FLORIDA INTERNATIONAL UNIVERSITY

Miami, Florida

WHAT ARE THE EFFECTS OF EARLY ALERTS AND INTERVENTION SYSTEMS

ON STUDENTS' GRADUATION RATES IN POSTSECONDARY EDUCATION?

A dissertation submitted in partial fulfillment of

the requirements for the degree of

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by

Pedro Alejandro Santos Acosta

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To: Dean William G. Hardin
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This dissertation, written by Pedro Alejandro Santos Acosta, entitled What are the Effects of Early Alerts and Intervention Systems on Students' Graduation Rates in Postsecondary Education? Having been approved in respect to style and intellectual content, is referred to you for judgment.

We have read this dissertation and recommend that it be approved.

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Pedro Alejandro Santos Acosta's dissertation has been approved.

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Senior Vice President for Research and Economic Development
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Florida International University, 2024

DEDICATION

This work is dedicated to my family, with special gratitude to my wife, daughters, mother, father, friends, and colleagues. The successful completion of this dissertation is a collective effort, and I sincerely appreciate the support, guidance, and patience extended by each of you during this period. Throughout the three years dedicated to this endeavor, there were numerous moments of reflection on the potential outcomes, and today, we can proudly acknowledge that we have accomplished our goal together.

I express my heartfelt thanks to my wife for her insightful encouragement in pursuing this Doctorate and for maintaining the equilibrium in our household, which allowed me to focus on both the dissertation and my professional responsibilities.

To my daughters, I am grateful for your understanding and for affording me the time required to dedicate myself to reading, learning, studying, and writing during this period. My appreciation extends to my parents for their unwavering support, even when they may not have fully comprehended the demands of this dissertation.

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To my classmates, who have now become cherished friends, your persistent support and camaraderie have been instrumental in helping me navigate and overcome numerous challenges throughout this period.

ABSTRACT OF THE DISSERTATION

WHAT ARE THE EFFECTS OF EARLY ALERTS AND INTERVENTION SYSTEMS

ON STUDENTS' GRADUATION RATES IN POSTSECONDARY EDUCATION?

by

Pedro Santos

Florida International University, 2024

Miami, Florida

Professor Yan Chen, Major Professor

This study investigates the effects of Early Alerts and Intervention Systems (EAISs) on student graduation rates in post-secondary education institutions, focusing on community college institutions. The use of EAIS as a support for student performance has been discussed by multiple scholars (Finnie et al.,2017; Simons, 2011; Tinto, 2017; Villano et al., 2018). The study builds on the student retention model for postsecondary institutions (e.g., community colleges or four-year institutions) (Tinto, 1975).

A quantitative method was used, and the model was tested using secondary data obtained from Miami Dade College students' graduation database. Statistical analysis of the data confirms the impact of EAIS on students' grades; however, the analysis did not provide enough evidence to support the effects of EAIS on students' graduation rates. In addition, the study confirmed previous findings on other factors that influence student graduation rates, such as communication with the faculty and students' grades.

The implications and limitations of the study were outlined, and ideas for future research were provided. Policymakers and other stakeholders can use the results to build robust EAIS systems that support students' journey in postsecondary education institutions.

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ABBREVIATIONS AND ACRONYMS

HEI	Higher education institutions
EAISs	Early Alerts and Intervention Systems
SRIM	Student Retention Integrated model
AI	Artificial Intelligence
GPA	Grade point average

I.   INTRODUCTION

Higher education institutions (HEI) play a vital role in the development and sustainability of communities. Through their educational, research, and outreach activities, they contribute significantly to their surrounding communities' social, economic, and cultural fabric (Arbo & Benneworth, 2007). In doing so, they provide quality education and training to individuals, equipping them with the knowledge and skills necessary to succeed in their careers and contribute meaningfully to society (Chatterton & Goddard, 2024). By offering a diverse range of academic programs, including undergraduate, graduate, and professional degrees, these institutions cater to the diverse needs of learners and promote lifelong learning (Arbo & Benneworth, 2007).

Additionally, HEI serves as a hubs of innovation and research, driving technological advancements, scientific discoveries, and creative endeavors that benefit the broader community (Alam & Mohanty, 2022). Faculty members and researchers engage in cutting-edge research across various disciplines, addressing societal challenges and generating new knowledge that can be applied to real-world problems (Arbo & Benneworth, 2007).

HSI fosters community engagement and partnerships through outreach programs, collaborative initiatives, and service-learning opportunities (Chatterton & Goddard, 2024). They collaborate with local businesses, government agencies, nonprofit organizations, and community groups to address community needs, promote social justice, and enhance the quality of life for residents (Alam & Mohanty, 2022). These institutions contribute to economic development by creating jobs, attracting investment, and supporting entrepreneurship and innovation ecosystems (Arbo & Benneworth, 2007). They serve as

engines of economic growth, driving regional development and enhancing the competitiveness of local industries (Chatterton & Goddard, 2024).

Despite the significance of HEI, they face many challenges and opportunities worldwide. Implementing new tools and processes that support HEI has been crucial to their survival. Creating new business models, such as short-term degrees, hybrid certificates, and partnerships with industry leaders to supply the workforce, are some initiatives institutions take to remain relevant to their students and communities (Alam & Mohanty, 2022).

Funding for HEI globally also faces significant challenges that impact its ability to fulfill its mission and maintain quality education and research standards. These challenges arise from various sources, including changes in government funding, rising operational costs, shifting demographics, and economic uncertainties (Altbach, Reisberg & Rumbley, 2019).

One of the primary funding challenges for HEI is the fluctuation in government support and public funding (Altbach, Reisberg & Rumbley, 2019). Budgetary constraints, competing priorities, and political dynamics often lead to reductions in state funding for higher education, forcing institutions to rely more heavily on tuition revenue and external funding sources (Altbach, Reisberg & Rumbley, 2019). Unfortunately, some of the challenges affect student enrollment, especially first-year students and persistence intentions (Lucas, C., Van Duser, K., & Cohen, S., 2020), having a direct impact on some of the essential metrics for HEI, such as retention, completion, and graduation rates. Table 1 shows student graduation rates within 150% of the average duration (i.e., 1.5 times the expected duration) at less-than-2-year postsecondary institutions. For instance, completing

an Associate of Arts degree typically takes two academic years; therefore, 150% of this

normal duration equates to three academic years (Reyna et al., 2010).

Table 1. Student graduation rates within 150% of normal time at less-than-2-year postsecondary institutions

Cohort Year	Graduation rate
2019	65.2%
2018	68.6%
2017	69.3%
2016	68.7%
2015	68.9%
2014	69.3%
2013	69.2%
2012	68.3%
2011	66.4%
2010	66.4%
2009	66.8%
2008	66.5%
2007	66.9%
2006	67.1%
2005	67.2%
2004	66.1%
2003	66.4%
2002	68%
2001	66.1%
2000	66.1%
1999	67.2%
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Graduation Rates component final data (2002 - 2021) and provisional data (2022).	

The reliance on tuition revenue has also become a significant concern, particularly

as tuition costs continue to rise faster than inflation (Archibald & Feldman, 2008). This

trend has raised affordability issues for students and their families, increasing student debt

and financial barriers to higher education (Altbach, Reisberg & Rumbley, 2019). This

factor has been among the most influential factors in students' access to higher education

and high dropout rates (Lucas, C., Van Duser, K., & Cohen, S., 2020). Table 2 shows the

average tuition and required fees for full-time undergraduate students at public postsecondary institutions operating on an academic year calendar system.

Table 2. Average amount of tuition and required fees for full-time undergraduate students at public postsecondary institutions operating on an academic year calendar system

Academic Year	Average amount (in USD)
2022-23	$6,771
2021-22	$6,527
2020-21	$6,434
2019-20	$6,435
2018-19	$6,346
2017-18	$6,114
2016-17	$5,918
2015-16	$5,753
2014-15	$5,560
2013-14	$5,396
2012-13	$5,211
2011-12	$4,961
2010-11	$4,632
2009-10	$4,340
2008-09	$4,080
2007-08	$3,908
2006-07	$3,748
2005-06	$3,545
2004-05	$3,390
2003-04	$3,147
2002-03	$2,854
Source: U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System (IPEDS), Institutional Characteristics component final data (2002-03 - 2021-22), and provisional data (2022-23).	

The COVID-19 pandemic has exacerbated funding challenges for HEI, with revenue losses from reduced enrollments, canceled events, and increased expenses for remote learning infrastructure and student support services (Archibald & Feldman, 2008).

Table 3 shows college enrollment rates of 18- to 24-year-olds by institution level from 2010 to 2021.

Table 3. College enrollment rates

Year	Total	2-year	4-year
2010	41.18	12.95	28.23
2011	41.98	12.03	29.95
2012	41.01	12.71	28.29
2013	39.93	11.59	28.34
2014	40.03	10.63	29.40
2015	40.46	10.58	29.88
2016	41.22	10.10	31.12
2017	40.41	10.01	30.40
2018	40.93	9.91	31.03
2019	40.67	10.28	30.39
2020	40.01	9.08	30.93
2021	38.06	8.31	29.75
Source: U.S. Department of Commerce, Census Bureau, Current Population Survey (CPS), October Supplement, 2010 through 2021.			

In response to these funding challenges, HEI are exploring alternative revenue streams, such as partnerships with industry, expanded online education offerings, and cost-saving measures (Altbach, Reisberg & Rumbley, 2019). Collaborations with private sector entities for research funding and technology transfer also play a role in diversifying revenue sources (Altbach, Reisberg & Rumbley, 2019).

Given low student enrollment rates and possible retention issues from student financial affordability, students' success is everyone's business in higher education, especially after 2020, when the academic world we used to know has transformed into many shapes and forms. A new set of unwritten rules has been discovered in the last 2-3 years due to the Covid-19 pandemic. The activities, actions, or steps institutions take to increase student graduation rates differ in every HEI. The introduction of Early Alert and

Interventions Systems (EAISs) to support students' experience, retention, and graduation rates is one of the steps that some institutions have taken.

EAISs have become valuable tools for HEI to support student success, retention, and academic achievement. These systems use data analytics, student performance metrics, and proactive strategies to identify students at risk of academic difficulties and provide timely interventions to help them stay on track (Larrabee Sønderlund et al., 2019). One of the critical benefits of EAISs is their ability to identify students who may be experiencing challenges early in the academic term (Sneyers & De Witte, 2018). By analyzing factors such as attendance, grades, course engagement, and behavioral patterns, these systems can flag students who may need additional support or resources to succeed (Sneyers & De Witte, 2018).

Additionally, EAISs facilitate personalized student support, allowing institutions to tailor interventions based on individual needs (Jokhan et al., 2019). Interventions may include academic advising, tutoring, counseling, study skills workshops, peer mentoring, and referrals to support services on and off campus (Jokhan et al., 2019). These systems promote collaboration among faculty, advisors, student support staff, and administrators, fostering a coordinated approach to student success (Sneyers & De Witte, 2018). Through data sharing and communication platforms, stakeholders can collaborate to monitor student progress, implement interventions, and track outcomes (Sneyers & De Witte, 2018).

Implementing EAISs also aligns with institutional efforts to improve retention, graduation, and overall student satisfaction (Jokhan et al., 2019). By addressing academic challenges and providing timely support, institutions can enhance student engagement, motivation, and persistence toward degree completion (Sneyers & De Witte, 2018).

To what extent has the efficacy of an EAIS been established to enhance student graduation rates? The determination of such effectiveness remains a subject of inquiry. The answers to such inquiry can help optimize resource allocation for institutions operating under constrained budgets by redirecting efforts, time, and financial investments toward alternative tools that foster higher student graduation rates. In addition, it provides insights into how to create a strategy for deploying an EAIS to support the institution better.

Hence, the principal objective of this study is to examine the effectiveness of the EAIS in relation to its impact on students' graduation rates. By delivering personalized interventions to students and allocating institutional resources judiciously, this tool can align the goals of both students and the institution. Specifically, the system aims to facilitate the timely completion of college studies for students while concurrently enabling the institution to fulfill its mandate of timely student graduation, thereby ensuring eligibility for state funding provisions. This study aims to provide evidence on the effectiveness of EAIS.

Additionally, studying the effectiveness of EAIS in increasing student graduation rates is critical for HEI's long-term sustainability and success. It aligns with broader institutional goals, addresses funding challenges, adapts to technological advancements, and enhances student support, ultimately contributing to a more educated workforce and thriving communities.

II.   LITERATURE REVIEW

Student retention in postsecondary education has garnered significant attention and research interest over several decades. Institutions and scholars alike have recognized the importance of understanding the factors influencing student persistence and success in higher education. As a result, numerous models, concepts, and theories have emerged, each offering insights into the foundational elements contributing to student retention (Aljohani, 2016). These models and theories provide frameworks for comprehending the complex dynamics involved in student retention, encompassing various psychological, social, and institutional factors. By exploring these diverse perspectives, researchers have sought to enhance our understanding of student retention and inform the development of effective interventions and strategies to promote student engagement and achievement. This section reviews major scholarly work and its influence on this study.

The study conducted by Aljohani (2016) offers a comprehensive review of the significant studies and theoretical models related to student retention, shedding light on the evolving landscape of this field of research. By examining these models, concepts, and theories, researchers can gain valuable insights into the multifaceted nature of student retention, paving the way for further exploration and advancements in this critical area of study. This study has been crucial to the development of this study since it comprises all the major studies in retention in HEI.

Spady's undergraduate dropout process model, developed by Arnold P. P. Spady, is a foundational theoretical framework that examines the stages and factors involved in the undergraduate dropout process in higher education (Spady, 1970, 1971). The model suggests that student departure from college is a complex process influenced by various

interrelated factors rather than a single event (Spady, 1971). It defines three critical stages in the dropout process: the pre-entry stage, the initial socialization stage, and the separation stage. These factors were considered for this research as a baseline to examine the effects of EAISs on graduation rates.

The pre-entry stage encompasses factors such as student background characteristics, motivations, expectations, and preparedness for college (Spady, 1970). Students' academic readiness, financial resources, family support, and educational aspirations during this stage influence their initial decisions to enroll in college.

The initial socialization stage focuses on students' experiences and interactions within the college environment (Spady, 1970). Factors such as academic experiences, social integration, campus climate, peer relationships, and faculty-student interactions are pivotal in shaping students' sense of belonging and commitment to the institution.

The separation stage represents the culmination of the dropout process, where students decide to leave college permanently (Spady, 1971). Factors contributing to separation may include academic difficulties, financial constraints, personal challenges, lack of social support, dissatisfaction with the college experience, and competing priorities.

Spady's model underscores the dynamic nature of student departure and emphasizes the importance of understanding the interactions between individual, institutional, and environmental factors in predicting dropout behavior (Spady, 1970).

The implications of Spady's undergraduate dropout process model for HEI are profound. Institutions can use the model to identify risk factors, design targeted interventions, and implement retention strategies that address students' needs at each stage of the dropout process (Spady, 1971). Some initiatives, such as academic advising, peer

mentoring, financial aid, student support services, and campus engagement programs, align with the principles of Spady's model and can contribute to higher retention rates and increase graduation rates.

Pascarella's student retention theory, developed by Ernest T. Pascarella and Patrick T. Terenzini, is a comprehensive framework that focuses on the complex interactions between students' backgrounds, experiences, and the college environment in predicting student retention and success (Pascarella & Terenzini, 1980).

At the heart of Pascarella's theory is student engagement, which encompasses academic and non-academic engagement (Pascarella & Terenzini, 1980). Academic involvement refers to students' participation in academic activities such as class discussions, studying, and interactions with faculty members. Non-academic involvement includes extracurricular activities, social interactions, and campus events.

According to Pascarella's theory, students actively involved in both academic and non-academic aspects of college are more likely to persist and succeed (Pascarella & Terenzini, 1980). This involvement leads to increased motivation, a sense of belonging, and positive peer interactions, all contributing to student retention.

Furthermore, Pascarella's theory emphasizes the role of the college environment in shaping student involvement and retention outcomes (Pascarella & Terenzini, 1980). Institutional size, campus climate, faculty-student interactions, and support services can influence students' involvement levels and likelihood of staying in college.

Moreover, Pascarella's theory acknowledges the diversity of student experiences and backgrounds, highlighting the importance of considering individual differences in predicting retention (Pascarella & Terenzini, 1980). Socioeconomic status, race/ethnicity,

first-generation status, and prior educational experiences can impact students' levels of involvement and retention trajectories.

By understanding the factors contributing to student involvement and retention as outlined in Pascarella's theory. This study can better measure how early alerts and interventions impact these critical aspects. Additionally, the theory's recognition of the role of the college environment in shaping student experiences underscores the importance of designing interventions that address individual factors and enhance institutional support structures and campus climate. The implications of Pascarella's theory for HEI are profound, as it provides a roadmap for designing effective interventions and creating inclusive environments that foster student engagement, retention, and overall satisfaction with the college experience (Pascarella & Terenzini, 1980).

Bean's student attrition model, developed by John P. Bean, is a widely recognized theoretical framework that explains the complex factors contributing to student attrition in HEI (Bean, 1980, 1982). The model highlights the interplay between student characteristics, institutional factors, and external influences in shaping students' decisions to persist or leave college.

Student, academic, and social integration are at the core of Bean's model (Bean, 1980). Academic integration refers to students' engagement with academic activities, coursework, faculty interactions, and the perceived value of their educational experiences. Social integration encompasses students' sense of belonging, peer relationships, campus involvement, and overall satisfaction with the college environment.

Bean's model emphasizes that students who feel academically and socially integrated are likelier to persist and succeed in college (Bean, 1982). Conversely, factors

that deter integration, such as inadequate academic support, limited social connections, financial challenges, and personal issues, contribute to attrition.

Furthermore, Bean's model considers the role of institutional factors in influencing student attrition (Bean, 1980). Institutional characteristics such as size, resources, support services, policies, and organizational culture can impact students' experiences and retention outcomes. Institutions prioritizing student support, providing effective advising, offering relevant programs, and creating a positive campus climate are more likely to retain students.

External influences, including family support, work obligations, financial constraints, and societal expectations, influence student attrition (Bean, 1982). Balancing these external factors with academic and social integration is crucial for student success and retention.

The implications of Bean's student attrition model for HEI are significant. Institutions can use the model to identify at-risk students, develop targeted interventions, and create supportive environments that enhance student integration (Bean, 1980). Strategies such as EAISs, academic advising, peer mentoring, financial aid, and campus engagement programs align with the principles of Bean's model and can improve student retention rates.

The student retention integrated model (SRIM), developed by John M. Braxton, Ernest T. Pascarella, and Anne-Marie Nunez, is a comprehensive theoretical framework that explores the multifaceted factors influencing student retention and success in higher education (Cabrera, Nora, & Castaneda, 1993). At the core of SRIM are three primary components: pre-college characteristics, college experiences, and college outcomes

(Cabrera, Nora, & Castaneda, 1993). The model integrates student background factors and institutional variables to provide a holistic understanding of student retention dynamics.

Pre-college characteristics encompass demographic variables such as students' socioeconomic status, academic preparedness, prior educational experiences, family background, and cultural factors (Cabrera, Nora, & Castaneda, 1993). These characteristics influence students' college entry and initial readiness for academic and social integration.

College experiences refer to students' interactions with the college environment, including academic engagement, social integration, campus climate, faculty-student interactions, support services utilization, and extracurricular involvement (Cabrera, Nora, & Castaneda, 1993). Positive college experiences contribute to students' sense of belonging, academic motivation, and persistence toward degree completion.

College outcomes encompass short-term and long-term outcomes related to students' educational attainment, including retention rates, academic performance, degree completion, post-graduation success, and satisfaction with the college experience (Cabrera, Nora, & Castaneda, 1993). These outcomes reflect the effectiveness of institutional efforts in supporting student success and retention.

SRIM emphasizes the dynamic and reciprocal nature of the relationships between pre-college characteristics, college experiences, and college outcomes (Cabrera, Nora, & Castaneda, 1993). The model posits that positive college experiences mediate the relationship between pre-college characteristics and college outcomes, highlighting the importance of supportive institutional environments in promoting student success.

The implications of SRIM for HEI are significant. Institutions can use the model to identify at-risk students, tailor interventions, and develop evidence-based retention

strategies that address students' diverse needs (Cabrera, Nora, & Castaneda, 1993). Initiatives such as early alert systems, academic advising, mentoring programs, financial aid, inclusive campus policies, and student engagement initiatives align with the principles of SRIM and can contribute to improved retention rates and student outcomes.

Researchers have explored multiple areas to understand better the factors contributing to student outcomes. One notable element of institutional action is the implementation of new support systems, such as EAISs, which aim to enhance student success by identifying and addressing challenges based on individual student characteristics early on. These initiatives align with supporting students in their academic journey and ensuring equitable opportunities for all, regardless of their background or circumstances.

The utilization of EAISs as a predictive tool for assessing student performance in higher education has garnered significant attention in academic research. Scholars have examined the effectiveness of EAISs in aiding students' academic progress and providing insights into their behaviors and performance (Jokhan et al., 2019).

EAISs in higher education have emerged as valuable tools for supporting students' academic progress, identifying at-risk behaviors, and providing timely interventions to enhance student success (Jokhan et al., 2019). Jokhan et al. (2019) conducted a comprehensive study to assess the effectiveness of EAISs in aiding students' academic progress and providing insights into their behaviors and performance. The research utilized a mixed-methods approach, combining quantitative data analysis and qualitative feedback from students and faculty members.

The study's findings revealed several key benefits of EAISs in supporting students' academic success. Firstly, EAISs helped identify students struggling academically or exhibiting behaviors that could hinder their progress (Jokhan et al., 2019). Factors such as low attendance, poor performance in assignments or exams, lack of engagement in coursework, and signs of academic distress were flagged early through the system.

In addition, EAISs facilitate proactive interventions by connecting students with appropriate support services and resources (Jokhan et al., 2019). Academic advisors, faculty members, counselors, and student support staff were able to reach out to at-risk students, provide academic assistance, offer personalized guidance, and refer students to relevant campus resources. EAISs provide valuable insights into the effectiveness of academic programs, teaching methods, and course design (Jokhan et al., 2019). Faculty members and administrators better understood students' needs, challenges, and areas for improvement, leading to data-informed decision-making and targeted interventions.

The research work by Jokhan et al. (2019) highlights the importance of EAISs in enhancing higher education student success and retention rates. Institutions can leverage EIASs to implement proactive support mechanisms, foster student engagement, improve teaching and learning practices, and create a culture of data-driven decision-making.

Several factors are crucial in determining students' success in higher education, including academic probation, student-faculty mentoring, and the availability of need-based grants. Extensive research has examined the relationship between these factors and student outcomes, with various theories and models shedding light on their influence. Furthermore, understanding how to maintain student enrollment and engagement at different stages of their educational journey has emerged as a critical aspect of fostering

student success (Sneyers & De Witte, 2018). This multifaceted approach recognizes the importance of addressing academic and non-academic factors to support students' holistic development and achievement in higher education. It contributes to a comprehensive understanding of the factors contributing to students' success and informs the design of effective interventions and strategies to enhance student outcomes.

Information systems, machine learning, and artificial intelligence (AI) have emerged as crucial components in studying and advancing models to support students' successful outcomes. These technologies have demonstrated significant potential in enhancing the effectiveness of EAISs and their implementation within HEI. Researchers have explored the benefits of integrating these tools alongside EAISs to improve student success outcomes (Gray & Perkins, 2019). By leveraging information systems, machine learning algorithms, and AI techniques, institutions can analyze large datasets to gain insights into student behavior, predict academic challenges, and provide personalized interventions and support. Utilizing these advanced technologies offers promising opportunities to optimize educational practices and interventions, ultimately fostering student success and retention in higher education.

Generative AI introduces a suite of new services that have the potential to significantly impact student success, including personalized tutoring, language translation, interactive learning, and adaptive learning (Baidoo-Anu & Ansah, 2023). These innovative services enhance the learning experience and play a crucial role in supporting student retention and graduation rates. Institutions are encouraged to closely monitor the development and implementation of generative AI technology, recognizing its capacity to revolutionize education (Baidoo-Anu & Ansah, 2023). By embracing artificial intelligence,

institutions can tap into a wide range of possibilities to support students better and develop applications that contribute to creating new procedures and processes aimed at helping students thrive academically and achieve their educational goals.

Vincent Tinto's student retention theory is an influential framework in higher education that examines the factors influencing student persistence and success in college settings. Tinto's theory posits that student retention is influenced by both academic and social integration into the college environment (Tinto, 1975). At the center of Tinto's theory is academic integration, which refers to students' engagement with academic activities, coursework, and faculty interactions (Tinto, 1975). According to Tinto, academically integrated students are likelier to persist and succeed in college. This integration encompasses academic support services, course relevance, faculty-student relationships, and intellectual engagement (Bean & Eaton, 2000).

In addition to academic integration, Tinto emphasizes the importance of social integration in student retention (Tinto, 1975). Social integration refers to students' sense of belonging, social interactions, peer support networks, and involvement in campus activities. Tinto claims that social integration is crucial in students' overall satisfaction with the college experience and their likelihood of graduation (Bean & Eaton, 2000).

Furthermore, Tinto's theory highlights the role of institutional commitment in student retention (Tinto, 1975). Institutions that commit to student success through effective support services, academic advising, mentorship programs, and a positive campus climate are more likely to retain students and foster their academic progress (Bean & Eaton, 2000).

Tinto's student retention theory has been selected as the baseline for this research because of its significant implications for HEI seeking to improve student outcomes and graduation rates. By understanding student retention factors, institutions can implement targeted interventions and support mechanisms to enhance academic and social integration (Tinto, 1975).

Tinto's student retention theory is the most suitable framework for this study due to its comprehensive approach to understanding the factors influencing student retention and success, particularly within Hispanic-serving institutions in the United States. Tinto's theory emphasizes both academic and social integration as critical components of student retention, aligning closely with the objectives of examining the effects of EAISs on graduation rates. Tinto's theory addresses the core elements that EAISs aim to enhance to improve student outcomes by focusing on academic integration, including factors such as academic support services and faculty-student interactions. Furthermore, Tinto's consideration of social integration, encompassing aspects like peer support networks and campus involvement, is crucial for understanding how interventions can foster a sense of belonging and engagement among Hispanic students, positively impacting their retention and graduation rates. Overall, Tinto's student retention theory provides a robust theoretical foundation for investigating the effects of early alerts and interventions on student graduation rates in Hispanic-serving institutions.

III.   THEORETICAL FRAMEWORK

The retention and student success theory, created and developed by Dr. Tinto, has been extensively studied and recognized as a prominent framework for understanding

factors influencing students' success and persistence in postsecondary education. This theory examines various elements, such as academic and social integration, institutional support, and student engagement, contributing to students' persistence and success in their educational journey.

EAISs have gained considerable attention as effective mechanisms for supporting student success and retention. Numerous studies have explored the impact of these systems on student outcomes, and the findings consistently highlight their positive effects on student retention, academic performance, and overall support. These systems involve timely identification of students at risk of academic or personal difficulties, followed by targeted interventions and support strategies to mitigate those risks.

Despite the existing body of research on EAIS, there is a specific research gap regarding its direct impact on students' graduation rates in postsecondary education. While previous studies have demonstrated the positive effects of these systems on student retention and support, their specific influence on students' ability to complete their degree programs successfully and graduate remains underexplored. Therefore, this study aims to bridge this research gap by investigating the direct effects of EAISs on students' graduation rates.

The conceptual framework for this study integrates the retention and student success theory with EAISs. By doing so, the study aims to examine the relationship between these two elements and their collective impact on students' graduation rates. The retention and student success theory provides a comprehensive perspective on the factors influencing student success, encompassing both individual and institutional aspects. EAISs serve as a specific intervention strategy that aligns with the broader framework of the

theory. This integration allows for a holistic examination of the direct effects of EAIS on students' graduation rates, considering the multifaceted nature of student success factors.

By focusing on the direct impact of EAIS on students' graduation rates under the retention and student success theory, this study proposes a research model and uses the model to guide the hypothesis development; both are discussed in the next section.

IV.   RESEARCH MODEL AND HYPOTHESIS DEVELOPMENT

The proposed research model (Figure 1) comprises a multivariate study analyzing potential correlations between the factors that impact Students' Graduation Rates in Postsecondary Education. In addition, the model builds upon established frameworks in the field, drawing from prior research conducted by Pascarella (1980) and Tinto (1975). These earlier models have served as foundational pillars in studying student retention and graduation, providing valuable insights and theoretical constructs for understanding the factors contributing to student success in higher education. Hence, the model also investigates the direct effect of EAIS on graduation rates in postsecondary education and the moderating effect on the relationships between influencing factors on graduation rates.

Figure 1. Research model
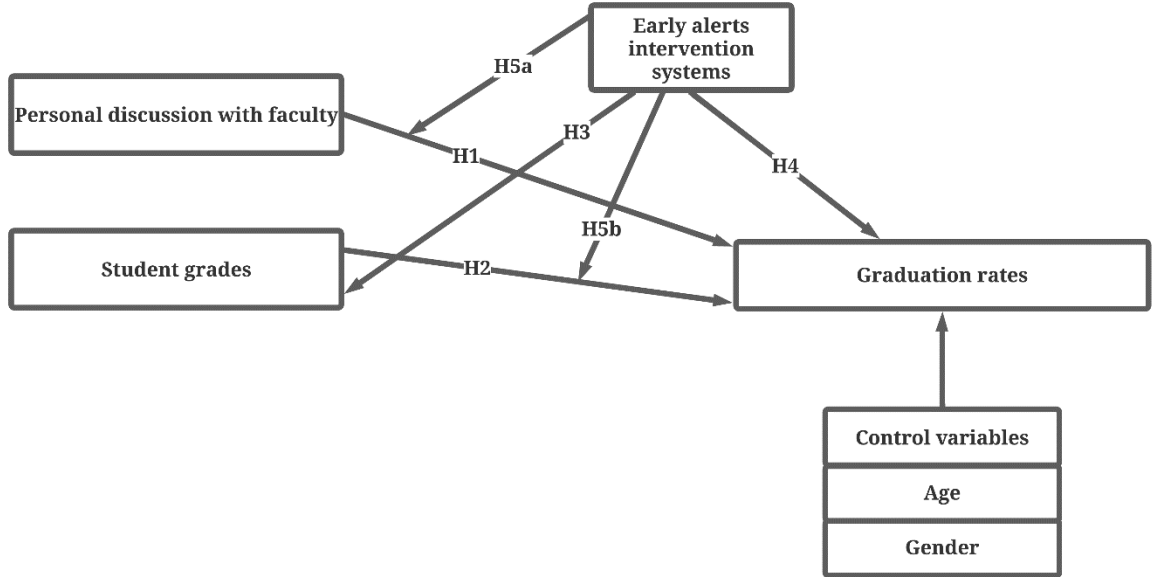
Hypothesis Development

A combination of several models was used to create the hypothesis of this research proposal (Aljohani, 2016; Bean & Metzner, 1985; Pascarella, 1980; Tinto,1975). This research looks into further improving student graduation rates and the effect of applying early alert intervention systems. The analysis of the processes in place and technologies in use have to be revised and re-evaluated to find areas for improvement due to the fast pace of the changes in student behavior in Post-Secondary Institutions. Faculty and administration must work together to provide students with the entire experience, from early alert interventions system and academic planning to carry them from the classroom to the graduation ceremony.

The interaction between faculty and students creates a bond for every post-secondary student. Engagement in campus activities during office hours and receiving support directly from the instructor will help the students navigate the college. These metrics have been studied in different studies. The existing models were analyzed to create the independent variables and measurement factors between the students and faculty. Specific to these constructs, this proposal will focus on student-faculty informal contact and college outcomes (Pascarella, 1980).

H1. An increase in communication between students and faculty is associated with an increase in student graduation rates.

Student academic performance can determine and help the students in their pursuit of completion on time and academic goals. For our research study, we will analyze some key performance metrics, mainly on students' sites, that will help to compare grade history and class engagement to determine the impact of those in retention, with the assumption that those who have better indicators will do better and stay in school.

Assessment through grading serves as a fundamental method for evaluating student work and delivering constructive feedback. Through this process, instructors effectively convey to students their performance levels within the course and identify areas where additional support or guidance is required to meet the course objectives successfully.

The abovementioned metrics directly impact students' academic performance, and their combination will trigger students' decision to stay or drop out of the institution. In addition, good grades are crucial due to the impact on graduating time for those students who fail classes, even the more basic ones, to give an example. A student who failed

Introduction to Microcomputer in her/his first semester will have to retake the course to complete their degree regardless of the major, so her/his academic map has to be modified because of the grade in that class. The impact and repercussions of a single class enormously affect the student graduation timeline (Bean & Metzner, 1985).

H2. An increase in student grades is associated with an increase in student graduation rates.

EAISs have been designed to support students not just academically but personally and mentally as well. Providing personalized service to students at risk of failing gateway classes is now available to retain them in their classes and support their path to graduation. Program implementation and promotion of the success of low-income students (Tinto, 2017), combined with an effective EIAS, will increase student retention in post-secondary institutions. The use of EAIS has been discussed by multiple scholars for many years (Finnie et al.,2017.; Simons, 2011; Tinto, 2017; Villano et al., 2018). However, its moderating impact on the relationship between the factors that impact student passing rates can be further analyzed. Various models have been proposed depending on the population and type of post-secondary institution (Community College, Four Year Institution) (Tinto, 1975).

H3. The application of the EAIS is associated with an increase in student grades.

H4. The application of the EAIS is associated with an increase in student graduation rates.

The use of EAIS has been discussed by multiple scholars for many years (Finnie et al.,2017.; Simons, 2011; Tinto, 2017; Villano et al., 2018). However, its moderating impact on the relationship between the factors that impact student GPA and graduation

rates can be further analyzed. Early Alert Intervention has been designed to support students academically. Providing faculty service to those students at risk of failing gateway classes is now available via EAIS to retain those students in their classes and to support their path to graduation. Student and faculty interactions generally promoted low-income students' success (Tinto, 2017). Early Alerts Intervention System program can further facilitate such interactions and thus increase student retention in students enrolled in a Post-Secondary Institution.

Similarly, past research shows a relationship between GPA and graduation rates (Denning et al., 2022). Students' GPAs strongly predict graduation rates, and for the last two decades, there has been an increase in student GPAs (Denning et al., 2022). An EAIS can assist students in increasing or maintaining their GPA. In addition, an EAIS can be programmed to trigger alerts if it notices a pattern change in students' performance so their GPAs remain stable. Hence, we hypothesized:

H5a. The application of the EAIS enhances the effect of personal discussion with faculty on student graduation rates.

H5b. The application of the EAIS enhances the effect of student grades on student graduation rates.

V.   METHODOLOGY

This study aims to expand on the research on the effect of EAIS on student graduation rates in post-secondary educational institutions. This study improves upon

previous research, as few studies have attempted to study the effects of EAIS on students'

graduation rates. The main instrument for collecting the data will be secondary data from

the business intelligence platform at Miami Dade College.

The use of the secondary data and the connection to explain the research question

is that education is sometimes viewed as an ineffective method (Smith, 2008); however,

re-using the data to discover patterns and testing the model helped to validate the

hypothesis for this research study. In terms of the data analysis, a linear regression was

performed to analyze the effects of each independent variable on the dependent variable.

The linear regression analysis was performed for this study because of its robustness in

analyzing complex relationships within datasets commonly encountered in educational

research. Linear regression is a foundational statistical method for examining the linear

association between variables, making it well-suited for exploring the predictive power of

independent variables on a dependent variable, such as academic performance or student

outcomes. In addition, a second set of linear regression was performed to test the

interaction between the effects of EAIS on different variables.

VI.   DATA ANALYSIS AND RESULTS

Data Description

A dataset of secondary data was used to facilitate the execution of the study. The

dataset was obtained from the Miami Dade College institutional effectiveness department.

The dataset contained information on students' progress toward graduation in two primary

academic terms (Fall and Spring). Initially, this dataset comprised approximately 15,000

individual records across 56 distinct data columns with variables irrelevant to this study,

such as citizen status, address, high school information, and more. After aligning the dataset with the model used for this study by removing irrelevant columns and records (i.e., students are not in degree-seeking programs), the final dataset contains 3,768 rows and 12 columns. These variables encompassed pivotal aspects of students' academic profiles, including their GPA, gender, age, participation and engagement in the EAIS, and, most notably, their progress along the continuum toward graduation. The following are the details.

The independent variables were divided into three categories (Table 4).

1- Student-faculty interaction

2- Student academic performance (student GPA)

3- EAIS

The variable student-faculty interaction measures the communication and contact between the student and the faculty. It provides information related to interaction between the student and the faculty. This variable is binary with 0=absence of interaction and 1= existence. These interactions have been studied in different papers (Pascarella, 1980), and they are an essential pillar of support for students' experience during their time in a HEI.

The second category includes GPA, which measures the student's academic performance (i.e., grades). Students' GPA scores are connected to the academic performance of students in the courses that they are taking. This variable plays an essential role in the graduation process of the students because it can be connected to an EAIS to track a change in a particular student and to provide support if needed. In addition, there are metrics that students should maintain to receive financial support and scholarships from the institution.

The third variable used in this study was EAIS. It is also a binary variable with 0=not used EAIS and 1=used EAIS. The EAIS has been designed to support students not just academically but personally and mentally as well. Providing personalized service to students at risk of failing gateway classes is now available to retain them in their classes and support their path to graduation. Program implementation and promotion of the success of low-income students (Tinto, 2017) combined with an effective Early Alerts Intervention program will increase students' graduation rates in students enrolled in a postsecondary institution.

Table 4 Definition and source of constructs

Constructs Definitions and Operationalization		
Independent Variables	**Definitions**	**Operationalization**
Students Faculty Interaction	Contact between the faculty and the student. Includes course-related activities and activities other than the course work/outside the course work (Chemosit, 2004). The measure that describes student-faculty interaction includes activities such as the teacher taking a personal interest in the student, the teacher considering the student's feelings, the teacher helping the student when he/she is having trouble with the work, and the teacher talking to with the student	
Personal discussions with faculty	The student has discussed a personal problem or concern with a faculty member.	Number of interactions between faculty and students.
Academic Variables	Academic variables are prominent in models of traditional student attrition as indicators of academic integration (e.g., Tinto, 1975). These variables—absenteeism, grades, and high school GPA— are expected to indirectly affect students' passing rates.	
Student grades	A student's GPA is a numerical measure that reflects their overall academic performance based on their course grades. It is calculated by assigning point values to each grade (e.g., A = 4 points, B = 3 points) and averaging them over all courses taken, with higher grades contributing more points.	GPA
EAIS	EAIS is a proactive system or process implemented within educational institutions to identify and address potential academic challenges or issues students face on time.	Utilization of the EAIS for students at any specific moment.
Control Variables		
Sex	Students gender	Students gender

Age	Student age		Student age
Dependent Variable	**Definitions**		**Operationalization**
Progress toward graduation	Progress toward graduation is the credits the student accumulates in their academic journey.		Total of credits earned by the student

The model includes control variables commonly used to control in similar studies in postsecondary institutions: sex and age.

Data Analysis

This section quantitatively analyzed the impact of EAISs on HEI graduation rates. This analysis is conducted through the lens of secondary data to offer insights into the various factors that influence the effectiveness of these systems. The findings from this study are intended to contribute significantly to the existing body of research in this area and offer valuable, data-driven recommendations for higher education policymakers and administrators seeking to enhance graduation rates through effective Early Alert strategies.

Descriptive Analysis

In this section, we conducted a descriptive analysis (see Table 4) to explore the factors implicated in EAIS relative to graduation rates at HEI. Leveraging a quantitative approach, we dissect secondary data to illuminate how age, sex, cumulative GPA, personal interaction with faculty, and the integration of EAIS sculpt students' educational journey. This systematic exploration analyzes singular metrics and examines the interrelations

between cumulative GPA and EAIS and the combined effect of faculty engagement and EAIS on academic progression.

Table 5 shows 3772 observations (N) for each variable. The variables listed include:

1. Age: The minimum age is 15, the maximum is 48, the mean age is 19.7, and the standard deviation is 2.005. The variance is 4.020, skewness is 0.450 (slightly right-skewed), and kurtosis is 3.479 (more peaked than a normal distribution).

2. Sex: It also ranges from 1 to 2, with a mean close to the mid-range at 1.51. The standard deviation is 0.500, the variance is 0.250, the skewness is -0.036 (very slight left-skew), and the kurtosis is -2.000 (flatter than a normal distribution).

3. Cum GPA: The minimum value is 0.10, and the maximum is 4.00, with a mean of 2.83 and a standard deviation of 0.833. The variance is 0.690, skewness is -0.767 (indicating a skewed distribution to the left), and kurtosis is 0.200 (indicating a less peaked distribution).

4. Personal_discussion: It ranges from 1 to 2, with a mean of 1.94. The standard deviation is very low at 0.244, indicating that most values are close to the mean. The skewness is -3.577 (highly left-skewed), and the kurtosis is 10.801 (indicating a very peaked distribution).

5. EAIS: Again, ranging from 1 to 2, with a mean of 1.33, a standard deviation of 0.470, variance of 0.221, skewness of 0.731 (right-skewed), and kurtosis of -1.467 (less peaked than a normal distribution).

6. Progress_toward_graduation: This variable has a minimum value of 10.00, a maximum of 100.00, and a mean of 66.5. The standard deviation is 27.863, variance is 776.334, skewness is -0.289 (slightly left-skewed), and kurtosis is -1.241 (less peaked than a normal distribution).

Table 5 Descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Age	3768	15	37	19.69	1.829	2.782	0.040	14.494	0.080
Sex	3768	1	2	1.51	0.500	-0.037	0.040	-2.000	0.080
Students grades	3768	0.10	4.00	2.8343	0.83079	-0.768	0.040	0.201	0.080
Personal discussions with faculty	3768	1	2	1.94	0.242	-3.612	0.040	11.049	0.080
EAIS	3768	1	2	1.33	0.470	0.729	0.040	-1.469	0.080
Progress toward graduation	3768	10.000	100.000	66.513	27.868	-0.288	0.040	-1.242	0.080

Assumption Test

The correlation matrix (Table 6) was first examined during our data analysis to discern critical interrelationships among the salient variables. The most striking revelation emerged from the unmistakable positive interplay between progress_toward_graduation and cum_gpa, as exemplified by a correlation coefficient of 0.474 ($p < 0.01$). In a parallel vein, the variable age manifested a subtle positive association with progress_toward_graduation (r=0.212, $p < 0.01$) and, concurrently, a moderate declination with personal_discussion (r=-0.378, $p < 0.01$). An observation meriting particular attention concerned sex1, which unfurled discernible negative affiliations with progress_toward_graduation, cum_gpa, and age, with respective coefficients of -0.096, -0.113, and -0.062, each cementing its significance at the 0.01 threshold. Furthermore, the dimension early alerts and intervention_current showcased a declining trend with progress_toward_graduation, cum_gpa, and age, substantiated by coefficients of -0.053, -

0.069, and -0.188, respectively, while simultaneously revealing a positive linkage with personal_discussion (r=0.071, p < 0.01). Although significant correlations were present, multicollinearity was not a concern for this study, as no correlation coefficients exceeded the 0.7 threshold (Johnson & Bhattacharyya, 2019).

Table 6 Correlations

| Correlations		Progress Toward Graduation	CUM GPA	AGE	Personal Discussion	Sex	Early Alerts and Intervention
CUM_GPA	Pearson Correlation	.474**	1	-.028	.018	-.113**	.069**
	Sig (2-tailed)	<.001		.084	.277	<.001	<.001
	N	3768	3768	3768	3768	3768	3768
AGE	Pearson Correlation	.212**	-.028	1	-.378**	.062**	-.188**
	Sig (2-tailed)	<.001	.084		<.001	<.001	<.001
	N	3768	3768	3768	3768	3768	3768
Personal_Discusion	Pearson Correlation	.023	.018	-.378**	1	-.008	.071**
	Sig (2-tailed)	.162	.277	<.001		.609	<.001
	N	3768	3768	3768	3768	3768	3768
Sex	Pearson Correlation	-.096	-.113**	.062**	-.008	1	-.019
	Sig (2-tailed)	<.001	<.001	<.001	.609		.238
	N	3768	3768	3768	3768	3768	3768
EAIS	Pearson Correlation	-.053 **	.059**	-.188**	.071**	-.019	1
	Sig (2-tailed)	.001	<.001	<.001	<.001	.238	
	N	3768	3768	3768	3768	3768	3768

The examination of Q-Q plots for continuous variables, particularly the plot for CUM_GPA as depicted in Figure 2, yields insights into the distribution characteristics of the dataset. The linearity of the data points along the 45-degree reference line for most values supports the assumption of normality for the distribution of CUM_GPA. This observation is crucial for subsequent statistical analyses, which often rely on the presumption of normality.

However, deviations from the linearity at the upper tail end indicate the presence of potential outliers, with the distribution having heavier tails than a normal distribution. This phenomenon might be attributed to exceptionally high-performing students or a grading system that allows for grade inflation. The range of CUM_GPA values falls between 0 and 5, aligning with the conventional GPA scales employed within academic institutions, thus validating the data's relevance and applicability.

The distribution of cumulative grade point averages (CUM_GPA) within the dataset exhibits predominantly typical characteristics, as revealed by the analysis of Q-Q plots (Figure 2). The conformity of data points to the 45-degree reference line in the Q-Q plot of CUM_GPA, as shown in Figure 2, affirms the usual distribution assumption, a foundational premise for many statistical tests. This adherence to normality is instrumental in validating parametric methods for subsequent analyses. Nevertheless, the observed deviations at the upper tail of the Q-Q plot signify the existence of outliers, suggesting a distribution with heavier tails than expected under normality. Such deviations could potentially be linked to the presence of high-achieving students. Despite these observations, the data range for CUM_GPA, which spans from 0 to 5, aligns with standard academic grading scales, confirming the data's pertinence and utility for this research

context. Consequently, although the noted anomalies in the tails warrant consideration, they do not significantly detract from the overall normal distribution of CUM_GPA within the sample.

Figure 2 Normal Q-Plot distribution

Normal Q-Q Plot of CUM_GPA
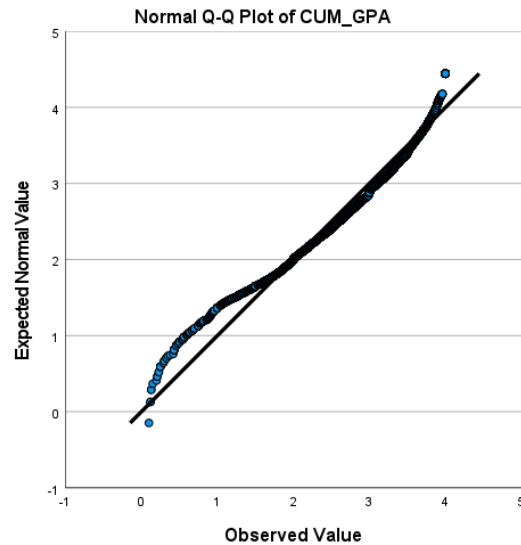
Results

Each hypothesis was tested using linear regression. For the analysis of each hypothesis, hierarchical regressions were conducted by testing the model containing only the control variables and then the models by adding the independent variables one at a time to evaluate each independent variable's explanatory power. The hierarchical regressions approach was used to understand how different sets of predictors contribute to explaining variation in the dependent variable, providing insights into the relative importance of each predictor block and helping to build more robust predictive models. Table 7 reports the direct effect results, and Table 8 presents the interaction results.

Table 7 Main effect results

Variables	Model 1 - (H1)	Model 2 (H1)	Model 3 (H2)	Model 1 (H3)	Model 2 (H3)	Model 1 - (H4)	Model 2 - (H4)
F	113.846	94.17	484.084	25.239	22.089	113.846	76.159
Sig.	<0.001b	<0.001c	<0.001c	<0.001b	<0.001c	<0.001b	<0.001c
R Square	0.057	0.069	0.278	0.013	0.017	0.057	0.057
Age	0.219***	0.265***	0.229***	-0.021*	-0.009*	0.219***	0.216***
Sex	-0.109***	-0.111***	-0.056***	-0.112***	-0.111***	-0.109***	-0.109***
Personal Discussion		0.122***					
Cum_GPA			0.474***				
EAIS					0.065***		-0.014*
GPAEAIS							
DisEAIS							
Dep. Var.	Progress Toward Plan	Progress Toward Plan	Progress Toward Plan	CUM GPA	CUM GPA	Progress Toward Plan	Progress Toward Plan
Notes: *, p<0.05; **, p<0.01; ***, p<0.001							

Table 8 Interaction results

Interaction Results				
Variables	**Model 1 (H5a)**	**Model 2 (H5a)**	**Model 1 (H5b)**	**Model 2 (H5b)**
F	113.846	17.537	113.846	94.17
Sig.	<0.001b	<0.001c	<0.001b	<0.001c
R. Square	0.057	0.070	0.057	0.224
Age	0.219***	0.263***	0.219***	0.220***
Sex	-0.109***	-0.111***	-0.109***	-0.056***
Personal Discussion		0.134**		
Cum_GPA				.554***
EAIS		0.023^{ns}		0.046*
GPAEAIS				-1.968**
DisEAIS		-0.040^{ns}		
Dep. Var.	Progress Toward Plan	Progress Toward Plan	Progress Toward Plan	Progress Toward Plan
Notes: *, p<0.05; **, p<0.01; ***, p<0.001; ^{ns}, not significant				

Hypothesis 1:

The effects of faculty-student interactions on student academic progression, as measured through regression analysis, yield insightful but ultimately inconclusive results towards our initial hypothesis. The analysis was conducted in two models: Model 1, which considered age and sex as predictors (Column 1 of Table 6), and Model 2, which added the variable of faculty-student interactions (Column 2 of Table 6) to the regression. While Model 2 demonstrates a slight increase in the explanatory power (R Square) from 0.057 to 0.069, suggesting that adding faculty-student interactions as a predictor offers a marginal improvement in explaining students' academic progression, this increase is not as substantial as anticipated. Specifically, the R Square change indicates only a 1.2% increase in variance explained by adding faculty-student interactions.

The F-statistic for both models shows statistical significance (Sig. <0.001 for both models), which indicates that the models are statistically significant predictors of student academic progression.

Hypothesis 2:

Multiple regression analyses confirm the influence of students' GPAs on graduation rates. When comparing the R-squared values of two models—one incorporating age and gender (Model 1 in Column 1 of Table 6) and the other expanding upon this with the predictor of interest (i.e., GPA) (Model 3 in Column 3 of Table 6), we found that this predictor enhanced the model's explanatory power from 5.7% to 27.8%, which substantiates the predictor's relevance.

The strength and reliability of the model are further affirmed by an F-test statistic of 484.084 and an effectively near zero p-value (p<0.001). This statistical evidence robustly counters the null hypothesis, suggesting that students' GPA significantly contributes to the variance in graduation rates.

The coefficient of GPA illustrates a direct and positive correlation: as a student's cumulative GPA ascends by one unit, there is an associated 0.474 unit rise in graduation rates while holding age and gender constant. This finding is underpinned by a t-test statistic with p<0.001, giving us considerable evidence to reject the null hypothesis. Hence, Hypothesis 2 is supported.

Hypothesis 3:

The regression analysis explored the potential impact of additional variables on students' academic achievements. The analysis was structured around two models: Model 1 H3 (column 4 of Table 6) included essential demographic variables, while Model 2 H3 (Column 5 of Table 6) introduced another predictor to assess its incremental effect.

Upon reviewing the results, it was observed that introducing the new predictor in Model 2 resulted in a slight increase in the model's R Square, from 0.013 (Column 4) to 0.017 (Column 5). This increment, representing a 0.4% increase in the explained variance of students' academic achievements, suggests a marginal improvement in the model's explanatory power. The F-statistics for both models are significant (Model 1: F = 25.239, Sig. <0.001, (Column 4); Model 2: F = 22.089, Sig. <0.001), (Column 5), demonstrating that the models are statistically valid. The path coefficient of EAIS was positive and significant ($\beta = 0.065$, p<0.001), supporting Hypothesis 3.

Hypothesis 4:

The regression analysis explored the potential impact of additional variables on students' academic achievements. This examination utilized two distinct models to parse out the effects of various predictors. Model 1 (Column 6 of Table 6) was designed to incorporate a set of core variables, while Model 2 (Column 7 of Table 6) added a variable to assess its incremental influence on the outcome.

The results of the analysis provide a detailed understanding. The F-statistics for model 1 indicate robust model fits Model 1: F = 113.846, p < 0.001; however, the values obtained in the introduced values were insignificant. Model 2: F = 76.159, p <0.05). In addition, the R Square values for both Model 1 (0.057) and Model 2 (0.057) remain

consistent, indicating that the introduction of the additional variable in Model 2 does not enhance the explanatory power of the model regarding the variance in the dependent variable. This consistency in R Square and the insignificant value for Model 2 suggests that the additional variable integrated into Model 2 fails to offer further insight or explanatory value to the regression analysis. Also, while the path coefficient of EAIS was significant, it is negative (β =- 0.014, p<0.05). Hypothesis 4 is not supported.

Hypothesis 5a

The regression analysis explored the potential impact of additional variables on students' academic achievements. This examination utilized two distinct models to parse out the effects of various predictors: Model 1 H5a (Column 1, Table 7), which incorporates age and sex as predictors, and Model 2 H5a (Column 2, Table 7), which adds the variables of interest (EAIS, faculty discussion, and their interaction term) alongside age and sex.

The results of the analysis provide a detailed understanding. The F-statistics for model 1 indicate robust model fits. Model 1: F = 113.846, p < 0.001. The path coefficients for age and sex were 0.291 significant -0.109, respectively, and were statistically significant. However, while model fit values for Model 2 were significant (Model 2: F = 17.537, p <0.001), the path coefficients for EAIS and the interaction effect of EAIS and faculty discussion were insignificant. Only the main effect of faculty discussion was significant (β = 0.134, p<0.001). A 2% increase of R square in Model 2 indicates that the introduction of the additional variables in Model 2 does not enhance the explanatory power of the model regarding the variance in the dependent variable. Hence, Hypothesis 5a is not supported.

Hypothesis 5b

The regression analysis explored the potential impact of additional variables on students' academic achievements. This examination utilized two distinct models to parse out the effects of various predictors: Model 1 H5b (Column 3, Table 7), which incorporates age and sex as predictors, and Model 2 H5b (Column 4, Table 7), which adds the variables of interest (EAIS, GPA and their interaction term) alongside age and sex.

The results of the analysis provide a detailed understanding. The F-statistics for model 1 indicate robust model fits. Model 1: F = 113.846, p < 0.001. The path coefficients for age and sex were 0.291 significant -0.109, respectively, and were statistically significant. The values of model fit for Model 2 were also significant (Model 2: F = 17.537, p <0.001). The GAP, EAIS, and their interaction term (GPAEAIS) coefficients are 0,544, 0.043, and -1.968, respectively, and all are significant. However, the negative sign of the interaction term 'GPAEAIS' shows that Hypothesis 5b is not supported, though it underscores a crucial finding: the influence of GPA on progress is conditional on EAIS. Specifically, this negative interaction implies that the advantage of the influence of GPA on progress diminishes when considering EAIS. This suggests that students with lower GPAs may require more support to achieve their planning goals than their higher-GPA counterparts, as the benefits of a higher GPA are not as pronounced when factoring in the interaction with EAIS.

Table 9 summarizes the hypothesis test results.

Table 9 Hypothesis test results

Hypothesis	Result
Hypothesis 1. An increase in communication between students and faculty is associated with an increase in student graduation rates.	**Supported**
Hypothesis 2. An increase in students' grades is associated with an increase in student graduation rates.	**Supported**
Hypothesis 3. The application of the EAIS is associated with an increase in student grades.	**Supported**
Hypothesis 4. The application of the EAIS is associated with an increase in student graduation rates.	**Not Supported**
Hypothesis 5a. The application of the EAIS enhances the effect of personal discussion with faculty on student graduation rates.	**Not Supported**
Hypothesis 5b. The EAIS application enhances student grades' effect on student graduation rates.	**Not Supported**

Alternative Method for Data Analysis:

A Structural Equation Modeling (SEM) was also run to verify the outcomes' reliability. SEM offers a powerful analytical approach for investigating complex relationships and pathways within data sets, making it a valuable method for data analysis for this dissertation (Hair et al., 2019). By utilizing SEM, this dissertation aims to understand the interconnections among variables related to students' success in postsecondary education. SEM allows for the simultaneous examination of multiple relationships and latent constructs, enabling the explore the direct and indirect effects of EAIS on student outcomes. This approach aligns with the methodological rigor required to uncover nuanced insights and identify critical factors influencing student success in higher education. Table 10 presents the SEM analysis results.

Table 10 SEM analysis results.

Hypothesis	Original sample (O)	P values
AGE -> PROGRESS_TOWARD_GRADUATION	0.266	0
EAIS -> PROGRESS_TOWARD_GRADUATION	0.047	0.79
EAIS -> CUM_GPA	0.146	0
Personal_Discusion -> PROGRESS_TOWARD_GRADUATION	0.518	0
Sex1 -> PROGRESS_TOWARD_GRADUATION	-0.117	0
CUM_GPA -> PROGRESS_TOWARD_GRADUATION	0.497	0
EAIS x Personal_Discusion -> PROGRESS_TOWARD_GRADUATION	-0.147	0.408
EAIS x CUM_GPA -> PROGRESS_TOWARD_GRADUATION	-0.058	0.018

The validation of the regression analysis results through SEM adds a layer of robustness to the study's findings, further reinforcing the study's validity. The SEM results confirm the patterns observed in the regression analysis and provide a more comprehensive understanding of the complex interplay among variables influencing students' progress toward graduation. For instance, the significant path coefficients identified in the SEM analysis, such as the strong positive relationship between Cumulative Grade Point Average (CUM_GPA) and Progress Toward Graduation, validate the initial hypotheses and highlight the importance of academic performance in predicting students' success.

VII.   DISCUSSION

The section presents an in-depth interpretation of the findings. Building upon examining how student-faculty interactions, academic performance metrics, and technological interventions intertwine to shape educational outcomes, this section seeks to interpret and contextualize these findings within the broader framework of current academic discourse. By dissecting the outcomes associated with each hypothesis—ranging

from the impact of student-faculty communication on graduation rates to the effectiveness of EAISs in academic success—this discussion aims to weave together the complexity of factors influencing student graduation rates. In doing so, it endeavors to validate the complex interplay of these variables and contribute insights into the strategies that educational institutions can leverage to foster enhanced academic achievement and overall student success.

Hypothesis 1

This study sought to explore the dynamics of student-faculty communication and its impact on graduation rates within higher education. The regression results were statistically significant, suggesting that the presence of communication contributes to higher graduation rates. The finding resonates with the research of Kuh et al. (2008), which highlighted the importance of student-faculty interaction for academic success, and Pascarella (1980), who reinforced the significance of these interactions in the educational sphere. This study extends the current literature by offering contemporary evidence that underscores the relationship between student-faculty communication and educational outcomes.

The implications of this finding are substantial for educational institutions. Therefore, schools and universities should strive to create environments that encourage open and frequent communication and consider the depth and context of these interactions. Initiatives such as mentorship programs, structured office hours, and interactive teaching

methods could be more effective if they emphasize meaningful engagement between faculty and students.

The findings of this study underscore the vital role of collaboration and rapport between faculty and students in enhancing student outcomes. It emphasizes that the active involvement of faculty in shaping the student journey is paramount, particularly in today's educational landscape. Faculty participation from the inception of a student's academic journey enables them to contribute meaningfully to designing and implementing effective strategies that support student success. By fostering a strong bond between students and faculty, students gain the confidence to engage in various extracurricular activities, enhancing their overall college experience and academic growth. Moreover, the administration plays a crucial role in this process by providing necessary resources and support to empower faculty as mentors and leaders inside and outside the classroom.

Creating new avenues for interaction and reinforcing this critical relationship benefits individual students and faculty members and enriches the institution as a whole. The establishment of collaborative spaces fosters innovation and creativity, leading to the emergence of new projects and initiatives. Additionally, highlighting successful collaborations between students and faculty inspires and motivates others within the institution, driving a culture of collaboration and continuous improvement. Ultimately, investing in and prioritizing the relationship between faculty and students contributes significantly to the overall success and reputation of the institution.

Hypothesis 2

The analysis provided empirical support for this hypothesis that a significant and positive relationship exists between student GPAs and graduation rates. This finding aligns

with the findings of Bean and Metzner (1985) and Tinto (1975) in establishing a connection between academic performance, student retention, and graduation rates. Moreover, this study echoes the conclusions drawn by Pascarella (1980) regarding the predictive power of academic performance on student retention and successful graduation. This consistency across different research studies provides a strong foundation on which educational institutions can base their strategic decisions, especially regarding academic support and intervention programs.

The implications of these findings are significant for educational institutions and policymakers alike. The strong association between grades and graduation rates underscores the fundamental role of academic performance as a critical determinant of student success. Institutions are thus urged to prioritize academic support services, including tutoring and academic advising, to aid students in maintaining or elevating their academic standing. This emphasis on support services becomes especially critical for students at risk of academic struggles, particularly during transitions from secondary to higher education. Ensuring that an EAIS effectively triggers support services for students who need them most is paramount, as it can prevent dropout rates that might go unnoticed without timely alerts.

Initiatives to create new avenues to bolster student performance are crucial in this context. Administrators are pivotal in securing resources to develop programs that offer innovative academic support mechanisms. This can include seeking grants and forging partnerships with institutions and companies to enhance students' outcomes, specifically regarding their GPA and overall academic success. Additionally, incorporating global challenges into the curriculum and fostering collaborations with community leaders can

provide students with valuable real-world experiences that motivate and inspire them in their academic pursuits, further reinforcing the link between academic engagement and student success.

Hypothesis 3

Hypothesis 3 concerning the impact of EAIS on student academic performance was supported. While EAIS is theoretically posited to aid in improving academic outcomes, the empirical evidence from this study suggests that their role may be more intricate than initially anticipated. The significant but modest influence of EAIS on cumulative grades prompts a consideration of alternative methods to assess their impact, particularly concerning student retention.

The broader literature on academic intervention strategies, as evidenced by studies conducted by Jokhan et al. (2019) and Gray and Perkins (2019), underscores the significant potential of EAIS to go beyond merely improving grades. When employed effectively, these systems serve as vital scaffolding mechanisms for at-risk students, offering them the necessary support to navigate their academic journey successfully. This can potentially improve grades and plays a crucial role in enhancing retention and success rates within HEI. Consequently, educational institutions must carefully consider the implications of implementing EAIS, recognizing their potential impact on student performance—a critical factor contributing to institutional success and student outcomes.

The application of EAIS is pivotal in providing comprehensive support for students' academic progress and success. A well-designed EAIS facilitates seamless communication among students, faculty, and administrators, establishing an efficient monitoring system to

track and address students' performance effectively. This real-time monitoring and intervention capability enables institutions to identify at-risk students promptly, offer timely support services, and implement targeted interventions, all of which are instrumental in improving overall student outcomes and fostering a conducive learning environment.

Furthermore, the strategic implementation of EAIS supports individual student grades and contributes to a holistic approach to student success and institutional effectiveness. By leveraging EAIS to bolster student performance, institutions can enhance student retention rates, promote academic engagement, and ultimately contribute to the broader goal of fostering a culture of academic excellence and student achievement.

Hypothesis 4

The study hypothesizes that implementing an EAIS would increase the number of students successfully completing their programs. Contrary to expectations, the findings did not support this hypothesis. The absence of a significant correlation between the use of EAISs and increased graduation rates suggests that these systems, in isolation, may not directly influence the graduation outcomes of students. It is also plausible that the utility of EAIS may manifest more prominently in metrics related to academic performance than retention, as retention is a multifaceted outcome influenced by a confluence of factors beyond grades alone.

This result is an essential contribution to understanding educational interventions within higher education. It indicates that the effectiveness of technological systems like Early Alerts in enhancing student graduation rates is perhaps more complex than initially anticipated. While these systems are designed to identify and assist students who are at risk

academically, their standalone implementation may not be sufficient to impact overall graduation rates significantly.

The study's findings align with the broader literature emphasizing the multifaceted nature of student success and retention in higher education (Fowler & Boylan, 2010; Merisotis & McCarthy, 2005; Tight, 2020). It suggests that while EAISs have the potential to play a supportive role in identifying at-risk students, they might be more effective when integrated into a broader, more comprehensive strategy of student support. This integrated approach could include additional elements such as academic advising, mentoring programs, and personalized support services, which collectively address student needs and challenges.

Moreover, the results imply that an EAIS cannot be effective without considering other factors influencing graduation rates, such as student engagement, institutional policies, quality of instruction, and the overall learning environment. The effectiveness of EAIS may be enhanced when these factors are adequately addressed, creating a more holistic approach to student support.

Hypothesis 5a

This hypothesis examines the effect of EAIS on the relationship between faculty communication and graduation rates. Contrary to expectations, the findings did not support the hypothesis that EAIS enhances such a relationship. The lack of support for the hypothesis indicates alternative explanations. Firstly, it indicates that while EAIS may be effective in certain areas, such as identifying students at risk academically, they do not necessarily improve all facets of the educational experience, particularly the dynamic

between faculty communication and student graduation rates. This finding is crucial as it suggests limitations to the scope of the effectiveness of these systems and points to the need for a more targeted approach in their implementation and use.

Secondly, the study's results highlight the complexity of factors influencing graduation rates. It implies that while technological interventions like EAIS have their place, they are not a panacea for all challenges in higher education. Factors such as the quality of faculty-student interaction, the curriculum, and the overall institutional environment may also play significant roles in student success. They should be considered in efforts to improve graduation rates.

Furthermore, the findings invite re-evaluating expectations surrounding technological interventions in educational settings. It underscores the importance of setting realistic goals and understanding that technology is a tool that works best in conjunction with other strategies. For instance, while EAIS can flag students needing assistance, the effectiveness of the subsequent intervention may largely depend on the quality of faculty-student engagement and other support services the institution provides.

In light of these findings, educational institutions are encouraged to adopt a holistic approach to student support and retention. This approach should integrate technological tools like EAISs with other strategies that foster effective faculty communication, mentorship, and a supportive learning environment. Such a comprehensive approach is more likely to address the multifaceted nature of student success and graduation rates.

In conclusion, the study provides valuable insights into the limitations of EAIS in enhancing the relationship between faculty communication and graduation rates. This outcome underscores the need for a balanced and integrated approach to addressing the

challenges of student retention and success in higher education. Therefore, institutions should consider a combination of technological, interpersonal, and institutional strategies to support their students' educational journeys effectively.

Hypothesis 5b

This hypothesis examines the effect of EAIS on the relationship between students' grades and graduation rates. Contrary to expectations, the findings did not support the hypothesis that EAIS enhances such a relationship. As discussed, the lack of support for the hypothesis indicates that EAIS may be practical only when used holistically with other tools and methods.

Moreover, combining the findings from Hypothesis 2 and the result from an ANOVA test on GPA between students in the EAIS and those not, we found that those students with lower grades seemed to benefit more from the EAIS than those with high grades. Hence, applying the Early Alerts and Interventions System can be focused on and programmed to support students at risk of failing or those obtaining low grades in their classes.

This study offers significant insights into the effects of EAIS in enhancing students' grades and graduation rates within HEI. The findings emphasize the necessity of a targeted and personalized approach when implementing EAIS, recognizing that not all students may require the same level of support to complete their degrees successfully.

The study's outcomes reveal that while EAIS can be practical tools for identifying at-risk students and providing timely interventions, their impact on overall student academic performance and graduation rates may be limited when used in isolation. This

highlights the need for HEIs to adopt a more nuanced approach to utilizing EAIS to ensure their effectiveness.

Based on the results of this study, to address these findings and maximize the benefits of EAIS, HEIs should consider several key strategies:

1. Personalized interventions: Instead of employing a one-size-fits-all approach, HEIs should tailor interventions provided through EAIS to meet the specific needs of individual students. This may include targeted academic support, mentoring programs, counseling services, and customized learning plans.

2. Holistic student support: EAIS should be integrated into a broader framework of student support services encompassing academic, social, and emotional well-being. This holistic approach can enhance student engagement, motivation, and persistence toward degree completion.

3. Data-informed decision-making: HEIs should utilize data analytics and student performance metrics generated by EAIS to inform strategic decision-making. This includes identifying trends, assessing the effectiveness of interventions, and continuously improving support mechanisms.

4. Faculty involvement: Involving faculty members in the EAIS process can enhance the quality and relevance of interventions. Faculty can provide valuable insights into students' academic progress, learning needs, and potential barriers to success.

By adopting these strategies, HEIs can overcome the limitations of EAIS and maximize its use to create a more effective and student-centered approach to supporting student success and graduation rates.

Contributions

This study contributes significantly to understanding EAISs and their impact on students' graduation rates in postsecondary education. By delving into the theoretical insights and practical implications of EAIS, the research enhances the discourse on student success and retention strategies in higher education.

One of the critical contributions of this study is its thorough analysis of EAIS as an essential mechanism for identifying and supporting students at risk of academic failure. The focus on the role of EAIS in improving graduation rates and student performance across various postsecondary environments adds depth to the existing literature on student success interventions.

Moreover, the study bridges the gap between theoretical constructs and real-world deployment of EAIS by providing a detailed evaluation of these systems. This nuanced approach enriches the ongoing conversation surrounding the effectiveness of EAIS and its capacity to effect positive change within educational frameworks.

The central focus on whether EAIS usage correlates with increases in graduation rates offers valuable insights into the potential impact of these systems on student outcomes. By uncovering a sophisticated understanding of how EAIS can contribute to improving graduation rates, the study provides actionable recommendations for institutions seeking to enhance student success and retention.

Theoretical Contributions:

The study enriches the academic discourse on EAISs in the context of community colleges. Theoretically, it builds on previous studies by offering new insights into the functioning and effectiveness of EAIS. The study broadens the theoretical discourse around

using such systems by exploring if an EAIS plays a role in academic performance and students' graduation rates. It moves beyond the simplistic characterization of EAIS as a solution for educational challenges, advocating for a more integrated perspective considering various factors influencing student success.

One of the key theoretical contributions of this investigation is its departure from conventional views of EAIS solely as a tool for identifying at-risk students. Instead, the study delves deeper into understanding the multifaceted role of EAIS in influencing academic performance and graduation rates. Doing so challenges existing theoretical frameworks and encourages scholars to adopt a more nuanced approach when examining the impact of EAIS.

The study's findings also provide unique insights that diverge from previous research on EAIS, student retention, and student completion. This divergence contributes to the theoretical richness of the academic discourse by highlighting the complexities and intricacies involved in implementing and evaluating intervention systems in academia. It prompts researchers to reevaluate existing assumptions and encourages the exploration of alternative theoretical models to better capture the dynamics of EAIS and their effects on student outcomes.

Furthermore, the study offers insights to other researchers by identifying variables that justify further discussion and examination using alternative approaches. This includes variables related to student engagement, institutional support systems, and the effectiveness of different intervention strategies. By focusing on these areas, the investigation stimulates future theoretical development and encourages a more comprehensive understanding of the factors shaping students' academic journeys.

Practical Contributions

Practically, the study offers significant contributions to the implementation and utilization of EAIS in community colleges. The findings provide practical guidance for institutions on effectively assessing the effect of EAIS implementation in providing support and direction to students. This is particularly relevant for community colleges, which often cater to a diverse student population with varying needs and challenges. The study highlights the importance of EAIS in providing timely and relevant support to students with higher GPAs. It also indicates that EAIS is not a silver bullet that can solve all the issues surrounding student performance and retention. The application of EAIS is one factor supporting the student journey. However, the application of new methods and the connection of the EAIS may need wraparound support services in HEI to benefit the students.

In light of the data presented, community colleges are strongly advised to recognize the potential of EAIS as an impactful short-term intervention method. It is geared towards increasing student involvement and commitment within their courses. However, in this study, EAIS has shown limited efficacy in sustaining students and enhancing their connection with faculty. This indicates that solely relying on EAIS may not guarantee significant advancements in graduation outcomes in the long haul. A multifaceted strategy, integrating a variety of techniques, is paramount to successfully tackle the issue of augmenting graduation rates at the community college level.

Several critical factors must be analyzed to ensure effective deployment when considering the implementation of EAIS in HEI. One crucial element is defining the target population for the EAIS within the institution. Research indicates that for new

implementations, starting with a smaller group of students and establishing control groups can facilitate a comparative assessment of EAIS effectiveness before scaling up to a more significant implementation. This approach may involve selecting a specific academic program or school within the institution for initial deployment.

Furthermore, the active involvement of the leadership team is paramount during the EAIS implementation phase, particularly in institutions where a data culture has not yet been firmly established. The engagement of institutional research and business intelligence teams is essential to leverage the data collected by these systems for analysis even before students graduate. Collaboration among departments is critical to the successful implementation and utilization of EAIS within the institution (Tinto, 2012)

For institutions already implementing EAIS, there are significant insights to be gained from this study to enhance student support and outcomes. A key finding from this research is that implementing EAIS on a large scale without targeting specific student cohorts may not yield optimal results, especially in larger institutions. Preselecting student cohorts based on characteristics such as GPA can significantly improve the effectiveness of EAIS. Additionally, providing comprehensive training to faculty, staff, and advisors on using EAIS is crucial for achieving positive outcomes and expanding the system's reach.

Moreover, incorporating the latest updates and new Business Intelligence tools into EAIS has enhanced their effectiveness in supporting student success in HEI. These advancements have made EAIS a more robust and efficient tool for all stakeholders involved in promoting student success within the institution (Tinto, 2012). Addressing these critical elements in the implementation and utilization of EAIS can significantly

contribute to the success of these systems in HEI, ultimately leading to improved student outcomes and graduation rates.

VIII.   LIMITATIONS, FUTURE STUDY, AND CONCLUSION

Despite the substantial insights furnished by this study on EAISs in community colleges, it is imperative to acknowledge its inherent limitations; primarily, its focused scope was on community colleges offering two-year and extended programs (Bailey, Jaggars, & Jenkins, 2015). While beneficial for in-depth understanding within this context, this specific concentration restricts the generalizability of the outcomes.

The study's findings, centered around community colleges, might not universally resonate when applied to distinct educational settings that diverge in academic offerings or student demographics (Belfield & Bailey, 2011). For example, four-year universities or vocational institutions, characterized by different academic structures and student needs, could yield different results when employing similar EAIS strategies (Jenkins, Lahr, & Fink, 2017). The efficacy and relevance of these insights may be less pronounced or require significant adaptation in such environments, given their distinct operational frameworks and educational goals (Calcagno & Long, 2008).

Moreover, community colleges often serve a highly diverse student body, including nontraditional students, part-time learners, and individuals from varied socioeconomic backgrounds (Cox, 2009). While this diversity offers a rich context for studying EAIS's impact, the dynamics might differ significantly in institutions with more homogenous student populations or those targeting specific student segments, such as traditional-age university students (Dowd, Pak, Bensimon, & Gabbard, 2013).

Additionally, community colleges' unique administrative and operational structures, which differ from other HEIs, shape the implementation and outcomes of EAIS (Goldrick-Rab, 2010). These differences include variations in funding models, governance structures, and resource availability, which could impact the scalability and practical application of EAIS in different institutional contexts.

Future Research

Reflecting on the insights provided by this study, several factors emerge as essential for future research regarding EAISs in community colleges. The first significant area of interest lies in a more thorough investigation into how EAISs improve student retention and reduce dropout rates to offer more transformative insights for educational practices. Such research would delve into the strategies and interventions within EAISs that are most effective in bolstering retention, thus identifying best practices in this crucial area. This proposed exploration aligns with existing research indicating that targeted interventions can significantly impact student persistence and success in community colleges (Kuh, Kinzie, Buckley, Bridges, & Hayek, 2006). Studies have shown that personalized support systems and early alert mechanisms are vital in enhancing student engagement and academic achievement, which are critical factors in reducing dropout rates (Tinto, 2012).

Future research in this domain could build upon the work of Bettinger and Baker (2014), who examined the role of academic support services in postsecondary institutions. Their findings suggest that well-designed support systems can positively impact student retention. Similarly, a study by Weiss, Visher, & Wathington (2010) on the effectiveness

of learning communities in community colleges highlighted the potential of integrated support services in improving student outcomes.

The investigation into EAIS's role in student retention could benefit from a closer examination of more demographic and contextual factors that influence student success. For example, study the application of the EAIS to specific groups of students based on their academic performance. Doing so may contribute to the students who need the support and the institutional effectiveness of the implementation of the EAIS, saving considerable sums of money for academic institutions. Moreover, research by Chen (2012) highlights the importance of considering diverse student backgrounds when designing and implementing support systems. Understanding the unique challenges different student groups face can lead to more tailored and effective interventions.

Additionally, future studies should consider grouping students by age to analyze whether the effects of EAIS vary across different age demographics. By examining age-specific responses to these interventions, researchers can identify whether younger and older students benefit differently from such support mechanisms. This differentiation could lead to more effective strategies for improving student graduation rates across diverse age groups within postsecondary institutions.

Moreover, analyzing students' demographics, including family income and professional background, will potentially support the creation of cohorts of students that will benefit the most from the application of EAIS. By understanding how these demographic factors influence students' academic success, researchers and educators can develop targeted intervention strategies that address the specific needs of these groups. This approach not only enhances the relevance and impact of EAIS but also promotes

equity in educational outcomes by providing tailored support to those who might otherwise be at a disadvantage.

Conclusions

This dissertation explored the pivotal role of EAIS in bolstering student academic performance and graduation rates within postsecondary education settings. A comprehensive analysis has demonstrated the surprising negative effect of EAIS on enhancing student retention. While our findings do not align with those underscoring the significance of personalized and timely intervention theoretical frameworks posited by Tinto (2012) and the empirical evidence from Bettinger and Baker (2014), they provide insights into the relationships between academic achievement and persistence.

In addition, the nuanced exploration of demographic and contextual variables reveals that the impact of EAIS is multifaceted, echoing the research by Chen (2012), who advocates for incorporating diverse student backgrounds in the design of support mechanisms. This dissertation advocates for a holistic approach to deploying EAIS, which is cognizant of the varied landscapes of student experiences and needs.

In light of the limitations encountered, this research calls for further investigation into the long-term effects of EAIS on different populations within the higher education ecosystem. Future studies should aim to delineate more precisely the elements of EAIS that most significantly contribute to student success, as suggested by the work of Weiss, Visher, & Wathington (2010).

In conclusion, EAISs emerge as a tool for mitigating dropout rates and as a fundamental component of a strategic framework for fostering an inclusive and supportive

educational environment. The ongoing refinement and adaptation of these systems, informed by continuous research and feedback, will be crucial in addressing the evolving challenges of higher education and achieving the overarching goal of maximizing student success.

LIST OF REFERENCES:

Alam, A., & Mohanty, A. (2022). Business Models, Business Strategies, and Innovations in EdTech Companies: Integration of Learning Analytics and Artificial Intelligence in Higher Education. 2022 IEEE 6th Conference on Information and Communication Technology (CICT), 1–6. https://doi.org/10.1109/CICT56698.2022.9997887

Aljohani, O. (2016). A Comprehensive Review of the Major Studies and Theoretical Models of Student Retention in Higher Education. Higher Education Studies, 6(2), 1. https://doi.org/10.5539/hes.v6n2p1

Altbach, P. G., Reisberg, L., & Rumbley, L. E. (2019). Trends in global higher education: Tracking an academic revolution. Brill.

Archibald, R. B., & Feldman, D. H. (2008). Explaining Increases in Higher Education Costs. The Journal of Higher Education, 79(3), 268–295. https://doi.org/10.1080/00221546.2008.11772099

Astin, A. W. (1999). Student Involvement: A Developmental Theory for Higher Education. Journal of College Student Development, 40(5), 12.

Attaran, M., Stark, J., & Stotler, D. (2018). Opportunities and challenges for big data analytics in US higher education: A conceptual model for implementation. Industry and Higher Education, 32(3), 169–182. https://doi.org/10.1177/0950422218770937

Baidoo-Anu, D., & Ansah, L. O. (2023). Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning. Journal of AI, 7(1), 52-62.

Bailey, T., Jaggars, S. S., & Jenkins, D. (2015). What We Know about Guided Pathways: Helping Students to Complete Programs Faster. Research Overview. Community College Research Center, Teachers College, Columbia University.

Bean, J. P. (1980). Dropouts and turnover: The synthesis and test of a causal model of student attrition. Research in higher education, 12, 155-187.

Bean, J. P., & Eaton, S. B. (2000). A psychological model of college student retention. Reworking the student departure puzzle, 1(48-61), 12.

Bean, J. P., & Metzner, B. S. (1985). A conceptual model of nontraditional undergraduate student attrition. Review of Educational Research, 55(4), 485-540.

Bean, J. P. (1982). Student attrition, intentions, and confidence: Interaction effects in a path model. Research in higher education, 17, 291-320.

Belfield, C. R., & Bailey, T. (2011). The Benefits of Attending Community College: A Review of the Evidence. Community College Review, 39(1), 46–68. https://doi.org/10.1177/0091552110395575

Bettinger, E., & Baker, R. (2014). The effects of student coaching in college: An evaluation of a randomized experiment in student mentoring. Educational Evaluation and Policy Analysis, 36(1), 3-19.

Burke, A. (2019). Student Retention Models in Higher Education: A Literature Review. College and University, 94(2), 12–21.

Cabrera, A. F., Nora, A., & Castaneda, M. B. (1993). College persistence: Structural equations modeling test of an integrated model of student retention. The journal of higher education, 64(2), 123-139.

Calcagno, J. C., & Long, B. T. (2008). The Impact of Postsecondary Remediation Using a Regression Discontinuity Approach: Addressing Endogenous Sorting and Noncompliance (w14194; p. w14194). National Bureau of Economic Research. https://doi.org/10.3386/w14194

Chatterton, P., & Goddard, J. (2024). The Response of Higher Education Institutions to Regional Needs.

Chen, R. (2012). Institutional characteristics and college student dropout risks: A multilevel event history analysis. Research in Higher Education, 53(5), 487-505.

Denning, J. T., Eide, E. R., Mumford, K. J., Patterson, R. W., & Warnick, M. (2022). Why Have College Completion Rates Increased? American Economic Journal: Applied Economics, 14(3), 1–29. https://doi.org/10.1257/app.20200525

Dowd, A. C., Pak, J. H., & Bensimon, E. M. (2013). The role of institutional agents in promoting transfer access. Education Policy Analysis Archives/Archivos Analíticos de Políticas Educativas, 21, 1-40.

Finnie, R., Fricker, T., Bozkurt, E., Poirier, W., & Pavlic, D. (2017). Using predictive modeling to inform early alert and intrusive advising interventions and improve retention.

Foster, C., & Francis, P. (2020). A systematic review on the deployment and effectiveness of data analytics in higher education to improve student outcomes. Assessment & Evaluation in Higher Education, 45(6), 822-841.

Fowler, P. R., & Boylan, H. R. (2010). Increasing student success and retention: A multidimensional approach. Journal of Developmental Education, 34(2), 2.

Goldrick-Rab, S. (2010). Challenges and Opportunities for Improving Community College Student Success. Review of Educational Research, 80(3), 437–469. https://doi.org/10.3102/0034654310370163

Gray, C. C., & Perkins, D. (2019). Utilizing early engagement and machine learning to predict student outcomes. Computers & Education, 131, 22–32. https://doi.org/10.1016/j.compedu.2018.12.006

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. European Business Review, 31(1), 2–24. https://doi.org/10.1108/EBR-11-2018-0203

Jenkins, D., Lahr, H., & Fink, J. (2017). Implementing Guided Pathways: Early Insights From the AACC Pathways Colleges.

Johnson, R. A., & Bhattacharyya, G. K. (2019). Statistics: principles and methods. John Wiley & Sons.

Jokhan, A., Sharma, B., & Singh, S. (2019). Early warning system as a predictor for student performance in higher education blended courses. Studies in Higher Education, 44(11), 1900–1911. https://doi.org/10.1080/03075079.2018.1466872

Kerby, M. B. (2015). Toward a New Predictive Model of Student Retention in Higher Education: An Application of Classical Sociological Theory. Journal of College Student Retention: Research, Theory & Practice, 17(2), 138–161. https://doi.org/10.1177/1521025115578229

Kim, H., Krishnan, C., Law, J., & Rounsaville, T. (2020). COVID-19 and US higher education enrollment: Preparing leaders for fall. New Jersey: McKinsey & Company.

Kuh, G. D., Kinzie, J. L., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2006). What matters to student success: A review of the literature (Vol. 8). Washington, DC: National Postsecondary Education Cooperative.

Lang, M. (2001). Student retention in higher education: Some conceptual and programmatic perspectives. Journal of college student retention: Research, theory & practice, 3(3), 217-229.

Larrabee Sønderlund, A., Hughes, E., & Smith, J. (2019). The efficacy of learning analytics interventions in higher education: A systematic review. British Journal of Educational Technology, 50(5), 2594–2618. https://doi.org/10.1111/bjet.12720

Longwell-Grice, R., & Longwell-Grice, H. (2008). Testing Tinto: How Do Retention Theories Work for First-Generation, Working-Class Students? Journal of College

Student Retention: Research, Theory & Practice, 9(4), 407–420. https://doi.org/10.2190/CS.9.4.a

Lucas, C., Van Duser, K., & Cohen, S. (2020). The Influence of Rising Tuition on First-Year Students' Enrollment and Persistence Intentions. College Student Journal, 54(4), 421-430.

Maher, M., & Macallister, H. (2013). Retention and Attrition of Students in Higher Education: Challenges in Modern Times to What Works. Higher Education Studies, 3(2), p62. https://doi.org/10.5539/hes.v3n2p62

Maldonado, S., Miranda, J., Olaya, D., Vásquez, J., & Verbeke, W. (2021). Redefining profit metrics for boosting student retention in higher education. Decision Support Systems, 143, 113493. https://doi.org/10.1016/j.dss.2021.113493

Merisotis, J. P., & McCarthy, K. (2005). Retention and student success at minority-serving institutions. New Directions for Institutional Research, 2005(125), 45–58. https://doi.org/10.1002/ir.138

Nieuwoudt, J. E., & Pedler, M. L. (2021). Student Retention in Higher Education: Why Students Choose to Remain at University. Journal of College Student Retention: Research, Theory & Practice, 152102512098522. https://doi.org/10.1177/1521025120985228

Pascarella, E. T., & Terenzini, P. T. (1980). Student-faculty informal contact and college outcomes. Review of Educational Research, 50(4), 545-595.

Pascarella, E. T., & Terenzini, P. T. (1980). Predicting freshman persistence and voluntary dropout decisions from a theoretical model. The journal of higher education, 51(1), 60-75.

Reyna, R., Reindl, T., Witham, K., & Stanley, J. (2010). Complete to Compete: Common College Completion Metrics. Technical Guide. NGA Center for Best Practices.

Simons, J. M. (2011). A national study of student early alert models at four-year institutions of higher education. Arkansas State University.

Smith, E. (2008). PITFALLS AND PROMISES: THE USE OF SECONDARY DATA ANALYSIS IN EDUCATIONAL RESEARCH. British Journal of Educational Studies, 56(3), 323–339. https://doi.org/10.1111/j.1467-8527.2008.00405.x

Spady, W. G. (1970). Dropouts from higher education: An interdisciplinary review and synthesis. Interchange, 1(1), 64-85.

Spady, W. G. (1971). Dropouts from higher education: Toward an empirical model. Interchange, 2(3), 38-62.

Sneyers, E., & De Witte, K. (2018). Interventions in higher education and their effect on student success: A meta-analysis. Educational Review, 70(2), 208–228. https://doi.org/10.1080/00131911.2017.1300874

Tamrat, W. (2021). The Indelible Challenges of Student Retention in Higher Education: Imperatives for a Closer Scrutiny [Preprint]. In Review. https://doi.org/10.21203/rs.3.rs-162412/v1

Tight, M. (2020). Student retention and engagement in higher education. Journal of Further and Higher Education, 44(5), 689–704. https://doi.org/10.1080/0309877X.2019.1576860

Tinto, V. (2012). Completing college: Rethinking institutional action. University of Chicago Press.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. Review of educational research, 45(1), 89-125.

Tinto, V. (2006). Research and practice of student retention: What next? Journal of college student retention: Research, Theory & Practice, 8(1), 1-19.

Tinto, V. (2017). Through the eyes of students. Journal of College Student Retention: Research, Theory & Practice, 19(3), 254-269.Trolian, T. L., Jach, E. A., Hanson, J. M., & Pascarella, E. T. (2016). Influencing Academic Motivation: The Effects of Student-Faculty Interaction. Journal of College Student Development, 57(7), 810–826. https://doi.org/10.1353/csd.2016.0080

Arbo, P., & Benneworth, P. (2007). Understanding the regional contribution of higher education institutions: A literature review.

Villano, R., Harrison, S., Lynch, G., & Chen, G. (2018). Linking early alert systems and student retention: A survival analysis approach. Higher Education, 76(5), 903–920. https://doi.org/10.1007/s10734-018-0249-y

Weiss, M. J., Visher, M. G., & Wathington, H. (2010). Learning Communities for Students in Developmental Reading: An Impact Study at Hillsborough Community College. National Center for Postsecondary Research.

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