



Early Pathways into the Education Profession: A comprehensive evaluation framework

This study was conducted for Education Systems Center at Northern Illinois University



NORTHERN ILLINOIS UNIVERSITY

NIU P-20 Research and Data Collaborative

Division of Outreach, Engagement and Regional Development

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Please cite this report as:

Creed, B., Bamberger, M. R., & Summers, K. (2023). Early Pathways into the Education Profession: A comprehensive Evaluation Framework. *Northern Illinois University: P-20 Research & Data Collaborative*.

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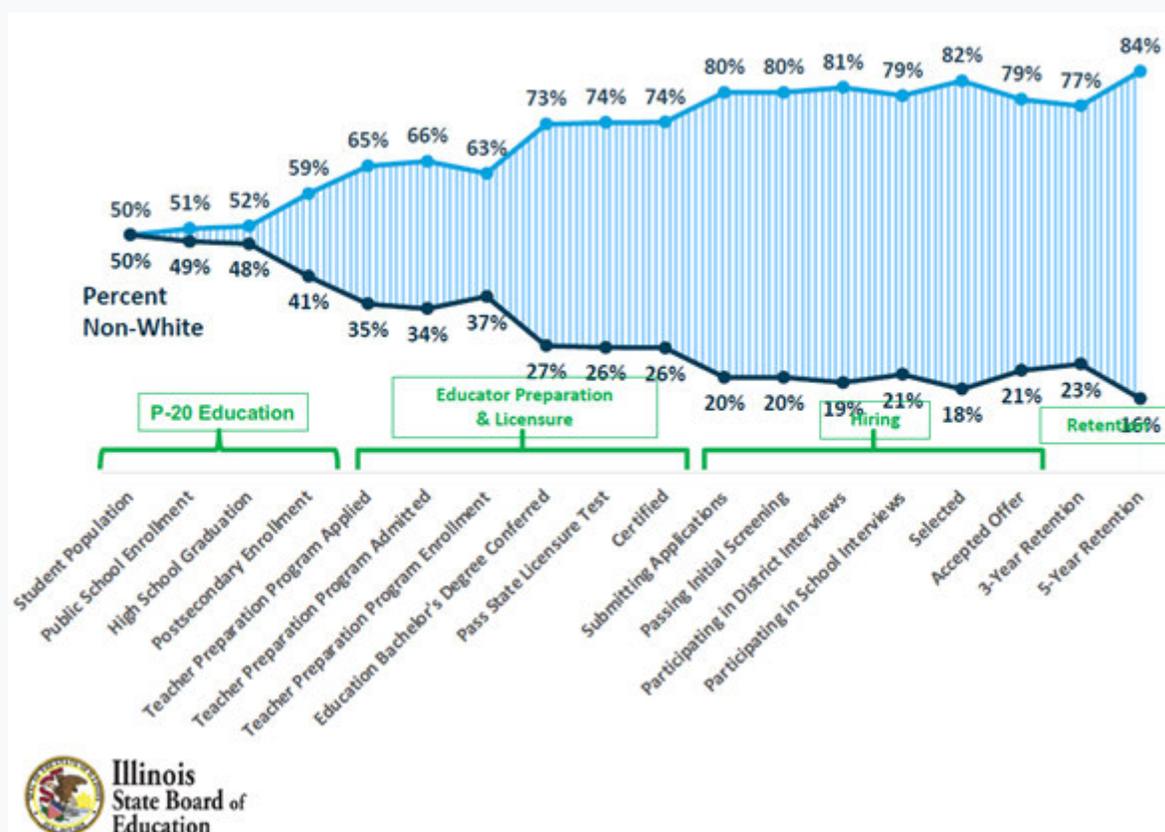
Comprehensive Evaluation Framework for Early Pathway Programs in Illinois



Context and Background of Early Pathways in Illinois

Like much of the nation, Illinois faces teacher shortages – by geographic location, subject matter, grade level, teacher demographics compared with communities served, etc. There are a number of State Agency, school district, and education sector-initiated programs aimed at alleviating teacher shortages by growing, diversifying, and supporting the teacher labor force to ensure all students have access to high quality teachers. ISBE is engaged in efforts to understand the causes of these shortages, the landscape of programs addressing the causes, and to support the strategic alignment, sustainability, and scaling of them to address specific teacher shortages. ISBE is also engaged directly in the design and implementation of efforts which address root causes of the teacher shortages in Illinois. One focus area within ISBE’s broad scope of work on educator shortages is developing the pool of potential teachers. ISBE has examined various constraints growing the supply of teachers, is working to identify and support programs which are engaged in producing more teachers, and contributing to the development of new programs to grow the future supply of teachers. One identified area for improvement is to close the racial/ethnic gaps between potential teachers and the teaching force through growing the number and proportion of traditionally underrepresented groups at each step along the pathway into teaching and remaining a teacher (see Figure 1). While enrollment in Illinois PK-12 public schools is approximately 52% white and 48% non-white, with each subsequent step along the path the gap widens. The transition from secondary school to applying to a teacher preparation program, and the subsequent completion of a bachelor’s degree represents the largest representation gap. As such, Illinois is focused on understanding efforts to alleviate teacher shortages based not only on the overall impact of such efforts but specifically on how various efforts impact the racial/ethnic gaps in the teacher pipeline.

Figure 1. Demographic Composition of the Teacher Pipeline in Illinois



Source: ISBE, 2023

ISBE is particularly interested in addressing these issues through programs it labels “Strategic Pathways.” Strategic Pathways are:

“community- and needs-centered partnerships that serve candidates and school districts, with the support of 2-year colleges, 4-year institutes of higher education, approved educator preparation programs, and/or non- profit organizations. Strategic Pathways seek to attract community members (e.g., high school students, college students, parents, career changers, or paraprofessionals) who are rooted in communities and reflect a specific targeted area of local student need (e.g., teachers that represent the demographic identities of the student bodies in these communities). These pathways:

- Intentionally attract, recruit and support individuals in entering and completing an educator preparation program
- Support prospective teachers in certifying and gaining employment in an area where staffing needs have been identified
- Continue to support the teachers they prepared in their early years in the classroom.

Generally, Strategic Pathway programs either build clearly defined routes into the educator workforce, offer supports and incentives to become teachers, or combine both approaches.” (ISBE, 2023, slide 5)

Teacher shortages, defined as not enough qualified individuals willing to fill open positions given compensation and work conditions, develop due to multiple factors including: too few individuals entering the profession or earning particular certifications (e.g. EL endorsements, subject area specialization, etc.), individuals leaving the profession (e.g. retirement, dissatisfaction, etc.), changes in policy or course offerings (e.g. reductions in class size, CTE courses, etc.), growing enrollments, teaching conditions, and pay (Sutcher et al., 2019). These factors produce teaching shortages which may look different from one geographic location to another, between subjects, among endorsement types, across the students served, and among schools with various characteristics.

Teacher representation gaps, defined as differences in the demographics and backgrounds of the teacher workforce compared to the students they teach (typically with an over-representation of White, female teachers) stem from multiple sources such as: a) inequitable quality of educational experiences for traditionally marginalized groups, b) biases and discrimination in the labor market, c) higher attrition rates, and d) perceptions of teaching as a desirable profession (Redding & Brewer, 2019).

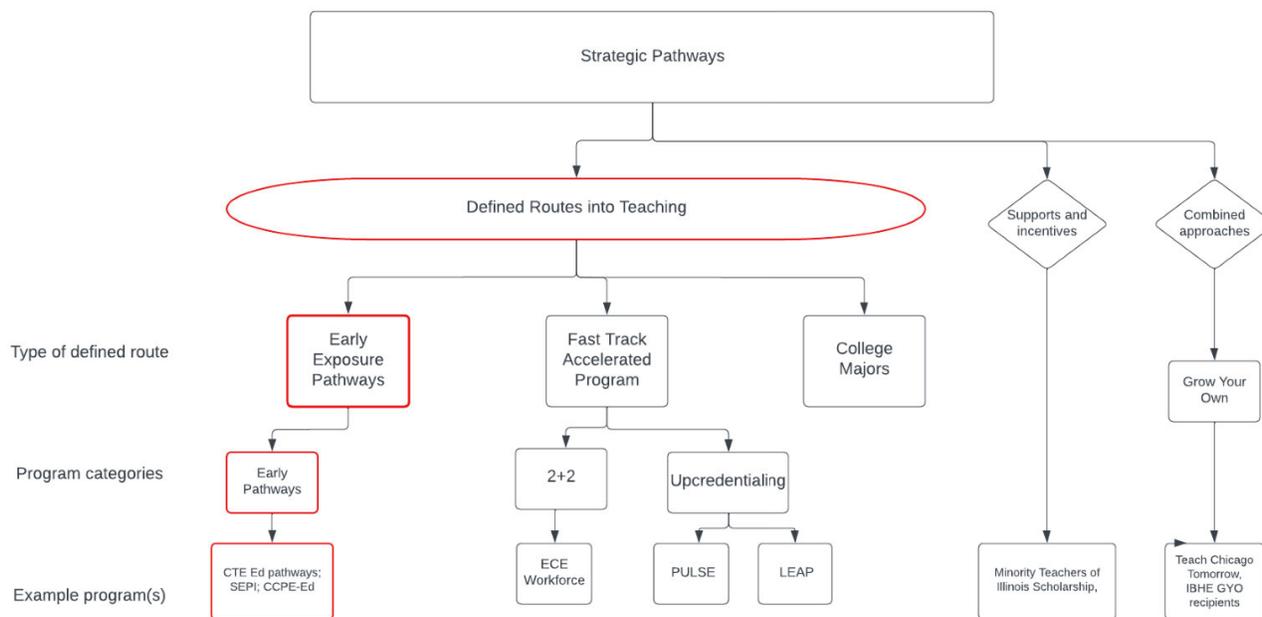
Strategic Pathways focus on increasing the overall supply of qualified individuals to meet the demands of the school districts while also helping to develop a more diverse, representative cadre of qualified individuals. This is done through multiple approaches. One is the provision of supports, opportunities, and incentives along the path to licensure to get and keep students interested while better preparing them for success as teachers. A second focus is on how compensation and working conditions impact both the willingness of those with teaching endorsements to enter the profession and their decision to remain in the profession. Together, Strategic Pathways represent an important route to addressing both teacher shortages and representation gaps in Illinois’ teacher workforce and aim to help Illinois build a stable, fully staffed, and representative teaching force.

Early Pathways Definition and Programs

This report examines one type of program within the Strategic Pathways construct. Within the set of efforts focused on growing the supply of teachers in Illinois is work aimed at providing individuals with early exposure to the educational profession – Early Exposure Pathways – through the combination of coursework and experiential learning opportunities. Early Exposure Pathways typically have two different focuses – experiences during secondary education or experiences during postsecondary education. Early Pathways into the Education Profession (Early Pathways) programs are those which focus on secondary education experiences and are offered during high school, often including partnerships with a postsecondary institution. While varied in their design, these types of programs expose high school students (or earlier) to the teaching profession through defined course sequences and experiential learning opportunities with the goal of promoting student college and career readiness in the field of education. Early Pathway Programs are differentiated from Early Exposure Programs which provide experiences in postsecondary settings. See Figure 2 for examples of the types of programs and approaches that fall within Strategic Pathways.

Early Pathways programs have the potential to contribute to growing the pool of potential teachers, narrowing representation gaps, and developing a more stable teacher labor force at a pivotal point - the

Figure 2. Example Types of Programs and Approaches Within Illinois Strategic Pathways



transition from secondary to postsecondary education. Through providing early exposure and firsthand experiences to the teaching profession to a representative group of students at a key point in their education career could help more students, and potentially a more diverse set of students, see themselves as future teachers, thus, putting them on a route to a career in education.

Evaluation Overview

To systematically understand the impact Early Pathways will have on teacher shortages, there is a need for a relevant evaluation framework and data systems which allow for its application. A framework for evaluating Early Pathways will support the analysis of, investment in, and, ultimately, the improvement of the teacher workforce in Illinois so that all children attend schools that are fully staffed, have a diverse teaching staff, and the expertise to provide high quality education to diverse learners.

The evaluation questions and methodological approaches to this evaluation framework are presented below. However, having an evaluation framework alone is not enough to achieve a systematic understanding. To have a systematic and ongoing evaluation of Early Pathways requires also having current data available to provide answers to the evaluation questions and to update the questions asked. Understanding the types of data necessary to conduct Early Pathways evaluations will lead to either identifying an existing data system which can facilitate the implementation of an evaluation or provide insights into what data is needed before a comprehensive evaluation of Early Pathways programs can occur. This is taken up in the section below titled, Feasibility of Using the Illinois Longitudinal Data System (ILDS) to Conduct Early Pathways Evaluations. To systematically evaluate Early Pathways programs, having usable data collected, the infrastructure built to connect data sources, and a unified evaluation framework are all necessary. Each of these components contributes to understanding what is working to eliminate teacher shortages, how it is working, who it is working for, and to understanding how programs and systems can be improved.

Evaluation goals and approach

A core goal of this project was to create a unified evaluation and data analysis framework which can be used to measure longitudinal outcomes and return on investment for Early Pathway Programs with adoption by relevant state agencies for continued use with various research and evaluation partners. To reach this goal, the

team developed a multi-step process which allowed for the refinement of the evaluation framework to account for insights from state agencies, realities of the data infrastructure available, and initial analytic insights.

The first step of the process was to develop a draft set of evaluation questions which were aligned with the goals of Early Pathways programs. The initial set of evaluation questions were developed based on conversations with ISBE staff, reviewing the relevant research, examining Early Pathways programs and their goals, and the intentional investigation of how students from diverse backgrounds matriculated through Early Pathways and into the labor force.

The second step was to submit the initial questions for review. The initial draft of questions were sent for review and refinement to ISBE staff, other stakeholder groups, and other experts in the field. The evaluation questions were refined based on the feedback received.

To continue refining the evaluation questions and begin developing the empirical methods associated with answering them, a pilot evaluation study was conducted on a subset of Early Pathways Programs as the third step in the process. While the initial plan was to leverage the Illinois Longitudinal Data System (ILDS) to conduct the pilot evaluation (see Feasibility of Using the Illinois Longitudinal Data System (ILDS) to Conduct Early Pathways Evaluations for details), the team ultimately conducted a study using publicly available data and interviews with administrators in secondary and postsecondary institutions (see Early Pathways Pilot Study below for details and results). This step allowed for the initial set of questions to be refined based on emergent patterns or themes in the data as well as the identification of any gaps which remained in the evaluation questions. Further, this step led to the development and refinement of analytic approaches to answering the evaluation questions.

The final step of the process was to solicit feedback on the refined evaluation questions and analytic approaches. Ultimately, this led to the development of the unified evaluation and data analysis framework for Early Pathway programs in Illinois, which is presented below. This framework has been refined through engagement with key stakeholders, learning from the implementation of a pilot evaluation, and it is grounded in the context of Illinois.

Evaluation Framework

The evaluation framework includes four topic areas to systematically understand Early Pathways programs in Illinois: a) the implementation of Early Pathways programs, b) access to Early Pathways programs; c) who completes Early Pathways programs, d) the impact of Early Pathways participation and completion. By evaluating Early Pathways programs along these four topics, a comprehensive view of what programs look like in practice, what is working, how it is working, and who it is working for can be developed. Importantly, the questions below will also lead to actionable insights which can facilitate how Early Pathways programs and the associated systems can be improved to further address the teacher shortages in Illinois.

Implementation questions. Examining the implementation of Early Pathways programs provides the foundation for the other evaluation questions and efforts. Evaluating program implementation allows for a better understanding of what a program looks like in practice, what parts of the program are working, and gives insights into how it is working. Table 1 presents an initial set of implementation questions, the potential data sources aligned with the questions, and suggested methods for answering the questions.

The implementation questions focus on investigating the design of the program as implemented, exploring who teaches within the program, identifying the types of supports offered across stakeholders to ensure successful implementation and knowledge levels, and documenting the costs associated with the Early Pathways program. Together, these questions provide the foundation to comprehensively understand a given Early Pathways program by enabling the evaluation of whether a program is being implemented with fidelity, identifying opportunities for improvement, insights into the operational costs of running the program, and allow for variation in the implementation of an Early Pathways program to be explored systematically across context. Similarly, these questions provide a common set of investigations which allow for cross-Early Pathways program comparisons through comparing the experiences and instructional practices across programs, the experience and credentials of the teachers delivering the content, identifying potential best or better practices in ongoing supports, and allow for the comparison of programs based on their costs to implement.

Answering the implementation-focused evaluation questions will require data not found in current state agency administrative data sets. This will include information on curricular and design aspects of the Early

Table 1. Evaluation questions related to the implementation of Early Pathway programs

	Questions	Data Sources	Methodology
Implementation	<ol style="list-style-type: none"> 1. What extracurricular experiences do Early Pathway participants have and what is the quality of these experiences? 2. Are non-Early Pathway program credentials or certificates included in the Early Pathway program? 3. How are Early Pathway courses, activities, and experiences recorded? 4. What teachers are assigned to teach in Early Pathway courses? 5. What, if any, supports and preparation do teachers receive to teach in Early Pathway programs? 6. What does classroom instruction look like in Early Pathway programs? 7. What, if any, supports or communications do staff, students, and families receive related to Early Pathway programs? 8. What are the costs and resources required to implement Early Pathway programs? 	ISBE SIS ISBE EIS New data collection	Explore nature of Early Pathway extracurricular experiences Profile and statistically examine for teacher- characteristic differences between those who teach Early Pathways courses and those who do not; examine variation in teacher quality by student and school characteristics School or district administrator, teacher, and/or student surveys, interviews, and/or focus groups

Pathways program(s) under evaluation, including data on the types of experiential learning opportunities embedded in the Early Pathway, whether or not particular credentials or certificates are attainable through the Early Pathway, and the types of supports offered to teachers, staff, students, and parents/guardians. It is likely new survey collection efforts, focus groups and interviews, as well as site visits and observations will be required. Data on the costs associated with implementing the program will likely come directly from districts and/or schools as this data does not exist within statewide datasets. ISBE’s Student Information System (SIS) and Employment Information System (EIS) can provide the data necessary to identify which teachers deliver courses within the Early Pathways programs.

Much of the analysis for this work will come from the analysis of the survey or qualitative data collected. The quantitative analysis of who teaches in Early Pathways and which students have access to which teachers will focus on descriptive and correlational analyses to identify patterns and trends in staffing. Finally, the cost study of the Early Pathways program could use the ingredient method (Belfield et al., 2018) or a similar technique. Answers to the question of the cost of Early Pathways could be used in formal Cost Benefit, Cost-Effectiveness, or Return on Investment analyses.

Access questions. Evaluation questions related to access can be further split into two categories: a) the location where Early Pathways programs are offered and b) understanding which students access available programs. Understanding where Early Pathways programs are offered and how this varies by Early Pathway will provide insight into what barriers may exist to access, what supports are necessary to expand access, and ultimately whether a program is scalable or applicable to a context. Evaluating which students access an available program, and which students do not, will highlight potential barriers which are in place, supports which are needed, or best practices which could be learned from. Table 2 presents key evaluation questions related to Early Pathway access, possible data sources, and suggested methods for answering the questions.

The evaluation questions focused on the access component of the framework are grouped by general questions about where Early Pathways programs are offered and questions about who accesses the programs. The first set of questions focuses on understanding the geographic dispersion of programs and can help clarify the role that Early Pathways design may play in program viability and/or availability. This can lead to insights

into whether targeted efforts are needed to expand Early Pathways programs into regions or contexts without a program in place and if there are certain Early Pathways program designs which are better suited to fill the general access question. The second set of questions focuses on how students within a given building or context access the program. Together, this set of evaluation questions is geared towards identifying patterns in access, highlighting opportunities for further investigation, and ultimately understanding which programs students have access to, which students access the programs (and which do not), and what is working to support access or needs further improvement.

Existing ISBE data can provide the backbone for understanding the patterns of Early Pathways availability and access. Much of the work related to program availability are descriptive in nature and could include mapping the availability of programs to identify geographic and regional patterns in program availability. The questions related to which students within a building access available programs requires more than just correlational analyses. Utilizing a regression framework can provide insights into what systematic differences exist between those who participate in Early Pathways programs and those that do not. Evaluation question 7 in this component is designed to understand the current efforts schools engage in which may influence which students access the available Early Pathway program. This may require school level surveys, focus groups with students and parents/guardians, and document review.

Table 2. Evaluation questions focused on understanding Early Pathway student access

	Questions	Data Sources	Methodology
Location of Early Pathways	1. What are the characteristics of schools where Early Pathway programs are offered? 2. How do patterns of availability differ by Early Pathway program?	ISBE SIS	Profile and statistically examine for school-characteristic and availability differences between (1) schools where Early Pathways are and are not offered and (2) school locations
Access to Early Pathways	3. Who participates in Early Pathway programs? 4. How do the patterns in participation in Early Pathways vary based on school characteristics? 5. What experiences do participants have in Early Pathway programs? 6. How do the patterns in experiences vary based on school characteristics? 7. What, if any, supports or communications do students, and families receive related to Early Pathway programs?	ISBE SIS New data collection (e.g., work-based learning experiences, extracurricular activities, etc.)	Profile and statistically examine for differences between participants and non-participants, school characteristics, and variation in patterns by Early Pathway program Student interviews/focus groups combined with school surveys and information from ISBE SIS

Completers of Early Pathways. The next component of the evaluation focuses on the secondary level experiences of those who have accessed an Early Pathways program. The questions revolve around understanding who amongst the Early Pathways participants successfully complete Early Pathway programs, if students gained the knowledge and skills expected from participation in the Early Pathway program, and what factors shape program completion. Table 3 presents the questions, data requirements, and suggested methods to understand who completes Early Pathway programs, who participates but does not complete the program, and what factors are systematically associated with those outcomes.

ISBE’s SIS data represents a likely source for information related to Early Pathway completion rates, examining who completes an Early Pathway and who participates but does not complete an Early Pathway, and exploring what student demographic or school level factors are associated with completion of an Early Pathway. Using a multivariate regression model to compare completers to non-completers represents a likely

path for understanding systematic differences between the two groups of students. Understanding student perceptions and specific knowledge/skill attainment will lay the ground for how completion of an Early Pathway impacts future decisions. This data does not exist within a statewide database, therefore, data from district data collection efforts and/or new data collection will be needed which is aligned with student perceptions and knowledge/skill development. As having more students interested in pursuing teaching as a profession is a key goal of Early Pathway programs, using a validated and/or theoretically grounded instrument for understanding how an Early Pathway impacted student perceptions related to the teaching is essential to evaluating Early Pathways.

Impact of Early Pathway Completion. As Early Pathways are designed to grow and diversify the pool of individuals with a teacher license and to shrink the teacher shortages, examining the impact of completing Early Pathways on related postsecondary and workforce outcomes is an essential step in evaluating Early Pathways programs. The evaluation questions below are broken into two categories: a) postsecondary and licensure outcomes and b) teaching outcomes (see Table 4). Through investigating whether what Early Pathways completers do immediately after completing their program differs from non-participants or non-completers represents a short-term outcome of interest related to understanding the impact of Early Pathways completion. This set of questions focuses on comparing the proportion of completers who enroll in postsecondary institutions, earn a degree related to education, and eventually earn their teaching license to a comparison sample that did not participate in Early Pathways.

Table 3. Evaluation questions related to the completion of Early Pathway programs

	Questions	Data Sources	Methodology
Completers of Early Pathways	1. Who successfully completes Early Pathway programs?	ISBE SIS	Longitudinal cohort study
	2. Who does not successfully complete Early Pathway programs?	New data collection	Profile and statistically examine for differences between completers and non-completers, schools attended
	3. What impact does the Early Pathway have on student perceptions of the educational profession?		Student, teacher, and/or guidance counselor interviews, focus groups, and/or surveys
	4. Do students gain the knowledge and skills outlined in the Early Pathway?		Learning assessments
	5. What factors are associated with completion and non-completion of Early Pathway programs?		

The second set of questions focuses on the impact of Early Pathway completion on obtaining a teaching position in comparison with a set of Early Pathway non-completers or Early Pathway non-participants. These questions focus on understanding the proportion of Early Pathway completers who obtain a teaching position, examining where they teach, what subjects they teach, and what grade levels they teach. As Early Pathways occur at the secondary level, evaluation question 6 explores variation based on where the individual engaged in Early Pathways and the postsecondary institutions they matriculated into.

The data for this set of questions is available through various state agency datasets. Data from SIS will identify those who complete an Early Pathway program as well as a comparison set of students. Data from the Illinois Community College Board (ICCB) and the Illinois Board of Higher Education (IBHE) will track Early Pathway completers who attended postsecondary institutions in Illinois and provides the information on the programs and degrees completed and earned. ISBE’s Employment Licensure Information System (ELIS) and Employment Information System (EIS) data sets contain information related to the earning of a teaching license and associated endorsements as well as data on where an individual is employed. The Illinois Department of Employment Security maintains records on employment in Illinois and, when linked to the other data, can be used to understand what other professions individuals entered after completing Early Pathways.

Descriptive profiles comparing Early Pathways completers to a comparison group of non-completers will allow for initial trends and patterns to be identified. Following this descriptive work up with a longitudinal cohort study will provide insights into the longer-term impact of Early Pathways participation and completion.

Summary

By bringing all four components of the comprehensive evaluation framework together, important insights into Early Pathways are possible. These include understanding how programs as implemented differ from how they were designed, the impact of Early Pathways program design on short term outcomes (e.g., completion of Early Pathways, perception changes, knowledge and skill development), medium term outcomes (e.g., postsecondary matriculation and completion, obtaining a teaching licensure), and long-term outcomes (e.g. growing and diversifying the teaching force). It also allows broader evaluation questions related to topics such as the return on investment of these programs to be answered.

Table 4. *Impact of Early Pathway Completion*

	Questions	Data Sources	Methodology
Postsecondary & Licensure Outcomes	1. What do completers of Early Pathway programs do after completing the program? Do they continue on to postsecondary institutions? Do they participate in support programs? What coursework and majors do they engage in? Do they take education related jobs?	ISBE SIS ICCB IBHE ISBE EIS	Longitudinal cohort study Profile and statistically examine for differences between completers and non-completers, schools attended, postsecondary enrollment and coursework, teaching licensure, jobs, etc.
	2. What proportion of Early Pathway program completers earn their teaching license and what proportion obtain jobs as teachers?	ISBE ELIS	
	3. How do patterns vary by completer characteristics (e.g. gender identities, racial/ethnic identities, socioeconomic status, etc.) and school attended?		
Teaching after Early Pathways Completion	4. What do the schools look like where Early Pathway completers work (e.g. geographies, student body characteristics, etc.)?	ISBE SIS ICCB IBHE	Longitudinal cohort study Profile and statistically examine for differences between school geographies and student body characteristics, subjects and grades taught, routes to first job, etc.
	5. What subjects and grades do they teach?	ISBE EIS ISBE ELIS	
	6. How does this vary by individual characteristics, by region, by secondary school attended, by postsecondary institution?	IDES	
	7. How does this compare with non-participants who go on to become teachers?		
	8. What routes do those who teach take prior to their first job as a licensed teacher (e.g. high school to 4 year to teacher; high school to education related job to 4-year to teacher; etc.)?		

The following sections of the report cover topics related to the initial efforts utilizing the Early Pathways Evaluation Framework to evaluate a set of Early Pathways programs. This includes exploring whether the Illinois Longitudinal Data System (ILDS) could serve as the source of administrative data used for evaluating Early Pathway programs (see Feasibility of Using the Illinois Longitudinal Data System to Conduct Early Pathways Evaluations). The first pilot evaluation of a subset of Early Pathways programs is also included (see Early Pathways Pilot Study), primarily addressing access related evaluation questions with some investigation of implementation questions. Finally, recommendations are included at the end of each section.

Feasibility of Using the Illinois Longitudinal Data System (ILDS) to Conduct Early Pathways Evaluations

Overview of Early Pathways and Role of ILDS in Understanding Early Pathways



Like much of the nation, Illinois faces teacher shortages – by geographic location, subject matter, grade level, teacher demographics compared with communities served, etc. There are a number of State Agency, school district, and education sector-initiated programs aimed at alleviating the teacher shortages by growing, diversifying, and supporting the teacher labor force to ensure all students have access to high quality teachers. Within this larger work, there has been a concerted focus on increasing the overall supply of qualified individuals to meet the demands of school districts while also helping to develop a more diverse, representative cadre of qualified individuals. A complimentary focus on how the compensation and working conditions impact both the willingness of those with teaching licensure to enter the profession and their decision to remain in the profession is outside the scope of this project but will help Illinois build a stable, fully staffed, and representative teaching force.

Within the set of efforts focused on growing the supply of teachers in Illinois is work high school districts and their post-secondary partners are doing through the use of Early Pathways into the Education Profession (Early Pathways) programs. While varied in their design, these types of programs expose high school students (or earlier) to the teaching profession through defined course sequences and experiential learning opportunities with the goal of promoting student college and career readiness in the field of education. Early Pathway programs have the potential to contribute to growing the pool of potential teachers, narrowing representation gaps, and developing a more stable teacher labor force.

Over the past five years, several Early Pathway programs have been initiated and implemented. For instance, Scaling Education Pathways in Illinois (SEPI) ran its first cohort in AY 2019-20. ISBE's CTE Education Career Pathways (CTE Ed Pathways) grants were first opened in FY 2020 and invested over \$5.6 million in the first three rounds of funding for developing and implementing articulated coursework and hands-on experiences in the secondary setting (ISBE, 2021; CTE Education Career Pathway RFP, 2022). With multiple cohorts having completed their Early Pathways programs and matriculated into postsecondary institutions, there are enough participants and completers to understand any short- to medium- term impacts of Early Pathways programs on the teaching pipeline. As more individuals participate in the growing number of Early Pathways, understanding what programs are working, who they are working for, and identifying opportunities for improvement at this moment will help ensure Early Pathways work as intended.

Understanding how Early Pathways programs impact teacher shortages requires understanding not just who participated in and completed these programs but also the longer-term outcomes of completing relevant four-year degree programs, earning teaching credentials, and, ultimately, obtaining a teaching position within Illinois. This necessitates having data which not only follows the matriculation of Early Pathway participants through the educational system and into the workforce but also these paths for a comparison set of non-Early Pathways participants. This longitudinal data set would contain data covering an individual's secondary education history, their postsecondary matriculation and attainment, and workforce data (in education or elsewhere). In Illinois, this would require obtaining and linking data from the Illinois State Board of Education (ISBE, secondary education), the Illinois Community College Board (ICCB) and the Illinois Board of Higher Education (IBHE, postsecondary education), the Employment Information System (EIS) and the Employment Licensure Information System (ELIS, education workforce information), and the Illinois Department of Employment Security (IDES, non-education workforce data). Only limited and piecemeal evaluations of Early Pathways is possible without this longitudinal data on both Early Pathway participants and a comparison group.

The Illinois Longitudinal Data System (ILDS) has the potential to facilitate access to and use of administrative data from various state agencies which would enable answers to an initial set of questions related to how Early Pathway programs impact the teacher workforce and, therefore, teacher shortages. The ILDS represents a centralized system where administrative data from Illinois state agencies can be linked together in one secure, centrally managed system. These agencies include those where the data for evaluating Early Pathways would come from, including ISBE, ICCB, IBHE, and IDES. Through the development and use of a Centralized Demographic Dataset Administrator Identification (CDDA-ID), an individual's data can be tracked not only across agencies but across time. This allows for the development of a longitudinal dataset which not only follows individuals within an administrative data set but across time and across administrative datasets.

As Early Pathway programs arrive at a point where initial evaluation work is possible and the ILDS has established the infrastructure to bring together the necessary data sets in a secure manner, this report engages with the following core question: **For Early Pathways, can the ILDS serve as the main source for longitudinal data at the individual level for Early Pathway evaluations?** Understanding the current and potential capabilities of the ILDS as they relate to Early Pathway evaluation at this early stage of Early Pathway implementation provides an opportunity to inform the development of the Early Pathway Evaluation Framework, identify

opportunities for the ILDS to support evaluation efforts related to Early Pathways, and understand the bounds around what the ILDS can provide to Early Pathway evaluation work.

Table 5 presents the types of data the ILDS can facilitate the linkage and use of in order to answer fundamental questions about the impact of Early Pathway programs. The connection of the unit records across time and agency would create the longitudinal data system necessary to evaluate how Early Pathway programs impact teacher shortages.

Table 5. Overview of the data which the ILDS could connect related to Early Pathways

Data Necessary for Evaluating Early Pathways	State Agency (data set if applicable)
Secondary Education Data <ul style="list-style-type: none"> • Demographics • Academic outcomes • Course information • Early Pathway participation, completion • School/district information 	Illinois State Board of Education (ISBE) - <i>Student Information System (SIS)</i>
2-Year Postsecondary Data <ul style="list-style-type: none"> • Demographics • Academic outcomes • Academic status • Student Goals • Financial Aid • School information 	Illinois Community College Board (ICCB)
4-Year Postsecondary Data <ul style="list-style-type: none"> • Demographics • Academic outcomes • Academic status • Program of study, major • Financial Aid • School information 	Illinois Board of Higher Education (IBHE)
Teacher Licensure/Endorsements <ul style="list-style-type: none"> • Licensure • Endorsements/Certifications 	ISBE - <i>Employment Licensure Information System (ELIS)</i>
Current Teachers <ul style="list-style-type: none"> • Teacher demographics • Teacher status (e.g., exit reason, retired, tenure) • Teaching position information • Unfilled position information 	ISBE - <i>Employment Information System (EIS)</i>
Workforce Data	Illinois Department of Employment Security (IDES)

The types of questions which would be able to be answered with a longitudinal data set include the information set forth in Table 6, which represent an important first set of questions focused on understanding the overall impacts of Early Pathways programs. To answer questions about Early Pathways implementation, the experiences of participants (both students and educators), and more individualized impacts of Early Pathways participation, supplemental data collection is likely necessary. Given the primacy of understanding the status of the ILDS as it relates to answering questions about the impact of Early Pathways on growing the pool of qualified teachers and teacher shortages, this report does not engage with the status of incorporating data outside of the state agencies administrative data systems. The use of other data sources with ILDS is left for future investigation.

Table 6. Overview of the types of Early Pathway questions possible with ILDS dataset

	Questions
Implementation	<ol style="list-style-type: none"> 1. What extracurricular experiences do Early Pathway participants have and what is the quality of these experiences? 2. What does classroom instruction look like in Early Pathway programs? 3. Are non-Early Pathway program credentials or certificates included in the Early Pathway program? 4. How are Early Pathway courses, activities, and experiences recorded? 5. What teachers are assigned to teach in Early Pathway courses? 6. What, if any, supports and preparation do teachers receive to teach in Early Pathway programs? 7. What, if any, supports or communications do staff, students, and families receive related to Early Pathway programs? 8. What are the costs and resources required to implement Early Pathway programs?
Access	
Location of Early Pathways	<ol style="list-style-type: none"> 1. What are the characteristics of schools where Early Pathway programs are offered? 2. How do patterns of availability differ by Early Pathway program?
Access to Early Pathways	<ol style="list-style-type: none"> 3. Who participates in Early Pathway programs? 4. How do the patterns in participation in Early Pathways vary based on school characteristics? 5. What experiences do participants have in Early Pathway programs? 6. How do the patterns in experiences vary based on school characteristics?
Completers of Early Pathways	<ol style="list-style-type: none"> 1. Who successfully completes Early Pathway programs? 2. Who does not successfully complete Early Pathway programs? 3. What impact does the Early Pathway have on student perceptions of the educational profession? 4. Do students gain the knowledge and skills outlined in the Early Pathway? 5. What factors are associated with completion and non-completion of Early Pathway programs?
Impact of Early Pathway Completion	
Postsecondary & Licensure Outcomes	<ol style="list-style-type: none"> 1. What do completers of Early Pathway programs do after completing the program? Do they continue on to postsecondary institutions? Do they participate in support programs? What coursework and majors do they engage in? Do they take education related jobs? 2. What proportion of Early Pathway program completers earn their teaching license and what proportion obtain jobs as teachers? 3. How do patterns vary by completer characteristics (e.g. gender identities, racial/ethnic identities, socioeconomic status, etc.) and school attended?
Teaching after Early Pathways Completion	<ol style="list-style-type: none"> 4. What do the schools look like where Early Pathway completers work (e.g., geographies, student body characteristics, etc.)? 5. What subjects and grades do they teach? 6. How does this vary by individual characteristics, by region, by secondary school attended, by postsecondary institution? 7. How does this compare with non-participants who go on to become teachers? 8. What routes do those who teach take prior to their first job as a licensed teacher (e.g., high school to 4-year to teacher; high school to education related job to 4-year to teacher; etc.)?

Approach To Evaluating the Current Status of the ILDS Against the Needs for Systematic Understanding of Early Pathways Programs in IL

In order to evaluate how well the ILDS can currently allow for assessing the impact of Early Pathway programs on growing the pool of possible teachers, the team developed the following plan: a) become familiar with agency codebooks and relevant ILDS documentation; b) compare available agency data with the analytic needs for Early Pathway impact studies; c) submit ILDS data request; d) obtain ILDS data; e) test data connections and usability via pilot analyses; f) make recommendations for using ILDS to evaluate Early Pathways.

Reviewing agency codebooks and relevant ILDS documentation. To understand what data elements were included in each state agency’s administrative data set, the team engaged in multiple efforts to find codebooks, data dictionaries, and other materials outlining variables, data elements, and definitions (all of these are referred to as codebooks for the remainder of the document). First, agency websites were searched for current materials. When these website searches were unsuccessful, search engines were used with key terms such as “Illinois State Board of Education Codebook”, “IBHE Data Dictionary”, “ICCB Codebook”, and similar combinations. Finally, direct outreach to agency contacts was used when codebooks were not found.

Through interactions with the ILDS governing board, reviewing ILDS documents, and conversations with agency stakeholders, the process for applying for ILDS data access was reviewed. This review process focused on identifying if the ILDS was able to provide access to the various agency data elements necessary to engage in Early Pathways evaluation efforts. If access to the needed variables was available, understanding how to navigate the process was investigated to identify a roadmap for Early Pathway evaluation efforts.

Comparing available agency data against analytic needs. Using a set of Early Pathways evaluation questions developed by the team with input from ISBE staff and other stakeholders (see Table 6 for the set of guiding questions), the team identified the types of information needed to operationalize key constructs in order to provide meaningful answers to the evaluation questions. From this set of constructs, the data available in state agency administrative data sets were compared against the data needed to identify where there was coverage, where gaps may exist, and where further investigation was necessary. Table 7 displays the key constructs which were identified as necessary to understand how Early Pathways impacted participants and the potential source for the data.

Table 7. *Constructs necessary to answer first order evaluation questions*

Information on Early Pathway participation and/or completion	ISBE
Student demographics	ISBE; ICCB; IBHE
Previous academic profile of students in secondary education (grades, course sequences, behaviors, supports, etc.)	ISBE
Concurrent academic profile of students at time of Early Pathways (grades, course enrollments, behavior, supports, etc.)	ISBE
Secondary school characteristics (e.g., funding, demographics, staffing, location, etc.)	ISBE
Postsecondary enrollment	ICCB; IBHE
Postsecondary academic profile (major, course sequence, etc.)	ICCB; IBHE
Engagement in other educator workforce programs in postsecondary	ICCB; IBHE
Educator licensure information (earned/not earned; subject area; grade level; endorsements; etc.)	ISBE-ELIS
Employment as a teacher	ISBE-EIS
Workforce data in education-related and other sectors	IDES

Evaluation of the ILDS as a Viable Data Source for Early Pathway Evaluation Efforts

The initial plan to understand if and how the ILDS could be used to support Early Pathway evaluations was to conduct a pilot study using the ILDS data. This would allow for an understanding of the entire process – from the formal request, to data procurement, to data access, and finally to data analysis – to determine recommendations and guidelines for using ILDS data for evaluating Early Pathways. The plan was to test the data via a pilot study of three Early Pathway programs – the Scaling Education Pathways in Illinois (SEPI) initiative, ISBE’s CTE Education Career Pathway initiative (CTE Ed Pathways), and the College and Career Pathway Endorsements in Human and Public Services in Education (CCPE-Ed) – in order to ensure the connections across agency data were valid, test the virtual environment, identify relevant business rules to ensure consistent analysis, and to produce first results related to Early Pathway impacts based on the data available.

However, through conversations with the ILDS governing board and state agency contacts it became clear that this was not possible during the time period of the project. The ILDS was engaged in refining the processes which will allow for this type of interagency data request to be processed. The ILDS governing board is in the process of developing a set of standing, updated datasets which future applicants will identify, select relevant elements from, and then the ILDS process will provision virtual machines with the relevant data and a set of statistical software packages. This structure has emerged due to the federated nature of agency data, a desire to minimize the demands on various agency data teams, and to ensure more efficient access in the future. As such, conversations have occurred with the ILDS governing board so they are aware of the future request, but no formal ILDS data request has been submitted. Without access to the ILDS data, the pilot work as initially conceived was not viable. Instead, publicly available data was used to provide first insights into two Early Pathway programs - SEPI and CTE Ed Pathways. Relying on publicly available data limited the Early Pathway Pilot Study to examining access related evaluation questions to these two programs. The evaluation focused on where CTE Ed Pathway courses were offered, who participated (took at least one CTE Ed Pathway course) or completed a CTE Ed Pathway, and the relationships between a district having been awarded a SEPI and/or a CTE Ed Pathway Grant had on participation and completion. The results of the updated pilot work are presented in a late section of this report (see Early Pathways Pilot Study section).

Despite the lack of a completed ILDS request and data access, what follows examines whether the ILDS, once updates are completed, will serve as a key data source for future evaluation of Early Pathways. After discussing the current state, recommendations and guidance are discussed.

Reviewing agency codebooks and comparing available agency data against analytic needs. After conducting website searches and reaching out to agency contacts, there were still gaps in the codebooks which were available. Some codebooks were never obtained despite multiple efforts while other times the only codebooks found were from previous years. When codebooks were not available or were out of date, reports and other materials were reviewed to determine if the agencies collected information – for example, if there were reports which differentiated results by gender the team assumed that gender data was collected by the agency or in the relevant data set. Based on the review of the codebooks on hand, several observations emerged.

First, the data necessary to serve as the foundation for any long-term evaluation of Early Pathways appear to be collected in the various agencies. At each point from secondary education settings to postsecondary matriculation and completion, to the earning of licenses and endorsements, through to education and non-education workforce data, the data exists to determine participation in statewide Early Pathways (e.g., CTE Ed Pathways, CCPE-Ed, etc.) or to link more localized participation data to students, and follow cohorts of individuals into college and career.

Second, data elements covering similar information (e.g., race/ethnicity) and how they were defined/coded (e.g., 1 = Asian; 2 = Hispanic; etc.) were consistent within an agency but not always consistent between agencies. While expected as each agency has the autonomy to define their variables in alignment with their needs and constraints, it creates the need for a process to ensure consistent translation of information in cross-agency linked data.

Finally, there was variation within and across agencies in the level of detail included in the codebooks and in the number of years of codebooks which were available. Certain datasets had associated codebooks which included information about how variables changed over time; others had multiple codebooks available

corresponding to the different years of data available. Having multiple years of codebooks or details about what variables changed over time are essential to understanding what data was collected and when.

Relevant ILDS documentation in relation to Early Pathway evaluation needs. The review of ILDS documentation included examining and attempting to utilize the Data Access Use Agreement (DAUA) and the Unified Data Request (UDR) documents. The documents were available for review and were clear on the surface. As the team began engaging with the documents, issues emerged in using the documents to facilitate the submission of an application to the ILDS governing board for review and eventual data access. The first document to develop and submit to the ILDS governing board is the DAUA. The primary portion of the DAUA for any application to have completed is related to a description of the project, including the purpose, benefits to state agencies, the questions the project will answer and the associated methodologies, the outcomes, and the timeline. In support of these components, there is also a requirement for the submission of a comprehensive list of data elements requested from the State agencies. During the development of the DAUA for the Early Pathways Evaluation work, the process was not well defined nor were there clear guidelines or documents for review. As the DAUA was never completed, the team did not attempt to complete the UDR but only reviewed the template.

An important type of document which currently does not exist are codebooks aligned with the standing datasets. Having ILDS provided documentation about which variables are in each dataset, along with information such as definitions and business rules related to alignment of variables, would greatly support the ability of Early Pathway evaluation efforts to navigate the ILDS data application process.

Conclusions and Recommendations Related To Using the ILDS To Evaluate Early Pathways

Based on a review of the agency codebooks and the current ILDS documentation, it appears that longitudinal datasets which will be made available through the ILDS infrastructure can eventually play an integral role in the evaluation of Early Pathway programs. Using data from any single agency alone will not provide the necessary information to assess the impact of Early Pathways on the teaching force - both in the type of data housed within a single agency or in the ability to examine the long-term outcomes of Early Pathway participation. As such, the maturation of the ILDS will singularly facilitate understanding if Early Pathways are succeeding in their goals, where they are succeeding, who they are succeeding for, and identify opportunities to improve Early Pathways in Illinois. As the ILDS currently exists, however, there are several limitations which are hindering its use as the main source for administrative data related to Early Pathways. As the team was unable to complete the ILDS application or data procurement, the following recommendations are limited and do not include any insights into the use of data from the ILDS, how the virtual environment operates, processes for exporting findings out of the virtual environment, and so on.

Recommendation 1 - Create resources for users to navigate the data application process so that evaluation of Early Pathways can proceed efficiently.

While there are forms and processes for accessing ILDS data, how to use these documents and the workflow is not well articulated. Despite being engaged in the process for over a year, the process to apply for access to the data continues to evolve. While this is to be expected with new processes, having clarity around this can facilitate timely evaluation of Early Pathways. The creation of a webinar, slide deck, or another stable resource about the process of applying for the data access would increase the efficiency of the application process for those doing Early Pathway evaluation work.

Recommendation 2 - Create curated codebooks and business rules for each standing dataset to facilitate application, data preparation, and analysis for Early Pathway evaluations.

Related to Recommendation 1, having a curated codebook for each standing dataset would ensure Early Pathway evaluation efforts were identifying the available variables, and the associated dataset they were in, needed for the evaluation. The development of consistent business rules, for example how to treat variation in gender or race/ethnicity within and across agency datasets, would ensure consistency across evaluation efforts.

Recommendation 3 - Guidance on the virtual environment, including statistical software available, would facilitate Early Pathway evaluations.

Early Pathway evaluators interested in using the ILDS as a data source would be better served by understanding the rules around accessing the virtual environment. Similarly, knowing what software will be available will ensure that evaluation teams are prepared for and able to complete the evaluation work within the virtual environment.

Early Pathways Pilot Study



Overview of Early Pathways in Illinois

The focus of this pilot study is Career and Technical Education (CTE) Education Pathways participation and concentration. A CTE Education Pathways participant is any student who took at least one CTE Education Pathways course. A CTE Education Pathways concentrator is any student who took two or more CTE Education Pathways courses. Some of the following analyses also examine the schools' statuses of earning Illinois State Board of Education (ISBE) grants or Scaling Education Pathways in Illinois (SEPI) grants. The ISBE grant is a multi-year, multimillion dollar CTE grant that funds career pathways in 101 high schools and vocational centers which serve over 1000 students with the aim of recruiting future educators. The SEPI initiative of the Education Systems Center at Northern Illinois University supports 50 school districts which contain a total of 72 high schools with each collaborative receiving a small grant for implementation of education pathways (\$8k-\$14k).

Purpose of the Pilot Study

The purpose of the pilot study was twofold. First, it was to produce the first evidence on a subset of evaluation questions which were answerable using either existing data or through initial novel data collection efforts. Second, the pilot study provided an opportunity to identify new questions or topics to incorporate into the overarching Early Pathway Evaluation Framework discussed above. The pilot study described below was a mixed methods investigation of four evaluation questions.

The quantitative pilot study investigated the following evaluation questions:

1. What are the characteristics of the schools where these programs are offered?
2. How do the patterns in participation vary based on school characteristics?

The qualitative pilot study explored the following evaluation questions:

3. What can we learn about the implementation of Early Pathways programs?
4. What can we learn about postsecondary efforts related to Early Pathway programs?

Quantitative Evaluation Methodology

All data for the quantitative pilot study analyses come from the Illinois (IL) Report Card 2022 data file. This data file includes data from AY 2021-2022 and is the most recent data publicly available. These analyses were conducted (1) statewide, (2) statewide excluding Chicago Public Schools (CPS), and (3) for CPS only when applicable and/or possible. There were only five high schools with enough data to report on their CTE Education Pathways in the City of Chicago School District 299: Farragut Career Academy High School, Roosevelt High School, Simeon Career Academy High School, Curie Metropolitan High School, and Juarez Community Academy High School.

Missing data within the IL Report Card can mean (1) the missing values were truly missing such that the school did not report the information, or (2) the value of the data point was too small to report (i.e., less than 10). Non-reported CTE Education Pathways participation and concentration data were treated as missing. It is likely that schools with no data reported on these variables had no student engagement in CTE Education Pathways. However, non-reported percentages of various student demographic groups out of the overall school population were treated as data points that were too small to report. There were likely less than 10 students in the numerator (group) which led to proportional enrollments that would be quite small (e.g., 0.4%). Consequently, the impact of saying these schools (i.e., schools with a small number of (or no) students in a particular demographic subgroup) have a percentage of 0% for a demographic subgroup is likely smaller than excluding these schools all together.

Quantitative Pilot Study Findings

Statewide Analysis

To address evaluation question one, what are the characteristics of schools where these programs are offered, we examined outcome variables related to the presence of Early Pathways in education. One outcome variable considered whether CTE education exists for education pathways (i.e., whether the school reported participation data in CTE Education Pathways). The second outcome variable considered whether the schools received funding for implementing CTE Education Pathways (i.e., whether the school received an ISBE grant and/or a SEPI grant, or CTE Education Pathways exists but the school received no funding). The predictors in

the following regression models include district type (unit vs. high school), per-pupil expenditure, total school enrollment, proportion of students who are White, proportion Black/African American, proportion Hispanic/Latinx, proportion Asian, proportion Multiracial, proportion of students with IEPs, proportion of students who are English Learners (ELs), and proportion of students who are low income.

Using these predictors, a binary logistic regression model was fitted to examine which school characteristics predict CTE Education Pathways being offered. Total school enrollment ($p < .001$), proportion of students in the school who are Multiracial ($p < .001$), and proportion of students who are ELs ($p = .005$) were all statistically significant predictors of education in CTE Education Pathways existing in schools. Proportion of students who are Asian ($p = .062$) and proportion of students who are White ($p = .070$) were marginally statistically significant predictors. As total enrollment increases, schools are 1.001 times more likely to have education in CTE Education Pathways. That is, there is a 0.1% higher odds that schools will have CTE Education Pathways as total enrollment increases. Due to the massive size of the odds ratios for proportion Multiracial, proportion EL, proportion Asian, and proportion White, the statistical significance (or marginal statistical significance) of these predictors may be due to outliers or other spurious reasons rather than a true effect.

Using the same predictors, another binary logistic regression model was fitted to examine which school characteristics predict funding via grants of the CTE Education Pathways that were offered. There were no statistically significant ($p < .05$) predictors of the ISBE and/or SEPI grant funding of CTE Education Pathways. See Table 8 for a summary of the binary logistic regression models examining the characteristics that are predictive of schools offering education in CTE Education Pathways or having received grant funding for such education.

Table 8. Regression Results Predicting Whether CTE Education Exists or is Funded (Statewide Analysis)

Predictor	CTE Education Exists ^a		CTE Education Funded ^b	
	b	SE	b	SE
District Type (High School)	0.23	0.29	-0.82	0.49
Per-Pupil Expenditure	0.00	0.00	-0.00	0.00
Total Enrollment	0.00***	0.00	0.00	0.00
Proportion White	14.80^c	8.18	-8.29	15.85
Proportion Black/African American	13.83	8.08	-5.35	15.88
Proportion Hispanic/Latinx	12.07	8.05	-5.54	15.36
Proportion Asian	15.70^d	8.42	-4.93	15.94
Proportion Multiracial	26.13***	7.64	-9.43	13.43
Proportion IEP	0.74	2.83	0.15	5.94
Proportion EL	8.20**	2.92	-5.57	6.22
Proportion low income	-1.29	0.82	0.82	1.45

Note. Through a statewide analysis (including CPS), these models describe which characteristics are associated with schools offering education in CTE Education Pathways by predicting whether (1) education for CTE Education Pathways exists or (2) the schools received funding for implementing CTE Education Pathways using binary logistic regression.

- a The full dataset for this analysis contained N = 640 high schools. After schools with missing data on per-pupil expenditure were removed, the analytic dataset contained n = 637 high schools.
- b The full dataset for this analysis contained N = 159 high schools. There was no missing data.
- c Marginally statistically significant ($p = .070$).
- d Marginally statistically significant ($p = .062$).

** $p < .01$. *** $p < .001$.

For reference, these models were conducted a second time, containing the proportion of White students as the only racial/demographic predictor, which shed light on the patterns that arise as schools become increasingly or decreasingly White proportionally. Total enrollment ($p < .001$) was the only statistically significant, positive predictor of education in CTE Education Pathways existing in schools. The odds ratio was the same as above. Of note, none of the odds ratios were massive in size, suggesting that these findings may be more reliable than the ones reported above. Also, the proportion of White ($p = .062$) was a marginally statistically significant, negative predictor of the ISBE and/or SEPI grant funding of CTE Education Pathways. As the proportion of White students in schools increase, schools are 12.82 times less likely to have ISBE and/or SEPI grant funding of CTE Education Pathways. That is, there is a nearly 1300% higher odds that schools will have CTE Education Pathways that are not grant-funded.

Statewide Analysis Excluding CPS

Using the same outcome and predictor variables and similarly fitting binary logistic regression models, the following reports the results when CPS schools are excluded from the analyses. Total enrollment ($p < .001$), proportion of students in the school who are Asian ($p = .027$), and proportion Multiracial ($p = .002$) were all statistically significant predictors of education in CTE Education Pathways existing in schools. As total enrollment increases, schools are 1.001 times more likely to have education in CTE Education Pathways. This finding did not change regardless of whether the analyses were conducted with or without CPS. Also, the odds ratios were again massive for proportion Asian and proportion Multiracial.

Using the same predictors, another binary logistic regression model was fitted to examine which school characteristics predict funding via grants of the CTE Education Pathways that were offered. There were no statistically significant ($p < .05$) predictors of the ISBE and/or SEPI grant funding of CTE Education Pathways. See Table 9 for a summary of the statewide (excluding CPS) results of the binary logistic regression models

Table 9. Regression Results Predicting Whether CTE Education Exists or is Funded (Statewide Analysis Excluding CPS)

Predictor	CTE Education Exists ^a		CTE Education Funded ^b	
	b	SE	b	SE
District Type (High School)	-0.05	0.31	-0.69	0.49
Per-Pupil Expenditure	0.00	0.00	-0.00	0.00
Total Enrollment	0.00***	0.00	0.00	0.00
Proportion White	13.26	8.17	-10.61	15.90
Proportion Black/African American	12.80	8.12	-7.61	15.94
Proportion Hispanic/Latinx	11.43	8.06	-7.28	15.37
Proportion Asian	19.27*	8.74	-7.30	15.99
Proportion Multiracial	23.17**	7.63	-8.69	13.38
Proportion IEP	1.77	3.22	-1.59	6.22
Proportion EL	7.00	4.21	-7.74	6.97
Proportion low income	-0.88	0.87	1.71	1.46

Note. Through a statewide analysis (excluding CPS), these models describe which characteristics are associated with schools offering education in CTE Education Pathways by predicting whether (1) education for CTE Education Pathways exist or (2) the schools received funding for implementing CTE Education Pathways using binary logistic regression.

- a The full dataset for this analysis contained N = 552 high schools. After a school with missing data on per-pupil expenditure was removed, the analytic dataset contained n = 551 high schools.
- b The full dataset for this analysis contained N = 154 high schools. There were no missing data.

* $p < .05$. ** $p < .01$. *** $p < .001$.

examining the characteristics that are predictive of schools offering education in CTE Education Pathways or having received grant funding for such education.

Again, these models were conducted a second time, containing the proportion of White students as the only racial/demographic predictor. Total enrollment ($p < .001$) remained the only statistically significant, positive predictor of education in CTE Education Pathways existing in schools. The odds ratio was the same as above. However, none of the odds ratios were massive for this model, suggesting that these findings may again be more reliable than the ones reported above. Additionally, proportion White ($p = .046$) was a statistically significant, negative predictor of the ISBE and/or SEPI grant funding of CTE Education Pathways. As the proportion of White students in schools increase, schools are 16.67 times less likely to have ISBE and/or SEPI grant funding of CTE Education Pathways. That is, there is a nearly 1700% higher odds that schools will have CTE Education Pathways that are not grant-funded.

CPS Analysis

The same outcome and predictor variables (with the exception of district type because all CPS schools are in unit districts) were used to fit a binary logistic regression model that analyzed the above evaluation question for CPS (N = 86 high schools after two schools with missing data on per-pupil expenditure were removed). There were no statistically significant ($p < .05$) predictors of education in CTE Education Pathways existing in schools. However, the coefficients and standard errors for many of the predictors were unusually large. These values were more typical when the regression model was conducted a second time, containing the proportion of White students as the only racial/demographic predictor. In this case, total enrollment ($p = .033$) was a statistically significant, positive predictor of education in CTE Education Pathways existing in CPS. As total enrollment increases, CPS schools are 1.003 times more likely to have education in CTE Education Pathways. That is, there is a 0.3% higher odds that CPS schools will have CTE Education Pathways as total enrollment increases. Due to the small sample size (N = 5) of CPS schools that offer CTE Education Pathways, an analysis examining the characteristics associated with schools having received funding for implementing CTE Education Pathways was not possible.

The current pilot study also examined evaluation question two, how do the patterns in participation vary based on school characteristics. The overall demographics of those participating in CTE Education Pathways were about the same as the state high school population, with slightly more White students and fewer Black/African American, Hispanic/Latinx, and Asian students (see Table 10). Moreover, patterns stayed relatively

Table 10. *Statewide Patterns of Participants in CTE Education Pathways*

<i>Predictor</i>	<i>Statewide</i>		<i>Statewide, Without CPS</i>		<i>CPS</i>	
	<i>Number of students</i>	<i>Percentage of total</i>	<i>Number of students</i>	<i>Percentage of total</i>	<i>Number of students</i>	<i>Percentage of total</i>
Total number of students	17,923	-	17,587	-	336	-
White students	8,993	50.18%	8,993	51.13%	0	-
Black/African American students	2,296	12.81%	2,212	12.58%	84	25.00%
Hispanic/Latinx students	4,545	25.36%	4,311	24.51%	174	51.79%
Asian students	449	2.51%	449	2.55%	0	-
Multiracial students	411	2.29%	411	2.34%	0	-
Students with IEPs	1,703	9.50%	1,680	9.55%	12	3.57%
English Learner (EL) students	1,179	6.58%	1,123	6.39%	35	10.42%
Low-income students	7,349	41.00%	7,036	40.01%	250	74.40%

Table 11. *Statewide Patterns of Concentrators in CTE Education Pathways*

Predictor	Statewide		Statewide, Without CPS		CPS	
	Number of students	Percentage of total	Number of students	Percentage of total	Number of students	Percentage of total
Total number of students	10,941	-	10,651	-	235	-
White students	5,835	53.33%	5,835	54.78%	0	-
Black/African American students	1,026	9.38%	960	9.01%	66	28.09%
Hispanic/Latinx students	2,700	24.68%	2,493	23.41%	158	67.23%
Asian students	160	1.46%	160	1.50%	0	-
Multiracial students	94	0.86%	94	0.88%	0	-
Students with IEPs	793	7.25%	793	7.45%	0	-
English Learner (EL) students	358	3.27%	315	2.96%	30	12.77%
Low-income students	4,131	37.76%	3,863	36.27%	216	91.91%

consistent from participants to concentrators, but there was an increased percentage of overall concentrators that are White and a decrease in Black/African American, Hispanic/Latinx, and Asian concentrators. Similarly, among concentrators, there were lower percentages of students with IEPs, who are ELs, or who are low income than in the population of students that are participants (see Table 11).

Statewide Analysis

Overall, approximately 6% of students in schools with CTE Education Pathways became participants in Education Pathways. With respect to student demographics, approximately 17% of Multiracial, 9% of Black/African American, 7% of Hispanic/Latinx, 6% of White, and 5% of Asian students participated. Also, 8% of low-income students, 7% of students with IEPs, and 7% of EL students participated (due to the median being less influenced by outliers than the mean, the median proportion is described here but see Table 12 for the mean, minimum, and maximum proportions as well).

Overall, approximately 5% of students in schools with CTE Education Pathways became concentrators in Education Pathways. With respect to student demographics, approximately 9% of Multiracial, 7% of Black/African American, 5% of Hispanic/Latinx, 5% of White, and 3% of Asian students became concentrators. Also, 6% of low-income students, 5% of students with IEPs, and 4% of EL students concentrated in Education Pathways (see Table 13).

To determine which variables might predict the proportion of participants and concentrators in CTE Education Pathways, the following predictors were included in the subsequent regression models: Title I status; per-pupil expenditure; school size; teacher retention rate; composite proficiency score in ELA, math, and science; postsecondary enrollment rate; and ISBE and/or SEPI grant status. However, none of these variables were statistically significant ($p < .05$) predictors of students' overall building-level participation or concentration in CTE Education Pathways (Table 14). There were no school-level factors associated with the proportion of students participating or concentrating in CTE Education Pathways.

While the above analyses suggest no systematic relationship between building level characteristics and overall CTE Education Pathways participation or concentration, the following set of analyses explores if there are patterns related to which students within the buildings engage in CTE Education Pathways. The following analyses progress as follows: a) comparing the demographics of students who either participate or concentrate in CTE Education Pathways with the demographics of all students in buildings that report data on CTE Education

Table 12. Number of Schools with Participants and Proportion of Participants in CTE Education Pathways (Statewide Analysis)

	Proportion of Participants in CTE Education Pathways^a				
	Number of Schools	Mean	Median	Minimum	Maximum
Overall	159	0.08	0.06	0.00	0.43
White students	142	0.09	0.06	0.01	0.43
Black/African American students	57	0.12	0.09	0.02	0.52
Hispanic/Latinx students	92	0.08	0.07	0.01	0.40
Asian students	23	0.08	0.05	0.01	0.32
Multiracial students	18	0.22	0.17	0.07	0.52
Students with IEPs	76	0.10	0.07	0.03	0.45
English Learner (EL) students	38	0.12	0.07	0.02	0.50
Low-income students	132	0.10	0.08	0.01	0.47

a Overall proportion computed as the total number of participants in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific participants in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

Table 13. Number of Schools with Concentrators and Proportion of Concentrators in CTE Education Pathways (Statewide Analysis)

	Proportion of Concentrators in CTE Education Pathways^a				
	Number of Schools	Mean	Median	Minimum	Maximum
Overall	142	0.06	0.05	0.00	0.29
White students	122	0.06	0.05	0.01	0.29
Black/African American students	40	0.08	0.07	0.01	0.24
Hispanic/Latinx students	74	0.05	0.05	0.01	0.14
Asian students	11	0.03	0.03	0.01	0.08
Multiracial students	7	0.13	0.09	0.08	0.26
Students with IEPs	53	0.06	0.05	0.02	0.18
English Learner (EL) students	20	0.05	0.04	0.02	0.13
Low-income students	107	0.07	0.06	0.01	0.34

a Overall proportion computed as the total number of concentrators in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific concentrators in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

Table 14. Regression Results Predicting Overall Participation and Concentration in CTE Education Pathways (Statewide Analysis)

Predictor	Overall Participation^a		Overall Concentration^b	
	b	SE	b	SE
<i>Title I status</i>	-	-	-	-
Schoolwide Title I program	0.06	0.84	-0.15	1.08
Targeted assistance Title I program	-0.24	0.98	-0.22	1.19
Per-pupil expenditure	-0.00	0.00	-0.00	0.00
School size	-0.00	0.00	-0.00	0.00
Teacher retention rate	0.01	0.08	0.04	0.12
Composite proficiency score	0.00	0.04	0.01	0.05
Postsecondary enrollment rate	-0.02	0.04	-0.01	0.06
<i>Grant</i>	-	-	-	-
ISBE and/or SEPI grant	-0.50	0.61	0.00	0.79

Note. These “overall” models are predicting the proportion of participants and concentrators in CTE Education Pathways using binary logistic regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. The reference category for the Grant categorical predictor is schools who did not receive any grants.

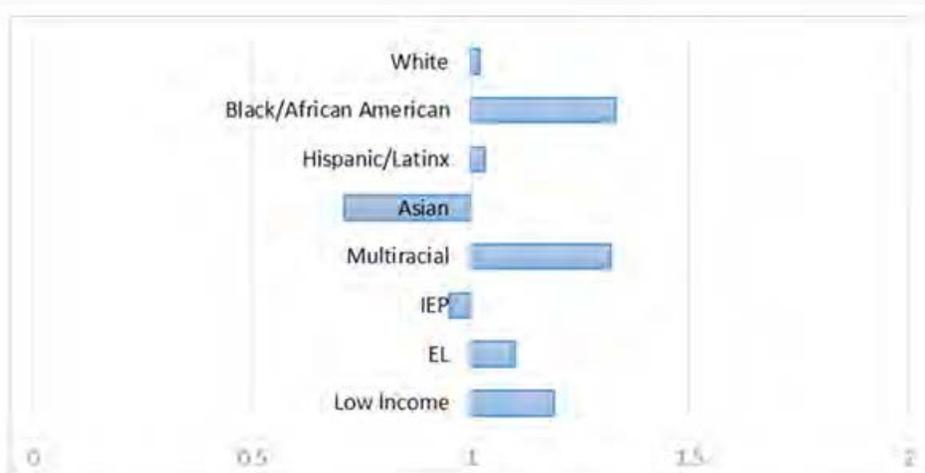
- a Sample size: N = 159 schools with sufficient CTE Education Pathways participation data to report.
- b Sample size: N = 142 schools with sufficient CTE Education Pathways concentration data to report.

Pathways engagement, and b) examining which school level factors are associated with patterns of student representation.

When different demographic groups of students enroll or participate in school programs (e.g., Advanced Placement coursework, CTE Education Pathways) at different rates, a disparity index is a useful measure of these different rates (Klopfenstein, 2004). Therefore, one way to analyze CTE Education Pathways participation and concentration is by using the disparity index, which is a summary statistic designed to assess the magnitudes of representational gaps (Darity et al., 2001; Klopfenstein, 2004; Shaw et al., 2008). One disparity index represents CTE Education Pathways participants of a particular student subgroup (e.g., Black/African American, EL) measured against their proportion of the total student population. Another disparity index represents CTE Education Pathways concentrations of a particular student subgroup (e.g., Black/African American, EL) measured against their proportion of the total student population. In this report, disparity indexes were computed using the formula from Darity and colleagues (2001) and Klopfenstein (2004), that is, % of subgroup of CTE student population / % of subgroup of total student population. Disparity indexes can be interpreted as follows: values greater than 1 indicate that the subgroup is overrepresented, values less than 1 indicate that the subgroup is underrepresented, and values of 1 indicate that the subgroup is equitably represented (i.e., parity) (Darity et al., 2001). The lowest possible value for a disparity index is zero, which indicates that the subgroup is not represented at all (Darity et al., 2001). However, although there are no interpretative cut-off points, disparity indexes that are near the middle line of 1 (see Figure 3) are likely fairly equally represented while those that stand out from the rest are worth exploring in more detail.

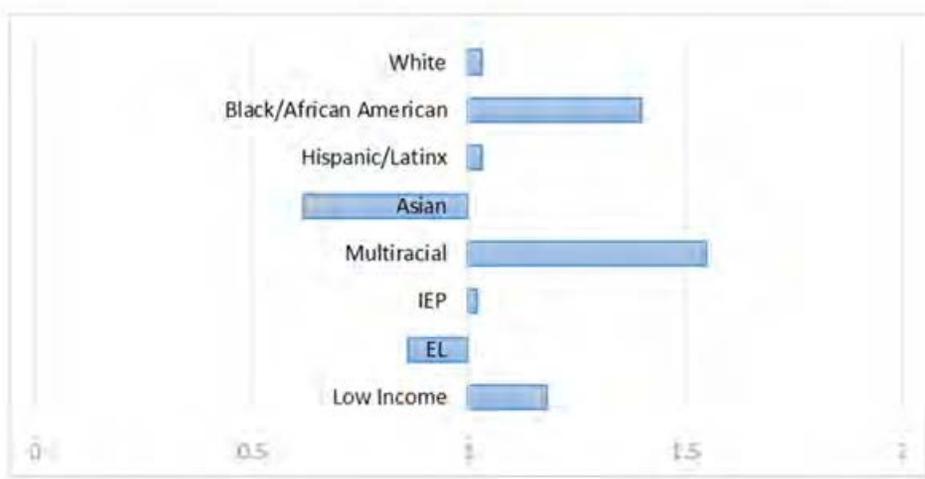
Black/African American (disparity index (DI) = 1.33) and Multiracial (DI = 1.32) students were overrepresented as CTE Education Pathways participants, whereas low income (DI = 1.19) and EL (DI = 1.10) students were also overrepresented but less so. White (DI = 1.02) and Hispanic/Latinx (DI = 1.03) students and students with IEPs (DI = 0.95) appear to be relatively equitably represented. Conversely, Asian (DI = 0.71) students were underrepresented.

Figure 3. Mean Disparity Indexes of CTE Education Pathways Participation (Statewide Analysis)



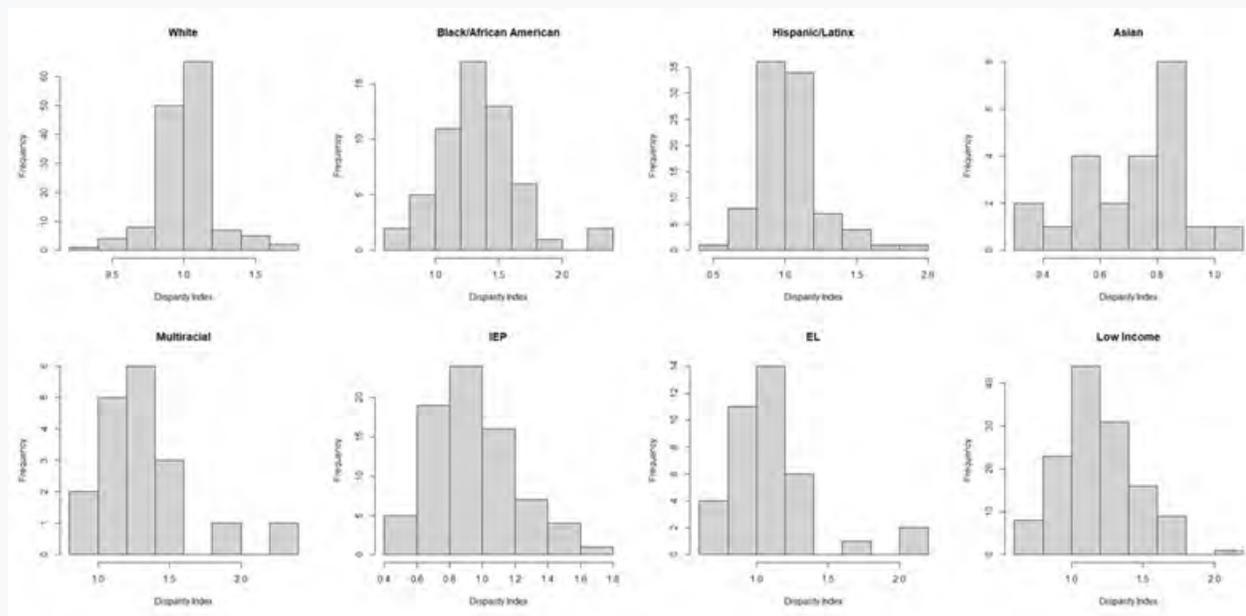
When looking at concentrators (see Figure 4), the patterns generally stayed the same with the over/underrepresented groups becoming more so as concentrators: Multiracial (DI = 1.55), Black/African American (DI = 1.40), and low income (DI = 1.18) students were overrepresented as CTE Education Pathways concentrators. White (DI = 1.03) and Hispanic/Latinx (DI = 1.03) students as well as students with IEPs (DI = 1.02) were relatively equitably represented. Meanwhile, Asian (DI = 0.62) students remained underrepresented. Of note and worth further exploration are the EL students (DI = 0.86) who switched from being slightly overrepresented as participants to underrepresented as concentrators.

Figure 4. Mean Disparity Indexes of CTE Education Pathways Concentration (Statewide Analysis)



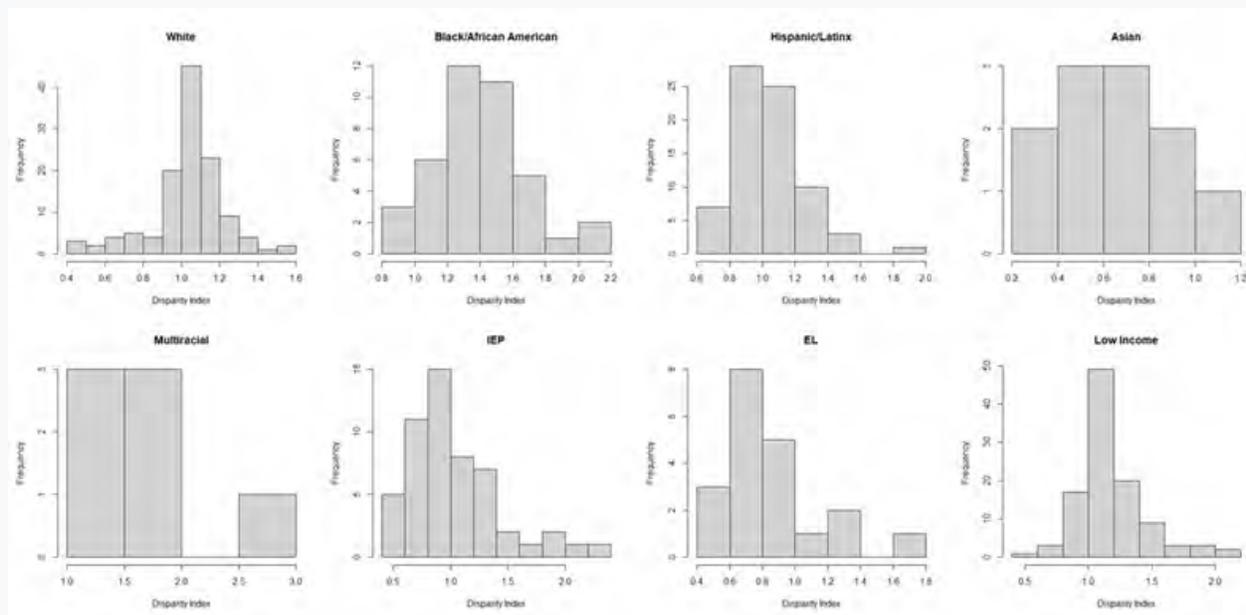
Despite these patterns in CTE Education Pathways participation and concentration, there was variation in representation patterns at the building level. As shown by the histograms in Figure 5, the representation patterns for CTE Education Pathways participation varied between under- and overrepresentation for White, Hispanic/Latinx, and IEP students at the building level. Conversely, these patterns varied between relatively equitable to overrepresentation for Black/African American, Multiracial, EL and low-income students. For Asian students, these patterns varied between underrepresentation and parity.

Figure 5. Histograms Depicting Variation in CTE Education Pathways Participation at the Building Level (Statewide Analysis)



Similarly, the histograms in Figure 6 show that the representation patterns for CTE Education Pathways concentration also varied between under- and overrepresentation for White, Hispanic/Latinx, and IEP students at the building level. For Black/African American and Multiracial students, these patterns varied between relatively equitable to overrepresentation. For Asian students, these patterns varied between underrepresentation and parity. Conversely, the representation patterns for CTE Education Pathways concentration differed from those of participation for EL and low-income students with their representation patterns varying between underrepresentation and overrepresentation at the building level.

Figure 6. Histograms Depicting Variation in CTE Education Pathways Concentration at the Building Level (Statewide Analysis)



Using the same predictors as before, a series of multinomial regression models were fitted to examine the patterns of CTE Education Pathways participation and concentration within specified demographic groupings at the building level. The models were run with and without CPS. Two operational definitions of the disparity index categorization for the outcome variable used in the following multinomial regression models were examined. The first operationalization considered disparity index values ranging from 0.9 to 1.1 to indicate equitable representation, values less than 0.9 to indicate under representation, and values greater than 1.1 to indicate over representation. The second operationalization considered disparity index values ranging from 0.95 to 1.05 to indicate equitable representation, values less than 0.95 to indicate under representation, and values greater than 1.05 to indicate over representation. In the following multinomial regression models, the second operational definition of the disparity index categorization generally allowed for better model fit due to providing for more adequate cell sample sizes compared to the first operational definition. Therefore, the models discussed below used the second disparity index operational definition as the outcome variables.

Building-Level CTE Education Pathways Participation by White Students

Title I status ($p = .011$) and postsecondary enrollment rate ($p = .027$) were both statistically significant predictors of the disparity index for White students' building-level CTE Education Pathways participation. Also, the composite proficiency score for White students was a marginally statistically significant predictor ($p = .066$). Pseudo R2 values show that between approximately 9% and 19% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, the Targeted Assistance Title I program negatively predicted the over representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = -1.42$, $p = .036$). Compared to schools eligible for but not a participant in the Title I program, the odds that schools with a Targeted Assistance Title I program will have an equitable representation of White students in CTE Education Pathways (vs. over representation) were 4.132 times higher (i.e., over 400% higher odds that White students will be equitably represented vs. over represented).

The composite proficiency score for White students positively predicted the under representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = 0.07$, $p = .025$). For each unit increase in the composite proficiency score for White students, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.072 times (i.e., 7.2% higher odds that White students will be underrepresented vs. equitably represented).

Postsecondary enrollment rate negatively predicted the under representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = -0.08$, $p = .011$). For each year increase in postsecondary enrollment rate, the odds of White students being equitably represented (vs. underrepresented) increased by 1.081 times (i.e., 8.1% higher odds that White students will be equitably represented vs. underrepresented).

Building-Level CTE Education Pathways Participation by Hispanic/Latinx Students

Building-level total per-pupil expenditure ($p = .071$) was a marginally statistically significant predictor of the disparity index for Hispanic/Latinx students' building-level CTE Education Pathways participation. No other variables were statistically significant predictors. Pseudo R2 values show that between approximately 13% and 29% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, per-pupil expenditure positively predicted the over representation (vs. equitable representation) of Hispanic/Latinx students as participants in CTE Education Pathways ($b = 0.00$, $p = .029$). For each unit increase in per-pupil expenditure, the odds of Hispanic/Latinx students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1 times. That is, although per-pupil expenditure is a positive predictor, there was no measurable increase in the over representation of Hispanic/Latinx students as participants in CTE Education Pathways due to an increase in per-pupil expenditure.

Building-Level CTE Education Pathways Participation by Students with IEPs

Title I status ($p = .011$) was a statistically significant predictor of the disparity index for the building-level CTE Education Pathways participation of students with IEPs. Also, school size was a marginally significant predictor ($p = .059$). However, examining the regression coefficients per each disparity index category, there were no

statistically significant predictors of CTE Education Pathways participation by students with IEPs. Pseudo R2 values show that between approximately 17% and 32% of the variance was accounted for by the complete set of predictors.

Building-Level CTE Education Pathways Participation by Low Income Students

Per-pupil expenditure was a marginally statistically significant predictor ($p = .059$) of the disparity index for the building-level CTE Education Pathways participation by low-income students. However, examining the regression coefficients per each disparity index category, there were no statistically significant predictors of CTE Education Pathways participation by low-income students. Pseudo R2 values show that between approximately 9% and 17% of the variance was accounted for by the complete set of predictors. See Table 15 for a summary of the results of the regression models predicting participation in CTE Education Pathways.

Building-Level CTE Education Pathways Concentration by White Students

Title I status ($p = .038$), school size ($p = .018$), composite proficiency score for White students ($p = .025$), and postsecondary enrollment rate ($p = .007$) were all statistically significant predictors of the disparity index for White students' building-level CTE Education Pathways concentration. Pseudo R2 values show that between approximately 23% and 43% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, the Targeted Assistance Title I program positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 2.61$, $p = .006$). Compared to schools eligible for but not a participant in Title I, the odds that schools with a Targeted Assistance Title I program will have an under representation of White students in CTE Education Pathways (vs. equitable representation) are 13.657 times higher (i.e., over 1300% higher odds that White students will be underrepresented vs. equitably represented).

Per-pupil expenditure was a marginally statistically significant positive predictor of the over representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .057$). For each unit increase in the per-pupil expenditure, the odds of White students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1 times. That is, there was no measurable increase in the over representation of White students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditure.

School size positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .031$). For each unit increase in school size, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.001 times (i.e., 0.1% higher odds that White students will be underrepresented vs. equitably represented). However, school size also positively predicted the over representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .010$). For each unit increase in school size, the odds of White students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.001 times.

The composite proficiency score for White students positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.12$, $p = .011$). For each unit increase in the composite proficiency score, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.123 times (i.e., 12.3% higher odds that White students will be underrepresented vs. equitably represented).

Finally, postsecondary enrollment rate negatively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = -0.14$, $p = .005$). For each year increase in postsecondary enrollment rate, the odds of White students being equitably represented (vs. underrepresented) increased by 1.145 times (i.e., 14.5% higher odds that White students will be equitably represented vs. underrepresented).

Building-Level CTE Education Pathways Concentration by Hispanic/Latinx Students

Per-pupil expenditure ($p = .040$) was a statistically significant predictor of the disparity index for Hispanic/Latinx students' building-level CTE Education Pathways concentration. Also, the composite proficiency score for Hispanic/Latinx students was a marginally statistically significant predictor ($p = .066$). Pseudo R2 values show that between approximately 23% and 45% of the variance was accounted for by the complete set of predictors.

Table 15. Regression Results Predicting Participation in CTE Education Pathways (Statewide Analysis)

Predictor	White ^a		Hispanic ^b		IEP ^c		Low Income ^d	
	b	SE	b	SE	b	SE	b	SE
<i>Title I status</i>	-	-	-	-	-	-	-	-
Schoolwide Title I program: <i>under</i> representation	0.37	0.00	-1.56	0.00	-0.16	0.00	-0.34	0.00
Schoolwide Title I program: <i>over</i> representation	-0.88	0.00	-1.38	0.00	0.98	0.00	0.07	0.00
Targeted Assistance Title I program: <i>under</i> representation	1.03	0.00	-1.55	0.00	8.64	0.00	0.65	0.00
Targeted Assistance Title I program: <i>over</i> representation	-1.42*	0.00	-1.25	0.00	10.86	0.00	1.72	0.00
Per-pupil expenditure: <i>under</i> representation	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Per-pupil expenditure: <i>over</i> representation	0.00	0.00	0.00*	0.00	0.00	0.00	-0.00	0.00
School size: <i>under</i> representation	-0.00	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00
School size: <i>over</i> representation	0.00	0.00	0.00	0.00	-0.00	0.00	-0.00	0.00
Teacher retention rate: <i>under</i> representation	-0.01	0.01	-0.08	0.02	-0.11	0.02	-0.01	0.02
Teacher retention rate: <i>over</i> representation	0.01	0.01	-0.02	0.02	-0.03	0.03	0.06	0.02
Composite proficiency: <i>under</i> representation	0.07*	0.03	0.02	0.04	-0.13	0.04	0.04	0.05
Composite proficiency: <i>over</i> representation	0.03	0.03	0.08	0.04	-0.14	0.03	-0.03	0.04
Postsecondary enrollment rate: <i>under</i> representation	-0.08*	0.03	0.02	0.03	0.05	0.03	0.02	0.04
Postsecondary enrollment rate: <i>over</i> representation	-0.04	0.03	-0.00	0.03	0.11	0.03	0.03	0.03
<i>Grant</i>	-	-	-	-	-	-	-	-
ISBE and/or SEPI grant: <i>under</i> representation	-0.07	0.00	0.59	0.00	0.06	0.00	-0.42	0.00
ISBE and/or SEPI grant: <i>over</i> representation	-0.57	0.00	0.96	0.00	1.36	0.00	-0.47	0.00

Note. These models predict a demographic-specific disparity index pertaining to participation in CTE Education Pathways and use multinomial regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. Whereas this composite score was an overall score for the “overall” models above, this score is a demographic-specific score for all of these models. The reference category for the Grant categorical predictor is schools who did not receive any grants. The sample sizes for the Black/African American (N = 56), Asian (N = 23) and Multiracial (N = 17) ethnic-group and EL (N = 38) disparity indexes were too small to fit regression models.

- a Sample size: N = 142 schools with sufficient CTE Education Pathways participation data to report for White students.
- b Sample size: N = 92 schools with sufficient CTE Education Pathways participation data to report for Hispanic/Latinx students.
- c Sample size: N = 74 schools with sufficient CTE Education Pathways participation data to report for students with IEPs.
- d Sample size: N = 132 schools with sufficient CTE Education Pathways participation data to report for low-income students.

* p < .05.

Examining the regression coefficients per each disparity index category, per-pupil expenditure negatively predicted the under representation (vs. equitable representation) of Hispanic/Latinx students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .029$). For each unit increase in the per-pupil expenditure, the odds of Hispanic/Latinx students being equitably represented in CTE Education Pathways (vs. underrepresented) increased by 1 times. However, per-pupil expenditure also negatively predicted the over representation (vs. equitable representation) of Hispanic/Latinx students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .043$). Again, though, for each unit increase in the per-pupil expenditure, the odds of Hispanic/Latinx students being equitably represented in CTE Education Pathways (vs. overrepresented) increased by 1 times. Therefore, there was no measurable increase in the equitable representation of Hispanic/Latinx students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditures.

The composite proficiency score for Hispanic/Latinx students positively predicted the under representation (vs. equitable representation) of Hispanic/Latinx students as concentrators in CTE Education Pathways ($b = 0.19$, $p = .048$). For each unit increase in the composite proficiency score, the odds of Hispanic/Latinx students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.205 times (i.e., 20.5% higher odds that Hispanic/Latinx students will be underrepresented vs. equitably represented). However, the composite proficiency score also positively predicted the over representation (vs. equitable representation) of Hispanic/Latinx students as concentrators ($b = 0.17$, $p = .042$). For each unit increase in the composite proficiency score, the odds of Hispanic/Latinx students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.190 (i.e., 19% higher odds that Hispanic/Latinx students will be overrepresented vs. equitably represented).

Building-Level CTE Education Pathways Concentration by Students with IEPs

There were no statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration of students with IEPs. Also, examining the regression coefficients per each disparity index category, there were no statistically significant predictors of CTE Education Pathways concentration of students with IEPs. Pseudo R² values show that between approximately 20% and 38% of the variance was accounted for by the complete set of predictors.

Building-Level CTE Education Pathways Concentration by Low Income Students

Per-pupil expenditure ($p = .012$) and school size ($p = .008$) were both statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration for low-income students. Pseudo R² values show that between approximately 16% and 29% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, per-pupil expenditure negatively predicted the over representation (vs. equitable representation) of low-income students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .026$). For each unit increase in the per-pupil expenditure, the odds of low-income students being equitably represented in CTE Education Pathways (vs. overrepresented) increased by 1 times. Therefore, there was no measurable increase in the equitable representation (vs. over representation) of low-income students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditures.

School size negatively predicted the under representation (vs. equitable representation) of low-income students as concentrators in CTE Education Pathways with marginal statistical significance ($b = -0.00$, $p = .066$). For each unit increase in school size, the odds of low-income students being equitably represented in CTE Education Pathways (vs. underrepresented) increased by 1.001 times (i.e., 0.1% higher odds that low-income students will be equitably represented vs. underrepresented). See Table 16 for a summary of the results of the regression models predicting concentration in CTE Education Pathways.

Table 16. Regression Results Predicting Concentration in CTE Education Pathways (Statewide Analysis)

<i>Predictor</i>	<i>White^a</i>		<i>Hispanic^b</i>		<i>IEP^c</i>		<i>Low Income^d</i>	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
<i>Title I status</i>	-	-	-	-	-	-	-	-
Schoolwide Title I program: <i>under</i> representation	1.53	0.00	-1.33	0.00	-0.43	0.00	-1.36	0.00
Schoolwide Title I program: <i>over</i> representation	0.59	0.00	1.24	0.00	0.25	0.00	0.00	0.00
Targeted Assistance Title I program: <i>under</i> representation	2.61**	0.00	-0.93	0.00	11.95	0.00	-1.60	0.00
Targeted Assistance Title I program: <i>over</i> representation	0.50	0.00	-0.55	0.00	13.15	0.00	0.43	0.00
Per-pupil expenditure: <i>under</i> representation	0.00	0.00	-0.00*	0.00	0.00	0.00	0.00	0.00
Per-pupil expenditure: <i>over</i> representation	0.00^e	0.00	-0.00*	0.00	-0.00	0.00	-0.00*	0.00
School size: <i>under</i> representation	0.00*	0.00	-0.00	0.00	0.00	0.00	-0.00^f	0.00
School size: <i>over</i> representation	0.00*	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
Teacher retention rate: <i>under</i> representation	-0.21	0.02	-0.16	0.03	-0.05	0.03	0.10	0.03
Teacher retention rate: <i>over</i> representation	-0.16	0.02	-0.04	0.03	0.06	0.03	0.12	0.02
Composite proficiency: <i>under</i> representation	0.12*	0.04	0.19*	0.08	0.03	0.04	-0.00	0.06
Composite proficiency: <i>over</i> representation	0.06	0.03	0.17*	0.07	-0.05	0.04	0.01	0.04
Postsecondary enrollment rate: <i>under</i> representation	-0.14**	0.04	-0.04	0.04	-0.00	0.04	0.02	0.06
Postsecondary enrollment rate: <i>over</i> representation	-0.04	0.04	0.03	0.04	0.08	0.04	-0.04	0.03
<i>Grant</i>	-	-	-	-	-	-	-	-
ISBE and/or SEPI grant: <i>under</i> representation	0.37	0.00	-1.06	0.00	0.81	0.00	-1.05	0.00
ISBE and/or SEPI grant: <i>over</i> representation	0.02	0.00	-1.04	0.00	0.47	0.00	0.24	0.00

Note. These models predict a demographic-specific disparity index pertaining to concentration in CTE Education Pathways and use multinomial regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. This score is demographic-specific. The reference category for the Grant categorical predictor is schools who did not receive any grants. The sample sizes for the Black/African American (N = 40), Asian (N = 11) and Multiracial (N = 7) ethnic-group and EL (N = 20) disparity indexes were too small to fit regression models.

- a Sample size: N = 122 schools with sufficient CTE Education Pathways concentration data to report for White students.
- b Sample size: N = 74 schools with sufficient CTE Education Pathways concentration data to report for Hispanic/Latinx students.
- c Sample size: N = 53 schools with sufficient CTE Education Pathways concentration data to report for students with IEPs.
- d Sample size: N = 107 schools with sufficient CTE Education Pathways concentration data to report for low-income students.
- e Marginally statistically significant (p = .057).
- f Marginally statistically significant (p = .066).

* p < .05. ** p < .01.

Statewide Analysis Excluding CPS

Overall participation in CTE Education Pathways does not change when CPS schools were excluded from the statewide analysis. This pattern held when broken down by student race as well as low-income students and students with IEPs; however, for EL students, participation changed from 7% with CPS to 8% without CPS. Nevertheless, CPS schools did not unduly influence education pathways participation (due to the median being less influenced by outliers than the mean, the median proportion is described here but see Table 17 for the mean, minimum, and maximum proportions as well).

Table 17. Number of Schools with Participants in CTE Education Pathways and Proportion of Participants in CTE Education Pathways out of Total Student Enrollment (Statewide Analysis Excluding CPS)

	Number of Schools	Proportion of Participants in CTE Education Pathways ^a			
		Mean	Median	Minimum	Maximum
Overall	154	0.08	0.06	0.00	0.43
White students	142	0.09	0.06	0.01	0.43
Black/African American students	55	0.12	0.09	0.02	0.52
Hispanic/Latinx students	88	0.09	0.07	0.01	0.40
Asian students	23	0.08	0.05	0.01	0.32
Multiracial students	18	0.22	0.17	0.07	0.52
Students with IEPs	74	0.10	0.07	0.03	0.45
English Learner (EL) students	35	0.12	0.08	0.03	0.50
Low-income students	127	0.11	0.08	0.01	0.47

a Overall proportion computed as the total number of participants in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific participants in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

Also, overall concentration in CTE Education Pathways does not change when CPS schools were excluded from the statewide analysis. This pattern held when broken down by all student demographics reported here. Therefore, CPS schools did not unduly influence concentration in CTE Education Pathways (see Table 18).

When a statewide analysis of the disparity indexes of CTE Education Pathways participants was conducted without CPS, the same over-, under-, and equitable-representation patterns held as with the statewide analysis that previously included CPS (see Figure 3 under the Statewide Analysis section). Similarly, when a statewide analysis of the disparity indexes of CTE Education Pathways concentrators was conducted without CPS, the same representation patterns held as with the statewide analysis that previously included CPS (see Figure 4 under the Statewide Analysis section). Therefore, CTE Education Pathways participation within various student subgroups across the state was not unduly influenced by CPS schools.

As before, to determine which variables might predict the proportion of participants and concentrators in CTE Education Pathways, the following predictors were included in the subsequent regression models: Title I status; per-pupil expenditure; school size; teacher retention rate; composite proficiency score for ELA, math, and science; postsecondary enrollment rate; and ISBE and/or SEPI grant status. None of these variables were statistically significant ($p < .05$) predictors of students' overall building-level participation or concentration in CTE Education Pathways (Table 19). There were no school-level factors associated with the proportion of students participating or concentrating in CTE Education Pathways when CPS schools were excluded.

Table 18. Number of Schools with Concentrators in CTE Education Pathways and Proportion of Concentrators in CTE Education Pathways out of Total Student Enrollment (Statewide Analysis Excluding CPS)

	Proportion of Concentrators in CTE Education Pathways^a				
	Number of Schools	Mean	Median	Minimum	Maximum
Overall	137	0.06	0.05	0.00	0.29
White students	122	0.06	0.05	0.01	0.29
Black/African American students	38	0.08	0.07	0.01	0.24
Hispanic/Latinx students	70	0.05	0.05	0.02	0.14
Asian students	11	0.03	0.03	0.01	0.08
Multiracial students	7	0.13	0.09	0.08	0.26
Students with IEPs	53	0.06	0.05	0.02	0.18
English Learner (EL) students	17	0.05	0.04	0.02	0.13
Low-income students	102	0.07	0.06	0.01	0.34

a Overall proportion computed as the total number of concentrators in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific concentrators in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

Table 19. Regression Results Predicting Overall Participation and Concentration in CTE Education Pathways (Statewide Analysis Excluding CPS)

Predictor	Overall Participation^a		Overall Concentration^b	
	b	SE	b	SE
<i>Title I status</i>	-	-	-	-
Schoolwide Title I program	0.05	0.83	-0.14	1.07
Targeted assistance Title I program	-0.24	0.99	-0.23	1.19
Per-pupil expenditure	-0.00	0.00	-0.00	0.00
School size	-0.00	0.00	-0.00	0.00
Teacher retention rate	0.01	0.08	0.04	0.12
Composite proficiency score	-0.01	0.05	-0.00	0.06
Postsecondary enrollment rate	-0.01	0.05	-0.01	0.06
<i>Grant</i>	-	-	-	-
ISBE and/or SEPI grant	-0.47	0.62	0.02	0.79

Note. These “overall” models are predicting the proportion of participants and concentrators in CTE Education Pathways using binary logistic regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. The reference category for the Grant categorical predictor is schools who did not receive any grants.

- a Sample size: N = 154 schools with sufficient CTE Education Pathways participation data to report.
- b Sample size: N = 137 schools with sufficient CTE Education Pathways concentration data to report.

Building-Level CTE Education Pathways Participation by White Students

When CPS schools were excluded, Title I status ($p = .011$) and postsecondary enrollment rate ($p = .027$) were both statistically significant predictors of the disparity index for the building-level CTE Education Pathways participation for White students. Also, the composite proficiency score for White students was a marginally statistically significant predictor ($p = .066$). Pseudo R2 values show that between approximately 9% and 19% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, the Targeted Assistance Title I program negatively predicted the over representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = -1.42$, $p = .036$). Compared to eligible schools, the odds that schools with a Targeted Assistance Title I program will have an equitable representation (vs. over representation) of White students in CTE Education Pathways were 4.132 times higher (i.e., over 400% higher odds that White students will be equitably represented vs. overrepresented).

The composite proficiency score for White students was a positive predictor of the under representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = 0.07$, $p = .025$). For each unit increase in the composite proficiency score, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.072 times (i.e., 7.2% higher odds that White students will be underrepresented vs. equitably represented).

Finally, postsecondary enrollment rate was a negative predictor of the under representation (vs. equitable representation) of White students as participants in CTE Education Pathways ($b = -0.08$, $p = .011$). For each unit increase in postsecondary enrollment rate, the odds of White students being equitably represented in CTE Education Pathways (vs. underrepresented) increased by 1.081 times (i.e., 8.1% higher odds that White students will be equitably represented vs. underrepresented).

Building-Level CTE Education Pathways Participation by Hispanic/Latinx Students

With the exclusion of CPS, there were no statistically significant predictors of the disparity index for the building-level CTE Education Pathways participation for Hispanic/Latinx students. Pseudo R2 values show that between approximately 13% and 27% of the variance was accounted for by the complete set of predictors.

However, examining the regression coefficients per each disparity index category, per-pupil expenditure positively predicted the over representation (vs. equitable representation) of Hispanic/Latinx students as participants in CTE Education Pathways ($b = 0.00$, $p = .042$). For each unit increase in per-pupil expenditure, the odds of Hispanic/Latinx students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1 times. Thus, there was no measurable increase in the over representation (vs. equitable representation) of Hispanic/Latinx students as participants in CTE Education Pathways due to an increase in per-pupil expenditures.

ISBE and/or SEPI grant was a marginally statistically significant, positive predictor of the over representation (vs. equitable representation) of Hispanic/Latinx students as participants in CTE Education Pathways ($b = 1.20$, $p = .076$). Compared to schools that received no grant, the odds that schools that received an ISBE and/or SEPI grant for education pathways will have an over representation (vs. equitable representation) of Hispanic/Latinx students in CTE Education Pathways were 3.323 times higher (i.e., over 300% higher odds that Hispanic/Latinx students will be overrepresented vs. equitably represented).

Building-Level CTE Education Pathways Participation by Students with IEPs

With CPS removed, Title I status ($p = .010$) was a statistically significant predictor of the disparity index for the building-level CTE Education Pathways participation for students with IEPs. Also, school size ($p = .051$) and grant status ($p = .072$) were marginally statistically significant predictors. However, examining the regression coefficients per each disparity index category, there were no statistically significant predictors of CTE Education Pathways participation of students with IEPs. Pseudo R2 values show that between approximately 18% and 34% of the variance was accounted for by the complete set of predictors.

Building-Level CTE Education Pathways Participation by Low Income Students

With CPS removed, building-level per-pupil expenditures ($p = .067$) was a marginally statistically significant predictor of the disparity index for the building-level CTE Education Pathways participation for low-income

students. However, examining the regression coefficients per each disparity index category, there were no statistically significant predictors of CTE Education Pathways participation of low-income students. Pseudo R2 values show that between approximately 8% and 16% of the variance was accounted for by the complete set of predictors. See Table 20 for a summary of the regression models predicting participation in CTE Education Pathways when CPS schools were excluded.

Building-Level CTE Education Pathways Concentration by White Students

When CPS schools were excluded, Title I status ($p = .038$), school size ($p = .018$), composite proficiency score for White students ($p = .025$), and postsecondary enrollment rate ($p = .007$) were all statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration for White students. Pseudo R2 values show that between approximately 23% and 43% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, the Targeted Assistance Title I program positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 2.61$, $p = .006$). Compared to schools eligible for but not a participant in Title I, the odds that schools with a Targeted Assistance Title I program will have an under representation of White students in CTE Education Pathways (vs. equitable representation) were 13.657 times higher (i.e., over 1300% higher odds that White students will be underrepresented vs. equitably represented).

Per-pupil expenditure was a marginally statistically significant positive predictor of the over representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .056$). For each unit increase in per-pupil expenditures, the odds of White students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1 times. Therefore, there was no measurable increase in the over representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditures.

School size positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .031$). For each unit increase in school size, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.001 times (i.e., 0.1% higher odds that White students will be underrepresented vs. equitably represented). However, school size also positively predicted the over representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.00$, $p = .010$). For each unit increase in school size, the odds of White students being overrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.001 times (i.e., 0.1% higher odds that White students will be overrepresented vs. equitably represented).

The composite proficiency score for White students positively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = 0.12$, $p = .011$). For each unit increase in the composite proficiency score, the odds of White students being underrepresented in CTE Education Pathways (vs. equitably represented) increased by 1.123 times (i.e., 12.3% higher odds that White students will be underrepresented vs. equitably represented).

Finally, postsecondary enrollment rate negatively predicted the under representation (vs. equitable representation) of White students as concentrators in CTE Education Pathways ($b = -0.14$, $p = .005$). For each unit increase in postsecondary enrollment rate, the odds of White students being equitably represented in CTE Education Pathways (vs. underrepresented) increased by 1.145 times (i.e., 14.5% higher odds that White students will be equitably represented vs. underrepresented).

Building-Level CTE Education Pathways Concentration by Hispanic/Latinx Students

With the exclusion of CPS, per-pupil expenditure ($p = .041$) was a statistically significant predictor of the disparity index for the building-level CTE Education Pathways concentration for Hispanic/Latinx students. Pseudo R2 values show that between approximately 20% and 39% of the variance was accounted for by the complete set of predictors.

Examining the regression coefficients per each disparity index category, per-pupil expenditure negatively predicted the under representation (vs. equitable representation) of Hispanic/Latinx students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .029$). For each unit increase in per-pupil expenditures, the odds of Hispanic/Latinx students being equitably represented in CTE Education Pathways (vs. underrepresented)

Table 20. Regression Results Predicting Participation in CTE Education Pathways (Statewide Analysis Excluding CPS)

Predictor	White ^a		Hispanic ^b		IEP ^c		Low Income ^d	
	b	SE	b	SE	b	SE	b	SE
<i>Title I status</i>	-	-	-	-	-	-	-	-
Schoolwide Title I program: <i>under</i> representation	0.37	0.00	-1.52	0.00	-0.15	0.00	-0.34	0.00
Schoolwide Title I program: <i>over</i> representation	-0.88	0.00	-1.30	0.00	1.00	0.00	0.06	0.00
Targeted Assistance Title I program: <i>under</i> representation	1.03	0.00	-1.40	0.00	8.73	0.00	0.58	0.00
Targeted Assistance Title I program: <i>over</i> representation	-1.42*	0.00	-1.09	0.00	11.00	0.00	1.64	0.00
Per-pupil expenditure: <i>under</i> representation	0.00	0.00	0.00	0.00	-0.00	0.00	0.00	0.00
Per-pupil expenditure: <i>over</i> representation	0.00	0.00	0.00*	0.00	0.00	0.00	-0.00	0.00
School size: <i>under</i> representation	-0.00	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00
School size: <i>over</i> representation	0.00	0.00	0.00	0.00	-0.00	0.00	-0.00	0.00
Teacher retention rate: <i>under</i> representation	-0.01	0.01	-0.00	0.02	-0.10	0.02	0.00	0.02
Teacher retention rate: <i>over</i> representation	0.02	0.01	0.05	0.02	-0.02	0.03	0.07	0.02
Composite proficiency: <i>under</i> representation	0.07*	0.03	-0.02	0.05	-0.12	0.04	0.03	0.05
Composite proficiency: <i>over</i> representation	0.03	0.03	0.05	0.04	-0.13	0.03	-0.03	0.04
Postsecondary enrollment rate: <i>under</i> representation	-0.08*	0.03	0.02	0.03	0.06	0.03	0.01	0.04
Postsecondary enrollment rate: <i>over</i> representation	-0.04	0.03	-0.00	0.03	0.11	0.04	0.02	0.03
<i>Grant</i>	-	-	-	-	-	-	-	-
ISBE and/or SEPI grant: <i>under</i> representation	-0.07	0.00	0.88	0.00	-0.14	0.00	-0.32	0.00
ISBE and/or SEPI grant: <i>over</i> representation	-0.57	0.00	1.20*	0.00	1.32	0.00	-0.38	0.00

Note. These models predict a demographic-specific disparity index pertaining to participation in CTE Education Pathways and use multinomial regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. This score is demographic-specific. The reference category for the Grant categorical predictor is schools who did not receive grants. The sample sizes for the Black/African American (N = 54), Asian (N = 23) and Multiracial (N = 17) ethnic-group and EL (N = 35) disparity indexes were too small to fit regression models.

- a Sample size: N = 142 schools with sufficient CTE Education Pathways concentration data to report for White students.
- b Sample size: N = 88 schools with sufficient CTE Education Pathways concentration data to report for Hispanic/Latinx students.
- c Sample size: N = 72 schools with sufficient CTE Education Pathways concentration data to report for students with IEPs.
- d Sample size: N = 127 schools with sufficient CTE Education Pathways concentration data to report for low-income students.
- e Marginally statistically significant (p = .076)

* p < .05.

increased by 1 times. However, per-pupil expenditure also negatively predicted the over representation (vs. equitable representation) of Hispanic/Latinx students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .038$). For each unit increase in per-pupil expenditures, the odds of Hispanic/Latinx students being equitably represented in CTE Education Pathways (vs. overrepresented) increased by 1 times. Hence, there was no measurable increase in the equitable representation of Hispanic/Latinx students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditures.

Building-Level CTE Education Pathways Concentration by Students with IEPs

With CPS removed, there were no statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration for students with IEPs. Also, examining the regression coefficients per each disparity index category, there were no statistically significant predictors. Pseudo R2 values show that between approximately 20% and 38% of the variance was accounted for by the complete set of predictors.

Building-Level CTE Education Pathways Concentration by Low Income Students

With CPS removed, per-pupil expenditure ($p = .012$) and school size ($p = .005$) were both statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration for low-income students. Pseudo R2 values show that between approximately 18% and 31% of the variance was accounted for by the complete set of predictors. Examining the regression coefficients per each disparity index category, per-pupil expenditure negatively predicted the over representation (vs. equitable representation) of low-income students as concentrators in CTE Education Pathways ($b = -0.00$, $p = .030$). For each unit increase in per-pupil expenditures, the odds of low-income students being equitably represented in CTE Education Pathways (vs. overrepresented) increased by 1 times. Hence, there was no measurable increase in the equitable representation (vs. over representation) of low-income students as concentrators in CTE Education Pathways due to an increase in per-pupil expenditures. See Table 21 for a summary of the regression models predicting concentration in CTE Education Pathways when CPS schools were excluded.

Table 21. Regression Results Predicting Concentration in CTE Education Pathways (Statewide Analysis Excluding CPS)

Predictor	White ^a		Hispanic ^b		IEP ^c		Low Income ^d	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
<i>Title I status</i>	-	-	-	-	-	-	-	-
Schoolwide Title I program: <i>under</i> representation	1.53	0.00	-1.25	0.00	-0.43	0.00	-1.29	0.00
Schoolwide Title I program: <i>over</i> representation	0.59	0.00	1.30	0.00	0.25	0.00	0.09	0.00
Targeted Assistance Title I program: <i>under</i> representation	2.61**	0.00	-0.79	0.00	11.95	0.00	-1.62	0.00
Targeted Assistance Title I program: <i>over</i> representation	0.50	0.00	-0.41	0.00	13.15	0.00	0.40	0.00
Per-pupil expenditure: <i>under</i> representation	0.00	0.00	-0.00*	0.00	0.00	0.00	0.00	0.00
Per-pupil expenditure: <i>over</i> representation	0.00*	0.00	-0.00*	0.00	-0.00	0.00	-0.00*	0.00
School size: <i>under</i> representation	0.00*	0.00	-0.00	0.00	0.00	0.00	-0.00	0.00
School size: <i>over</i> representation	0.00*	0.00	-0.00	0.00	0.00	0.00	0.00	0.00
Teacher retention rate: <i>under</i> representation	-0.21	0.02	-0.09	0.03	-0.05	0.03	0.11	0.03
Teacher retention rate: <i>over</i> representation	-0.16	0.02	0.03	0.03	0.06	0.03	0.14	0.02
Composite proficiency: <i>under</i> representation	0.12*	0.04	0.14	0.03	0.03	0.04	-0.01	0.07
Composite proficiency: <i>over</i> representation	0.06	0.03	0.12	0.03	-0.05	0.04	0.01	0.05
Postsecondary enrollment rate: <i>under</i> representation	-0.14**	0.04	-0.03	0.03	-0.00	0.04	0.01	0.06
Postsecondary enrollment rate: <i>over</i> representation	-0.04	0.04	0.04	0.03	0.08	0.04	-0.05	0.04
<i>Grant</i>	-	-	-	-	-	-	-	-
ISBE and/or SEPI grant: <i>under</i> representation	0.37	0.00	-0.95	0.00	0.81	0.00	-0.81	0.00
ISBE and/or SEPI grant: <i>over</i> representation	0.02	0.00	-0.97	0.00	0.47	0.00	0.46	0.00

Note. These models predict a demographic-specific disparity index pertaining to concentration in CTE Education Pathways and use multinomial regression. The reference category for the Title I status categorical predictor is schools eligible for but not a participant in the Title I program. Per-pupil expenditure is the building-level total of per-pupil expenditures. Composite proficiency score is the combined average of ELA, math, and science proficiency scores. This score is demographic-specific. The reference category for the Grant categorical predictor is schools who did not receive grants. The sample sizes for the Black/African American (N = 38), Asian (N = 11) and Multiracial (N = 7) ethnic-group and EL (N = 17) disparity indexes were too small to fit regression models.

- a Sample size: N = 122 schools with sufficient CTE Education Pathways concentration data to report for White students.
- b Sample size: N = 70 schools with sufficient CTE Education Pathways concentration data to report for Hispanic/Latinx students.
- c Sample size: N = 53 schools with sufficient CTE Education Pathways concentration data to report for students with IEPs.
- d Sample size: N = 102 schools with sufficient CTE Education Pathways concentration data to report for low-income students.
- e Marginally statistically significant (p = .057).

* p < .05. ** p < .01.

CPS Analysis

Within CPS, overall approximately 5% of students in schools with CTE Education Pathways became participants in Education Pathways. With respect to student demographics, approximately 5% of Black/African American and 4% of Hispanic/Latinx students participated. Also, 6% of students with IEPs, 5% of low-income students, and 4% of EL students participated (due to the median being less influenced by outliers than the mean, the median proportion is described here but see Table 22 for the mean, minimum, and maximum proportions as well).

Table 22. *Number of Schools with Participants and Proportion of Participants in CTE Education Pathways (CPS Analysis)*

	Proportion of Participants in CTE Education Pathways^a				
	Number of Schools	Mean	Median	Minimum	Maximum
Overall	5	0.05	0.05	0.01	0.13
White students	0	-	-	-	-
Black/African American students	2	0.05	0.05	0.05	0.05
Hispanic/Latinx students	4	0.06	0.04	0.01	0.13
Asian students	0	-	-	-	-
Multiracial students	0	-	-	-	-
Students with IEPs	2	0.06	0.06	0.04	0.08
English Learner (EL) students	3	0.06	0.04	0.02	0.12
Low-income students	5	0.06	0.05	0.01	0.13

a Overall proportion computed as the total number of participants in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific participants in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

Within CPS, overall approximately 4% of students in schools with CTE Education Pathways concentrated in Education Pathways. With respect to student demographics, approximately 4% of Black/African American and 3% of Hispanic/Latinx students concentrated. Also, 4% of low income and 3% of EL students concentrated (see Table 23).

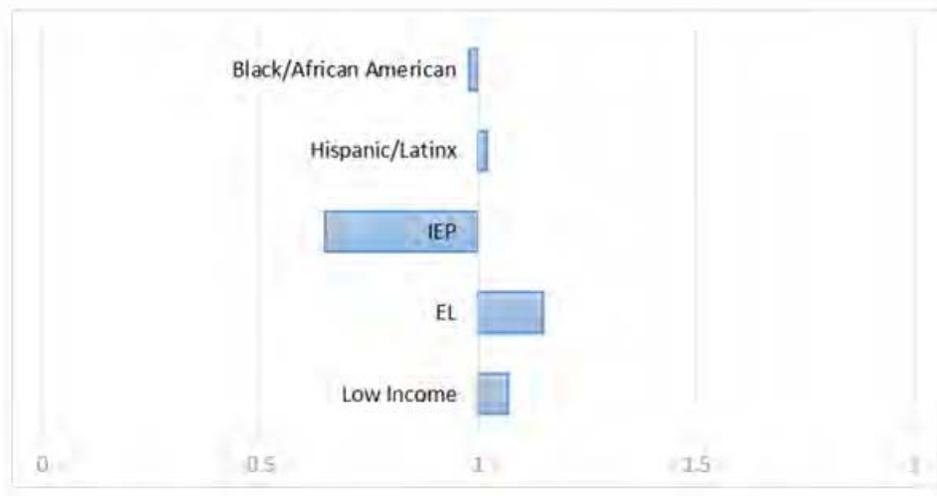
Table 23. Number of Schools with Concentrators and Proportion of Concentrators in CTE Education Pathways (CPS Analysis)

	Proportion of Concentrators in CTE Education Pathways^a				
	Number of Schools	Mean	Median	Minimum	Maximum
Overall	5	0.05	0.04	0.01	0.11
White students	0	-	-	-	-
Black/African American students	2	0.04	0.04	0.04	0.05
Hispanic/Latinx students	4	0.05	0.03	0.01	0.11
Asian students	0	-	-	-	-
Multiracial students	0	-	-	-	-
Students with IEPs	0	-	-	-	-
English Learner (EL) students	3	0.04	0.03	0.02	0.07
Low-income students	5	0.05	0.04	0.01	0.11

a Overall proportion computed as the total number of concentrators in CTE Education Pathways divided by the total number of students enrolled per high school that offers CTE Education Pathways. Proportions for demographic groups computed as the number of demographic-specific concentrators in CTE Education Pathways divided by the total number of demographic-specific students enrolled per high school that offers CTE Education Pathways.

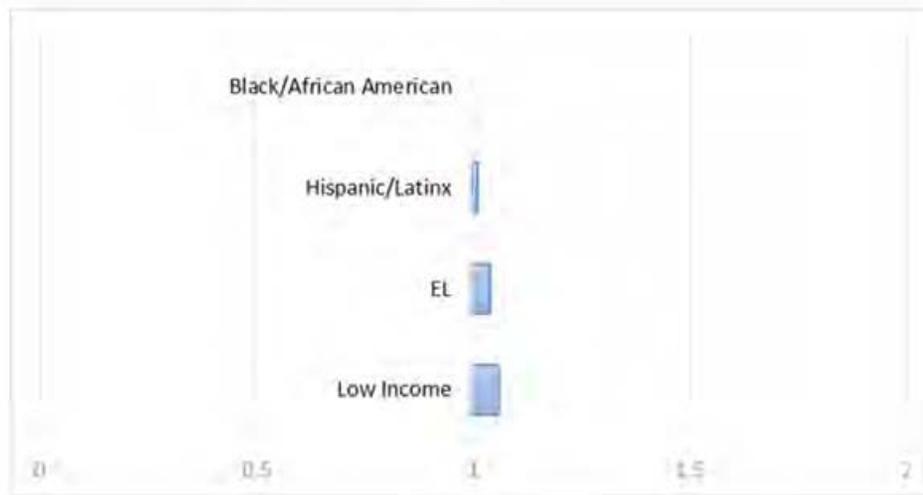
For CPS, Black/African American (DI = 0.98), Hispanic/Latinx (DI = 1.02), and low income (DI = 1.07) students were relatively equitably represented as CTE Education Pathways participants (see Figure 7). Students with IEPs (DI = 0.65) were underrepresented. Although the disparity index indicates slight overrepresentation for EL students (DI = 1.15), EL students were actually underrepresented in two schools and overrepresented in only one school, but the overrepresentation was more substantial than the underrepresentation. There were no data available for White, Asian, and Multiracial students.

Figure 7. Mean Disparity Indexes of CTE Education Pathways Participation (CPS Analysis)



The patterns for concentrators within CPS appear to be near parity for all groups where there was sufficient data reported: Black/African American (DI = 1), Hispanic/Latinx (DI = 1.01), EL (DI = 1.04) and low income (DI = 1.06) students (see Figure 8). Students with IEPs who were underrepresented as CTE Education Pathways participants typically do not reach the point of becoming concentrators. This is evidenced by there being no concentrator data reported for students with IEPs.

Figure 8. Mean Disparity Indexes of CTE Education Pathways Concentration (CPS Analysis)



Qualitative Evaluation Methodology

A small qualitative pilot study was conducted which included four interviews from two groups of interviewees; high school administrators and employees at four-year public colleges. Interviews were conducted one on one with participants via Zoom and took about 30 minutes to complete. Institutional Review Board approval was obtained for the qualitative pilot study. Two high school administrators from diverse suburbs in the Chicagoland area participated, one admissions counselor from a centrally located large 4-year university participated, and one college of education department chair from the southern part of the state participated. The small qualitative pilot study was designed to address the following questions:

1. What can we learn about the implementation of Early Pathways programs?
2. What can we learn about postsecondary efforts related to Early Pathway programs?

Some information shared by the participants was unique and context specific, however, several cross-cutting themes emerged across interviews, which are summarized below.

Qualitative Pilot Study Findings

Coherence in Instruction

Typically at the high school level, students who choose to participate in an education pathway take a set sequence of courses, usually starting in freshman or sophomore year. In addition, there was a consistent theme that hands-on, or clinical type experiences were an important part of the program. By senior year, students had interactions with younger children within their home district in a teaching type of situation by job-shadowing or observing. In all instances high school education pathways participants' clinical requirements were conducted with either pre-school or primary grade students. One high school administrator shared that the high school has an onsite preschool, so the pathways students are able to go to the preschool for their clinical observation hours. Required clinical observation hours varied by program with administrators and the college admissions counselor indicating that in most cases, the clinical component is between three and seven hours.

An issue raised by all participants was regarding the curriculum used at the high school level. In most cases schools and districts are developing and implementing their own teacher-created curriculum. However, the college admissions counselor noted that the Educators Rising website and corresponding curriculum provides a coherent structure for schools to follow if they choose to use it. The high school administrators who were interviewed both indicated that there was no contact with their “feeder” middle schools regarding education pathways; students self-identify pathway interest once they are in high school.

One common complaint between the high school administrators was related to state graduation requirements and the lack of flexibility allowed for non-traditional schooling experiences such as education pathways. By participating in a pathway, students are giving up some other curricular experience.

When the issue of dual-credit with local community colleges was raised, both high school administrators stated that there was one opportunity for a dual-credit course in senior year. Neither high school had opportunities for endorsement or certifications within education pathways.

Student Participants

Both high school administrators indicated that their education pathway programs focus on early childhood or elementary education. While located in the suburban Chicagoland region, both high schools are majority minority schools with over 80% and over 60% Hispanic students in both schools. Both administrators stated that education pathways participants are disproportionately Hispanic and female compared to the total school population. At the four-year university level, neither the college admissions counselor or department chair knew specifically what the racial breakdown of declared education majors were in their schools, but both stated confidently that the students were overwhelmingly female as in both cases their colleges of education housed elementary, special, and middle school education programs whereas other colleges within the university structure housed the secondary education programs.

Long-range Tracking

An issue raised by all participants was that of long-range tracking of students who participate in education pathways. For example, both high school administrators indicated that once students graduate, they have no way of knowing if they continued within the field of education either in community college or at a four-year university. One high school administrator indicated that they have a signing event similar to signing events held for athletes, where pathways students commit to going to college to become educators. The college admissions counselor and the college of education department chair echoed frustration with lack of long-range tracking for pathways students. They stated that even though they attend recruiting events at high schools, and they know of some high schools that have education pathways, there is no way to know which students were part of an education pathway in high school once they get to the university. If the student came to the university from a community college, while they might qualify for a 2+2 type of situation, the four-year university still has no way of knowing if the student was part of an education pathway program in high school. Universally, all participants indicated that there should be better long-range tracking of such students and stronger vertical articulation amongst high schools, community colleges, four-year universities, and ultimately the ELIS system to know if education pathways are producing more or better trained educators.

Summary of Findings Together

In exploring the first evaluation question, we conducted a quantitative pilot study to determine the school characteristics associated with schools offering CTE Education Pathways. We found that, as total school enrollment increases, schools are more likely to offer education in CTE Education Pathways. Also, as the proportions of White students in schools increase, schools are less likely to have ISBE and/or SEPI grant funding of their CTE Education Pathways.

In exploring the second evaluation question, we sought to determine how the patterns in CTE Education Pathways participation and concentration differed based on school characteristics. In doing so, building-level student participation and concentration in CTE Education Pathways were examined with respect to a variety of school-characteristics and student demographics. To gain greater insight into this, we also conducted a qualitative pilot study to learn about the implementation of Early Pathways programs and postsecondary efforts related to Early Pathway programs.

Due to sample size limitations from the quantitative pilot study, only the following student demographic groups could be considered: White students, Hispanic/Latino students, students with IEPs, and low-income

students. There were not enough schools in the IL Report Card who had an adequate amount of Black/African American, Asian, Multiracial, or EL students participating or concentrating in CTE Education Pathways where these students' data were reported. The discussion below focuses on the findings of interest from both the quantitative and qualitative pilot studies.

White Students

As the schools' composite proficiency scores in ELA, math, and science for White students increased, White students were more likely to be underrepresented as both participants and concentrators in CTE Education Pathways. This may be unsurprising given that our qualitative findings indicated that students' hands-on or clinical experiences within the education pathways curriculum tends to be conducted with either pre-school or primary grade students. Students with both greater proficiency in a subject area and interest in becoming an educator may seek a career as a secondary teacher, which the current education pathways clinical experiences do not seem to promote according to our qualitative pilot study findings. Moreover, a relevant concern was brought up by the participants in our qualitative study: when students participate in the education pathway, they are unable to have other educational experiences such as more advanced coursework in the subject area in which they are more proficient.

Also, as the schools' postsecondary enrollment rates increased, White students were more likely to be equitably represented in CTE Education Pathways as both participants and concentrators. This may be associated with the extent to which students are offered dual credit for their education pathways coursework. Unfortunately, our qualitative findings suggest that students only have the opportunity to earn dual credit for one course in their senior year with no opportunities to earn endorsements or certifications. Of note, our quantitative findings stayed the same (i.e., identical regression coefficients, significance values, etc.) when CPS schools were excluded because the sample of schools with adequate data to report for White students did not change. This was not always the case for Hispanic/Latinx students, students with IEPs, or low-income students.

Hispanic/Latinx Students

The student body of the two high schools included in the qualitative pilot study consisted of a majority of Hispanic/Latinx students, with the education pathways participants being disproportionately Hispanic/Latinx compared to the schools' total populations. However, our quantitative pilot study found that, for Hispanic/Latinx students, there were no meaningfully statistically significant predictors of the disparity index for Hispanic/Latinx students' building-level CTE Education Pathways participation. Of note, when CPS schools were excluded, schools that were awarded ISBE and/or SEPI grants were more likely to have Hispanic/Latinx students overrepresented in CTE Education Pathways as participants compared to schools that were not awarded one or both of these grants. Interestingly, grant funding was not a cross-cutting theme that emerged from the qualitative pilot study.

In comparison, when concentration in CTE Education Pathways was examined for Hispanic/Latinx students, increases in schools' composite proficiency scores in ELA, math, and science scores for Hispanic/Latinx students were associated with Hispanic/Latinx students being more likely to be underrepresented as concentrators in CTE Education Pathways in such schools. However, increases in these composite proficiency scores were also associated with Hispanic/Latinx students being more likely to be overrepresented in CTE Education Pathways. Nevertheless, when CPS schools were excluded, there were no meaningfully statistically significant predictors of the disparity index for the building-level CTE Education Pathways concentration of Hispanic/Latinx students. Also, it may be of concern that, at the four-year university level, the participants from our qualitative study did not know the racial breakdown of the elementary education majors which were housed in their college, much less the breakdown of secondary education majors which were housed in other colleges across the university.

Students with IEPs and Low-Income Students

Although we see evidence that students with IEPs were represented around parity, we did not find any school factors which were associated with higher or lower levels of representation in CTE Education Pathways participation or concentration. For low-income students, the overrepresentation that we found in participation and concentration also did not appear to be associated with any of the school-level factors that we explored. These findings held, both when CPS schools were included in and excluded from the analyses. Moreover, our qualitative pilot study did not shed light on the education pathways participation of students with IEPs or low-income students.

Pilot Study Recommendations/Themes/Implications

Recommendation 1

We found that schools with greater total enrollment were more likely to offer courses within CTE Education Pathways. This may be unsurprising given that schools with more students are usually better able to offer a greater number and variety of classes. Greater student enrollments in the schools likely mean greater student interest in engaging with CTE Education Pathways. However, rural school districts typically experience more difficulties with recruiting and retaining a quality teaching force (e.g., Goldhaber et al., 2020; Moeller et al., 2016; Shah et al., 2018). Therefore, despite the small size of many rural schools, it is important to recruit students from rural schools into the teaching profession starting through early pathways, such as CTE Education Pathways. Colleges and universities have begun to resolve the problems presented by small class sizes in rural schools for Advanced Placement (AP) and dual credit offerings. For instance, AP and dual-credit courses may be offered online at rural schools or over the summer in rural communities to reach more rural students and help these students begin experiencing college-level coursework and building a college transcript (Gagnon & Mattingly, 2016; Harris & Stovall, 2013). Although rural households often have limited internet access, rural schools typically have adequate internet, and students can be given time in their normal school schedules to take these online courses (Harris & Stovall, 2013). Future research should be conducted to determine whether online or summer course offerings for CTE Education Pathways are not only possible but also practical and effective for recruiting rural students into the education profession.

Recommendation 2

More notably, we found that schools that had greater proportions of White students were less likely to have received ISBE and/or SEPI grants to fund their CTE Education Pathways. Schools that were recipients of ISBE and/or SEPI grants were more likely to have an over representation of Hispanic/Latinx students as participants in CTE Education Pathways (i.e., students who took at least one course in the Pathway) compared to schools that were not grant recipients. Therefore, it appears that the grants may increase the representation of a traditionally marginalized group in early education pathways, which may be one hurdle to achieving a more diverse and representative cadre of qualified teachers. Despite this possible success, the current implementation and use of the ISBE and SEPI grants did not increase the representation of Hispanic/Latinx students as concentrators in CTE Education Pathways (i.e., students who took two or more courses in the pathway). Moreover, this school characteristic did not improve the representation of Hispanic/Latinx students when CPS schools were included in the analysis. Thus, future research should explore why grant programs may be differentially effective depending on students' levels of engagement and the locale of the school. Additionally, the teacher pipeline begins with students' first exposures to the profession in their K-12 academic careers, yet research on the teacher pipeline typically focuses on pre- and in-service teachers with little research on early exposure teacher pipeline programs in general as well as for minority high school students (Irizarry & Donaldson, 2012; Lac, 2019, 2021). Therefore, more research should examine the outcomes associated with grant-supported early pathways into the education profession, particularly in terms of the effect on the minority representation gaps within the education profession and the current teacher shortage.

Recommendation 3

One of the high school administrators interviewed in our qualitative study stated that one of the schools more successful pathways was the medical professions pathway because students within that pathway were able to become Certified Nursing Assistants upon pathway completion. A suggested improvement is to provide guidance on how schools can implement a similar certification process for students who complete an education pathway in high school. For example, two of the ways of obtaining a paraprofessional endorsement in the state of Illinois include: High School Diploma or GED and a score of 460 or higher on the [ETS Parapro](#) test OR High School Diploma or GED and the following scores on the [ACT Workkeys](#): Applied Mathematics/Applied Math (with a score of 4) and Reading for information/Workplace Documents (with a score of 4). While there are some schools currently offering credentials related to early childhood, this could be expanded upon for other high need areas. It stands to reason that education pathways programs housed within high schools could embed the ETS Paraprofessional test within their curriculum. This would allow students to work as paraprofessionals shortly after graduation or after reaching age 19.

Recommendation 4

Schools with education pathways could allow for some sort of flag or indicator on students' high school diplomas that denotes successful completion of an education pathway program. This would allow for community colleges and four-year universities to be able to better track which education majors were part of a pathway

in high school, which has longer-term implications for recruitment of future educators. While there is a College and Career Pathway Endorsement flag, there are possible scenarios where students may complete the CTE Ed Pathway course sequence but do not complete all criteria for earning the CCPE - Education flag.

Recommendation 5

Schools could also allow for more seamless vertical integration and access to longer-range outcomes for their high school graduates. Education pathways are not the only type of pathway offered in high schools. It is important for high schools, especially publicly-funded high schools, to know which programs best prepare students for college and career success so that those programs can receive adequate funding. Conversely, if a program is not producing successful college and career outcomes for students, a school has a fiduciary responsibility to know that and change the program accordingly.

Pilot Study Brief Summary Conclusion

All participants in our qualitative pilot study mentioned issues with long-range tracking of students who participate in education pathways. There is no way to track whether high school education pathways participants continue to take education courses and/or become education majors at the community college or four-year university level. Similarly, our quantitative pilot study was limited in that we were only able to examine building-level education pathways data at the high-school level. Due to data system limitations and data inaccessibility, we were unable to perform longitudinal analyses by leveraging and connecting student-level high school data, community college and four-year postsecondary data, and workplace data. These limitations ultimately constrain the conclusions that can be drawn and recommendations that can be made from this pilot study. Nevertheless, evidence suggests that some of the current efforts made in the context of early education pathways such as the ISBE and SEPI grants are increasing the diversity of students entering the teacher workforce.

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