effects of covariates were fixed to zero since the purpose of this analysis is descriptive (e.g., the demographics of Cluster 1 vs. Cluster 2) rather than predictive (e.g., race/ethnicity contributes to cluster assignment). As "inactive covariates," they do not affect the parameters of the original final models. Additionally, the Probabilities/Means (ProbMeans) option in Latent GOLD (6.0) provides the distribution/proportional assignment and descriptive profile of a given covariate across clusters (Vermunt & Magidson, 2005). Across each row is the proportion or conditional probability of belonging within each cluster for a given covariate. Because the majority of the students were in **Clusters 1** and **2** across all Tiers (see Table 23), the largest proportion of student across covariates were in those two clusters (e.g., the majority of students from low-income families and the highest dosage of City Connects are in **Clusters 1 and 2**). Since the general pattern of LCA results with (and without) covariates was that the proportion of students decreased with the increase in clusters, changes to this pattern was noted and examined more closely. When 100% and 0% of the total number of students were present/absent in a given cluster, further examination was also carried out. Detailed tables of the proportional class assignments for each Student Tier based on covariates can be found in Appendix G.

Table 23

Proportional Class Assignment for Students Tiers across Clusters

	Cluster						
Tier	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1 (n=363)	0.42	0.29	0.13	0.10	0.07		
2a (n=566)	0.29	0.28	0.11	0.10	0.08	0.08	0.05
2b (n=574)	0.25	0.23	0.15	0.15	0.09	0.07	0.05
3 (n=428)	0.36	0.25	0.15	0.13	0.11		

Note. These are slightly different from results in Table E.1, E.2, E.3, and E.4, Appendix E. This is because early on in the investigation, not all of the indicators were set as nominal. They were set as nominal in subsequent analyses.

Taken all together, results show that across all Student Tiers of Strengths/Risks, though the majority of students are in **Clusters 1** and **2**, the majority of students who identify as Asian, "Other," and students with immigrant status tend also to be present in other clusters as well, suggesting that service tailoring could be different for these particular groups of students. Further, within each Student Tier, clusters vary considerably for Grade level (e.g., clusters with only K-5 grades and clusters with only 5-9 grades), showing that patterns of service assignment could be associated with grade level/age. Additionally, dosage years also varied across clusters. Finally, there are clusters that consist of all or most of the students from 1 to 3 schools. This could mean that schools strongly influence patterns of service assignment.

Chapter 5: Discussion

This chapter reviews the highlights of the results and discusses the findings of this study, which comprises two substudies (Study 1 and Study 2), in light of the extant literature and the study's research aims. Study implications and limitations along with future directions for research will also be discussed.

Review and Discussion of Findings

The overarching research question this dissertation sought to answer is as follows: What is the evidence that services and supports are being tailored to each individual student in City Connects schools? Both Study 1 and Study 2 aimed to 1) look for evidence of tailoring at the *nomothetic* (general findings) and *differential* (group differences) levels, and 2) to look for evidence of tailoring at the *nomothetic* (general findings) and *idiographic* (individual) levels. Additionally, Study 2 also aimed to see if there are discernible, latent patterns in service delivery among students with unique, unshared patterns of services.

Taking a three-dimensional (nomothetic, differential, and idiographic) approach to examining patterns of service delivery optimizes the description and explanation of how City Connects individualizes supports to meet children's developmental needs (e.g., Lerner & Lerner, 2019; Lerner et al., 2019; Rose, 2016; Salvatore & Valsiner, 2010).

Five Ways City Connects' Service Matching Process Gives Evidence of Tailoring

I. First Evidence of Tailoring: Overall, Intensity of Services Matches the Provisional Level of Need

After the assessment of every child through the Whole Class Review (WCR), the majority of students in this study were provisionally assigned to Student Tier 1 (minimal risk) and Tier 2a (mild risk) for the academic year. There were less students assigned to Tier 2b (moderate risk) than Tier 2a, and there were more students assigned to Tier 2b than Tier 3 (high

risk). Most students received Tier 1 (enrichment/prevention) and Tier 2 (early intervention) Services. Fewer students received Tier 3 (intensive/crisis intervention). The number/percentage of students decreased as Student Tier/risk level increased. Students assigned to a higher Student Tier tend to receive a higher percentage of intense services and a higher mean number of services than students assigned to a lower Student Tier. *In other words, students with higher needs are receiving more support. Both the mean number of resources and a systematic approach to allocate limited resources are critical in responding especially to students with high/intensive needs. At the same time, the number of students with intensive needs tends to be lower than those with non-intensive needs.*

These findings align with the literature on risk and resilience and childhood adversity and are consistent with City Connects' annual reports (e.g., City Connects, 2016, 2018, 2020; Masten & Labella, 2016). *Researchers in developmental and intervention science have emphasized the need to promote students' strengths and competencies without losing sight of risks and deficiencies* (Lerner, 2001; Lerner & Lerner, 2019; Masten, 2014; Masten & Cicchetti, 2010; Masten & Labella, 2016). That is to say, most children have the capacity to thrive despite adversity, and the right support at the right time increases the likelihood of actualizing this capacity. For example, the vast majority of the students in this study were from low-income families and under-resourced communities that faced multiple psychosocial and financial challenges. However, at the initial Whole Class Review (WCR), it was apparent that the majority of students required mostly enrichment/prevention and early interventions and did not need more intensive interventions. Thus, City Connects provides mostly enrichment/prevention and early intervention services in order to capitalize on students' (and their families') strengths already present and to prevent known risk factors from cascading into more difficult, future problems.

More intensive and individualized, and often more costly, services are reserved for a smaller group of students given the challenges in their lives. Comprehensively assessing the strengths and needs of every child and systematically allocating limited resources contribute to an intervention's efficaciousness and cost-effectiveness (Bowden et al, 2015; Bowden et al., 2017; Walsh et al., 2002; Wasser Gish, 2019).

II. Second Evidence of Tailoring: Intensity of Services Do Not Always Match the Provisional Level of Need

When analyzing the data nomothetically to find general trends, the results show that students assigned to a higher Student Tier/risk level tend to receive more intensive services and a higher mean number of services than students in the lower Student Tiers. When analyzing the data differentially to look for between-group differences and idiographically to look for between-individual differences, the results showed, that not all students received Tier 1 Services and not all Tier 3 Students received Tier 3 Services, contrary to expectations. In Study 1, nearly 100% of the students in all Student Tiers received at least one Tier 1 Service, though there were few exceptions: in Class A among 4th graders, 91% of Tier 1 Students and 75 % of Tier 2a students received at least one Tier 1 Service; and in Class B among 5th graders, 67% of Tier 3 Students received at least one Tier 1 Service. In Study 2, between 98 % to 99 % of students across the four Student Tiers received at least one Tier 1 Service. Thus, it appears that within City Connects even enrichment/preventive (low intensity) or the so-called "universal" services are assigned to students according to needs rather than indiscriminately delivered to all. However, it could also be the case that due to high student mobility among this population, students might have changed schools before being assigned enrichment/prevention services.

Further, approaching the data more idiographically, it is clear that there are cases in which a relatively moderate to high percentage of non-Tier 3 Students received as much, or even more, Tier 3 Services as Tier 3 Students. For example, in Class A in Study 1, among all the services the 3rd graders (n=17) in the sample received, there was only one Tier 3 Service, and it was a 2a Student who received that service, though there were two Tier 3 3rd graders also in the sample. *These results suggest that though City Connects follows a systematic and uniform protocol in assessing needs and matching services in order to ensure high fidelity in intervention implementation, City Connects is also a support system that is flexible and adaptive in responding to the less covert needs of individuals as circumstances change in the course of time.*

Children grow and develop within complex, multilevel contexts (Bronfenbrenner, 1974; Lerner, 1991; Reardon, 2011; Walsh et al., 2002; Walsh & Murphy, 2003). The environment shapes the child, and the child shapes the environment, continually through time (Lerner et al., 2019; Cicchetti & Sroufe, 2000; Sameroff, 2009; Walsh et al., 2002). *Children's needs change in the course of development and as their environment changes. Thus, situating children in their specific and multiple contexts prevents falling into the short-sighted traps of overgeneralization and determinism (e.g., All Tier 1 Students need the same thing.)*. A child might be considered "minimal risk" (Tier 1 Student) overall because they have many apparent strengths and skills, but a crisis (e.g., medical, family, housing, mental health) could occur at any moment. Conversely, a child might be considered "high risk" (Tier 3 Student) for many reasons (e.g., behavioral problems, disabilities, academic difficulties, homelessness) that could be related to the child's personality/temperament or the multiple risk factors present in the child's history and environment, or both. For this reason, "high risk," like all the student risk indicators, are provisional and does not predetermine unequivocally the course of action to take in supporting a

specific child at a specific moment in time (e.g., Bornstein, 2015, 2017; Bornstein et al., 2017; Lerner et al., 2019).

Often, the literature on child development and intervention science emphasizes "plasticity" and describes children as "resilient" and "adaptive," and to a certain extent this is true. However, this puts the burden on children to tolerate the inequities and injustices and other modifiable risk factors that render their environment stressful and toxic. Emphasizing a child's strengths and adaptability as the loci for intervention without addressing the systemic issues is a short-sighted and an unsustainable solution. On the contrary, comprehensive and responsive support systems such as City Connects are "malleable" (Masten & Labella, 2016). They are designed to tailor resources and adapt to each child's unique sets of strengths and needs as circumstances and individuals change (Masten & Labella, 2016; Walsh & Theodorakakis, 201). City Connects helps to create an environment/culture of support and partnership that promotes opportunities for thriving and success.

III. Third Evidence of Tailoring: Unique Patterns of Services at the Individual Level

Beyond the general patterns (nomothetic) and group mean differences (differential) in the overall aggregate data, there are other patterns at the individual level that are less covert. Based on the literature across multiple disciplines (e.g., developmental science, health communication, personalized medicine, personalized education, and business marketing), the following provisional description of "tailoring" as a construct was formulated and used to guide the investigations in this study: *Tailoring is the process of matching unique patterns of services based on each student's cumulative strengths and needs and the availability of services*.

At the individual level (idiographic), the results showed that there were two types of unique sets of service patterns/combinations among the students' service profiles. A unique pattern was either "shared" (more than one student has the same combination of services) or "unshared" (only one student has a particular combination of services). In Study 1, at the Classroom level across three grade levels, between approximately 48% to 87% of the individual students had a unique pattern of service not shared with any other student. In Study 2, among all students (n=5,849), approximately 33% had unique unshared patterns. However, the percentage of unshared patterns ranged from approximately 18% to 55% across all grade levels (K to 9th). Further, the original data set of n=7,381 (which included students who did not have City Connects for at least one year and those with missing Tier assignment) was used to calculate the "true" patterns (without applying exclusion criteria). And results showed that approximately 35% of the students (n=2,552) had unshared patterns, and among the 65% of the students (n= 4,829) with shared patterns, there were a total of 839 unique patterns shared among those n=4,829 students. *Moving back to the nomothetic/differential level, the general pattern showed that as grade level increased, the percentage of students with unshared patterns also increased, on average.*

These results quantitatively illustrate Werner's Orthogenetic Principle: development is characterized by movement from a state of globality to differentiation and integration (Werner, 1948, 1957; Werner & Kaplan, 1956). As children grow and develop, their physical, psychosocial, cognitive, emotional, and behavioral needs become more differentiated and complex. Supportive systems guide the naturally occurring differentiation in a way that is adaptive and integrative rather than maladaptive and fragmented. City Connects pattern of service delivery captures to a certain extent a support system's response to the increasingly

differentiated needs of students. Service patterns became increasingly individualized as students moved from kindergarten to high school.

IV. Fourth Evidence of Tailoring: Service Patterns Match Children's Developmental Needs

While the analysis showed that students' service patterns generally became more differentiated and distinct as the students became older (Third Evidence), *the results also showed that as Student Tier of Strengths/Risks (or level of risk) increased, the percentage of unique unshared patterns also increased*. In fact, the relationship between grade level and percentage of unique unshared patterns was not always consistent especially around the late middle school and high school grade level. However, the relationship between Student Tiers of Strengths/Risks and percentage of unique unshared patterns was consistent. Further, examining the data more idiographically, pattern analysis using relatively small samples of students within the samples from both Study 1 and Study 2 showed that students with the same Student Tier of Strengths/Risks and were in the same grade and school had service patterns that differed by 2 to 9 services.

These results reiterate the caution against the notion that development is linear and limited to age and clearly demarcated stages/sequences (Bornstein et al., 2017; Jones & Peskin, 2010; Lerner et al., 2013; Masten, 2007). The differentiation of students' strengths and needs does not only occur between grade levels/age groups but also within them. At the nomothetic dimension, the results indicate that there is a linear progress from less individualized service patterns to more individualized service patterns (Third Evidence). However, at the differential dimension, the inconsistencies in the percentage of unshared, individualized patterns among students around middle school age could be related to factors such as puberty and the challenges

of transitioning from elementary school to middle school and from middle school to high school. Further, regardless of grade level, higher needs resulted in higher percentages of students with unshared/individualized patterns, and service patterns for students in the same Student Tier and from the same school and grade level could be minimally (2 services) or dramatically (9+ services) different from one another. This illustrates to a certain extent Bornstein's Specificity Principle that basically proposed that small differences/changes could have a big impact (e.g., Bornstein, 2015, 2017). Some students require more services and more variety of service than others and some students require less, and neither more nor less can be said to be better or worse apart from the context of the individual undergoing assessment and treatment.

Taken all together, *these results suggest that City Connects responds to developmental needs for each child as they arise rather than having a set plan of action for each Student Tier and grade level/age group.* Both within and between group differences are carefully considered in the service matching process.

V. Fifth Evidence of Tailoring: Matching of Services Is Not Random

Latent Class Analysis (LCA) of the unique unshared patterns by Student Tiers *1) suggest that there is a latent order or rule guiding the service tailoring/delivery process, 2) confirms the complexity of pinpointing precisely the needs of Tier 2a and Tier 2b Students, 3) and indicates that the schools students attended might influence the service matching process*.

Based on the pattern of services students received, LCA results show that Tier 1 and Tier 3 Students are divided into 5 Clusters/Classes; and Tier 2a and Tier 2b Students are divided into 7 Clusters/Classes. When the services with a moderate to very high proportion of students receiving services and the services with the highest within-cluster proportion were identified for each cluster with each Student Tier, the degree (i.e., very low, low, moderate, moderate/high,

high, very high) and type/specification (e.g., T1, T2, and 3; T1 and T3; T2 and T3) combinations were clearly distinct for each cluster within each Student Tier. That is to say, tailoring/service matching among students with unique unshared patterns was purposeful and followed latent rules/patterns of service delivery. Though City Connects coordinators did not intentionally seek to give each child a unique pattern of services, City Connects' approach to assessment and treatment of each child as a unique individual with unique sets of strengths and needs generated unique patterns of services, shared and unshared.

LCA results also suggest that there might be more variability in the service matching process for Tier 2a and Tier 2b Students than Tier 1 and Tier 3 Students. Students with the lowest risks (Tier 1 Students) and the highest risks (Tier 3 Students) were assigned to the least number of clusters, and the students whose risks were in the mild and moderate range (Tier 2 and Tier 2b Students), had more number of clusters based on latent patterns of service assignments. This could mean that strengths are more apparent for children with few risks (Tier 1) and for children with many risks (Tier 3). Identifiable strengths facilitate the matching of services, and less identifiable strengths might require more variability in service tailoring.

These results align with the literature on the challenges of differentiating student needs and risks and the intensity of services to be delivered (Camasso & Jagannathan, 2000; Dery et. al, 2020; Herman et al., 2012; Taxman & Smith, 2020). Since assigning students to a provisional Tier of Strengths/Risks is unique to City Connects, there is limited research on the characteristics of the strengths/needs of students within each Student Tier. However, Herman et al. (2012) criticized the three-tiered prevention model (e.g., Multi-Tier Support System [MTSS]) for making Tier 2 a "catchall category" with services that address needs ranging from minimal to severe.

City Connects, unlike other conventional three-tiered prevention models, remedies this challenge by 1) assigning students to provisional tiers of strengths/risks and by 2) differentiating Tier 2a from Tier 2b students to better identify needs of individual students, who at a first glance might seem to have the same needs, and provide the appropriate services specific to those needs. More time and effort might be required to understand how best to support the complex needs of students whose strengths/skills are not as obvious as Tier 1 and Tier 3 students. By differentiating mild (2a) from moderate (2b) needs/risks, City Connects substantially improves previous models, which put all ambiguous cases into one category. In fact, City Connects found that students with moderate (Tier 2b) and high (Tier 3) risk often improved significantly (moved to lower tier level) after receiving a few years of support from the intervention (Petsagourakis, 2022; Petsagourakis et al., 2018, August; Petsagourakis et al., 2019, August). Thus, the provisional assignment of students to a tier level, as opposed to tiering only services by intensity level, provides a better gauge for how a student is progressing overall rather than assigning services until specific, isolated outcomes improve (e.g., City Connects, 2016; Petsagourakis, 2022). In short, the LCA results in this study have made visible this latent and complex dynamic with regard to the differentiation of the levels of needs/risks and intensity of services.

Finally, LCA results with covariates revealed a surprising phenomenon: at times a cluster/class consisted entirely of students from one school. This could indicate the school students attend might have a particularly strong influence on how services are tailored. Grade level, dosage, and race/ethnicity also seem to vary from cluster to cluster and did not follow the general pattern (i.e., decrease in proportion of students with an increase in number of clusters), and this was the case across all Student Tiers. How the other factors are related to cluster assignment are not apparent and require further investigation.

Study Implications

The above Five Ways that give evidence of tailoring are the result of a preliminary attempt to conceptualize and operationalize "tailoring" as a construct. Taken all together, these findings and the process of arriving at them have several implications for research and practice. This section will discuss this study's theoretical, methodological, and practical implications for intervention/prevention science in general and school-based interventions in particular.

Theoretical

This study has provisionally defined and operationalized the construct of "tailoring" based on developmental theories and empirical research to address the practical and semantic crisis that has become a stumbling block for research, practice, and policy strategies (e.g., Chan & Ginsburg, 2011; Kreuter et al., 1999; Shemshack & Spector, 2020). The framework that this study provides could help guide and systematize future efforts in designing and implementing person-centered interventions with a clear and objective end goal.

Developmental science–as well as advocates of personalized medicine, personalized education, and individualized health communication–in recent decades have emphasized the uniqueness of individuals' history, group membership, personality, and context and the need to tailor or customize interventions and systems of support based on uniqueness (Chan & Ginsburg, 2011; Hawkins et al., 2008; Joyner & Paneth, 2019; Kreuter et al., 1999; Shemshack & Spector, 2020; Schumann et al., 2007). Similarly, in the area of business marketing, personalized branding and messaging have also been encouraged to attract more customers and optimize sales and profit (Vesanen, 2007). However, pinpointing or concretizing precisely what factors/variables or combinations of factors/variables that make individuals and their developmental trajectories unique (and similar) has been a challenge particularly for intervention

and prevention science. Is it possible to quantify, and subsequently tailor to, uniqueness or degrees of uniqueness? If individuals are indeed unique, how unique are they? Are they dramatically different from one another? Or, are the differences miniscule? Do small differences make a big difference? What role does uniqueness play in assessment and intervention?

Many attempts to tailor or personalize/customize/individualize interventions across multiple fields of study have been made before establishing and operationalizing the construct based on theory and research. Consequently, without a viable theoretical framework, efforts to develop and implement interventions have become fragmented and costly. The evaluations of these attempts have often returned back to the foundational question: What is tailoring and how do we know we are doing it?

In this study, students' uniqueness can be observed indirectly through the patterns of services matched to their strengths and needs at a particular point in time. The patterns of service matching discovered in this study provides quantitative evidence of how an exemplary support system–City Connects–responded to individuals' uniqueness via individualized combinations of services at a given point in time. Unique patterns are either unshared (no other students have this pattern of services) or shared (two or more students share a pattern of services). Older students tend to have more individualized patterns than younger students. Students with higher levels of needs/risks tend to have more individualized patterns than students with lower levels of needs/risks. Most students have unique patterns that are shared by two or more students, though at the classroom level, the number of unique patterns that are not shared by any other student can exceed the number of unique shared patterns. These patterns or combinations of services provide evidence that City Connects takes into account each student's unique needs, which become

apparent through the Whole Class Review (WCR) when City Connects coordinators discuss with teachers the strengths and needs of every student in their classroom.

Methodological

In addition to the theoretical implications, this study also has several methodological implications. This study:

1) introduced a novel way to quantify "tailoring" as a construct based theory, research, and practice

2) focused on optimizing description and explanation rather than on predicting future outcomes using selected variables as in statistical regression analysis prevalent in educational and psychological research (e.g., Lamiell, 1998, 2003; Lerner & Lerner, 2019; Lerner et al., 2019; Salvatore & Valsiner, 2010)

3) used an iterative, three-dimensional approach (nomothetic-differential-idiographic) to data analysis.

By allowing theory and data to be mutually transformative, a novel method of studying patterns of service/intervention tailoring emerged. The bulk of this study employed descriptive analysis so that the data could in a sense speak for itself. The quest to find evidence for tailoring began with the search for theories that described the phenomenon across different fields of study. The idea of how slight changes to the "patterns" or "combinations" of factors or variables could alter the effects of an intervention eventually emerged from this preliminary research. For example, changing a few words in a health messaging intervention to fit the unique needs of a group or an individual could increase the intervention's efficacy. Bringing this initial, theoretical understanding of tailoring to City Connects' secondary data, which came from the regular monitoring of students' progress and the services they received, heightened the awareness of

potential patterns present in the data. Preliminary descriptive analysis of relatively small samples of individual students began to show distinct patterns (shared and unshared) of services received. This finding helped to refine the study's provisional definition of tailoring, which in turn further shaped the method for analyzing patterns in this study.

With a provisional definition of tailoring and a method for analyzing service patterns established, more descriptive analysis was used to find potential patterns that could either confirm or refute the initial definition. Catherine Raeff (2016) wrote: "It is thus critical not to conflate predicting with either explaining or understanding…. We do not have to be able to predict future events in order to understand and/or explain current or past ones" (p. 69). Investing time and effort into the tedious task of describing the patterns already present in the data is in itself a worthwhile contribution to developmental science. Rather than selecting variables that may be related to some developmental outcomes, this study observed and described the patterns of response that an integrated student support system made to meet the needs and strengths of each individual student. Examining quantitatively what was happening to a specific child in terms of the interventions they were receiving at a given moment in time in a specific context elucidates understanding of child development and a support system's response to it.

Further, this study modeled a three-dimensional approach to analyzing quantitative data. This study put into dialogue the general findings from the aggregate data (nomothetic), group differences (differential), and individual differences (idiographic) (e.g., Lerner & Lerner, 2019; Lerner et al., 2019; Salvatore & Valsiner, 2010). For example, after examining the overall percentage of unshared patterns vs. shared patterns of services for the entire data set, the next step was to look at the percentages in terms of grade levels and student tiers. Following this step, the patterns of services for individuals within the same grade, tier level, and school were

compared to determine if the differences were dramatic or miniscule. Data analysis moved from broad to narrow and specific, from less differentiation to more differentiation regarding groups and individuals with each step. This three-dimensional, quantitative descriptive analysis provided a comprehensive view of the data from multiple angles without regression modeling and hypothesis testing. Even the effects for the Latent Class Analysis (LCA) portion of the study were fixed when covariates were added with the aim of providing descriptions of the classes/clusters rather than predicting class membership based on the covariates. Thus, this study both 1) responded to the call in developmental research for more idiographic (individual-focused) methods that are quantitative and 2) presented the findings in the context of the general trends in the data (e.g., Gayles & Molenaar, 2013; Hill, 2021; Lerner & Lerner, 2019; Molenaar & Nesselroade, 2012; Rose, 2016). This way exceptions to the general or universal patterns can have a prominent place in the analysis and are not eclipsed by the general trends.

Practical

Finally, this study has implications for practice. To be able to identify evidence for service tailoring and to be able to measure the degree (e.g., percentage of unshared vs. shared patterns or the number of unique patterns, shared and unshared) to which services are being tailored have implications for both intervention design and evaluation and policy strategies. In terms of research, knowing how tailoring is associated with student outcomes across Developmental Domains could provide invaluable information on how best to adjust an intervention's assessment and intervention process. Having a better sense of which services or combinations of services are prevalent or rare can guide practitioners and policymakers in deciding how to allocate limited resources in a systematic, purposeful, and cost-effective manner. For practitioners (e.g., City Connects coordinators) in particular, this study could

heighten their awareness and intentionality when they consider which combinations of services will meet the needs of each individual student at a given moment in time. With a framework to reflect on the patterns of services being tailored, practitioners can become more intentional and efficient in matching services to each student based on their strengths, risks/needs, and context.

In terms of program evaluation, the framework for conceptualizing and operationalizing tailoring of interventions in this study could be used as a measure of fidelity and accountability. If a program claims that it tailors to each child's unique sets of strengths and needs, it has to be able to provide evidence for the claim. Further, if future research consistently shows that a certain ratio of unshared vs. shared patterns of services/interventions for a specific intervention in a specific population is the ideal ratio for multiple positive outcomes, then being able to measure the degree of tailoring (e.g., percentage of unshared vs. shared patterns or the number of unique patterns, shared and unshared) will be conducive in setting tailoring goals and expectations.

Study Limitations

In spite of its strengths and the contributions it would make to developmental and intervention/prevention science, this study has a couple of limitations.

This study required the coding of many service labels (especially for Study 1) and detailed analysis of the data at multiple levels, and since they were carried out by only one person, mistakes were inevitable. To remedy this problem, I executed the various analyses (e.g., descriptive analysis, pattern analysis, LCA) several times to make sure that the results were consistent. Discrepancies were always minor and were remedied accordingly. Ideally, having another person to check the coding and run the analyses separately to confirm results would better ensure accuracy and precision.

Given the exploratory nature of this study, at times there were inconsistencies in the analytical procedures. For example, early on in the investigation, the Latent Class Analysis software (Latent GOLD 6.0) was not commanded to treat all variables (indicators and covariates) as nominal variables. Most of the subsequent analysis (e.g., isolating statistically significant indicators, highlighting services with moderate to high proportions of students, highlighting services with the highest within-cluster proportion of students) were carried out using the results of the earlier LCA analysis. Later on in the investigation, this came to my attention, and I eventually set all variables as nominal variables. For this reason there were minor discrepancies between the proportion of class/cluster sizes for the earlier and later LCA results (without covariates).

Further, given the large number of indicators and covariates, it was a challenge to find a way to interpret the LCA results. This problem was in part remedied by running separate LCA analyses by Student Tier only for students with unshared patterns of services to make interpretation more feasible. There were also theoretical reasons for this; namely, students were provisionally assigned a Tier of Strengths/Risks before they received services. Thus, it did not seem justifiable to make Tiers of Strengths/Risks a covariate. Moreover, while discernable patterns could be seen by color-coding the results by the proportion of students receiving services (very low, low, moderate, high, and very high), it was difficult to generate names for each distinct cluster that would do justice to its characteristics.

Finally, while it would have been interesting to see what types of patterns would emerge from the data set with both shared and unshared patterns combined, the data would not converge with them together, and as the LCA models improved, the number of clusters also increased, rendering interpretation almost impossible. Future studies could use factor analysis to reduce the

number of indicators and covariates. However, this would also eliminate the potentially illuminating details that could emerge from leaving the variables the way they are.

Conclusions

Considering how the data and the theories employed in this dissertation align with one another, this last section offers preliminary conclusions for consideration and future research. Theoretical frameworks guide the research questions, research design, data analysis and interpretation of the results. Conversely, the results of the investigation then in turn refine and deepen understanding of the theories and their impact on research and practice. This section will begin with a discussion on the value of a multidimensional approach to data analysis. Then, key findings will be discussed in light of the Specificity Principle, Orthogenetic Principle, and Developmental Contextualism. Finally, this section will end with a brief reflection on City Connects as an exemplary Integrated Support System (ISS) not only because it has effectively improved students' developmental outcomes over the past two decades, but also made it possible to explore and operationalize the elusive construct of "tailoring" that almost every intervention claims to do.

This dissertation provided a model for a quantitative, multidimensional—nomothetic, differential, and idiographic—approach to analysis using City Connects rich data, which is the product of rigorous tracking and monitoring of the assessments and interventions students received and their response to intervention. In order to dig deeply into the data, this study relied heavily on descriptive analysis. Describing in detail what is present in the data before carrying out statistical tests and analysis allows the data to in a sense speak for itself. Description is no less critical than prediction and interpretation especially in the field of developmental science (e.g., Lerner & Lerner, 2019; Lerner et al., 2019). Such an approach illuminates the richness and

complexity of the data and pushes against the tendency to formulate simplistic conclusions and generalizations (e.g, Salvatore & Valsiner, 2010). For example, it is well established that most students have many identifiable strengths and require minimal high intensity services (e.g., crisis counseling). At the same time, looking at the data more closely in this study at the individual level, or ideographically, it can be seen that many students identified as "low risk" or having more identifiable strengths than needs also received high intensity services. A deeper examination of the service profiles of a sample of students show that having many strengths does not make one immune to the unpredictability of future challenges and crisis (e.g., broken arm, illness, family problems) that would require intensive intervention (e.g. physical therapy, medical intervention, attendance assistance). Thus, a multidimensional approach to data analysis moves from general trends in the aggregated data to person-level differences to allow the data to tell a more in depth and comprehensive and contextualized story.

Furthermore, the idiographic findings of this dissertation illustrates the Specificity Principle's role in guiding the process of tailoring services to the unique strengths and needs of each individual student. At its foundation, the Specificity Principle can be summed up as follows: small differences/changes can make a big impact (Bornstein, 2015, 2017; Bornstein, et al., 2017; Lerner et al., 2019). The results show that among students with distinct/unique patterns of services not shared with any other student, the patterns could differ from between one or more services. Students with similar characteristics and needs also have patterns that differed by one or more services. This raises the question of how different service patterns have to be in order for tailoring to occur. The Specificity Principle affirms that one seemingly small difference could make a big difference for an individual child at a specific moment in time. For this reason, the central focus of tailoring interventions to students' specific needs ought not be the accumulation

of as many resources (e.g., funding) as possible, but rather to employ them in a systematic and efficient manner that would optimize their positive impact.

Juxtaposing the Specificity Principle with the results of the Latent Class Analyses (LCA) in this study highlights an interesting paradox for further consideration. Since only unshared service patterns were examined using LCA, it would have been reasonable initially to hypothesize that due to the uniqueness or distinctiveness of each service pattern, the data would not converge, indicating that there is no shared, underlying characteristics among these patterns. However, interestingly, though every student had distinct service patterns, the data successfully converged in the LCA and grouped the students in distinct clusters/classes based on shared characteristics within the service patterns. That is to say, there appears to be discernible, underlying patterns in the service assignment process in spite of a lack of shared service patterns among the students. There is evidence for some unifying, organizational process. Factors such as sharing the same school coordinator or sharing the same limited number of resources available at a given school could help explain why certain students with apparently different service patterns are grouped within the same cluster/class. Perhaps, a well-designed system of support like City Connects with high implementation fidelity allows for both variability and consistency in the matching of services to student strengths and needs.

While the differences in service patterns occurred because of each individual student's specific needs at a specific moment in time, the LCA findings nevertheless affirm that individual uniqueness always occurs within the context of commonality and similarity. The particular is tied to the universal (Aristotle & Lawson-Tancred, 1999). In fact, most people are more similar than they are different, and the significance of the differences and their impact depend on each individual case and specific context.

As with the Specificity Principle, how the findings of this dissertation and the Orthogenetic Principle align with one another also generate insights that merit attention and make for rich discussion. The discovery of shared (more than one student with the same pattern) and unshared (only one student with a particular pattern) service patterns demonstrates quantitatively the Orthogenetic Principle. The Orthogenetic Principle describes development in terms of increase in complexity, differentiation, and integration (Werner, 1948, 1957; Werner & Kaplan, 1956). The results of this study show that, on average, at the nomothetic and differential levels, distinctiveness or uniqueness of service patterns increased as grade level and risk level increased (e.g., more apparent needs than strengths results in higher risk). At the same time, by comparing students within the same school, same grade level, and the same tier of strengths/risks, it can be seen that at times service patterns varied significantly despite the similar characteristics that the students shared.

It is understood that as an organism grows and age, its needs become more complex and characteristics become more differentiated from members of its own species. However, the Orthogenetic Principle does not propose that development is linear or perfectly correlated with age. In fact, the data shows that though there was a general increase of unshared service patterns with grade level, this trend was not perfectly consistent (e.g., between 6th grade to 7th grade and 8th grade to 9th grade, percentage of unshared/distinct service patterns decreased). However, what is consistent was that as the level of risks/needs increased, so did the percentage of unshared patterns. Perhaps development is more closely tied to overall strengths and needs at a moment in time than with age/grade. The data therefore shows that City Connects' response to an increase in complexity and differentiation and an increase in need for integration involves an increase in individualization of service patterns regardless of grade level. This is not to say that age/grade

level plays a small role in development. At the same time, a laser-eye focus on developmental stages and expected outcomes and milestones based on age/grade, or some other easily quantifiable attributes (e.g., height, weight), could make one lose sight of modifiable risk factors or loci for intervention.

Finally, the findings of this dissertation confirm that developmental-contextualism takes precedent over universalism without excluding it (e.g., Walsh et al., 2002). Data analysis led to the conclusion that more tailoring or individualization of service patterns occurs as risk and grade level increases. This conclusion is a form of universal claim that could be generalized to most children. However, this claim is limited in its applicability. City Connects delivered services based on assessments of each individual child's developmental strengths and needs within their specific context at a specific moment in time rather than intentionally making service patterns distinct based on the complexity and intensity of the needs. That is to say, the practice or intervention preceded the evidence for tailoring, and the evidence of tailoring supports the intervention's responsiveness to individual uniqueness. Thus, the primary concern of intervention science is the individual within their context rather than the process of tailoring in itself. However, without being able to demonstrate that tailoring is occurring, it is difficult to justify that the positive outcomes of the intervention are the result of the attention and care given to each individual person.

Taken altogether, the integration of theory and practice in this dissertation's effort to elucidate the deceptively simple idea of "tailoring" could not have been possible without an exemplary Integrated Support System like City Connects. The question of whether tailoring is occurring can be explored only after there is evidence that each individual child's strengths and needs are being assessed and that the intervention is effective in improving students' outcomes

(e.g., academic, social/behavioral). That is to say, caring for the individual in practice precedes the study and operationalization of the phenomenon of tailoring of services/interventions, and evidence of change precedes the exploration and investigation of the mechanisms (i.e., tailoring) of change.

Because City Connects effectively fulfills these two criteria, it is fertile ground for exploring the question of tailoring of services/interventions. City Connects' uniqueness as compared to other systems of support in part lies in the Whole Class Review (WCR) that biannually assesses every child's strengths and needs regardless of apparent risk level at a given moment in time. Every child is accounted for. Additionally, the rigorous data collection and management by City Connects has made it possible to demonstrate empirically City Connects' effectiveness in improving students' outcomes. Thus, the research-based practice that City Connects employed established a sturdy foundation for the practice-based research that enabled this dissertation to carry out.

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Appendix A: Service Codes

Table A1

Service codes for Class A, 2019-2020 (4th Grade) and 2020-2021 (5th Grade) (MyConnects)

Intensity	Label	Code for Provider and Label/Type
2	Academic Skills and Interests	A2 XX Elementary: XX Elementary Summer School Engagement Team
2	Family Assistance and Support	B2 XX Elementary: Technology Support throughout COVID-19
3	Family Assistance and Support	C3 City of Boston: Pandemic EBT (P-EBT)
2	Family Assistance and Support	D2 Home for Little Wanderers: Boston-Suffolk County Family Resource Center
3	Crisis Intervention	E3. XX Elementary: Dever Elementary - High Needs Group
1	Donation/Family	F1 City Connects Coordinator
2	Donation/Health Medical	G2 Catie's Closet
2	Counseling	H2 Wediko Children's Services: MassSTART
1	Youth Development	I1 Boys and Girls Clubs of Dorchester - Walter Denney
2	Accommodations and Adaptations	J2 XX Elementary
1	Donation	K1 Cradles to Crayons
3	Youth Development	L3 Boston Youth Sanctuary
2	Family Assistance and Support	M2 XX Elementary (Family)
2	Attendance Support	N2 XX Elementary

2	Health Programming	O2 American Red Cross
1	Academic Skills and Interests	P1 Paraclete Program
1	Donations	Q1 American Red Cross: Red Cross - Thanksgiving Turkey Drive
1	Family Assistance and Support	R1 XX Public Schools: X Public Schools - Staples Card Distribution
1	Donations	S1 XX Elementary: X Elementary School Backpack Distribution
1	Donations	T1 XX Elementary: Distribution of School Supplies
2	Accommodations and Adaptations	U2 XX Public Schools: IEP/Special Education
2	Family Assistance and Support	Z2 Rosie's Place

[a]Highlighted services were unique to 2020-2021 academic year (5th graders).
[b]"XX" indicates that the school/district name has been de-identified.
[c]Intensity: 1 = prevention/enrichment; 2 = early intervention; 3 = intensive/crisis intervention.

Table A2

Service codes for Class B, 2019-2020 (4th Grade) and 2020-2021 (5th Grade) (MyConnects)

Code/Intensity	Service Label	Provider/Type
G2	Academic Skills and Interests	XX: Engagement Tracker–Covid-19
G2a	Academic Skills and Interests	XX: Technology Support–Covid-19
A1h	Accommodations and Adaptations	XX: (Social/Emotional/Behavioral, SEB)
A1i	Health Programming	XX: Fresh fruit and vegetables program
H1	Arts-based Services	Tony Williams Dance Center: Nutcracker
I1	Sports or Physical Activities	Playworks
J1	Health/Medical Intervention	Smart Smile
A1k	Sports or Physical Activities	XX
A1j	Youth Development (Academic)	XX

K2	Donations (Family)	Catie's Corner
L1	Youth Development (Family)	YMCA
M1	Mentoring	Strong Women, Strong Girls Social/Emotional/Behavioral (SEB)
A2l	IEP (Family)	Door-to-Door Food Delivery (Covid-19)
A2	Transition Assistance (Academic)	XX
B1	Family Engagement (Academic)	City Connects Coordinators
C2	Family Assistance and Support	City of Boston: Pandemic EBT
A1a	Donations	XX: Staples Cards and Distribution
A2b	IEP: Special Education	XX
F1	Family Assistance and Support	Cradles to Crayons
F1a	Donations	City Connects Coordinators (?)
B2a	Family Assistance and Support	City Connects Coordinators
A3c	Speech and Language	XX
A3d	IEP: Occupation Therapy	XX
D2	Donations (Family)	United Way
B1b	Psychosocial	City Connects Coordinators
A3e	Accommodations and Adaptation (Family)	XX
E2	Family	ABCD (Action for Boston Community Development)
A2f	Accomodations and Adaptation	XX: 504 Plan

[a]Highlighted services were unique to 2020-2021 academic year (5th graders).
[b]"XX" indicates that the school/district name has been de-identified.
[c]Intensity: 1 = prevention/enrichment; 2 = early intervention; 3 = intensive/crisis intervention.

Table A3

Service codes for Class A, 2018-2019 (3rd Grade) (SSIS Data)

Service Label/Type	Code (Intensity)
Counseling: Student (community-provided)	230(2)
Enrichment: Academic	266(2)
After-School Program (community-provided)	223(2)
Classroom/Group Social Skills Intervention	296(2)
504 Plan (school-provided)	329(1)
Health Screening – Vision	312(1)
Health Screening – Hearing	310(1)
Enrichment: Youth Development (community-provided)	268(2)
Family Assistance	264(1)
Parent/Family Donations – Early Intervention (community-provided)	305(2)
Parent/Family Donations – Intensive (community-provided)	349(2)
Attendance Support (school-provided)	202(1)
Enrichment: Arts (community-provided)	267(2)
IEP: Physical Therapy	247(3)
Family Conference/Meeting	211(1)
Parent/Family Donations – Intensive (school-provided)	346(1)
After-School Program (school-provided)	201(1)
Behavioral Support: District	307(1)
Behavioral Support: City Connects School Site Coordinator	204(1)
Classroom-based Social Skills Intervention	209(1)
Summer Programming: Enrichment (community-provided)	240(2)

Note. Intensity: (1) = prevention/enrichment; (2) = early intervention; (3) = intensive/crisis intervention.

Table A.4

Service codes for Class B, 2018-2019 (3rd Grade) (SSIS Data)

Service Label/Type	Code (Intensity)
Academic Classroom Support	200(2)
Sports or Physical Activity (community-provided)	269(1)
Sports or Physical Activity (school-provided)	218(1)
Mentoring	235(2)
Classroom-based Social Skills Intervention	209(2)

Enrichment: Youth Development (school-provided)	263(1)
Health Screening – Vision	312(1)
Health Screening – Hearing	310(1)
Classroom/Group Health Intervention	295(2)
Enrichment: Youth Development (community-provided)	268(1)
Enrichment: Arts (community-provided)	267(1)
Before-School Program (school-provided)	203(1)
After-School Program (community-provided)	201(1)
Family Assistance	264(2)
Counseling: Student (community-provided)	230(3)
IEP: Speech and Language	248(3)
Enrichment: Academic	266(1)
IEP: Occupational Therapy	246(3)
Health/Medical (community-provided)	233(3)
Summer Programming: Academic (school-provided)	321(1)
Psycho-Social Group	216(2)

Note. Intensity: (1) = prevention/enrichment; (2) = early intervention; (3) = intensive/crisis intervention.

Appendix B: Indicators/Service Labels

Table B1

Indicators/Service Labels (n=77)

Service Label (Tier 1)		Service Label (Tier 2)		Service Label (Tier 3)	
afterschool_program_community	1	academic_classroom_support	2	i504_plan_school_provided	3
afterschool_program_school	1	academic_support	2	attendance_support	3
afterschool_program_academic	1	behavioral_support_ccnx	2	checkin_ccnx_site_coordinator	3
before_school_program_community	1	behavioral_support_district	2	counseling_family	3
before_school_program_school	1	behavioral_social	2	counseling_student_community	3
before_school_program_academic_c	1	ccnx_healthy_life_skills_small_g	2	counseling_student_school	3
before_school_program_academic_s	1	classroom_based_health_int	2	crisis_intervention_community	3
ccnx_healthy_life_skills_cls	1	classroom_based_social_in	2	crisis_intervention_school	3
college_career_assistance_c	1	classroom_group_health_int	2	health_medical_school	3
college_career_assistance_s	1	classroom_group_social_int	2	iep_accommodations_adaptations	3
esl_parent_family	1	family_assistance	2	iep_behavioral_therapy	3
enrichment_academic	1	family_conference_meeting	2	iep_counseling	3
enrichment_arts_community	1	individual_tutoring_school	2	iep_hearing	3
enrichment_arts_school	1	literacy_intervention	2	iep_occupational_therapy	3
enrichment_youth_dev_community	1	math_intervention	2	iep_physical_therapy	3
enrichment_youth_dev_school	1	mentoring	2	iep_speech_language	3
health_screening_bmi	1	parent_family_don_early_int_c	2	iep_vision	3
health_screening_hearing	1	parent_family_don_early_int_s	2	informal_screening_diagnostic	3
health_screening_post_sco (scoliosis)	1	psycho_social_group	2	intensive_care_coordination	3
health_screening_vision	1	staff_mentoring	*2*	mentoring_peer	2
health_medical_community	1	student_family_tran_assistance	2	parent_family_don_intensive_c	3
individual_tutoring_community	1			parent_family_don_intensive_sc	3
parent_family_engagement	1			psychiatric_services	3
parent_family_support	1			special_education_evaluation	3
sports_physical_activity_c	1			therapeutic_mentoring	3

sports_physical_activity_s	1			**violence_intervention**	3
summer_programming_academic_s	1				
summer_programming_enrichment_s	1				
summer_programming_enrichment_c	1				
violence_prevention	1				

Note. c=community; cls=class; ccnx=City Connects; s/sc=school; g= group; dev=development; tran=transition; don=donation; in/t=intervention

Appendix C: Patterns from Reduced and Original Data Sets for Comparison

Table C1

Distribution of Shared and Unshared Service Patterns across Grade Levels from Original Data Set (n=7,381)

	Grade									
	K	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Group										
Unshared (%)	240 (20.82)	314 (25.76)	431 (33.18)	531 (40.47)	395 (39.90)	211 (40.73)	70 (53.85)	105 (35.84)	57 (58.76)	198 (53.51)
Shared (%)	913 (79.18)	905 (74.24)	868 (66.82)	781 (59.53)	595 (60.10)	307 (59.27)	60 (46.15)	188 (64.16)	40 (41.24)	172 (46.49)
Total n=7381	**1153 (15.62)**	**1219 (16.52)**	**1299 (17.60)**	**1312 (17.78)**	**990 (13.41)**	**518 (7.02)**	**130 (1.76)**	**293 (3.97)**	**97 (1.31)**	**370 (5.01)**

Note. See Table 16 for comparison.

Table C2

Distribution of Shared and Unshared Service Patterns across Student Tiers from Original Data Set (n=7,381)

	Student Tier				
	No Tier	**1**	**2a**	**2b**	**3**
Group					
Unshared	66 (27.85)	422 (20.81)	710 (31.00)	747 (42.61)	607 (56.57)
Shared	171 (72.15)	1606 (79.19)	1580 (69.00)	1006 (57.39)	466 (43.43)
Total n=7381	237 (3.21)	2028 (27.48)	2290 (31.03)	1753 (23.75)	1073 (14.54)

Note. See Table 17 for comparison.

Appendix D: Calculation of Shared Patterns from Original Data

Table D1

Maximum Count of Unshared and Shared Service Patterns from Original Data Set (n=7, 381)

X	Y	Y/X
(Maximum number of Students sharing one pattern)	**(Number of Students sharing X pattern)**	**(Total number of unique patterns with X-number of students)**
1	2552	2552
2	708	354
3	495	165
4	296	74
5	260	52
6	234	39
7	133	19
8	120	15
9	126	14
10	100	10
11	88	8
12	132	11
13	104	8
14	70	5
15	45	3
16	80	5
17	51	3
18	108	6
19	76	4
20	20	1
21	42	2
22	66	3

23	92	4
24	24	1
25	50	2
26	130	5
30	90	3
31	31	1
32	32	1
33	33	1
34	34	1
36	72	2
37	37	1
38	76	2
39	78	2
41	41	1
43	43	1
47	94	2
51	102	2
55	55	1
58	58	1
66	66	1
74	74	1
77	77	1
86	86	1
	Total Unique Patterns (Unshared+Shared)	3391
	Total Unshared	2552
	Total Shared	839

Appendix E: LCA Proportions without Covariates

Table E.1

LCA Proportions of Tier 1 Students by Statistically Significant Indicators and Class/Cluster

		Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
T1 N=363 Cluster size		0.5394	0.1635	0.1311	0.0967	0.0692
before_school_program_academic_s	***	0.0102	0.0507	0.0002	0.2559	0.0003
enrichment_academic	***	0.4843	0.2713	0.9222	0.0026	0.3607
college_career_assistance_c	***	0.0255	0.0002	0.2725	0.0003	0.0004
enrichment_arts_community	***	0.0766	0.0003	0.3349	0.0005	0.0007
enrichment_arts_school	***	0.0722	0.0174	0.4585	0.0009	0.9537
academic_classroom_support	***	0.3672	0.0685	0.0632	0.712	0.5581
academic_support	*	0.0215	0.1178	0.0167	0.0002	0.0003
literacy_intervention	***	0.5339	0.2416	0.021	0.2862	0.1617
math_intervention	***	0.4743	0.2364	0.0207	0.0017	0.0421
attendance_support	***	0.6598	0.9779	0.4747	0.9982	0.0848
enrichment_youth_dev_community	***	0.0289	0.1354	0.9936	0.9958	0.0021
enrichment_youth_dev_school	***	0.0255	0.2354	0.0002	0.0003	0.1195
mentoring	***	0.0818	0.8238	0.0009	0.2853	0.0016
behavioral_support_ccnx	*	0.0712	0.0002	0.2524	0.0004	0.0006
behavioral_support_district	***	0.6369	0.7084	0.1903	0.0596	0.0039
classroom_based_social_in	***	0.0052	0.0002	0.0003	0.0004	0.9926
classroom_group_social_int	**	0.0612	0.0003	0.0004	0.0006	0.9929
psycho_social_group	**	0.0242	0.2059	0.0848	0.0856	0.0799
ccnx_healthy_life_skills_cls	***	0.0153	0.2859	0.0421	0.0003	0.0005
health_screening_vision	**	0.7554	0.9995	0.9365	0.9709	0.9989
health_medical_community	***	0.0255	0.1179	0.0631	0.3129	0.0006
sports_physical_activity_c	***	0.0457	0.1019	0.0425	0.0005	0.715
sports_physical_activity_s	***	0.1416	0.8452	0.0859	0.9961	0.0025
ccnx_healthy_life_skills_small_g	**	0.0051	0.0001	0.1886	0.0002	0.0002
classroom_based_health_int	**	0.0104	0.7565	0.2311	0.0009	0.0013
classroom_group_health_int	***	0.2331	0.9807	0.0012	0.0017	0.1611
esl_parent_family	***	0.0408	0.0002	0.0003	0.1424	0.437
parent_family_engagement	**	0.29	0.3375	0.0251	0.9965	0.9951
family_conference_meeting	***	0.0255	0.017	0.0003	0.5402	0.0799
parent_family_don_early_int_c	*	0.2194	0.0006	0.4186	0.001	0.0014
parent_family_don_early_int_s	*	0.0358	0.1012	0.0004	0.0006	0.9929
afterschool_program_school	*	0.01	0.0001	0.1268	0.0001	0.0002
before_school_program_community	**	0.0102	0.0001	0.0001	0.0001	0.2383
before_school_program_school	***	0.0153	0.0001	0.2306	0.0002	0.0003

Note.[a] *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; [b]Academic (before_school_program_academic_s to attendance support); SEB (enrichment_youth_dev_community to psycho_social_group); Health (ccnx_healhty_life_skills_cls to classroom_group_health_int); Family (esl_parent_family to parent_family_don_early_int_s); [c] Green = Tier 1 Services; Yellow = Tier 2 Services; Red = Tier 3 Services; [d] It was not clear to which Developmental Domain after_school_program, before_school_program_community, and before_school_program_school belonged, but they were included here.

[c] Legend:

Very Low	Less than 1%
Low	Between 1% and 25%
Moderate	Between 25% and 50%

High	Between 50% and 75%
Very High	Between 75% and 100%

Table E.2

LCA Proportions of Tier 2a Students by Statistically Significant Indicators and Class/Cluster

		Cluster1	Cluster2	Cluster3	Cluster4	Cluster5	Cluster6	Cluster7
T2a N=566 Cluster Size		0.2968	0.221	0.1378	0.1131	0.0967	0.0831	0.0514
before_school_program_academic_s	*	0	0.008	0.2432	0.0001	0.0001	0.0001	0.0002
enrichment_academic	***	0.2254	0.5466	0.0009	0.2348	0.9616	0.9982	0.2422
college_career_assistance_c	***	0.0119	0.016	0.0001	0.0001	0.3283	0.0213	0.0002
college_career_assistance_s	***	0.0742	0.1274	0.3713	0.0003	0.4306	0.0004	0.0007
enrichment_arts_community	*	0.101	0.0481	0.0001	0.0001	0.2372	0.0002	0.0003
enrichment_arts_school	***	0.1012	0.0082	0.0003	0.0627	0.0004	0.9975	0.9959
academic_classroom_support	***	0.2819	0.4615	0.5126	0.0943	0.1255	0.3192	0.7909
individual_tutoring_school	**	0.0357	0.0558	0.0001	0.0001	0.0185	0.1698	0.2061
literacy_intervention	***	0.1893	0.9596	0.5253	0.3439	0.0197	0.0012	0.2421
math_intervention	***	0.2857	0.5747	0.4099	0.1098	0.0008	0.0009	0.1387
iep_accommodations_adaptations	***	0.0164	0.2892	0.1796	0.0003	0.1283	0.1701	0.3095
iep_occupational_therapy	*	0.0118	0.1358	0.0001	0.0001	0.0183	0.0001	0.0688
iep_speech_language	***	0.0314	0.2157	0.0385	0.0002	0.0311	0.0002	0.1376
i504_plan_school_provided	**	0.0487	0.0636	0.0257	0.1716	0.1799	0.0426	0.0003
attendance_support	***	0.0476	0.0001	0.0767	0.0157	0.0001	0.0001	0.0001
enrichment_youth_dev_community	***	0.0004	0.0486	0.6019	0.3436	0.9111	0.9979	0.0015
enrichment_youth_dev_school	**	0.0059	0.0081	0	0.156	0.0001	0.0001	0.1031
mentoring	**	0.0779	0.0071	0.1411	0.9981	0.0011	0.0005	0.0008
behavioral_support_ccnx	***	0.19	0.1202	0.0387	0.1251	0.4928	0.0429	0.138
behavioral_support_district	***	0.6543	0.6066	0.0904	0.9053	0.02	0.6591	0.0025
classroom_based_social_in	***	0.0808	0.331	0.3971	0.9984	0.0007	0.0008	0.2759
classroom_group_social_int	*	0.0808	0.331	0.3971	0.9984	0.0007	0.0008	0.2759
psycho_social_group	***	0.0487	0.0226	0.0898	0.2029	0.0185	0.1275	0.4122
checkin_ccnx_site_coordinator	***	0.1965	0.0876	0.1283	0.3901	0.0187	0.2551	0.1724
health_screening_bmi	***	0.2143	0.2794	0.3717	0.3436	0.329	0.5524	0.0014
health_screening_hearing	***	0.4578	0.8661	0.8585	0.4848	0.7425	0.405	0.7237
health_screening_post_sco	***	0.5995	0.0607	0.0389	0.1565	0.6498	0.0008	0.0014
health_screening_vision	***	0.4786	0.966	0.987	0.9996	0.9255	0.9783	0.9305
sports_physical_activity_c	***	0.0119	0.0719	0.0001	0.0313	0.0366	0.0002	0.5836
sports_physical_activity_s	***	0.2162	0.0215	0.9987	0.7646	0.1655	0.0009	0.0015
classroom_based_health_int	***	0	0.024	0.0001	0.0001	0.0001	0.0002	0.9611
classroom_group_health_int	***	0	0.024	0.0001	0.0001	0.0001	0.0002	0.9611
esl_parent_family	**	0.1425	0.0163	0.0257	0.0001	0.0002	0.0002	0.2062
parent_family_engagement	***	0.1251	0.3915	0.9859	0.297	0.0009	0.001	0.9968
family_assistance	**	0.1782	0.1599	0.1794	0.0783	0.0371	0.3611	0.0694
family_conference_meeting	***	0.0358	0.0478	0.2561	0.0001	0.0002	0.0002	0.1376
parent_family_don_early_int_c	***	0.0069	0.3981	0.0003	0.0004	0.0004	0.9975	0.0008
parent_family_don_early_int_s	**	0.0206	0.1162	0.0002	0.1093	0.0002	0.0215	0.9956

Note.[a] $*p < 0.05$; $**p < 0.01$; $***p < 0.001$; [b] Academic (before_school_program_academic_s to attendance_support); SEB (enrichment_youth_dev_community to checkin_ccnx_site_coordinator); Health (health_screening_bmi to classroom_group_health_int); Family (esl_parent_family to parent_family_don_early_int_s); [c] Green = Tier 1 Services; Yellow = Tier 2 Services; Red = Tier 3 Services

[d] Legend:

Very Low	Less than 1%
Low	Between 1% and 25%
Moderate	Between 25% and 50%

High	Between 50% and 75%
Very High	Between 75% and 100%

Table E.3

LCA Proportions of Tier 2b Students by Statistically Significant Indicators and Class/Cluster

		Cluster1	Cluster2	Cluster3	Cluster4	Cluster5	Cluster6	Cluster7
T2b N=574 Cluster size		0.3307	0.2284	0.1406	0.0926	0.075	0.0716	0.0611
before_school_program_academic_s	**	0	0.0457	0.0001	0.0001	0.3246	0.0001	0.0001
summer_programming_academic_s	**	0.0316	0.0381	0.0001	0.0377	0.2319	0.0001	0.0002
college_career_assistance_s	***	0.2473	0.0002	0.0003	0.0004	0.9509	0.0006	0.1715
enrichment_academic	***	0.2462	0.3499	0.9827	0.1514	0.0015	0.9981	0.9977
enrichment_arts_community	***	0.0181	0.0348	0.0371	0.0001	0.0001	0.0001	0.3133
enrichment_arts_school	***	0.074	0.0303	0.0003	0.5637	0.0005	0.9971	0.0006
academic_classroom_support	***	0.2683	0.3929	0.6748	0.6206	0.3489	0.3173	0.0015
individual_tutoring_school	**	0.0371	0.0079	0.061	0.094	0.0002	0.2189	0.0002
literacy_intervention	***	0.3651	0.3197	0.998	0.5855	0.9519	0.0016	0.0019
math_intervention	***	0.2562	0.1158	0.4726	0.4514	0.9977	0.001	0.0012
iep_accommodations_adaptations	***	0.133	0.1188	0.199	0.3782	0.3947	0.4382	0.1431
iep_speech_language	***	0.1529	0.0288	0.2605	0.0775	0.0003	0.0247	0.0289
i504_plan_school_provided	***	0.0576	0.0771	0.1851	0.0566	0.0699	0.0976	0.3135
attendance_support	***	0.6789	0.8103	0.9869	0.077	0.999	0.999	0.0029
enrichment_youth_dev_community	***	0.0614	0.5057	0.0005	0.0007	0.0009	0.9974	0.9685
mentoring	***	0.079	0.4796	0.0006	0.0004	0.0236	0.0005	0.029
behavioral_support_ccnx	***	0.2714	0.1587	0.2802	0.3386	0.1167	0.0252	0.6557
behavioral_support_district	***	0.5109	0.6066	0.9205	0.4333	0.0945	0.7067	0.0022
classroom_based_social_in	***	0.2005	0.3944	0.6706	0.1887	0.9978	0.0012	0.0014
psycho_social_group	***	0.0448	0.2171	0.0496	0.3946	0.0004	0.049	0.0004
checkin_ccnx_site_coordinator	*	0.2877	0.2182	0.1573	0.3386	0.0703	0.2438	0.1148
ccnx_healthy_life_skills_cls	**	0.1045	0.07	0.0242	0.0002	0.2553	0.2191	0.0004
health_screening_bmi	***	0.1749	0.3314	0.1525	0.0194	0.3485	0.5113	0.371
health_screening_hearing	***	0.5507	0.6599	0.9994	0.8113	0.4889	0.2696	0.6285
health_screening_post_sco	***	0.5449	0.0626	0.0035	0.0757	0.1399	0.0008	0.4849
health_screening_vision	***	0.5836	0.9859	0.9997	0.9996	0.9995	0.9995	0.8571
sports_physical_activity_c	***	0.1101	0.0077	0.049	0.3591	0.0003	0.0003	0.0003
sports_physical_activity_s	***	0.055	0.8423	0.0005	0.0008	0.9977	0.001	0.2005
classroom_based_health_int	***	0.0105	0.0001	0.0001	0.5635	0.0002	0.0002	0.0002
classroom_group_health_int	***	0.0001	0.347	0.0304	0.0003	0.0004	0.0004	0.5697
informal_screening_diagnostic	*	0.0113	0.1284	0.0002	0.0564	0.0929	0.0002	0.0002
esl_parent_family	**	0.0527	0.0384	0.0243	0.1879	0.0002	0.0002	0.0002
parent_family_engagement	***	0.0464	0.6151	0.0671	0.9982	0.9514	0.0011	0.0013
family_assistance	***	0.2498	0.1984	0.1305	0.1321	0.418	0.4626	0.2287
parent_family_don_early_int_c	***	0.0425	0.0002	0.1728	0.3948	0.0005	0.997	0.0006
parent_family_don_early_int_s	***	0.0174	0.1349	0.1488	0.5636	0.0004	0.0004	0.0289
afterschool_program_community	**	0.1483	0.1558	0.2155	0.1507	0.4178	0.0735	0.2851
afterschool_program_school	**	0.0641	0.0063	0.0001	0.0001	0.0001	0.0001	0.2278

Note.[a] $*p < 0.05$; $**p < 0.01$; $***p < 0.001$; [b] Academic (before_school_program_academic_s to attendance support); SEB (enrichment_youth_dev_community to checkin_ccnx_site_coordinator); Health (ccnx_healthy_life_skills_cls to informal_screening_diagnostic); Family (esl_parent_family to parent_family_don_early_int_s); [c] Green = Tier 1 Services; Yellow = Tier 2 Services; Red = Tier 3 Services; [d] It was not clear to which Developmental Domain after_school_program, before_school_program_community, and before_school_program_school belonged, but they were included here.

[c] Legend:

Very Low	Less than 1%
Low	Between 1% and 25%
Moderate	Between 25% and 50%
High	Between 50% and 75%

Very High	Between 75% and 100%

Table E.4

LCA Proportions of Tier 3 Students by Statistically Significant Indicators and Class/Cluster

		Cluster1	Cluster2	Cluster3	Cluster4	Cluster5
T3 N=428 Cluster Size		0.4218	0.1895	0.164	0.124	0.1007
enrichment_academic	**	0.3865	0.2357	0.9958	0.0015	0.2119
college_career_assistance_s	***	0.0689	0.3572	0.4092	0.0007	0.1586
academic_classroom_support	***	0.5913	0.5916	0.2731	0.2649	0.1401
literacy_intervention	***	0.7471	0.5179	0.0705	0.2273	0.2111
math_intervention	***	0.4924	0.4315	0.0288	0.5652	0.0017
attendance_support	***	0.5964	0.7768	0.6421	0.8861	0.8408
iep_accommodations_adaptations	***	0.2497	0.505	0.2972	0.0009	0.0012
iep_speech_language	**	0.1881	0.0372	0.0853	0.0192	0.0005
special_education_evaluation*		0.1106	0.0863	0.0144	0.1695	0.0237
enrichment_youth_dev_community	***	0.006	0.3573	0.7675	0.0008	0.1167
behavioral_support_ccnx	**	0.376	0.1484	0.3266	0.4711	0.3282
behavioral_support_district	***	0.6537	0.3837	0.2685	0.66	0.8121
classroom_based_social_in	***	0.3395	0.4068	0.0242	0.0012	0.9968
classroom_group_social_int	*	0.2654	0.111	0.0004	0.0005	0.0006
mentoring	***	0.0445	0.1111	0.057	0.1885	0.8344
psycho_social_group	**	0.0719	0.1602	0.0146	0.2072	0.2089
staff_mentoring	***	0.0056	0.0001	0.0002	0.4326	0.0003
checkin_ccnx_site_coordinator	***	0.2317	0.0377	0.2428	0.8659	0.6059
counseling_student_school	*	0.0119	0.0247	0.0001	0.0941	0.1124
health_screening_hearing	***	0.8907	0.6414	0.7265	0.0026	0.5116
health_screening_post_sco	***	0.1297	0.05	0.4809	0.9785	0.4602
health_screening_vision	***	0.9526	0.9873	0.8916	0.0031	0.8401
sports_physical_activity_s	***	0.0004	0.9981	0.0279	0.0386	0.8118
classroom_group_health_int	***	0.0057	0.0003	0.242	0.0005	0.8342
health_medical_school	***	0.1328	0.0127	0.0005	0.884	0.0008
informal_screening_diagnostic	***	0.0825	0.234	0.0145	0.0004	0.2573
parent_family_engagement	***	0.2988	0.9726	0.001	0.02	0.1405
family_assistance	***	0.2782	0.3207	0.2245	0.584	0.3714
family_conference_meeting	***	0.1273	0.2341	0.0005	0.4705	0.0007
parent_family_don_early_int_s	**	0.1658	0.0003	0.0145	0.0004	0.3249

Note.[a] $*p < 0.05$; $**p < 0.01$; $***p < 0.001$; [b] Academic (before_school_program_academic_s to attendance support); SEB (enrichment_youth_dev_community to psycho_social_group); Health (ccnx_healhty_life_skills_cls to classroom_group_health_int); Family (esl_parent_family to parent_family_don_early_int_s); [c] Green = Tier 1 Services; Yellow = Tier 2 Services; Red = Tier 3 Services;

[d] Legend:

Very Low	Less than 1%
Low	Between 1% and 25%
Moderate	Between 25% and 50%

High	Between 50% and 75%
Very High	Between 75% and 100%

Appendix F: LCA Cluster Differentiation for All Student Tiers

Table F.1

Differentiation of Clusters Based on Academic Services for Tier 1 Students

Tier 1 Academic Cluster	Number of Academic Supports with Moderate to Very High Proportion of Students Receiving (n=11)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Moderate (5; 45.45%)** enrichment_academic (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) attendance_support (T3)	literacy_intervention (T2) math_intervention (T2)
2	**Low (2; 18.18%)** enrichment_academic (T1) attendance_support (T3)	academic_support (T2)
3	**Moderate (5; 45.45%)** enrichment_academic (T1) college_career_assistance_c (T1) enrichment_arts_community (T1) enrichment_arts_school (T1) attendance_support (T3)	enrichment_academic (T1) college_career_assistance_c (T1) enrichment_arts_community (T1)
4	**Moderate (4; 36.36%)** before_school_program_academic_s (T1) academic_classroom_support (T2) literacy_intervention (T2) attendance_support (T3)	before_school_program_academic_s (T1) academic_classroom_support (T2) attendance_support (T3)
5	**Moderate (3; 27.27%)** enrichment_academic (T1) enrichment_arts_school (T1) academic_classroom_support (T2)	enrichment_arts_school (T1)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.2

Differentiation of Clusters Based on Social/Emotional/Behavioral Services for Tier 1 Students

Tier 1 SEB Cluster	Number of SEB Supports with Moderate to Very High Proportion of Students Receiving (n=6)	Services with highest within-cluster proportion across the five clusters (Supports Specification)

1	**Low (1; 16.67%)** behavioral_support_district (T2)	N/A
2	**Moderate (2; 33.33%)** mentoring (T2) behavioral_support_district (T2)	enirhcment_youth_dev_school (T1) mentoring (T2) behavioral_support_district (T2) psycho_social_group (T2)
3	**Moderate (2; 33.33%)** enrichment_youth_dev_community (T1) behavioral_support_ccnx (T2)	behavioral_support_ccnx (T2)
4	**Moderate (2; 33.33%)** enrichment_youth_dev_community (T1) mentoring (T2)	enrichment_youth_dev_community (T1)
5	**Moderate (2; 33.33%)** classroom based social in (T2) classroom_group_social_int (T2)	classroom based social in (T2) classroom_group_social_int (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.3

Differentiation of Clusters Based on Health Services for Tier 1 Students

Tier 1 Health Cluster	**Number of Health Supports with Moderate to Very High Proportion of Students Receiving (n=8)**	**Services with highest within-cluster proportion across the five clusters (Supports Specification)**
1	**Low (1; 12.50%)** health_screening_vision (T1)	N/A
2	**High (5; 62.50%)** ccnx_healthy_life_skills_cls (T1) health_screening_vision (T1) sports_physical_activiy_s (T1) classroom_based_health_int (T2) classroom_group_health_int (T2)	ccnx_healthy_life_skills_cls (T1) health_screening_vision (T1) classroom_based_health_int (T2) classroom_group_health_int (T2)
3	**Low (1; 12.50%)** health_screening_vision (T1)	ccnx_healthy_life_skills_small_g (T2)
4	**Moderate (3; 37.50%)** health_screening_vision (T1) health_medical_community (T1) sports_physical_activiy_s (T1)	health_medical_community (T1) sports_physical_activiy_s (T1)
5	**Low (2; 25.00%)** health_screening_vision (T1) sports_physical_activity_c (T1)	sports_physical_activity_c (T1)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.

[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.4

Differentiation of Clusters Based on Family Services for Tier 1 Students

Tier 1 Family Cluster	Number of Academic Supports with Moderate to Very High Proportion of Students Receiving (n=5)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Low (1; 20.00%)** parent_family_engagement (T1)	N/A
2	**Low (1; 20.00%)** parent_family_engagement (T1)	N/A
3	**Low (1; 20.00%)** parent_family_don_early_int_c (T2)	parent_family_don_early_int_c (T2)
4	**Moderate (2; 40.00%)** parent_family_engagement (T1) family_conference_meeting (T2)	parent_family_engagement (T1) family_conference_meeting (T2)
5	**High (3; 60.00%)** esl_parent_family (T1) parent_family_engagement (T1) parent_family_don_early_int_s (T2)	esl_parent_family (T1) parent_family_don_early_int_s (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.5

Cluster Differentiation Summary for Tier 1 Students across All Developmental Domains

	Tier 1			
Cluster	**Academic**	**SEB**	**Health**	**Family**
1	Moderate (T2)	Low (Unspecified)	Low (Unspecified)	Low (Unspecified)
2	Low (T2)	Moderate (T1, T2)	High (T1, T2)	Low (Unspecified)
3	Moderate (T1)	Moderate (T1)	Low (T2)	Low (T1, T2)
4	Moderate (T1, T2, T3)	Moderate (T2)	Moderate (T1)	Moderate (T1,T2)

5	Moderate (T1)	Moderate (T2)	Low (T1)	High (T1, T2)

Table F.6

Differentiation of Clusters Based on Academic Services for Tier 2a Students

Tier 2a Cluster Academic	Number of Academic Supports with Moderate to Very High Proportion of Students Receiving (n=15)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Low (2)** academic_classroom_support (T2) math_intervention (T2)	(Unspecified)
2	**Moderate (5)** enrichment_academic (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) iep_accomodations_adaptations (T3)	literacy_intervention (T2) math_intervention (T2) iep_occupational_therapy (T3) iep_speech_language (T3)
3	**Moderate (4)** college_career_assistance_s (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2)	before_school_program_academic_s (T1) attendance_support (T3)
4	**Low (1)** literacy_intervention (T2)	Unspecified
5	**Low (3)** enrichment_academic (T1) college_career_assistance_c (T1) college_career_assistance_s (T1)	college_career_assistance_c (T1) college_career_assistance_s (T1) enrichment_arts_community (T1) i504_plan_school_provided (T3)
6	**Low (3)** enrichment_academic (T1) enrichment_arts_school (T1) academic_classroom_support (T2)	enrichment_academic (T1) enrichment_arts_school (T1)
7	**Low (3)** enrichment_arts_school (T1) academic_classroom_support (T2) iep_accomodations_adaptations (T3)	iep_accomodations_adaptations (T3)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.7

Differentiation of Clusters Based on Social/Emotional/Behavioral Services for Tier 2a Students

Tier 2a SEB Cluster	Number of SEB Supports with Moderate to Very High Proportion of Students Receiving (n=9)	Services with highest within-cluster proportion across the five clusters (Supports Specification)

1	**Low (1; 11.11%)** behavioral_support_district (T2)	Unspecified
2	**Moderate (3; 33.33%)** behavioral_support_district (T2) classroom_based_social_in (T2) classroom_group_social_int (T2)	Unspecified
3	**Moderate (3; 33.33%)** enrichment_youth_dev_community (T1) classroom_based_social_in (T2) classroom_group_social_int (T2)	Unspecified
4	**High (6; 66.67%)** enrichment_youth_dev_community (T1) mentoring (T2) behavioral_support_district (T2) classroom_based_social_in (T2) classroom_group_social_int (T2) checkin_ccnx_site_coordinator (T3)	enrichment_youth_dev_school (T1) mentoring (T2) behavioral_support_district (T2) classroom_based_social_in (T2) classroom_group_social_int (T2) checkin_ccnx_site_coordinator (T3)
5	**Low (2; 22.22%)** enrichment_youth_dev_community (T1) behavioral_support_ccnx (T2)	behavioral_support_ccnx (T2)
6	**Moderate (3; 33.33%)** enrichment_youth_dev_community (T1) behavioral_support_district (T2) checkin_ccnx_site_coordinator (T3)	enrichment_youth_dev_community (T1)
7	**Moderate (3; 33.33%)** classroom_based_social_in (T2) classroom_group_social_int (T2) psycho_social_group (T2)	psycho_social_group (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.8

Differentiation of Clusters Based on Health Services for Tier 2a Students

Tier 2a Health Cluster	**Number of Health Supports with Moderate to Very High Proportion of Students Receiving (n=8)**	**Services with highest within-cluster proportion across the five clusters (Supports Specification)**
1	**Moderate (3; 37.50%)** health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1)	N/A
2	**Moderate (3; 37.50%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1)	health_screening_hearing (T1)
3	**Moderate/High (4; 50.00%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_s (T1)	sports_physical_activity_s (T1)
4	**Moderate/High (4; 50.00%)**	health_screening_vision (T1)

	health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_s (T1)	
5	**Moderate/High (4; 50.00%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1)	health_screening_post_sco (T1)
6	**Moderate (3; 37.50%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1)	health_screening_bmi (T1)
7	**High (5; 62.50%)** health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_c (T1) classroom_based_health_int (T2) classroom_group_health_int (T2)	sports_physical_activity_c (T1) classroom_based_health_int (T2) classroom_group_health_int (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.9

Differentiation of Clusters Based on Family Services for Tier 2a Students

Tier 2a Family Cluster	Number of Family Supports with Moderate to Very High Proportion of Students Receiving (n=6)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Very Low (0; 0.00%)**	
2	**Moderate (2; 33.33%)** parent_family_engagement (T1) parent_family_don_early_int_c (T2)	parent_family_engagement (T1)
3	**Moderate (2; 33.33%)** parent_family_engagement (T1) family_conference_meeting (T2)	family_conference_meeting (T2)
4	**Low (1; 16.67%)** parent_family_engagement (T1)	
5	**Very Low (0; 0.00%)**	
6	**Moderate (2; 33.33%)** family_assistance (T2) parent_family_don_early_int_c (T2)	family_assistance (T2) parent_family_don_early_int_c (T2)
7	**Moderate (2; 33.33%)** parent_family_engagement (T1) parent_family_don_early_int_s (T2)	esl_parent_family (T1) parent_family_don_early_int_s (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.

[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.10

Cluster Differentiation Summary for Tier 2a Students across All Developmental Domains

	Tier 2a			
	Academic	**SEB**	**Health**	**Family**
Cluster				
1	Low (Unspecified)	Low (Unspecified)	Moderate (Unspecified)	Very Low (Unspecified)
2	Moderate (T2, T3)	Moderate (Unspecified)	Moderate (T1)	Moderate (T1)
3	Moderate (T1, T3)	Moderate (Unspecified)	Moderate/High (T1)	Moderate (T2)
4	Low (Unspecified)	High (T1, T2, T3)	Moderate/High (T1)	Low (Unspecified)
5	Low (T1, T3)	Low (T2)	Moderate/High (T1)	Very Low (Unspecified)
6	Low (T1)	Moderate (T1)	Moderate (T1)	Moderate (T2)
7	Low (T3)	Moderate (T2)	High (T1)	Moderate (T1, T2)

Table F.11

Differentiation of Clusters Based on Academic Services for Tier 2b Students

Tier 2b Academic Cluster	**Number of Academic Supports with Moderate to Very High Proportion of Students Receiving (n=14)**	**Services with highest within-cluster proportion across the five clusters (Supports Specification)**
1	**Moderate (4; 28.57%)** academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) attendance_support (T3)	Unspecified
2	**Moderate (4; 28.57%)** enirchment_academic (T1) academic_classroom_support (T2) literacy_intervention (T2) attendance_support (T3)	Unspecified
3	**Moderate (6; 42.86%)** enirchment_academic (T1) academic_classroom_support (T2)	academic_classroom_support (T2) literacy_intervention (T2) iep_speech_language (T3)

	literacy_intervention (T2) math_intervention (T2) iep_speech_language (T3) attendance_support (T3)	
4	**Moderate (5; 53.71%)** enrichment_arts_school (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) iep_accomodations_adaptations (T3)	Unspecified
5	**Moderate/High (7; 50.00%)** before_school_program_academic_s (T1) college_career_assistance_s (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) iep_accomodations_adaptations (T3) attendance_support (T3)	before_school_program_academic_s (T1) summer_programming_academic_s (T1) college_career_assistance_s (T1) math_intervention (T2) attendance_support (T3)
6	**Moderate (5; 35.71%)** enirchment_academic (T1) enrichment_arts_school (T1) academic_classroom_support (T2) iep_accomodations_adaptations (T3) attendance_support (T3)	enirchment_academic (T1) enrichment_arts_school (T1) individual_tutoring_school (T2) iep_accomodations_adaptions (T3) attendance_support (T3)
7	**Low (3; 21.43%)** enirchment_academic (T1) enrichment_arts_community (T1) i504_plan_school_provided (T3)	i504_plan_school_provided (T3)

Table F.12

Differentiation of Clusters Based on Social/Emotional/Behavioral Services for Tier 2b Students

Tier 2b SEB Cluster	Number of SEB Supports with Moderate to Very High Proportion of Students Receiving (n=7)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Moderate (3; 42.86%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) checkin_ccnx_site_coordinator (T3)	Unspecified
2	**High (4; 57.14%)** enrichment_youth_dev_community (T1) mentoring (T2) behavioral_support_district (T2) classroom_based_social_in (T2)	mentoring (T2)
3	**Moderate (3; 42.86%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) classroom_based_social_in (T2)	behavioral_support_district (T2)
4	**High (4; 57.14%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) psycho_social_group (T2) checkin_ccnx_site_coordinator (T3)	psycho_social_group (T2) checkin_ccnx_site_coordinator (T3)
5	**Low (1; 14.29%)** classroom_based_social_in (T2)	classroom_based_social_in (T2)

6	**Moderate (2; 28.57%)** enrichment_youth_dev_community (T1) behavioral_support_district (T2)	enrichment_youth_dev_community (T1) individual_tutoring (T2)
7	**Moderate (2; 28.57%)** enrichment_youth_dev_community (T1) behavioral_support_ccnx (T2)	behavioral_support_ccnx (T2)

Table F.13

Differentiation of Clusters Based on Health Services for Tier 2b Students

Tier 2b Health Cluster	Number of Health Supports with Moderate to Very High Proportion of Students Receiving (n=10)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Moderate (3; 30.00%)** health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1)	health_screening_post_sco (T1)
2	**Moderate/High (5; 50.00%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_s (T1) classroom_group_health_int (T2)	informal_screening_diagnostic (T3) health_screening_vision (T1)
3	**Low (2; 20.00%)** health_screening_hearing (T1) health_screening_vision (T1)	health_screening_hearing (T1) health_screening_vision (T1)*
4	**Moderate/High (5; 50.00%)** health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_c (T1) classroom_based_health_int (T2) sports_physical_activity_s (T1)	health_screening_vision (T1) sports_physical_activity_c (T1) classroom_based_health_int (T2) health_screening_vision (T1)
5	**Moderate/High (5; 50.00%)** ccnx_healthy_life_skills_cls (T1) health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activity_s (T1)	ccnx_healthy_life_skills_cls (T1) health_screening_vision (T1) sports_physical_activity_s (T1) health_screening_vision (T1)
6	**Moderate (3; 30.00%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_vision (T1)	health_screening_bmi (T1) health_screening_vision (T1)
7	**Moderate/High (5; 50.00%)** health_screening_bmi (T1) health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1) classroom_group_health_int (T2)	classroom_group_health_int (T2)

Table F.14

Differentiation of Clusters Based on Family Services for Tier 2b Students

Tier 2b Family Cluster	Number of Family Supports with Moderate to Very High Proportion of Students Receiving (n=6)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Very Low (0; 0.00%)**	Unspecified
2	**Low (1; 16.67%)** parent_family_engagement (T1)	Unspecified
3	**Very Low (0; 0.00%)**	Unspecified
4	**Moderate/High (5; 50.00%)** parent_family_engagement (T1) parent_family_don_early_int_c (T2) parent_family_don_early_int_s (T2)	esl_parent_family (T1) parent_family_engagement (T1) parent_family_don_early_int_s (T2)
5	**Moderate (2; 33.33%)** parent_family_engagement (T1) family_assistance (T2)	Unspecified
6	**Moderate (2; 33.33%)** family_assistance (T2) parent_family_don_early_int_c (T2)	family_assistance (T2) parent_family_don_early_int_c (T2)
7	**Low (0; 0.00%)**	Unspecified

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.15

Cluster Differentiation Summary for Tier 2b Students across All Developmental Domains

	Tier 2b			
	Academic	**SEB**	**Health**	**Family**
Cluster				
1	Moderate (Unspecified)	Moderate (T1)	Moderate (T1)	Very Low (Unspecified)
2	Moderate (T2)	High (T1, T3)	Moderate/High (T1, T3)	Low (Unspecified)
3	Moderate (T2)	Moderate (T1)	Low (T1)	Very Low (Unspecified)
4	Moderate (T2, T3)	High (T1, T2)	Moderate/High (T1)	Moderate/High (T1, T2)
5	Moderate/High (T2)	Low (T1)	Moderate/High (T1, T2)	Moderate (Unspecified)
6	Moderate	Moderate	Moderate	Moderate

	(T1, T2)	(T1)	(T1)	(T2)
7	Low (T2)	Moderate (T1)	Moderate/High (T2)	Very Low (Unspecified)

Table F.17

Differentiation of Clusters Based on Academic Services for Tier 3 Students

Tier 3 Academic Cluster	Number of Academic Supports with Moderate to Very High Proportion of Students Receiving (n=9)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**High (5; 55.56%)** enrichment_academic (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) attendance_support (T3)	academic_classroom_support (T2) literacy_intervention (T2) iep_speech_language (T3)
2	**High (6; 66.67%)** college_career_assistance_s (T1) academic_classroom_support (T2) literacy_intervention (T2) math_intervention (T2) attendance_support (T3) iep_accomodations_adaptations (T3)	academic_classroom_support (T2) iep_accomodations_adaptations (T3)
3	**High (5; 66.67%)** enrichment_academic (T1) college_career_assistance_s (T1) academic_classroom_support (T2) attendance_support (T3) iep_accomodations_adaptations (T3)	enrichment_academic (T1) college_career_assistance_s (T1)
4	**Moderate (3; 33.33%)** literacy_intervention (T2) math_intervention (T2) attendance_support (T3)	math_intervention (T2) attendance_support (T3) special_education_evaluation (T3)
5	**Low (1; 11.11%)** attendance_support (T3)	Unspecified

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.18

Differentiation of Clusters Based on Social/Emotional/Behavioral Services for Tier 3 Students

Tier 3 SEB Cluster	Number of SEB Supports with Moderate to Very High Proportion of Students Receiving (n=10)	Services with highest within-cluster proportion across the five clusters (Supports Specification)

1	**Moderate (4; 40.00%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) classroom_based_social_in (T2) classroom_group_social_int (T2)	classroom_group_social_int (T2)
2	**Moderate (4; 40.00%)** enrichment_youth_dev_community (T1) behavioral_support_district (T2) classroom_based_social_in (T2) mentoring (T2)	Unspecified
3	**Moderate (3; 30.00%)** enrichment_youth_dev_community (T1) behavioral_support_ccnx (T2) behavioral_support_district (T2)	enrichment_youth_dev_community (T1)
4	**Moderate (4; 40.00%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) staff_mentoring (T2) checkin_ccnx_site_coordinator (T3)	behavioral_support_ccnx (T2) psycho_social_group (T2) staff_mentoring (T2) checkin_ccnx_site_coordinator (T3)
5	**Moderate/High (5; 50.00%)** behavioral_support_ccnx (T2) behavioral_support_district (T2) classroom_based_social_in (T2) mentoring (T2) checkin_ccnx_site_coordinator (T3)	behavioral_support_district (T2) classroom_based_social_in (T2) mentoring (T2) psycho_social_group (T2) counseling_student_school (T3)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.19

Differentiation of Clusters Based on Health Services for Tier 3 Students

Tier 3 Health Cluster	Number of Health Supports with Moderate to Very High Proportion of Students Receiving (n=7)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Moderate (2; 28.57%)** health_screening_hearing (T1) health_screening_vision (T1)	health_screening_hearing (T1)
2	**Moderate (3; 42.86%)** health_screening_hearing (T1) health_screening_vision (T1) sports_physical_activiy_s (T1)	health_screening_vision (T1) sports_physical_activiy_s (T1)
3	**Moderate (3; 42.86%)** health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1)	health_screening_post_sco (T1)
4	**Moderate (2; 28.57%)** health_screening_post_sco (T1) health_medical_school (T3)	health_medical_school (T3)
5	**Very High (6; 85.71%)** health_screening_hearing (T1) health_screening_post_sco (T1) health_screening_vision (T1) sports_physical_activity_s (T1) classroom_group_health_int (T2) informal_screening_diagnostic (T3)	classroom_group_health_int (T2) informal_screening_diagnostic (T3)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.20

Differentiation of Clusters Based on Family Services for Tier 3 Students

Tier 3 Family Cluster	Number of Family Supports with Moderate to Very High Proportion of Students Receiving (n=4)	Services with highest within-cluster proportion across the five clusters (Supports Specification)
1	**Moderate/High (2; 50.00%)** parent_family_engagement (T1) family_assistance (T2)	N/A
2	**Moderate/High (2; 50.00%)** parent_family_engagement (T1) family_assistance (T2)	parent_family_engagement (T1)
3	**Very Low (0; 0.00%)**	N/A
4	**Moderate/High (2; 50.00%)** family_assistance (T2) family_conference_meeting (T2)	family_assistance (T2) family_conference_meeting (T2)
5	**Moderate/High (2; 50.00%)** family_assistance (T2) parent_family_don_early_int_s (T2)	parent_family_don_early_int_s (T2)

Note.
[a]To determine the degree of support needed/received, the number of services with a moderate to very high proportion of students receiving those services was divided by the total number of services available within a given Developmental Domain in a given Student Tier.
[b]1% or less = very low; between 1% and 25% = low; between 25% and 50% = moderate; between 50% and 75% = high; between 75% and 100% = very high

Table F.21

Cluster Differentiation Summary for Tier 1 Students across All Developmental Domains

	Tier 3			
Cluster	**Academic**	**SEB**	**Health**	**Family**
1	High (T2, T3)	Moderate (T2)	Moderate (T1)	Moderate/High (Unspecified)
2	High (T2, T3)	Moderate (Unspecified)	Moderate (T1)	Moderate/High (T1)
3	High (T1)	Moderate (T1)	Moderate (T1)	Very Low (Unspecified)
4	Moderate	Moderate	Moderate	Moderate/High

	(T2, T3)	(T2, T3)	(T3)	(T2)
5	Low (Unspecified)	Moderate/High (T2, T3)	Very High (T2, T3)	Moderate/High (T2)

Appendix G: LCA Proportions with Covariates

Table G.1.

LCA Proportions with Introduction of Covariates for Tier 1 Students

T1	**Cluster1**	**Cluster2**	**Cluster3**	**Cluster4**	**Cluster5**
Overall	0.42	0.29	0.13	0.10	0.07
Covariates					
Grade					
0	0.33	0.44	**0.00**	0.19	0.04
1	0.37	0.54	**0.00**	0.06	0.03
2	0.49	0.26	**0.00**	0.17	0.08
3	0.40	0.39	**0.00**	0.10	0.10
4	0.43	0.29	**0.00**	0.14	0.14
5	0.88	0.09	0.03	**0.00**	**0.00**
6	0.06	**0.00**	0.94	**0.00**	**0.00**
7	0.37	**0.00**	0.63	**0.00**	**0.00**
8	0.40	**0.00**	0.60	**0.00**	**0.00**
9	**0.00**	**0.00**	1.00	**0.00**	**0.00**
School					
1	0.19	0.81	**0.00**	**0.00**	**0.00**
2	**0.00**	1.00	**0.00**	**0.00**	**0.00**
3	0.01	0.99	**0.00**	**0.00**	**0.00**
4	0.94	0.06	**0.00**	**0.00**	**0.00**
5	1.00	**0.00**	**0.00**	**0.00**	**0.00**
6	**0.00**	**0.00**	1.00	**0.00**	**0.00**

7	**0.00**	1.00	**0.00**	**0.00**	**0.00**
8	1.00	0.00	**0.00**	**0.00**	**0.00**
9	0.40	0.60	**0.00**	**0.00**	**0.00**
10	**0.00**	1.00	**0.00**	**0.00**	**0.00**
11	0.98	**0.00**	0.02	**0.00**	**0.00**
12	1.00	**0.00**	**0.00**	**0.00**	**0.00**
13	1.00	**0.00**	**0.00**	**0.00**	**0.00**
14	1.00	**0.00**	**0.00**	**0.00**	**0.00**
15	0.68	**0.00**	0.32	**0.00**	**0.00**
16	0.06	0.94	**0.00**	**0.00**	**0.00**
17	0.03	**0.00**	0.97	**0.00**	**0.00**
18	**0.00**	**0.00**	**0.00**	**0.00**	1.00
19	**0.00**	**0.00**	**0.00**	1.00	**0.00**
20	1.00	**0.00**	**0.00**	**0.00**	**0.00**
21	1.00	**0.00**	**0.00**	**0.00**	**0.00**
Gender					
Female	0.42	0.28	0.13	0.08	0.08
Male	0.42	0.29	0.12	0.12	0.05
Race/Ethn					
Asian	0.12	0.25	**0.00**	0.63	**0.00**
Black	0.42	0.27	0.16	0.09	0.06
Hispanic	0.38	0.33	0.14	0.08	0.07
Other	0.76	0.01	0.22	**0.00**	**0.00**
White	0.64	0.12	0.00	0.12	0.12
ELL					
0	0.45	0.28	0.12	0.09	0.05
1	0.19	0.34	0.15	0.13	0.19
Immigrant					
0	0.43	0.29	0.13	0.09	0.06
1	0.25	0.08	0.08	0.33	0.25
SPED					

0	0.46	0.25	0.13	0.09	0.07
1	0.18	0.49	0.14	0.12	0.08
Low Income					
0	0.59	0.21	0.04	0.07	0.09
1	0.37	0.31	0.15	0.10	0.06
Dosage Years					
1	0.25	0.31	0.10	0.19	0.15
2	0.53	0.34	0.09	0.02	0.01
3	0.57	0.26	0.17	**0.00**	**0.00**
4	0.37	0.27	0.33	0.03	**0.00**
5	0.76	0.12	0.12	**0.00**	**0.00**
6	0.70	0.07	0.23	**0.00**	**0.00**
7	1.00	**0.00**	**0.00**	**0.00**	**0.00**

Table G.2.

LCA Proportions with Introduction of Covariates for Tier 2a Students

T2a							
	Cluster1	**Cluster2**	**Cluster3**	**Cluster4**	**Cluster5**	**Cluster6**	**Cluster7**
Overall	0.29	0.28	0.11	0.10	0.08	0.08	0.05
Covariates							
Grade							
0	0.42	0.16	**0.00**	0.16	0.06	0.13	0.06
1	0.54	0.15	**0.00**	0.05	0.10	0.12	0.04
2	0.26	0.23	0.15	0.09	0.09	0.06	0.12
3	0.43	0.15	0.17	0.06	0.06	0.11	0.03
4	0.28	0.12	0.21	0.08	0.10	0.16	0.05
5	0.20	0.17	0.20	0.08	0.22	**0.00**	0.12
6	**0.00**	0.72	**0.00**	0.28	**0.00**	**0.00**	**0.00**
7	**0.00**	0.79	**0.00**	0.21	**0.00**	**0.00**	**0.00**

8	**0.00**	0.91	**0.00**	0.09	**0.00**	**0.00**	**0.00**
9	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
School							
1	0.98	0.02	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
2	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
3	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4	0.14	0.86	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5	**0.00**	0.23	**0.00**	0.77	**0.00**	**0.00**	**0.00**
6	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
7	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00
8	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
9	0.11	0.89	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
10	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
11	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
12	0.69	0.31	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
13	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**
14	0.17	0.83	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
15	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
16	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
17	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
18	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
19	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	**0.00**
20	**0.00**	**0.00**	**0.00**	**0.00**	1.00	**0.00**	**0.00**
21	**0.00**	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**
Gender							
Female	0.28	0.26	0.12	0.09	0.10	0.10	0.05
Male	0.30	0.29	0.11	0.10	0.06	0.07	0.06
Race/Ethn							
Asian	0.60	0.20	**0.00**	**0.00**	0.20	**0.00**	**0.00**
Black	0.29	0.27	0.06	0.15	0.08	0.10	0.05
Hispanic	0.28	0.32	0.10	0.08	0.08	0.08	0.07

Other	0.26	0.24	0.17	**0.00**	0.08	0.25	**0.00**
White	0.38	0.05	0.26	0.16	0.10	0.05	**0.00**
ELL							
0	0.29	0.25	0.12	0.12	0.09	0.09	0.05
1	0.31	0.38	0.10	0.02	0.06	0.04	0.09
Immigrant							
0	0.30	0.28	0.11	0.10	0.08	0.08	0.05
1	**0.00**	0.33	0.11	**0.00**	0.33	0.11	0.11
SPED							
0	0.24	0.30	0.12	0.11	0.08	0.09	0.06
1	0.45	0.20	0.08	0.06	0.10	0.06	0.04
Low Income							
0	0.24	0.21	0.09	0.29	0.04	0.10	0.03
1	0.30	0.29	0.12	0.07	0.09	0.08	0.06
Dosage Years							
1	0.37	0.23	0.07	0.05	0.04	0.18	0.04
2	0.38	0.31	0.15	0.03	0.09	0.01	0.03
3	0.14	0.26	0.28	0.09	0.10	0.01	0.12
4	0.16	0.48	**0.00**	0.11	0.18	0.05	0.02
5	0.12	0.26	0.03	0.24	0.18	**0.00**	0.18
6	0.19	0.31	**0.00**	0.38	0.13	**0.00**	**0.00**
7	**0.00**	0.08	**0.00**	0.92	**0.00**	**0.00**	**0.00**

Table G.3.

LCA Proportions with Introduction of Covariates for Tier 2b Students

2b							
	Cluster1	**Cluster2**	**Cluster3**	**Cluster4**	**Cluster5**	**Cluster6**	**Cluster7**
Overall	0.25	0.23	0.15	0.15	0.09	0.07	0.05
Covariates							
Grade							
0	0.18	0.47	0.14	0.19	**0.00**	0.03	**0.00**

1	0.16	0.45	0.16	0.11	**0.00**	0.03	0.10
2	0.15	0.34	0.12	0.14	0.13	0.07	0.05
3	0.18	0.27	0.11	0.19	0.09	0.08	0.07
4	0.17	0.07	0.22	0.23	0.14	0.10	0.08
5	0.19	0.09	0.19	0.19	0.17	0.17	**0.00**
6	0.58	**0.00**	0.42	**0.00**	**0.00**	**0.00**	**0.00**
7	0.85	**0.00**	0.15	**0.00**	**0.00**	**0.00**	**0.00**
8	0.82	**0.00**	0.18	**0.00**	**0.00**	**0.00**	**0.00**
9	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
School							
1	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
2	0.03	0.97	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
3	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4	0.76	0.19	0.04	**0.00**	**0.00**	**0.00**	**0.00**
5	0.20	0.02	0.78	**0.00**	**0.00**	**0.00**	**0.00**
6	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
7	**0.00**	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**
8	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
9	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
10	0.17	0.83	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
11	0.95	**0.00**	0.05	**0.00**	**0.00**	**0.00**	**0.00**
12	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**
13	**0.00**	**0.00**	**0.00**	**0.00**	1.00	**0.00**	**0.00**
14	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
15	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
16	**0.00**	0.60	0.40	**0.00**	**0.00**	**0.00**	**0.00**
17	1.00	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
18	**0.00**	**0.00**	0.06	**0.00**	**0.00**	**0.00**	0.94
19	**0.00**	**0.00**	0.02	0.98	**0.00**	**0.00**	**0.00**
20	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	1.00	**0.00**
21	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**

Gender							
Female	0.28	0.24	0.14	0.14	0.07	0.08	0.03
Male	0.23	0.23	0.16	0.17	0.09	0.06	0.06
Race/Ethn							
Asian	0.50	**0.00**	**0.00**	**0.00**	**0.00**	0.50	**0.00**
Black	0.31	0.21	0.16	0.12	0.08	0.09	0.03
Hispanic	0.25	0.24	0.14	0.17	0.09	0.07	0.06
Other	0.07	0.29	0.29	0.21	0.07	**0.00**	0.07
White	0.12	0.27	0.25	0.11	0.11	0.09	0.04
ELL							
0	0.26	0.23	0.17	0.13	0.09	0.07	0.04
1	0.21	0.24	0.10	0.23	0.06	0.07	0.09
Immigrant							
0	0.25	0.23	0.15	0.15	0.09	0.07	0.05
1	0.02	0.23	0.20	0.22	0.11	0.22	**0.00**
SPED							
0	0.27	0.21	0.15	0.18	0.07	0.06	0.05
1	0.20	0.27	0.15	0.12	0.10	0.10	0.05
Low Income							
0	0.20	0.22	0.35	0.09	0.07	0.04	0.03
1	0.26	0.24	0.12	0.16	0.09	0.08	0.06
Dosage Years							
1	0.27	0.23	0.12	0.19	0.06	0.04	0.10
2	0.24	0.32	0.16	0.09	0.07	0.09	0.03
3	0.26	0.15	0.08	0.13	0.27	0.11	**0.00**
4	0.30	0.19	0.11	0.24	0.04	0.10	0.02
5	0.04	0.24	0.28	0.24	**0.00**	0.20	**0.00**
6	0.29	0.07	0.64	**0.00**	**0.00**	**0.00**	**0.00**
7	**0.00**	**0.00**	1.00	**0.00**	**0.00**	**0.00**	**0.00**

Table G.4.

LCA Proportions with Introduction of Covariates for Tier 3 Students

T3					
	Cluster1	**Cluster2**	**Cluster3**	**Cluster4**	**Cluster5**
Overall	0.36	0.25	0.15	0.13	0.11
Covariates					
Grade					
0	0.57	0.13	0.19	**0.00**	0.12
1	0.51	0.25	0.15	**0.00**	0.09
2	0.47	0.34	0.04	**0.00**	0.15
3	0.47	0.20	0.22	**0.00**	0.12
4	0.27	0.26	0.33	**0.00**	0.15
5	0.11	0.50	0.13	0.03	0.24
6	**0.00**	0.25	**0.00**	0.75	**0.00**
7	0.37	0.56	**0.00**	0.06	**0.00**
8	**0.00**	0.25	**0.00**	0.75	**0.00**
9	**0.00**	**0.00**	**0.00**	1.00	**0.00**
School					
1	0.96	0.04	**0.00**	**0.00**	**0.00**
2	1.00	**0.00**	**0.00**	**0.00**	**0.00**
3	**0.00**	**0.00**	**0.00**	**0.00**	1.00
4	0.81	0.19	**0.00**	**0.00**	**0.00**
5	0.96	0.04	**0.00**	**0.00**	**0.00**
6	**0.00**	**0.00**	**0.00**	1.00	**0.00**
7	**0.00**	**0.00**	1.00	**0.00**	**0.00**
8	**0.00**	1.00	**0.00**	**0.00**	**0.00**
9	0.24	0.76	**0.00**	**0.00**	**0.00**
10	1.00	**0.00**	**0.00**	**0.00**	**0.00**
11	**0.00**	1.00	**0.00**	**0.00**	**0.00**
12	**0.00**	1.00	**0.00**	**0.00**	**0.00**
13	**0.00**	1.00	**0.00**	**0.00**	**0.00**

14	1.00	**0.00**	**0.00**	**0.00**	**0.00**
15	**0.00**	0.87	**0.00**	0.13	**0.00**
16	1.00	**0.00**	**0.00**	**0.00**	**0.00**
17	0.32	**0.00**	**0.00**	0.68	**0.00**
18	**0.00**	0.07	**0.00**	**0.00**	0.93
19	**0.00**	**0.00**	1.00	**0.00**	**0.00**
20	1.00	**0.00**	**0.00**	**0.00**	**0.00**
21	**0.00**	1.00	**0.00**	**0.00**	**0.00**
Gender					
Female	0.38	0.21	0.17	0.14	0.10
Male	0.35	0.27	0.13	0.12	0.12
Race/Ethn					
Asian	0.04	0.63	0.34	**0.00**	**0.00**
Black	0.42	0.22	0.19	0.08	0.09
Hispanic	0.36	0.24	0.13	0.14	0.12
Other	0.25	0.75	**0.00**	**0.00**	**0.00**
White	0.27	0.33	0.18	0.12	0.09
ELL					
0	0.37	0.25	0.15	0.12	0.11
1	0.32	0.27	0.13	0.16	0.12
Immigrant					
0	0.37	0.25	0.15	0.13	0.11
1	**0.00**	0.83	**0.00**	0.17	**0.00**
SPED					
0	0.34	0.26	0.14	0.13	0.12
1	0.39	0.24	0.15	0.12	0.10
Low Income					
0	0.18	0.43	0.14	0.11	0.14
1	0.38	0.24	0.15	0.13	0.11
Dosage Years					
1	0.41	0.21	0.18	0.09	0.10

2	0.45	0.26	0.08	0.16	0.05
3	0.19	0.36	0.16	0.22	0.08
4	0.26	0.12	0.21	0.09	0.32
5	0.15	0.29	0.25	0.13	0.19
6	**0.00**	0.43	**0.00**	**0.00**	0.57
7	**0.00**	0.83	**0.00**	0.17	**0.00**