



# Computer Science Cohorts in New Student Orientation to Promote Departmental Identification, High Impact Practices

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## ABSTRACT

Sufficiently serving computer science students at minority serving institutions entails systematic communication of the “hidden curriculum”- the unwritten rules and tacit norms of traversing a disciplinary academic space- knowledge that students might learn from those with college-going backgrounds. At Kean University, department-run new student orientation has become a mechanism for integrating new students into the institution as well as into the computer science department’s community. The course addressed what Kezar and Holcombe call “Elements of STEM student success”, or the needs of students at the intersection of first-generation familial experiences and STEM student college newcomers. In this work in progress experience report, we use data from retrospective pre post surveys to show student participants in the orientation indicate greater intent to engage in High Impact Practices, greater confidence in their major choice, and strong identification with their STEM discipline. The authors discuss how systemic, department level orientation processes at institutions that serve underrepresented student populations can impart academic and career path blueprints that move beyond institutional retention and improve equitable advancements in computing.

## CCS Concepts

**Professional topics- Computing education - Computing education programs- Computer science education**

## Keywords

Retention; first year students; diversity and inclusion; cohort development; new student orientation

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## 1 INTRODUCTION

### 1.1 Issue of Equity and Policy- Disconnection of institutional, departmental practice

Students who come to college without the inheritance of higher education in their familial background enter institutions with varied expectations of institutional and departmental support for their success [1]. Institutions with a legacy or mission for serving students from diverse racial, ethnic, and economic backgrounds have developed practices and policies that promote student achievement [2], yet the human, financial, and material resources to do so are typically housed in institutional spaces, such as integrated student success offices, media centers and libraries, and large-scale tutoring centers. Often institutional goals of retention are less tied to the disciplines of students but instead to the institution—a change of major towards a perceived “less demanding” field would be of less concern in these circles than a transfer to another school or a stop-out. Within an institution-level system of student support, departmental belonging and discipline-specific guidance can be overlooked. An example of this tendency to silo support for students is the collaborative study at Hispanic Serving Institutions in California—the disconnection in support services left some needs unmet, and the support was found insufficient to meet STEM students’ diverse needs. The lack of coordination, allowed for students to slip through administrative cracks [3].

The needs of first-generation college students studying STEM in higher education are varied, and span developmental, financial, emotional, academic, and advisory realms—the table below is adapted from the work of Kezar and Holcombe [4] regarding the complex needs of first-generation STEM students may have in their early college careers.

**Table 1. Student Success Needs, First Generation STEM**

First Generation Specific Needs	Computer Science Specific Needs
Family support	CS advising
Structured Academic Pathways	Hands-on/experiential learning
Working with faculty	CS career awareness
Setting expectations	Peer mentors in the major
Creating college knowledge	Develop a CS identity
Intrusive Advising	Peer based learning models



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Based on this understanding of the specific needs of STEM students who are first in their families to attend college, the computer science department created a bridging activity in the form of a new student orientation across “silos” to provide CS specific and first-generation specific support structures for entering computer science majors. A part of this work involved making college best practices clear to students and encouraging their involvement in the high-impact practices known to support student retention [5, 6]. High Impact Practices for college student success include peer engagement, collaborative work with student peers, faculty engagement, student research, learning communities, and first year experiences. In this work in progress experience report, we describe the department-led initiative built with first generation computer science (CS) students in mind. By building the activity into general education requirements for first year students at the university, the department increased student receptiveness to the course. Through the department led initiative, students met peers as well as facilitators of High Impact Practices (e.g., Supplemental Instructors served as teaching assistants for the CS orientation). Initial results indicate the course was successful in improving student intentions and interests related to college engagement practices.

## 2 DESCRIPTION OF PRACTICE

### 2.1 Context

Kean University is a mid-sized, Mid-Atlantic US institution with a majority/minority student population. The enrollment of students, according to institutional documentation patterns for categorizing demographics is 35% Hispanic, and 30% Black/African American. Sixty percent of first year students are eligible for Pell grants, compared with a national average of 32% of all students in higher education, with elite universities enrolling around 20% Pell eligible students on average, a rate that is declining [7]. More than 42% of students entering Kean University are the first in their family to attend college. The department serves approximately 800 students per year, and while racial ethnic makeup is slightly less diverse than the institutional student body for black/African American students, the rates of enrollment of Hispanic/Latinx/o/a has surpassed parity in first year student enrollment. Gender makeup of the CS faculty is 8 women and 7 men, yet the departmental student population remains male dominant with approximately 80% men. The department utilizes multiple student support structures [8], such as supplemental instruction and tutoring models, and has four staff members in the department dedicated to student guidance, programmatic support, and role modeling—all are women of color who graduated from Kean University, and two are authors of this paper.

### 2.2 Audience

Students entering their first year in the computer science department during the fall of 2023 at Kean University were the target audience for the initiative. A total of 160 students enrolled in the Computer Science New Student Orientation (CS NSO) weeklong program, and survey data reported in this experience report were collected from 67 students who completed the course

in August 2023. The proportions of racial and ethnic groups that are minoritized in computing (in the United States, African American/Black, Hispanic or Latina/o/x, Pacific Islander, and American Indian or Alaskan Native) who participated in the course mirrored the representation of these groups in the first-year enrollment for computer science at Kean- for example, while 29.26% of the 311 first year CS student enrollment was reportedly African American or black, 29.9% of the initiative survey respondents self- identified as Black or African American on the survey. Similarly, 39.9% of first year computing students were listed as Hispanic or Latina/o/x in institutional research data records, and a slightly greater proportion of New Student Orientation students self-identified as Hispanic or Latina/x/o (43.3%). Systemic racism in the United States [9] has led to a disproportionate share of Black and Hispanic/Latinx/o/a students eligible for Pell grants (57% of all Black students, 46% of all Hispanic/Latinx/o/a students) [10].

**Table 2: Computer Science New Student Orientation Survey Respondent Descriptors of Race and Ethnicity**

Demographic Responses, Retrospective survey, CS New Student Orientation	Frequency	Percent
Asian	4	6.0%
Black	20	29.9%
Hispanic or Latina/o/x	29	43.3%
Middle Eastern or North African	4	6.0%
White	3	4.5%
Black, Hispanic or Latina/o/x	3	4.5%
Black, Middle Eastern or North African	1	1.5%
Hispanic or Latina/o/x, White	2	3.0%
Middle Eastern or North African, White	1	1.5%
<b>Total</b>	<b>67</b>	<b>100.0</b>

Nearly half (42%) of the students who enrolled in the computer science new student orientation in fall 2023 were first generation college students based on FAFSA documentation completed at the university, while a slightly lower percent of those who completed the survey in this report indicated they were first in their family to attend college (36%). Survey respondents were slightly more likely to be Pell-grant eligible, (63% survey respondents, compared with 62% orientation enrolled in the course). This data indicate that students who attended the new student orientation and completed a survey were similar to the first year student body in terms of Pell grant eligibility (60% of first year students at Kean compared with 63% survey respondents), though perhaps less likely to be first generation students in college (42% of Kean students compared with 36% from the survey). The reliance on FAFSA completion for documenting first generation status as well as for documenting Pell grant eligibility may skew results slightly towards students with an understanding of college going –those who do not complete the FAFSA are not registered as “first generation” students, yet knowledge of college application processes is needed to complete the paperwork.

The demographic data are presented in the audience section for two reasons- a) to indicate the level of demographic diversity in the department in this minority serving institution, and b) to show that the students who chose to enroll in the four-day New Student Orientation within the major did not differ demographically from the larger pool of eligible students. Self-selection bias is often cited as an issue when voluntary efforts are utilized to support diverse student success—demographic similarity to the target population is one mechanism for checking for self-selection bias.

## 2.3 Approach

Students attended a 4-day course the week before class began in fall of 2023, led by computer science faculty and near peer mentor staff. They engaged in multiple activities, assignments, and sessions. The table below shows how the 4-day CS NSO built first generation needs as documented by higher education research and institutional policies to support engagement and retention and STEM student needs built from discipline based educational research into the curriculum of the course. The table outlines each element of Kezar and Holcombe's model, and describes programmatic elements that address each element.

**Table 3: CS NSO Approach to Meeting First Generation, STEM Student Needs**

<b>First Generation Specific Needs (Kezar and Holcombe)</b>	
Structured Academic Pathways	Students who are further along in the department outline their pathways in narrative storytelling as well as in their description of departmental opportunities for courses, extracurricular, and work-related positions.
Working with faculty	CS teaching faculty led each section of CS NSO, so first year students interact immediately with CS instructors, even before the first day of classes. Faculty describe specific ways the students might join research and/or club activities with the faculty in the future.
Setting expectations for effective college going	Study skills are addressed, including the tri-note method; Explicit messaging from current CS students written into the lesson plans and daily schedules include: need for problem solving and active participation, need to learn to take good notes. Students role play an office hours scenario with faculty to support the expected action of attending faculty office hours. In these ways, CS NSO make the “hidden curriculum” of college success explicit to incoming students.
Creating college knowledge	Orientation to academic, financial, and wellness, services at Kean as well as technical tools available to students is covered in CS NSO. Staff and peers from CS lead these discussions, and a
	campus scavenger hunt adds to the engagement of students and creates a social atmosphere for getting to know CS first year peers.
Intrusive Advising	Students develop a draft study plan during the CS NSO, and learn about the CS faculty-led practice of study plan review and approval that

	occurs each semester.
<b>Computer Science Specific Needs (Kezar and Holcombe)</b>	
CS advising	Advising comes from near-peer students' perspectives and faculty members' perspectives—in storytelling as well as in presentations of what courses are needed in what order
Hands-on/experiential learning	Near peer students lead problem solving lessons which support logical thinking and support pre-programming—they are led as problem or puzzle based activities.
CS career awareness	Near-peers describe their internship and research experiences in the field so that first year students might see themselves in their stories of CS success.
Peer mentors in the major	Six peers served as teaching assistants who take on instructional responsibility in portions of the CS NSO. In many cases, the students who serve as near peer mentors are also leaders in the department who are supplemental instruction leaders, club organizers, and student researchers, modeling not only successful CS student behaviors but also leadership and serving behaviors.
Develop a CS identity	Multiple activities were designed to support individual and collective computer science identities—students spent class time reflecting upon their major and their reasoning for choosing it and creating elevator pitches describing their interests; group efforts in hands-on, experiential computing supported collective CS identity development

## 2.4 Goals and Outcomes

The purpose of the CS department-run New Student Orientation was to support positive college-going behaviors including High Impact Practices among new CS students, to create a sense of community through shared identity in CS among cohort members and their near peers, build relationships with faculty in the major to support help seeking and guidance success, and to introduce incoming students to the major in a hands-on, project-based way. Students were asked about their dedication to their major before and following their experience in CS NSO. Data indicate a positive change that is statistically significant, from a 2.80 to a 3.08 mean score on a 4-point scale. See the tables below for more specific statistical detail.

**Table 4: Student Dedication to the Major, Before and Following CS NSO**

<b>CS NSO impact on Student Dedication to the Major</b>							
<b>Statement</b>	<b>Before NSO</b>		<b>After NSO</b>		<b>t-Test statistics</b>		<b>Effect size</b>
	<b>M</b>	<b>SD</b>	<b>M</b>	<b>SD</b>	<b>t</b>	<b>p</b>	
<b>Dedication to major</b>	2.80	.938	3.08	.906	-3.19(66)	0.000	0.3000

Faculty engagement early in the college experience is a High Impact Practice for college retention—and undergraduate research is also seen as an impactful way to engage students in the content of the discipline. Following the CS NSO, students surveyed responded more positively regarding their intended faculty interaction, with students more likely to agree to research, seek out research, and ask for faculty support when needed. Each item saw strong, statistically significant growth from less than 3 to more than 3 on a 4-point scale. See table below

**Table 5: Faculty Engagement/Help Seeking Gains Following CS NSO**

CS NSO impact on Faculty Engagement/help seeking							
Statement	Before NSO		After NSO		t-Test statistics		Effect size d
	M	SD	M	SD	t(#)	p	
[Asking a professor to work on a research project]	2.784	1.008	3.43	0.743	-6.661	0.000	0.7330
[Agreeing to work on a research project with a professor]	2.806	0.953	3.36	0.792	-5.411	0.000	0.6301
[Ask for help when you need it]	2.896	1.017	3.604	0.574	-6.835	0.000	0.8584

The CS NSO emphasized the importance of engaging in activities on campus, including student support structures like tutoring and supplemental instruction. Students reported greater intention to engage in these activities following the CS NSO, including interest in attending SI or tutoring pods, attending more general tutoring in the library, and interest in joining a group on campus. All differences were statistically significant.

**Table 6: Student Interest in Tutoring, SI and Student Clubs**

CS NSO impact on interest in studying, engaging with campus groups							
Statement	Before NSO		After NSO		t-Test statistics		Effect size d
	M	SD	M	SD	t(#)	p	
[Attending Supplemental Instruction (SI) or STEM Tutoring Pods]	2.679	1.032	3.46	0.765	-6.628	0.000	0.8622
[Attending tutoring in the library for STEM subjects]	2.754	0.971	3.45	0.702	-6.528	0.000	0.8192
[Joining a student club or organization]	2.627	0.9667	3.24	0.818	-6.998	0.000	0.6833

Students indicate they are more interested in seeking out peer groups and a sense of belonging following their experience of the CS NSO—all differences are statistically significant from pre to post course experience. Students were slightly more likely to join an existing group rather than initiate a peer group study session, and students appear invested in finding a social group at Kean University, all of which High Impact Practice research indicates can support retention.

**Table 7: Student Interest in Student Peer Support**

Statement	CS NSO impact on Student Peer Support						
	Before NSO		After NSO		t-Test statistics		Eff. size d
	M	SD	M	SD	t(#)	p	
[Inviting peers to meet in a study group]	2.575	0.897	3.18	0.796	-6.295	0.000	0.7126
[Joining peers to meet in a study group]	2.731	0.910	3.39	0.717	-6.770	0.000	0.8017
[Find a group where you feel you belong]	2.572	1.031	3.164	0.756	-5.818	0.000	0.6550

Overall, data indicate student increased interest in departmental services and socialization, faculty engagement, and research, all designed to support first generation STEM student success. The cohort model may additionally support computer science identity development, which could be supportive of student retention in the major.

### 3. POSITIONALITY STATEMENT

Authors are cisgender women. Two are professional staff members of the computer science department at Kean University with college degrees in social science fields, and who identify as black. One author is a white woman with a background in learning sciences and evaluative experience with computer science. Another author is a white woman who serves as department chair of computing at Kean University. The staff members were co-developers of curriculum and content for the New Student orientation, and serve the department as advisors to student professional development and academic growth. The department chair was a non-traditional graduate student in computer science, attending later in life following a career in industry. She has demonstrated dedication to equity in computer science through her development and facilitation of multiple National Science Foundation grants meant to broaden participation in computing, as well as her involvement in research related to gender parity. Three authors serve as insiders within Kean University, while the fourth author has an external perspective on the department.

#### 4. LIMITATIONS AND ASSUMPTIONS

A limitation of the current CS NSO is that the course is prohibitive for full time, day shift workers—it will be important to develop a mechanism for providing this subpopulation a way to engage with departmental staff, faculty, and peer resources early in the semester.

#### 5 IMPLICATIONS

The department-led new student orientation is gaining traction at Kean University- fall 2023 saw a piloted version of the NSO at the college level to support STEM students more broadly—efforts to study the CS NSO will align with evaluation at the STEM NSO to see if the general approach is valued in the same way as the discipline-specific approach. The cohort model is viewed as a viable way of supporting first generation student knowledge of and use of High Impact Practices, and simultaneously viewed as a way to develop computer science identification in the department. As students matriculate and extend their enrollment in further semesters, our study will involve comparing retention rates, social networks, and departmental engagement of students who enrolled in CS NSO with their peers who opted for a different version of the general education course at Kean.

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