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CONTENTS

I. INTRODUCTION

Recognizing community colleges' central role in the US workforce development infrastructure, the US Department of Labor has invested nearly $2 billion in Trade Adjustment Assistance Community College Career and Training (TAACCCT) grants to strengthen community colleges' ability to meet workforce needs. The overarching goals of the grants are to: 1) increase student attainment of industry-recognized credentials, 2) develop innovative approaches to instructional delivery, and 3) improve students' employment outcomes. In the fourth and most recent round of TAACCCT grants, awarded in 2014, the focus is on "advancing innovative, sector-based system change in regional and statewide economies" with the goal of "creating industry-driven strategies that are responsive to regional labor markets and state economies" (US DOL, 2014).

In 2014, the Department of Labor awarded Ivy Tech Community College in Indiana a $2.5 million TAACCCT grant to reform its computing programs. This grant is supporting the reform of these programs through several activities that promote greater alignment with workforce needs. These activities include the purchase of supplies to support hands-on learning; the professional development of faculty; the redesign or enhancement of program pathways; the development of a student advising tool and student competitions; and the expansion of employer outreach and connections with the workforce system. Through these activities, Ivy Tech sought to strengthen its computing program statewide and to improve the retention, completion, and employment outcomes of its computing students.

The Education and Employment Research Center (EERC) at Rutgers, The State University of New Jersey is working with Ivy Tech to conduct a comprehensive evaluation of this TAACCCT grant. The evaluation utilizes a mixed methods approach to gather data from multiple perspectives on grant implementation and outcomes. This report is the first in a series of three evaluation reports on Ivy Tech's TAACCCT grant. The report discusses the implementation of grant activities by documenting the implementation of the grant activities; identifying promising practices and areas for improvement; and providing baseline information on key data points of interest in areas where implementation is just beginning. This report also provides information on the characteristics of students in computing programs enrolled during the grant period and their early outcomes, and compares them with students who enrolled in prior computing programs at the same school. Future reports will discuss ongoing implementation activities and provide more in-depth analyses of student outcomes.

The body of the report begins with a section that describes the qualitative and quantitative methods used in the evaluation. Following that section, another provides background and context for the grant activities. Subsequent sections of the report include findings on the following topics: hands-on learning, advising, employer engagement, and early outcomes. The report concludes with a discussion of next steps in grant implementation and in the evaluation.

II. METHODS

The evaluation used a mixed methods approach including multiple sources of data. The EERC evaluation team collected data through site visits, by examining existing program documents, and by administering online surveys. The team analyzed these data along with the administrative records of students enrolled at the college. This section describes each of these data sources.

Site Visits

The EERC evaluation team conducted one-day site visits in November and December 2015 at six different Ivy Tech campus locations—Bloomington, Fort Wayne, Indianapolis, Lafayette, Muncie, and South Bend. During these site visits, EERC conducted focus groups with students and interviewed faculty, advisors, and administrators. EERC staff conducted a total of 10 student focus groups ranging in size from 3 to 16 students. EERC conducted interviews with 24 faculty members, 7 faculty chairs or assistant faculty chairs, 8 advisors, and 4 central college staff. Two of the four interviews with Ivy Tech central staff were conducted via telephone. All but three of the interviews were recorded and transcribed. In the case of the remaining three interviews, comprehensive notes were taken in lieu of recording. Interview transcriptions and notes were coded through the use of NVivo qualitative data management software and then analyzed by EERC team members.

Document Review

The qualitative methodology for this report also included content analysis of college goals and activities-to-date. This analysis was based on the grant proposal's statement of work; communication with the campuses through grant newsletters; internal presentations and planning documents; notes and minutes from meetings; spreadsheets for tracking supply purchases and implementation; and the college website.

Survey Data

The evaluation team developed three surveys—two fielded to students and one fielded to faculty members of programs offered by the newly formed School of Computing and Informatics (CPIN). The first of these, referred to as the "CPIN student survey," was aimed at all students enrolled in any CPIN class and was designed to ask a wide range of students about their information needs and decision-making processes with regard to the CPIN programs and related careers, their experiences with academic advising, their current employment situation, and their potential interest in internships. This survey, fielded in February 2016, included students who were early in their college enrollments and may not have chosen a field of study, as well as those who had been enrolled for a longer period of time.

The second survey was targeted at only those students who, in fall 2015, were enrolled in ITSP135, NETI100 and NETI105—the classes that were most likely to have been affected by the new supplies purchased under the grant. This survey, referred to as the "hands-on learning student survey," was designed to ask students about their hands-on learning experiences in these classes. This survey was fielded in February–March 2016. The students to whom the survey was administered were identified with the assistance of the Ivy Tech institutional research department.

The third and final survey, referred to as the "CPIN faculty survey," was fielded by the EERC in March 2016 and targeted at all faculty teaching courses in the CPIN program statewide. The survey was administered to a population that was based on a list provided by the TAACCCT project director. The survey collected information on faculty use of supplies and hands-on learning, perceptions of students' information needs and their decision-making processes with regard to the CPIN programs and related careers, and their experiences with employer engagement.

Appendix A includes a detailed table that summarizes the sample sizes, response rates, timing, and average length of each of these surveys.

Student Administrative Records Data

Student administrative records data were provided by Ivy Tech's Institutional Research (IR) Central Office. Data included student demographics, enrollment status, course history, credential completion, and wage record from fall 2014 through fall 2015. The data administrator de-identified all data files before they were made available to the EERC team for analysis. Information on campuses, programs, courses, and curricula were provided by the TAACCCT project director in various formats and encoded into data files. From combined data, we derived several key indicators including the CPIN programs group, the prior computing programs group, cohorts, enrollment type, retention, and degrees pursued. Appendix B provides a detailed description of how we constructed each indicator.

III. BACKGROUND AND CONTEXT

The reforms in the TAACCCT grant built on a preexisting reorganization of Ivy Tech's computing and informatics programs. The reorganization of these programs—which occurred separately prior to the grant—was motivated by larger efforts centered on better aligning programs with labor market needs and improving the clarity of program pathways for students. In this section, we provide an overview of the program restructuring alongside existing research that provides a context for the approach to program restructuring. We then describe the model for the TAACCCT grant reforms and a brief review of the literature related to these reforms.

Program Restructuring

Ivy Tech organized efforts to restructure their computing programs in response to feedback from industry that its graduates did not have the depth of skill needed for the workplace. With the idea that their existing computing and informatics programs were too broad to lead to employment in the information technology industry, Ivy Tech sought to develop programs that were more specific to areas of industry need. To do so, they organized an advisory board and held a meeting where they listened to industry representatives discuss their skills needs with regard to computing and informatics workers. A college committee then reviewed this list of skills to see how they grouped and began to develop a list of new programs. Because they were creating a new school within the college—the School of Computing and Informatics (CPIN)—they sought to develop a common core of classes across these programs.

Prior to the reorganization, Ivy Tech offered the following four programs:

- Computer information technology—hardware (CINT)
- Computer information systems—software (CINS)
- Information security (INSE)
- Computer science (CSCI)

After the restructuring, Ivy Tech offered the following eight programs, which were launched in fall 2014:

- Server administration (SVAD)
- Network infrastructure (NETI)
- Database management (DBMS)
- Informatics (INFM)
- Software development (SDEV)
- Information technology support (ITSP)
- Computer security information assurance (CSIA)
- Computer science (CSCI)

While the expansion to eight programs that were more narrow and specific in scope than the previous offerings was implemented to better prepare students for the labor market, these changes added greater complexity to students' decision-making. This program redesign created more avenues for students to pursue that are intended to lead to better employment outcomes, but in doing so, it also increased the need for improved information and advising.

The transition phase during which the college implemented the restructured programs created challenges for advisors as they learned the new system. Central staff members noted that general advisors are expected to know some information about all the programs their campus offers but are not expected to know everything about individual programs. Rather than helping students select a major, their training is more focused on helping students develop general class schedules and directing students to fundamental resources such as financial aid,

housing assistance, and transportation options. This has created challenges relative to the recent change in CPIN programs, since the programs are now geared toward specific career paths within the larger field of computing—pathways that general advisors were previously expected to know little about. The eight programs are now more nuanced, creating potential confusion for advisors as well as students when selecting a program. A central staff member commented on the pros and cons of moving to the eight-program model:

> I think its way better because they [students] can get more specialized. But I think sometimes it seems overwhelming to students at first. And some of the distinctions between the programs . . . it gets a little hard trying to understand the individual focuses for each of the programs.

To alleviate the strain—on both students and advisors—of having to choose from among eight programs, central staff is working to create a common first semester for all computing students. One central staff member discussed this process: "There are different rules, different requirements for each of the eight programs. [But] there's some commonality, and we're trying to come up with it [exactly what overlaps all eight programs]." Currently, most campuses are running several first-semester courses that are broad enough to cover most of the eight programs. Students are able to take these courses without being "locked" into a program, giving them time to choose which program they prefer to pursue after the first semester is complete. Although this seems like a good solution, it carries its own complications; these will be discussed in more detail below.

Another change that has recently occurred within the School of Computing and Informatics is that certificates are no longer embedded in the classes offered in 2015–16. Beginning in fall 2016, the school plans to offer certificate preparation and testing as stand-alone classes that in many cases will be required to complete degree programs. Previously, the school required students to prepare and test for certificates throughout the program, resulting in a total of 10 certifications by the time they graduated. Some students feel the change is positive; one student reported the multiple certification tests were stressful and "discouraging"—if she did not pass a certification, she felt deflated, "like I couldn't do this." This student much prefers the program now that certifications are not embedded. Other students, however, liked the idea of taking a class and immediately getting a certificate. These students felt that the certificate represented a direct correlation between what they were learning and the workforce. This is interesting, considering that the move to eight programs was done in order to better align students' learning with workforce needs. Faculty also had mixed responses to this shift. Some were very concerned that removing the certificates from the programs would make the students less likely to take and complete the certification and thus be much less prepared for the workforce. Others reported this change was welcome because students were often not fully prepared for the exams and were rushed and overwhelmed in taking them as part of their program. With the new programs, students can take the certification exams as part of separate one-credit classes apart from their other classes.

Grant Reforms

The TAACCCT grant was designed to support these efforts to restructure Ivy Tech's computing and informatics programs and its new school, CPIN, to create better pathways to employment. To do so, the grant sought to accomplish several broad goals:

1) improve student advising
2) promote hands-on learning
3) expand employer engagement

To meet these goals, they proposed several activities:

- purchase of supplies to support hands-on learning
- support of faculty professional development
- redesign or enhancement of program pathways
- development of an online advising tool
- development of student competitions
- expansion of employer outreach
- expansion of connections with the workforce system

These activities and their outcomes are summarized in the logic model for the project. See Appendix C.

Hands-on Learning

Prior research supports the goal of promoting hands-on learning for its role in engaging students in learning and preparing them for the workplace. Working hands-on with supplies instead of with simulations may also help students stay motivated in their courses and programs (Corter et al., 2011), and this increase in motivation could lead to an increase in retention—an overarching goal of the structural change to the CPIN programs at Ivy Tech. One study comparing students who took a hands-on learning course with those who took a similar course without hands-on learning found that those who were in the hands-on course had significant retention gains over those who were not (Knight et al., 2007). Another key rationale for the increased use of hands-on learning in instruction is to improve the transfer of skills to a professional setting (Pucher & Lehner, 2011). A 2014 study found that students in a freshman computer science course who participated in optional hands-on practice sessions were better prepared with the skills needed for success in their field than were those who did not experience hands-on learning; they also had higher academic scores and were less stressed about the course (Wu et al., 2014).

A goal of the Ivy Tech TAACCCT grant was to promote hands-on learning through the purchase of supplies for dedicated IT labs at 18 of the college's 32 campuses; for 13 data centers supporting either the network infrastructure or server administration programs at high demand

campuses; and for increased capacity in the virtual data center. To support the use of these supplies for hands-on learning, the grant included plans to engage faculty in professional development by training them on how to use the supplies and preparing them to earn the industry certifications required to deliver the new CPIN programs.

Finally, the grant also included plans to run student competitions with the goal of recruiting students. Central staff eventually came to view these competitions as an opportunity to engage employers with the competitions and also offer students hands-on learning activities.

Advising

While the new programs created through the program restructuring sought to be more aligned with labor market needs, the greater number of options may pose a challenge for students in understanding their options and making decisions. Prior research evidence has suggested that fewer options and clearer pathways may actually help students successfully complete their programs by reducing confusion and simplifying their potential pathways (Scott-Clayton, 2011). Deil-Amen and Rosenbaum (2003) argue that colleges can help to "structure" student success by simplifying student pathways and investing in better quality, more active advising. The "guided pathways model" described by Bailey, Jaggars, and Jenkins (2015) incorporates both of these strategies; it seeks to simplify students' pathways through college by offering clearer choices and intensive advising—a stark contrast to the plethora of choices and limited guidance that is often the case. An important element of their model is providing default curricula to guide students and advisors in creating academic plans that will enable students to take the courses they need to achieve their educational goals as quickly as possible. In addition, the model proposes a systematic process for advising students upon enrollment, upon selection of a program, and throughout a program to ensure that students stay on track.

To address concerns about students' ability to navigate the various CPIN program options, the Ivy Tech TAACCCT grant planned for improvements to student advising by providing more information about the new programs, not only to advisors, but directly to the students themselves. This was to be done through the development of an online advising tool. To this end, existing research points to the development of online resources as a way to support students' decision-making about education and careers. Research on student access to advising information has found that students frequently engage in self-advising, and many prefer to receive information via interactive, Web-based technology (Herndon, 2011). Having access to a website with program and course information may also help students who are working or balancing education and family life, allowing them to access information during alternative timeframes (Venable, 2010).

Employer Engagement

Employer engagement by community colleges can include a variety of activities with the goal of a long-term, mutually beneficial relationship (Wilson, 2015). Based on a review of these activities, Wilson identifies five levels of employer engagement: 1) advising or asking employers for input on programs, 2) building capacity or working together to meet both college and employer needs, 3) co-designing curriculum and pathways, 4) convening workforce partnerships, where educators act as the convener to meet workforce needs, and 5) leading and sustaining regional partnerships to meet the needs of industries or sectors. Previous research on the role of faculty in employer engagement finds challenges with employer engagement in that such activity has been generally limited, however, and is not supported by institutions (Brewer & Gray, 1991).

To better prepare students for employment, the Ivy Tech TAACCCT grant planned to expand employer engagement in the new CPIN programs through advisory boards to promote employer involvement in curriculum reviews, the provision of internships and capstone projects, and placement in employment. In addition to developing relationships with specific employers, the grant also sought to promote engagement with the workforce system as a whole.

Student Population

To understand the effects of these program reforms on students, we first examine the enrollment and demographic characteristics of all students enrolled in computing programs at the start of the grant in fall 2014, when the new CPIN programs were launched. We then compare the students enrolled in the CPIN programs with the students enrolled in the previous computing programs.

Enrollments

Among all students enrolled in Ivy Tech from fall 2014 through fall 2015, 8,485 took at least one CPIN course (see Table 1Table 1. CPIN STUDENTS, FALL 2014—FALL 2015). These students are defined as CPIN students and are further broken down into several subgroups based on their program enrollment status. Of all CPIN students, then, only about half—4,094—were CPIN majors—students who officially declared or were already pursuing one of the new CPIN majors during that period. Of the CPIN students who were not majors, 2,227 were identified as pursuing a previous computing major—one of the programs that were offered before the restructuring—and the remaining 2,164 either took courses only but were not enrolled at the school, were enrolled but had not yet declared a major, or were enrolled in a non-CPIN major.

Table 1. CPIN STUDENTS, FALL 2014—FALL 2015

	N
All CPIN students	8,485
Ever declared a CPIN major	4,094
Previous computing major	2,227
Not in a CPIN or previous computing major	2,164
Taking courses only	1,061
Undeclared major	45
Non-CPIN major	1,058

Source: Ivy Tech Student Administrative Records Data

Among the new CPIN majors, the SDEV, ITSP, CSIA, and CSCI programs have the largest proportions of CPIN students; together, these four programs account for nearly three quarters of CPIN students. Although many CPIN faculty who were interviewed noted that general advisors tend to first direct advisees to the CSCI program once they have expressed an interest in computers, the data show that CSCI is not necessarily disproportionately enrolled; in fact, SDEV attracts nearly three times as many enrollees. The smallest CPIN programs are SVAD, DBMS, NETI, and INFM. Among the previous computing programs, the largest enrollments were in the CINT and CINS programs. Table 2 shows students' enrollment by major across the new CPIN and previous computing programs.

Table 2. ENROLLMENT BY MAJOR FOR STUDENTS EVER ENROLLED IN A CPIN OR PREVIOUS COMPUTING PROGRAM, FALL 2014—FALL 2015

	Number of Students	Percent of Students
CPIN major as of Fall 2015[a]		
Software development (SDEV)	1,116	27
Information technology support (ITSP)	862	21
Computer security information assurance (CSIA)	626	15
Computer science (CSCI)	364	9
Informatics (INFM)	257	6
Network infrastructure (NETI)	241	6
Database management (DBMS)	258	6
Server administration (SVAD)	207	5
Switched to non-CPIN major as of Fall 2015	196	5
Total	**4,094**	**100**
Previous computing programs as of Fall 2015		
Computer information technology—hardware (CINT)	1,002	45
Computer information systems—software (CINS)	855	38
Computer science (CSCI)	274	12
Information security (INSE)	96	4
Total	**2,227**	**100**

Source: Ivy Tech Student Administrative Records Data

[a] Includes students who declared a CPIN program as their major sometime between Fall 2014 and Fall 2015 even if they eventually changed their major to another program.

[b] Most commonly, these students switched from a CPIN to major in general studies (47 students), business administration (31 students), criminal justice (10 students), and liberal arts (10 students). The remaining students switched to pursue a wide range of other majors such as health care support nursing, industrial technology, design technology, pre-engineering, and education. A few students switched to a "courses only" designation.

The entering cohorts of CPIN students reflect the transitional nature of the CPIN programs during this time period. Many students in entering cohorts at Ivy Tech before the launch of the new CPIN programs eventually enrolled in the new CPIN programs. Although these CPIN programs did not begin until fall 2014, 42 percent of students in these programs had enrolled at Ivy Tech prior to that date. The remaining 58 percent of students enrolled in CPIN programs were in entering cohorts at Ivy Tech after fall 2014 when the new CPIN programs were launched. In contrast, a much larger proportion—in fact, a majority (93 percent)—of students in the previous computing programs had first enrolled prior to fall 2014. Though a small number of students (7 percent) chose to enroll in the previous computing programs even after the new CPIN programs were launched, the overall trend in program enrollment by entering cohorts at Ivy Tech clearly reflects the transition away from the older computing programs toward the new CPIN programs. Table 3 shows entering cohorts for students enrolled in CPIN and previous computing programs.

Table 3. PROPORTION OF STUDENTS ENROLLED IN CPIN AND PREVIOUS COMPUTING PROGRAMS COMPOSED OF EACH ENTERING COHORT, FALL 2014–FALL 2015

Entering cohort	All CPIN Students	Students in CPIN Programs	Students in Previous Computing Programs[a]
After Fall 2014	**40%**	**59%**	**7%**
Fall 2015	10%	18%	--
Spring 2015	15%	19%	4%
Fall 2014	15%	22%	3%
Before Fall 2014	**60%**	**41%**	**92%**
Spring 2014	11%	8%	12%
Fall 2013	8%	6%	13%
Spring 2013	8%	5%	12%
Fall 2012	6%	3%	11%
Spring 2012	5%	3%	9%
Prior to spring 2012	22%	16%	35%
Sample size	**8,485**	**4,094**	**2,227**

Source: Ivy Tech Student Administrative Records Data

Note: Numbers in columns represents proportion of students in each group during the fall 2014–fall 2015 period who originally enrolled in Ivy Tech during the term represented in each row.

[a] Numbers do not add to 100 percent due to rounding.

The typical CPIN student is a full-time, continuing student enrolled in an AAS track. About two thirds (69 percent) of all students in CPIN majors enroll on a full-time basis. In addition, about twice as many CPIN students pursue AAS degrees (61 percent) compared to AS degrees (32 percent), and only a small number of students enroll in certificate (4 percent) or technical certificate (3 percent) tracks. Some enrollment characteristics shifted in the new CPIN programs compared to the previous computing programs. For example, although the majority of students in both groups enroll on a full-time basis, the new CPIN programs have a greater percentage of students enrolled on a part-time basis (31 percent) compared to the previous computing programs (26 percent; see Table 4).

Table 4. ENROLLMENT CHARACTERISTICS OF COMPUTING PROGRAMS, FALL 2014 THROUGH FALL 2015

	All CPIN Students	Students in CPIN Programs	Students in Previous Computing Programs
Enrollment type			
Full time	73%	69%	74%
Part time	27%	31%	26%
Degrees pursued			
Associate of Applied Science (AAS)	52%	64%	68%
Associate of Science (AS)	24%	28%	24%
Certificate (CT)	2%	4%	1%
Technical certificate (TC)	3%	4%	5%
Courses only	13%	--	1%
Other	5%	--	1%
Sample size	**8,485**	**4,094**	**2,227**

Source: Ivy Tech Student Administrative Records Data

Demographic Characteristics

Overall, CPIN students are primarily young, male, and white. As shown in Figure 5, among students enrolled in a CPIN course from fall 2014 to fall 2015, 76 percent were male, 61 percent were white, and 48 percent were between ages 20 and 29. Female students are greatly underrepresented in CPIN programs, comprising only 20 percent of students. Looking at race/ethnicity in terms of white/nonwhite, CPIN programs are somewhat representative of the Indiana population where, according to US Census Bureau data, 62 percent are white (non-Hispanic), 13 percent are black, 13 percent are Hispanic or Latino, and 5 percent are Asian or Pacific Islander. Because of the high proportion of CPIN students with an unknown race (15 percent), however, it is not possible to determine whether the population of students served by CPIN programs is representative of the Indiana population beyond the white/nonwhite measure.

Overall, students enrolled in CPIN programs are demographically similar to students enrolled in the previous computing programs offered by Ivy Tech. As we observed in the overall CPIN student population, students in the CPIN majors and previous computing programs also tend to be young, white males in their 20s. (See Table 5.) Importantly, however, a slight difference exists in the age range of students served. The previous computing programs tend to include fewer younger students (ages 15–19) than the new CPIN programs. This difference may be because the previous programs include more students from older enrollment cohorts. The data are inconclusive on any shifts in racial/ethnic compositions because of the high rate of missing data for this variable. Our data suggest that the proportion of white students in the previous computing programs group is higher (77 percent) than that of the

CPIN programs group (60 percent). If the missing data from the CPIN programs group were to account for that gap, however, it would mean that both groups are disproportionately white as compared with the general population of Indiana. This issue is worthy of further investigation, as it may reveal a need for targeted outreach.

Table 5. DEMOGRAPHIC CHARACTERISTICS OF STUDENTS ENROLLED IN COMPUTING PROGRAMS, FALL 2014 THROUGH FALL 2015

	All CPIN Students	Students in CPIN Programs	Students in Previous Computing Programs
Gender (Percent)			
Male	76	80	82
Female	20	19	18
Unknown	4	1	1
Race/Ethnicity (Percent)			
White	64	60	77
Black	10	11	10
Hispanic	4	4	4
Asian/Pacific Islander	2	2	3
Multi-race	2	2	2
Other race	2	2	2
Unknown	15	19	3
Age range			
15–19	25	22	7
20–29	43	47	49
30–39	17	18	24
40–49	9	9	14
50 and older	5	4	7
Sample size	**8,485**	**4,094**	**2,227**

Source: Ivy Tech Student Administrative Records Data

IV. HANDS-ON LEARNING

A major part of the TAACCCT grant centered on purchasing supplies for each of the campuses in order to improve classrooms and instruction, better prepare students for the workforce, and help them develop marketable skills. Further, the addition of supplies to the CPIN programs across the state was presumed to assist in meeting TAACCCT's overarching goal of increasing student enrollment and completion rates and preparing students for employment. Supply purchases would do this by expanding the quality and content of CPIN courses and programs and increasing the quality of instruction. The primary reason for adding and updating supplies across Ivy Tech campuses was to increase the amount of hands-on learning students are able to do in CPIN programs. Supply purchases fell into two distinct categories: 1) supplies for hands-

on, face-to-face labs and data centers and 2) supplies for a virtual data center to supplement and support online courses. The following discussion will focus on supplies for face-to-face and hands-on instruction. These supplies included items such as routers, servers, switches, and racks.

This section begins with an introduction to Ivy Tech's goals and intentions relative to the implementation of hands-on learning in the CPIN programs as part of the TAACCCT grant project. Then we discuss how new supplies were allocated across campuses along with the related challenges associated with installation delays, limitations on student installation of supplies due to safety concerns, and space limitations. Next, we discuss early faculty resistance to the addition of supplies, and subsequent shifts in program and course curriculum, as well as pedagogical change. We then explore student and faculty perceptions of hands-on learning, and although it is still early in implementation, we also present some concerns with regard to the sustainability of the supplies and program changes. We conclude this section with a brief summary of findings and recommendations relative to hands-on learning in the CPIN programs.

Implementation

Implementation efforts began immediately after grant funds were dispersed. The first step in implementation relative to purchase and distribution of supplies was determining individual campus needs and making informed purchases. The next step was distributing and installing the supplies on each campus. The final step was integrating the new supplies into coursework and instruction. As will be discussed below, each period of implementation had its challenges and delays, but overall, implementation efforts have gone well, and the supplies have been successfully integrated.

Supply Allocation

Supplies were allocated differently across the campuses. The process for the distribution of supplies was directed by TAACCCT grant management and Ivy Tech central staff. These decisions were based on statewide expectations, space limitations on each campus, and region-specific needs and concerns.

Ivy Tech's statewide expectations for what the CPIN programs should offer in terms of curriculum and learning objectives provided overarching guidance in the supply-allocation process. Some campuses were closer to meeting those standards than others prior to the grant. Central staff members visited each campus to determine individual campus needs in spring 2015. Decisions about supply allocation were then made based on campus need and programs offered. Some campuses received minor IT centers or upgrades, while others received new, fully equipped data centers and classrooms. Currently, supply purchases across all campuses have focused more on the network-and-hardware side of CPIN programs and not as

much on the software side. However, at many campuses software courses are making use of the autonomous network as well as some of the supplies.

The amount of supplies a campus could receive was sometimes limited by space. In Terre Haute, for example, the campus had fairly expansive space available, thus they were able to construct a new data center within their primary classroom. Ivy Tech central staff worked with Terre Haute's department chairs and their facilities department to change the layout of the room to accommodate both the classroom and the data center. Other campuses were not so lucky with space allocations. Campuses with limited space had difficulty troubleshooting how to set the space up to have control of everything at one desk. Where space was limited, it often turned out to be impossible to have everything in one area. On some campuses, CPIN programs shared classroom space with other courses and programs, which decreased the amount of supplies that could be placed at the campus because the supplies required dedicated space.

At times, campus facilities departments were extremely involved with decision-making relative to supply allocation. One example of this was the appropriation of ladders to CPIN programs. Students are allowed to climb a ladder, but they are not allowed to enter the plenum above the ceiling. So while students need to learn how to attend to wiring in plenum spaces using ladders, they are limited by facilities as to how far they can go. At some campuses, asbestos was an issue, and modifications required contractors. Facilities departments at each campus compiled information for central staff members, who then came up with special instructions to accompany data ladders on each campus. These instruction sheets provided clear information to faculty members with regard to the limitations on students in their classroom plenum spaces. Policy information from the central office on this issue provided guidance on the difference between employees versus students.

As of fall 2015, some campuses were still in need of minor supply allocations or reallocations. Kokomo was still in need of shelving at the time of EERC's site visits, for example. Central staff was in the process of reviewing funding to see if the shelving could be ordered as well as determining if anyone else needed it. Some campuses had surplus supplies instructors did not need, while at the same time they lacked other supplies. In these cases, the surplus was redistributed to other campuses, which helped reduce costs. Shelving, racks, old computers (used for disassembling and reassembling practice), and monitors were redistributed. Redistribution allowed the supplies budget to be stretched to better accommodate the needs of all campuses.

Although supplies for data centers varied widely across campuses, tool kits issued to each campus were basically the same. Each campus was given a tool kit consisting of items such as connections for wiring; brackets for mounting supplies to drywall, practice walls, termination walls, and plywood; tape measures; hammers; knives; drills; and a step ladder. Campuses received supplies for their tool kit as needed, and for the most part these resupply requests were relatively uniform. Every campus also received an expensive tool designed to test cables and detect flaws and breaks. Since it was so expensive, each campus received only one

(as opposed to one for each student in a course), but grant management felt the tool was important enough that students needed to have access to one so they could learn how to use it.

Initially, grant management ran into some resistance from some faculty members regarding the upgrades to labs and data centers. With the addition of physical supplies came changes to curriculum—for some campuses these changes were minor, but for others they were quite dramatic. Many faculty members simply did not understand the goals behind the changes or how the new technology would work within their individual courses and curriculum. There were many questions such as: "If we put this [supply] in there [labs or data centers], how are we going to be able to do this?" There was a lack of clarity about how the new supplies and other changes to the classroom would improve the student experience. These needs had been defined by the curriculum committee.

Delays

The original goal was to have the supplies purchased and installed on every campus by the end of the first year of the grant (September 2015). Delays in purchasing and renovation, however, coupled with long approval processes at some campuses, pushed the timeline back in some areas. At the time of EERC's site visits (December 2015), most campuses had their supplies up and running, but a few were still finishing installation.

The installation of raised floors for data centers was a major delay that affected many campuses. At some campuses, the delay simply involved finding contractors and scheduling the work—determining who would install the floors and when could they be installed (i.e., when students were not in the space). At other campuses, the raised floors were logistically challenging because raising the floor decreased headroom. In classrooms with already low ceilings, this was a challenge. Supplies arrived, but some faculty felt they could not be installed because the floors had not yet been raised. Storage of supplies then became an issue, that in some cases caused further delays and logistical challenges. Many campuses simply had to install their supplies and then remove them later to place the floors.

Much thought went into what type of raised floors to install at the campuses. The TAACCCT project director, another central staff member, and a statewide chair of network infrastructure spent considerable time looking at floor types and figuring out the best one for the campuses. A big consideration in raising the floors was cable management, as well as the ability to reconfigure data centers without involving the campuses' facilities departments. Ease of access to cabling also allows students to reconfigure their data center as part of their curriculum—something that helps them get comfortable taking the supplies apart and putting it back together. Additionally, learning how to take the floors apart is a skill in itself—one that students will likely have to know on the job. The installation of the raised floors was further delayed because that work required approval from the US DOL in order to be performed in conjunction with the grant.

At individual campuses, the RFP for supply installation had to be posted for a minimum amount of time before a contractor could be chosen to complete the work, which also caused some delays. Most campuses received supplies slowly over the course of the summer, and renovation and installation had to be done quickly at the end of the summer during the short break before fall semester began. Some campuses used additional funds from other grants to include upgrades such as new furniture, additional supplies, or upgrades and renovations to the campuswide network. Although central staff set up the expectations and supply allocations for the grant, regions and individual campuses were given latitude to modify their classrooms and the data centers as they saw fit. Some campuses, for instance, have five classrooms with a central data center, and others have one classroom integrated with their data center.

The Bloomington campus, for example, recently appropriated campus space to allow expansion of their School of Computing and Informatics. They have appropriated one entire wing of a building for the school, which has allowed CPIN classrooms—and CPIN students—to be more concentrated in one area. In the new wing, the department was able to create a central data center (funded by TAACCCT), with classrooms and lab space surrounding it. The centralized feel has allowed students to create cohorts, which also encourages comradery and curricular support.

Some campuses had unforeseen issues that delayed installation. The Marion campus, for example, ran into some issues that caused major delays because the data center and the lab were not located next to each other. The campuses' IT center is located between the two rooms. Thus, the wiring conduit for the lab and the data center could not be run through the ceiling (as it is at other campuses) because the IT center would not allow the wiring to be run above their equipment. Holes had to be cut in the concrete, and the wiring had to be run under the floor. Running the wiring in the flooring required an additional 25 feet of wire that they did not have. More wiring had to be ordered, which caused further delays. This also happened to be one of several campuses that had to order anti-static flooring, which also delayed installation.

All 20 campuses are currently planning for full implementation of supplies and data centers by spring semester of 2016. An additional four campuses are being considered for fall 2016.

Lab Technicians

Part-time lab technicians were also hired for each campus with grant dollars. These technicians were temporary hires brought on to assist the individual campuses with the installation of the supplies. In most cases, the process went smoothly. At one campus, a change in the department head led to the hire of the lab technician "slipping through the cracks." Once this was discovered, a lab technician was hired, and installation began. Several campuses retained their lab technician after the installation of supplies was finished; for example, the Bloomington campus hired their lab tech to work in their central information technology department.

Professional Development

Professional development opportunities were available to help faculty effectively install and use the supplies. In addition, the grant provided faculty with the opportunity to train for industry certifications; in many cases, such certifications are required to teach using the supplies.

Training on Supplies

Once the spaces were renovated, central staff conducted training to ensure campus staff knew how to install the supplies. A training was given in early July 2015 on how to establish the networks and to outline each network's layout and minimum specifications. Multiple in-person and webinar trainings were offered over the course of the summer, and the TAACCCT project director visited individual campuses to offer extra support and assistance with wiring, specifications, etc. Central staff compiled and shared a detailed PowerPoint with instructions and images on how to set up the supplies.

Faculty responses were mixed relative to their need for professional development on how to use the supplies. Some faculty stated they did not need training because they already knew how to use it. For example, one stated: "I saw the equipment [supplies], and I knew what we need to do." Other faculty expressed interest in seeing what others were doing with the supplies to get potential ideas:

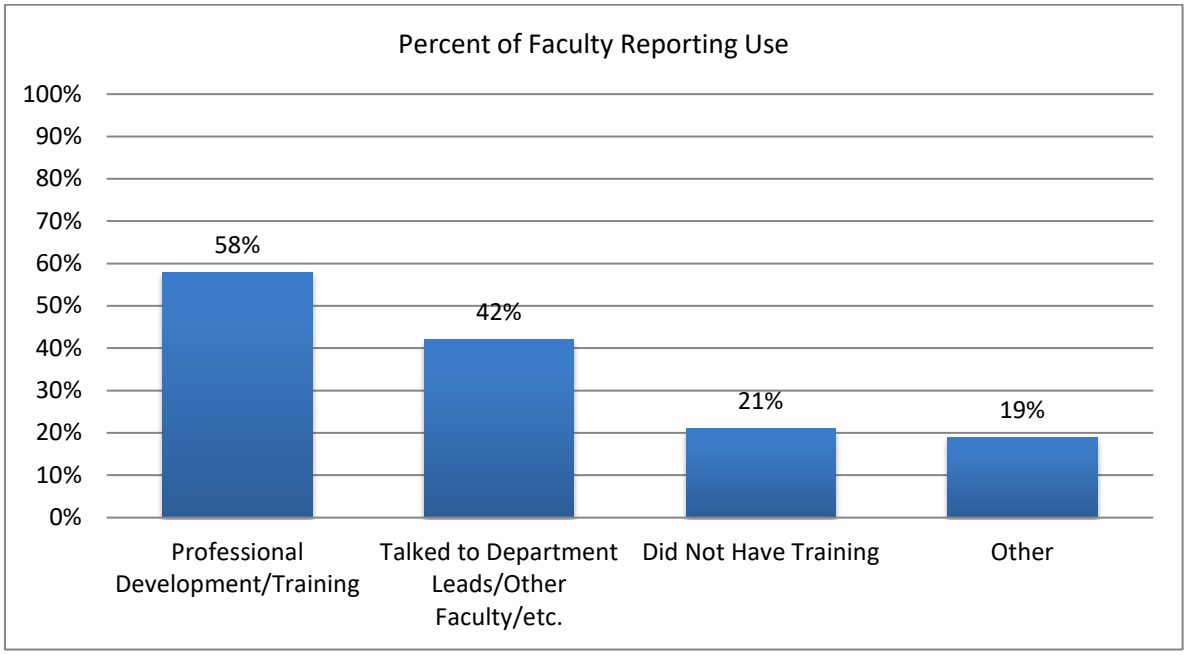
> What is somebody else doing? Let me steal what exactly others are doing and make it my own . . . Time is precious for us [faculty]; I'd like to see what other people are doing. I can't be the smartest person in the room.

In addition, faculty chairs and department deans at some campuses are taking on some one-on-one training to help instructors learn the new supplies. One faculty chair commented on the training needed for an instructor to get used to the new supplies:

> We've been taking classes down in the data center, but the CISCO people, in particular [one instructor] . . . we're really trying to get [the instructor] to work more [with the supplies by] actually going down there, because students need to test the CISCO devices, routers and switches and things in the data center, to plug [in] the cables and [then] "look what happened!" So we started to do that.

The majority of faculty—58 percent—indicated that the biggest source of preparation they had relative to increasing the amount of hands-on learning they use in their courses was professional development/training. (See Figure 6.) However, 21 percent noted they did not have any training on the new supplies, indicating that more training may need to occur for some faculty members to embrace the change.

Figure 1. FACULTY-REPORTED PREPARATION SOURCES FOR TRAINING IN INSTRUCTION USING HANDS-ON LEARNING.



Source: CPIN faculty survey

Industry Certifications

Apart from the targeted professional development aimed at training faculty on the new supplies purchased with grant funds, most professional development activity under TAACCCT was budgeted for years two and three of the grant, and the specifics of this activity—aimed at preparing faculty for industry certifications—required planning. To assess the need for faculty professional development across campuses, the project director for the grant sent a survey to all faculty members to collect information on their training wants and needs. This information will be updated each year as more information is gathered and will determine the directions in which the programs should grow. Faculty reported they were waiting to see what would happen next with professional development; some wondered if they would be rewarded for gaining industry certifications.

Industry certifications are an important focus for faculty professional development because several courses require industry certifications to teach the material. For example, in order to be qualified to teach CISCO courses, faculty must complete multiple certification exams. Several faculty members highlighted this issue as a motivation for seeking professional development for a range of industry certifications. For example, one faculty member stated:

> The ones needed for me are those I need to teach classes. Those would be CISCO, Linux certification, Network class, Microsoft server certification. I am not sure how it was before, but they [are now] strict [about] the standards at Ivy Tech.

Beyond meeting the requirements to teach classes, some faculty who had completed industry certifications prior to the grant period reported that preparing for their exams helped them develop knowledge that allowed them to better teach their classes using the new supplies. They found that the training and certification process had helped them to develop better, more up-to-date skills that, combined with the new supplies, improved the quality of the instruction they were able to provide. One faculty stated: "I do believe that if you're going to be teaching, you need to stay current." Others also mentioned that their industry certifications helped them gain a greater variety of examples to draw from when demonstrating skills to students:

> I have taken classes at the higher level and did some certifications. As a result, you know a lot more—you know how to manipulate the hardware, you can give different scenarios at the much different level. And you can better help students out. If there is a problem, it is easier to understand it.

Faculty also discussed ways that taking certification exams helped them better prepare their students to take the same exams in the future. Completing the exam themselves gave faculty specific knowledge of the test that they could share with students. In addition, holding the certification added a sense of legitimacy to their role as an instructor teaching the material for the exam and also allowed them to stand as a positive model for students to emulate. For example, one faculty member stated the following:

> My rule is I don't like to teach a class if I'm not certified. Not because I can't do it, but I want to show students it can be done. I want to show them that "here are things that are on the test"—[and] when I talk [about] a topic in week three, "remember this because it will be on your cert [certification exam] in some form."

Another instructor said: "I think it adds credibility when I'm speaking to my students that either I had the experience or I've passed the criteria, so I know what I'm talking about."

Not all faculty members interviewed thought industry certifications were useful to them. Some reported that the industry certification did not help them with their teaching. For example, one stated: "I don't find my A+ [certification] valuable. It's pretty elementary. I can teach the class, but I don't find the cert [certification] itself helps me teach the class." This concern may be particularly true in more entry-level classes such as A+ rather than in more advanced classes.

Some faculty mentioned being concerned about the professional development process. The challenge of providing time for adjuncts to prepare for and complete the industry certification exams was mentioned. Further, some faculty expressed concerns about ongoing efforts to maintain industry certifications. Those who already had certifications mentioned the need to renew them when they expire and the ongoing need to invest time and resources in preparing for the exam and updating their knowledge. The ability to maintain the industry

certifications required for faculty to continue delivering the programs is an ongoing question as to the sustainability of the grant reforms.

Pedagogical Changes

One of the overarching goals behind the allocation of supplies was to positively impact the quality of instruction across CPIN programs. The grant manager stated that the concept behind the supply allocations is that if there are "things that are keeping [faculty] from being able to instruct in their programs properly, then . . . we are providing that through the grant" if possible.

Having hands-on learning supplies has already drastically changed the teaching in some courses. For instance, a course at one campus that had been running as an eight-week course was redesigned to a 16-week course to take advantage of the opportunity for hands-on instruction that the new supplies provide. The instructor noted that now "we can put more hands-on [learning] in those classes, put software on the computers, maybe build them a little domain and do those kind of things."

Early indications point to changes in pedagogy among faculty. Grant management and central staff members feel the supply allocations will have drastic effects on the amount of hands-on learning students will have. In turn, this will fundamentally change teaching methods. One staff member stated:

> I think that whole teaching methods will change. [One instructor], for example, [is] teaching a particular subject where he would have to use videos or some other tools in this classroom; now he will be able to take them into the data center, and they will be able to experience it firsthand. Everybody will be able "get their hands dirty" so to speak. With those opportunities . . . the advantage that our students will have!

Among instructors who had an increase in access to supplies and used these supplies in their instruction, the majority—80 percent—reported that it changed their instructional approach.

Faculty reported an increase in the use of hands-on learning. For most instructors, the biggest change in their teaching methods has been a shift from lecture and simulation — showing students how to do something—to having the students actually use the supplies to accomplish tasks themselves. One faculty member said: "That is how you learn . . . you learn by getting on the equipment [supplies], making mistakes, figuring out what you did wrong and doing stuff over and over again." Another faculty member described the difference in how she taught before versus after the addition of the supplies at her campus:

> I had to lecture to them [before], and I had nice screen shots—PowerPoint and whatever—I could walk them through, 'this is how you change book sequence' and whatnot . . . [but] now they can actually do it themselves. Students have different ways in which they learn things. If they go in and do it themselves, it's a better learning experience.

Another said:

> We try to give them [students] lots of hands-on, real-world experience. It's different from the structured labs we used to do. Now we have them do it as if they are really working. Like, I'll tell them what we need done and have them write up bids for it, every step written out, that kind of thing. Real hands-on. Because that is what they're going to have to do in the work world.

One instructor noted that the new supplies' ability to better simulate real-world conditions is not its only advantage; working in the new data centers also lends itself to a decrease in setup time, which leads to better quality lab experience and more time for learning:

> When students do the lab, no longer will they have to go and get equipment [supplies], get down underneath [their] desk to plug things in. They will connect [a] few wires, which is more realistic to what they will encounter in the job market. It is a more friendly environment, and thus students will spend more time working in the labs rather than setting up their equipment [supplies]. The challenge then is going to be the lab itself, not setting up all the equipment [supplies]. Ten to fifteen minutes for setting up the equipment [supplies] does not sound terribly bad, but when you have only two hours to do the lab, 15 minutes setting up plus 15 minutes cleaning up, it is the whole quarter of the class time gone.

Nearly all Ivy Tech staff that we interviewed tied the new supplies and the related increase in hands-on learning to an increase in the quality of teaching in CPIN programs.

Local Control of the CPIN Network

Along with the addition of new supplies, Ivy Tech campuses also installed a separate dedicated network for use by the CPIN programs. This allows courses within CPIN programs to run on a network that is separate from the campus's Ivy Tech network. On most campuses, this change removed the campus's central information technology department from the day-to-day operations of the CPIN programs, allowing the CPIN faculty to make decisions about the network, add software, and manage the system without assistance from their central information technology technicians. Although this change is still fairly new on most campuses, enough time has passed to illuminate some benefits and drawbacks of operating on a separate network. About one half of the faculty members surveyed reported that they now have control over their local network. Among these, over three quarters—77 percent—reported that it changed how they taught their class.

Benefits of Network Control

The most widely discussed benefit to having the separate network was that faculty members are able to have control of the system without having to wait for the campus information technology department to attend to their requests. One faculty member echoed how most faculty felt about the network change: "Being on our own network, it impacts everyone in a big way. Not having to go through the hoops with IT with the college. That freedom I'm very excited about."

Network control allows faculty to freely add software as needed. Nearly all (90 percent) of the faculty members who had network control and reported that it changed their instruction reported that a benefit of having network control was autonomy in software downloads. In most cases, prior to the change, CPIN faculty had to get authorization from their campus information technology department to add software, do certain scans, or change settings. One instructor said: "Now if we need the software, we just install it. Students will never have to be held hostage by software that is missing." It also allows the CPIN network to stay current relative to hardware and software downloads, so they can match what the industry is currently using.

Network control allows faculty to engage students in a wider range of hands-on learning activities. Most (83 percent) of the faculty members who had local network control and reported it changed their instruction, reported that having the control allowed them to do more simulated activities in cybersecurity. Campus information technology departments often did not allow certain things to occur on the network, such as hacking or cybersecurity tests. One instructor discussed what her students are now able to do that they were unable to attempt previously:

> They have levels of authorization where they can go in and try things and change things on the PC or within the operations system which they didn't have the authorization to do before. When you're on the [campus-wide] system network, they certainly cannot allow a student to go in and try things and change things, even to download a vulnerability scanner. We just could not download and store certain software.

One faculty member noted: "another good thing is being able to break things without bringing down the entire critical network," which is a "definite plus." An important part of students' education is being able to learn real-world scenarios and apply classroom knowledge to actual problems. "Breaking things" on the network, introducing viruses, hacking security information, and creating general technology issues are all great learning experiences for students who will encounter these issues in their careers. Understandably, however, these were things the campus wished to keep from occurring on their network—where student grades, Blackboard shells, and faculty data are also stored. By separating the networks, security issues were no longer a concern for the general campus; CPIN programs could therefore create—and fix—chaos on their own network without impeding function and security for the rest of the college.

A positive side effect of network control is that students are able to try things without fear. Several students brought this up when asked about the network in focus groups. One said the network is "great because I'm not afraid anymore that I'm going to mess something up. I can learn way better now." Instructors are now able to tell students to "go crazy here" and "try anything"—without ramifications. One instructor discussed the ability to release a virus in an isolated area of the network and let students find it and remove it—something he never would have been able to do before.

Drawbacks of Network Control

The most common drawback to the separate network is the addition of time and responsibility for maintaining the network. Among faculty who had local network control and reported it changed their instruction, over half (53 percent) reported they were concerned it would be time-intensive to maintain. A faculty chair stated: "The good news is we have the ability to mess with it ourselves, but at the same time we have the responsibility to mess with it ourselves." Given that faculty are often strapped for time, the addition of the network has added significantly to their workload. As one instructor stated: "We have over 100 student computers that we have to manage here, which means updating, hosting, all the things that our IT had done for us in the past." Another faculty member noted that "this infrastructure requires time and attention to support." An instructor reported that the lack of dedicated live support for troubleshooting issues on the new network creates reliance on faculty to "be around." Some departments are attempting to find funding for a full-time lab manager—even suggesting diverting funds set aside for additional instructors to do so. Others have implemented automated maintenance plans for the network, which decreases the time faculty need to spend maintaining it.

Impact of Supplies

Students are enthusiastic about the ability to learn and apply skills in a real-world setting. For most students the ability to do hands-on work was an important factor in their selection of program. In fact, 80 percent indicated that the opportunity to have a hands-on learning experience was either extremely important or important to them when they selected their CPIN program. Among survey respondents in classes that make intensive use of the new supplies (ITSP 135, NETI 100, and NETI 105), 63 percent indicated that they have now experienced either some or a lot of hands-on learning. Although the addition of the supplies is fairly recent, most campuses are already seeing positive changes in their classrooms, labs, and pedagogy. These include improving students' learning experiences, increasing workplace preparation, increasing student engagement and confidence, increasing recruitment capability, and changing how instructors teach in ways that ultimately improve the quality of courses and programs. The following discussion includes perceptions of the recent changes from students and faculty that demonstrate the impact the new supplies have had.

Improved Learning Experience

Across the campuses, the addition of supplies has allowed students to have hands-on experiences that have improved their learning in the classroom. For example, having servers onsite has allowed students to learn how to correctly take them apart and put them back together—a skill they will need on the job. Prior to the TAACCCT grant, only a few campuses had some form of separate network established and had a limited amount of capacity to teach this hands-on skill to students. Students are now able to build a network in reality using the proper parts instead of virtually using simulations in the virtual data center. The virtual method previously let students understand the concepts behind building a network, but it did not teach

them how to physically do it, which some administrators and employers felt was "a problem." Basic network infrastructure is a required component of NETI 100 and NETI 105 courses, and learning basic network infrastructure requires a termination wall. Termination walls were therefore installed at many campuses through the TAACCCT grant, which has allowed students to learn the required skill using a hands-on method rather than through a simulation.

Prior to the grant, students were using a software program that simulated basic network infrastructure setup. In most cases, students also had computers in a classroom or lab space that they could use to simulate the hands-on pieces of the procedures. To do this, students would go back and forth between the software simulation and the computers. Now that the new supplies are in place, students are able to do the work in one location. The grant manager summarized the benefits of the new setup by explaining that the infrastructure:

> . . . allows them to be in one spot. They can see it right there. Not only that, some courses, like [the] rerouting and switching course, they have to set up three computers and a network, and they can put a laptop and a desktop right there on the computer and connect it all up through the network back to the data center or at their desk. They don't have to go to different places other than the data center.

Some more minor supply purchases, such as monitors, were small in scale but have had a big impact. Previously, some faculty members were teaching on 15-inch monitors. Now, they are able to teach on two 20-inch monitors, and students also have the larger dual monitors to learn with. One faculty member said:

> It's a huge difference. If you're a programmer, you really need two monitors in the first place. You need the landscape space to be able to develop a program that goes onto a normal screen. It affects the other programs—not just network infrastructure, server administration, and ITSP, but our other programs can utilize that. Software development and computer science—you really cannot do those programs unless you have two monitors. It's impossible. It allows those programs to be done properly.

In other cases, simple computer upgrades have made big differences in what students are able to do. For example, some campus computers were outdated, running only limited amounts of RAM. Upgrades to computers with larger RAM have allowed students to run more operating systems and true database systems and have more functionality.

Just having racks in some cases has allowed better hands-on learning because students are able to do switching and cabling by hand and see it all in a more organized setup. Being able to do this by hand is imperative, because students learn how hard they can push without breaking the supplies. In some cases, the campus had racks, but not enough for each student. Now students can use separate racks and do not have to spend as much valuable classroom time waiting for their turn to practice a skill. However, needs still exist; some campuses are not able to support a full class of students due to limited funds.

Students indicate that they are thinking about what they learn in the classroom because of the hands-on nature of the supplies. One student said: "We have some competitions with the other classes, and we can use real computers now—take them apart and figure things out. I like it because I can apply what I learn in lecture and really see it work." Another pointed to the supplies at his desk and said: "See this? We didn't used to have that. The instructor had *one*, and he would say, 'imagine if you are doing this,' but now we all have one. And we don't imagine; we do." Another student noted that, "Before, we had all these carts and things for equipment [supplies], and it was a mess. Plus, that's not how it is in the real world. It's like this. It's so much better now."

Some faculty members cautioned that hands-on learning can distract from understanding theory. These faculty feel that students are all too eager to skip the theory and go straight to the lab work. Students are inclined to "think the 'doing' takes the place of the textbook." Faculty members have to be vigilant to notice when students are not completing reading assignments and to make sure students understand the importance of both the theory and the 'doing.' One instructor discussed how he has been able to include both theory and practice in some activities in his class:

> One class broke computers for another class to fix. That class had to apply the theory to fix the computers. It was a complex problem that required knowing the theory. I saw that really work. They talked about the theory; they had to get out their textbooks and read and talk it out. They couldn't just 'do.' They had to do both. Employers want both. They have to know, and they have to do.

Student Engagement

According to faculty members, an increase in student enthusiasm and engagement is one of the biggest improvements brought on by the new supplies. One faculty member noted that "a lot of students that come here are more tactile-learning students and want to have hands-on [experiences]. They want a combination of reading a chapter and applying that information." Another instructor discussed a dramatic change in his students since the addition of a hands-on lab in his course:

> I teach a software development/computing logic class, and it is as dry as popcorn with no butter. It really is tough. Overcooked burned popcorn with no butter . . . So I think the ability for them to . . . say "okay, we don't have to sit through two more chapters' worth of PowerPoints, today we're going to go in, and the first hour we're going to make cables, the second hour we're going to hook the cables that we made up to the switch that we configured, and then we're going to move to the wireless"—I mean, time will go just like that. Now, every student learns differently, but last night these kids couldn't wait to get to these computers. They couldn't wait. So I issued [them] all a tool kit, and they were like "[Instructor], can I start?" "[Instructor], can I start?" It was just a completely different feel last night in the practical exercises than I normally have in that class.

Another faculty member discussed the difference she is also seeing in her students, saying, "It has been really positive." She noted that the change from simulators to hands-on supplies has especially benefitted those students who need extra help: "Before, they could come if they had questions, and I talked them through the process using software simulators. But you don't get the same experience as actually plugging in and making sure that the lights are up."

One instructor said she feels that students are better able to relate the hands-on learning to their real lives than they are with simulations or book learning. Some students are applying their learning to their own jobs or small businesses, something the instructor feels did not happen as much prior to the addition of the supplies. This is an indication that students are now more engaged in their learning experience. Students also indicate that they are more engaged in their learning since the shift to an increase in hands-on learning. One student said: "Hands-on gives you emotional engagement. Emotional engagement makes you want to learn it, and then you learn it." Another said: "When you do a project, you still have to learn the theory, the underpinning, but you have to make it your own. At the end of the day, you made something. So you learn a lot more."

Another indicator of the increase in learning capacity for students is the willingness and eagerness of students to continue learning and studying outside of classroom time. Faculty reported seeing more interest from students in their programs since the addition of hands-on learning supplies. Further, 56 percent of students reported in a survey that they use classroom lab supplies outside of classroom hours, indicating that students are eager to continue learning after class. Faculty and administrators also feel they are seeing an increase in retention because of hands-on learning. Students are staying in the programs because they are interested in what they're learning.

Workplace Preparation

Hands-on learning helps students gain specific skills needed for the workplace. Across the campuses, a relatively minor change that has had a major impact in the classroom has been the desktop termination of wires. Desktop termination of wires allows students to:

> . . . directly connect the USB connection to the CISCO routers, so [students] can configure the routers from their computer without having to go into the other room . . . Normally you'd do that [work on the routers] remotely after you set them up initially, and [students] need to get used to not being in that same physical space.

Because of these supplies, students have been given the opportunity to experience real-world situations. Student lab techs have also been given expanded opportunities because of the new supplies. In Lafayette, for example, lab techs have been able to vastly expand their skill sets:

> The expansion of space and equipment [supplies] has let us bring on more work-study lab techs. They can work their way up, too. First they are a lab tech, then a TA [teaching assistant], then a coordinator. [One of the lab techs] is really a good example of what the changes and expansion has let us do. And she won't be with us long, unfortunately, because she will get a great job. They

> always do. The experience is great for them, and they get snapped up. The lab techs get supervisor experience, and that gets them jobs.

Universally, faculty, staff, administrators, and students alike all commented that hands-on learning has helped better prepare students for the workforce. One administrator said:

> [The supply allocation] allows teaching the student . . . how things actually work, especially in the cybersecurity and the server admin [programs]. Those two programs will allow them to install software, build the server, set up domain, set up users, set up account. Practical experience that they learn in the classroom—when they go to the real world, they should be able to do that without any training or teaching them how to do stuff.

A faculty member commented that hands-on learning "for some . . . may be the light that they see that says, 'yes there is a real job there.'"

Another faculty member described scenarios that occur in the real world that were impossible to duplicate when working from simulations. For instance, she likes the ability to change cables around on the servers that students have been working on when they get up for a break. When they return, their server is no longer set up the way they had it, and now they have to figure out what was changed and how to change it back. She says "That's real life, and that's what I've got to get students to understand. It is not just a textbook, 'do this, see this, do this, you're done.' No, it's 'do this, see this, what happened, fix it, *now* you're done.'" Another faculty member said the new supplies are "easier, neater, and more meaningful, too, because [they show students] the kind of environment they are going to see in the real world."

Students also see the link between what they are learning (and doing) in the classroom and what will be expected of them in the workplace. One student stated that "being able to touch and handle the equipment [supplies] matters. It should count as work experience, actually, because that's what it is." Another student said: "You learn a lot more hands-on. The physical learning is real learning." A third discussed the difference between real-world learning for the workplace and simulations:

> It's better now because before we just had a lot of simulations. And they taught us things like how to always win Battleship. But I don't need to know how to always win Battleship. Learning hands-on is how the brain works.

A faculty chair at one of the campuses said: "The equipment [supplies] is one of the major factors that they [students] cite as being able to get employed." This conveys that students view the hands-on learning they experience throughout their program as directly (and positively) impacting their ability to get a job.

Increased Student Confidence

Another benefit to students from hands-on learning is greater confidence. Many faculty members reported an increase in their students' confidence as they entered the job

market. One said his students are telling him: "I know what I'm doing now, so I feel confident going out there and interviewing." Another said he was:

> . . . glad to hear already from students that they're feeling more confident in their skills, and they're going out and getting interviews where they were kind of timid about that before. That's a major accomplishment there. Not only do they have the knowledge but they have the confidence in themselves.

Most faculty members agree that hands-on learning has given students more confidence in their skills and has helped them acquire more skills. Faculty who teach capstone classes report that students graduating since the new supplies were added have listed more learned skills on their résumés than students did who graduated prior to the supplies being added. The increase in skills also indicates a shift in how faculty are teaching their courses—students are learning more and are more confident in acknowledging their own skills. A faculty member who has taught a capstone course for 20 years commented that:

> They [students] are just more confident now than students used to be. And they have something to show—something real: skills. And they are prepared more for interviews, and of course the confidence helps in interviews. One student had an app on his phone that he created, and when the employer asked for skills, he plopped his cell phone down and said "Here. I did this. Let me show you." And he got hired.

Social Dynamics

Many campuses reported that student social dynamics shifted with the change in space allocation and the new supplies. Having labs and a central data center has brought CPIN students together in one area, where at many campuses they were previously spread out among various campus computer labs. Students are now "meeting and talking with each other" more often, as well as "running into" instructors in the hallways and visiting instructor's offices. This change has had a positive effect on students and has the potential to positively impact retention and completion rates, as well as student grades.

Increased Recruitment

Central staff also expect that an increase in hands-on learning and a shift in pedagogy will attract more new students and make CPIN programs more popular. As one staff member stated:

> Eventually the word will get out . . . [Students will] say "my friend or my cousin just finished your program and I'm interested too." . . . I think it's going to help enrollment eventually, and more than anything it will give students that learning experience that they wouldn't [have] otherwise had.

One campus is already experiencing this benefit—prior to TAACCCT, the campus had not been able to run face-to-face courses for hardware or software support because of a lack of students. The campus is now looking forward to running face-to-face courses on these topics in spring

2016 due to an increase in students registering for the classes. Faculty members believe the access to hands-on learning supplies is responsible for the increase in student interest and the subsequent rise in registrations. A faculty member at another campus reported seeing a similar uptick in his course registrations: "I think with this, now that word's getting out, I think that some of these classes and everything will start growing." Another campus that is currently planning marketing material centered on the new supplies hopes to see an increase in student enrollment as a result. An administrator there said: "I think . . . because of what we're going to do to tell the world about what we've got, we're going to see a big bump in our [number of] students."

Sustainability

With the addition of so many new supplies and so much new infrastructure for the CPIN programs, some concerns are beginning to surface over how the new additions will be sustained after the grant period has ended. Especially because the new supplies have changed the type and quality of learning students are able to receive through their CPIN programs, it is imperative that sustainability be discussed and planned for. Given that technology is a rapidly changing field, concerns over obsolescence are warranted. One instructor noted that CPIN had become a "great program" with all the recent changes, but "all [the] equipment [supplies] will be obsolete in five years." Without replacements for it, he feels the programs will have to revert back to simulations and demonstrations, which will in essence "undo" the strides recently made in hands-on learning. At the same time, constantly updating supplies every few years has an impact on the institution as well as the students: "If we get state-of-the-art equipment [supplies] all the time, we can't keep a low cost-per-credit-hour." Since implementation has just finished, sustainability conversations have just recently begun. This is an issue that grant management and the individual campuses will be considering more in the near future, and will be discussed in future reports.

Summary and Recommendations

Supply delivery and installation was delayed across campuses for several reasons; however, although data for this report were collected early in implementation (winter 2015), impacts from the new supplies could already be observed. The first noticeable impact was a change in faculty attitude regarding the new supplies that often led them to make changes to their curriculum and teaching style. At the time of this report, faculty members were predominantly positive about the changes, and shifts in pedagogy could already be seen. Remaining faculty resistance is potentially due to a lack of training; since 21 percent of faculty who reported an increase in hands-on learning indicated they had not been trained on the supplies, it is possible more training should occur and could further facilitate the use of the supplies.

The positive impact of the shift in CPIN programs to encompass more hands-on learning has already been seen. Survey data, interviews, and focus groups with faculty members and students show that the increase in hands-on learning has increased students' confidence,

technical skills, and employability. This is not surprising; literature indicates many disciplines are using experiential learning to provide career-based competencies for students. These hands-on experiences provide students with skills and real-world experience that gives them a competitive edge for employment after graduation.

Control over a local CPIN network has also allowed instructors to offer more learning opportunities to students, resulting in more freedom for students to explore on a network environment without fear of "breaking" the entire campus computing system. Having control of the network has made it easier for instructors to install software and avoid delays from the campuses' central information technology department, but it has also added a significant workload for some instructors. Sustainability is therefore a concern with regard to maintenance of the network, for some campuses more than others. Sustainability of the supplies and infrastructure, on the other hand, is a concern on all campuses. Since technology changes so rapidly, keeping the supplies up-to-date for CPIN courses and programs could be challenging. These issues will need special consideration before the grant period ends; sustainability plans should be drawn up for each campus.

Based on these findings, some recommendations for Ivy Tech to consider are as follows:

- More training for faculty should occur relative to the new supply allocations; training should focus on how to use the supplies and how to increase hands-on learning for students.
- Grant management might consider offering resources to faculty and/or opportunities to share their approaches to using the supplies. This exchange of ideas might further facilitate the use of the supplies and increase its impact on students by expanding hands-on learning opportunities.
- Conversations about sustainability of supplies and hands-on learning in the classroom should begin.
- It might benefit campuses to have conversations as a consortium about how campuses might leverage funds to hire a lab tech to manage the CPIN networks on each campus.

V. ADVISING

In recent years, Ivy Tech has started a gradual redesign of advising. The TAACCCT grant has allowed for further reform, specifically relative to the CPIN programs. The redesigned CPIN pathways created a greater and more urgent need for restructured advising, as the work of general advisors was further complicated by the shift from the four previous computing programs to the eight CPIN programs. This section begins with an introduction to Ivy Tech's current advising model; this is considered a "baseline" analysis and sets the stage for proposed changes to CPIN advising. Within the current advising model, this section takes a close look at the two current levels of advising—general advising and faculty advising—and how each occurs within the larger framework of student advising. Additionally, perceptions of general

advisors, faculty members, and students are explored relative to their personal experiences with both levels of advising. Current models of advising supplementation—such as courses (IVY 111 and IVY 115) and informational material—are discussed, with emphasis on student perceptions of each. Math requirements for the CPIN courses are also examined, noting differences in perceptions between faculty members and students regarding students' awareness of and perceived importance of the role math plays in CPIN programs.

This discussion of the current advising model is meant to provide context for the implementation of the advising tool by understanding the current state of advising and how the change to CPIN programs has increased concerns about student advising, and. Ivy Tech central staff members as well as TAACCCT staff are aware of some of the challenges with CPIN advising, and reforms are underway. Because implementation efforts for the advising reforms have only recently begun, this section spends more time reviewing the current advising model than describing any planned changes to it. This is because this document is meant to help identify areas need the most attention for reform and provide a baseline assessment to understand grant changes over time. It also presents the perceptions of advisors, faculty, and students, both relative to the current advising model and to the proposed online advising tool. This section concludes with a brief summary of these findings as well as some recommendations for addressing key issues.

Current Advising Model

Ivy Tech currently has a dual advising system based on an intake model. Students are not required to use an academic advisor unless they are in a program with limited enrollment[1]—such as nursing—or have not yet chosen a field of study. Students interested in programs that are not limited—such as computer informatics—are given a PIN number for enrollment, which they must visit the advising center to receive. Once students receive their PIN, they may meet with an advisor, or they may leave and enroll on their own. Students that choose to use an academic advisor are assigned one. Some campuses have a secondary advisor, and advisors on some campuses are co-assigned with a faculty advisor. Mostly, however, a student sees one general advisor who does academic advising across all programs at Ivy Tech.

New students using an academic advisor see that advisor until they complete a minimum of 15 credit hours. After this point, students transfer to a faculty advisor in their major program to receive more detailed advising aligned with their program of choice. General advisors at two campuses, however—Indianapolis and Bloomington—see students through their first 24 credit hours before transferring them to a faculty advisor. Central staff members noted that Indianapolis's large student population was a factor in this decision; having students see general advisors for a longer period reduced the burden on faculty by decreasing the

[1] Limited-enrollment programs are competitive majors at Ivy Tech that control enrollment numbers based on available resources—e.g., the availability of credentialed faculty and clinical space—in an effort to maintain program quality and ensure adherence to certain accreditation and professional certification standards (Ivy Tech Community College, n.d.).

amount of time they needed to spend with each student. Moreover, administrators at Bloomington felt students were better prepared and had access to more of the tools they needed to make program decisions with general advising, believing the shorter period of time spent with faculty would be better utilized as more of a "career conversation" focused on the transition from the educational setting to the workforce.

Regardless of the amount of time students spend with an academic advisor, the first year of advising is meant to be "holistic"; thus, we describe the current advising system as operating under a holistic advising model. General advisors ask students questions and gather information from them to find out "where they want to go" and what they want to do in their future career. All Indiana students attending school full time (enrolled in 15 or more credit hours) are required to have an advising plan all the way through to graduation. General advisors help students set and modify this plan as they progress through their program. The general model for advising is that students meet with an advisor for 45-minute blocks of time, although this varies across campuses. Several students reported that they had seen a variety of academic advisors during their time in general advising, and most of these students felt that seeing multiple advisors had negative consequences for them. One student said:

> After meeting with [my first] advisor, there has been [a] kind of path of advisors, and each suggested different things. That led me on a confusing road until I got to where I am now. I told people exactly the same things over and over again, but I got four or five different answers. Finally, I got to talk to a professor here, and she suggested something I wanted to do.

Another student discussed her advising experience as "rushed." She indicated that she did not have a 45-minute advising session, and she illuminated another issue relative to general advising—advisors often have high caseloads and do not have time to give students the help they may need:

> My original counselor [advisor] . . . was absolutely no help in any regard. She said I should take networking as a fundamental class because I was new to IT, which was the worst advice she could have given me. She doesn't know IT, and she seems overworked because it can be impossible to meet with her, and when I did get to sit down and speak to her, she'd only have, like, 10 minutes. Our meetings were always rushed in a way that made me feel expendable.

The recent change to programs has complicated advising for prospective CPIN students, since general advisors are not yet trained on the differences between the programs or how courses fit within them. Many students find the differences between the eight programs nuanced and confusing. It is often difficult for students to choose between the programs, and they report that general advisors are unable to help them make that decision. Several students summed up this confusion when they discussed their experiences trying to choose CPIN courses and programs with general advisors:

> I was trying to figure out what classes will be good together, and I [was told to take] some classes that were impossible to take together. And I did not drop them in time, and it cost me a lot of

> money . . . I just felt like some advisors are not well trained in IT [programs]. After that, I started my own research and touching base with IT people. I felt the advisors need to be more trained in IT-specific stuff.
>
> Although I am almost done, it took me more time. That is because they [general advisors] don't have specialization or understanding [of] what the programs mean. Yes, they have [a] template but have no ideas where to place us.
>
> I told them [general advisors] I wanted to be a network architect, and they had no idea what I was talking about. I knew the job I wanted to do, but to be able to relate courses to [the career]—I did not receive good advice on that. I took extra courses until I found out what I need to take.

Also, since the change to eight programs is relatively recent, there are still some practices "left over" from the previous model of broad programs. This has caused some confusion for students trying to choose courses and course sequences in some places because the course catalog had not been updated. Additionally, some students had chosen programs based on old material, only to find those programs no longer existed when they enrolled. One student said:

> I was signing up for classes during [the] switch of programs; they were canceling a lot of programs and starting new ones, so information was extremely hard to come by for about the first two semesters, and I had trouble getting transferred from my starting advisor to my faculty advisor.

In many cases, students trying to choose a program of study are told to "just pick one" and assured that they can change it later. Faculty members, however, caution against this approach, stating that not all CPIN programs are interchangeable; some students could find themselves "stuck" in a program they don't necessarily want or switching into a program having already taken courses they did not actually need. In many cases, this can lead to the program taking longer to complete than the two years it's designed to take.

Advising Approaches

Within the general framework of the holistic advising model, the process of advising is two-pronged: students first see a general advisor and later see a faculty advisor. The nuances of this dual process vary somewhat across Ivy Tech's campuses, but most campuses share general characteristics, such as information-gathering, advising supplements, and courses designed to help students narrow their program options. Additionally, faculty advising occurs at every campus, albeit at different points in credit attainment (after 24 credit hours on two campuses versus after 15 credit hours on all other campuses). The following discussion considers each step in the process of advising and the differing approaches typically embraced by general advisors versus faculty members. We discuss these processes to provide a baseline of current advising practices before the complete implementation of the advising tool. In later reports, we will examine how these processes change and the role of the advising tool in these processes.

General Advising

General advisors tend to encourage exploration for those students who are undecided. General advisors interviewed during the site visits feel that sometimes students "have to stick a toe in the water" to find out if they are a good fit for a program. They like the idea of students being able to take common courses during their first semester so they can make a more educated decision when they choose from among the eight CPIN programs available to them. Many reported difficulties distinguishing between the programs—both because they do not understand the nuanced differences between them and because students often come in with only a vague idea of what they want to do. For the most part, advisors take a holistic approach that is meant to assist students in making their own decisions about what they want to do. Several students gave their perceptions of the holistic advising experience, noting that advisors tend to rely heavily on what students tells them they want to do. Many students said they simply don't know what they want to do yet, and they are looking for more information and options. One student said: "When you meet with a [general] advisor, they normally advise you on what you tell them. They don't give you any other options outside of what you have told them."

General advisors may not feel comfortable "steering" or redirecting students away from the programs they choose, regardless of their skill set or assessment results. Anecdotally, the general advisors we interviewed depicted an encouraging approach when discussing potential program options with students. In fact, they often described encouraging students to "try something," regardless of test scores, if it was something the student expressed interest in. Some faculty and students described the approach of general advisors in a similar fashion. Rather than try to find a career pathway better suited to a particular student's skill set, a general advisor may instead try to help the student overcome potential academic barriers blocking his or her pathway of choice. For example, when students lacking solid math skills come to general advisors wanting to enroll in computing and informatics, general advisors are likely to recommend that they enroll in remedial math or encourage them to repeat math courses they did not do well in previously.

While some students found their general advising session(s) helpful, many students and faculty reported concerns. One student said: "I thought they [advisors] were very useful. I told them what I want to do for my profession, and they recommended what I need to do based on my time schedule and other factors." However, many students and faculty raised the concern that general advising lacks specific information about the individual CPIN programs and may inadvertently place students in the wrong course(s) or program. Many students in our focus groups reported that they would go straight to a faculty advisor and avoid general advising altogether if they were to repeat their community college experience. One student said: "The advisory system is lacking. I [have] learned a lot since I have been here, but in terms of advising—it is not very strong." When discussing general advising, another student stated: "The process was terrible. I was put into classes I didn't need, and I was also put into two very

time-dense courses. I mean, the advisor helped with some things, but not with others. Mostly it was not good."

Faculty Advising

After their initial 15 credit hours (or 24, depending on the campus), students are moved from general advising to a CPIN faculty advisor. In most cases, the faculty approach to advising is very different from that of general advising. Faculty advisors are specialists in their own program or across a couple of programs. Therefore, they are able to provide targeted information about their own program(s) as well as explain the nuanced differences between their program(s) and the others. Faculty for the most part feel that putting students in "any program" just to try it out by taking common courses the first semester is not a good idea. In some cases, even when courses overlap, the sequencing is different. Thus, students who take a "common" course first could find that they have thrown off the sequencing for the rest of their program—resulting in the need for a fifth semester. Faculty members stress the importance of placing a student in the correct program from the beginning.

Faculty advisors use informal assessments to determine whether a particular program is a good fit for the student. Faculty members practice a range of informal "assessments" to test a student's interest in, aptitude for, and skills ability relative to computing fields. Many faculty members said they determine a student's level of self-sufficiency in order to understand his or her ability to manage a program. For instance, they may ask students questions about their keyboarding skills, how often they e-mail, or what they do on their mobile devices. One faculty member noted that while a student may be proficient at Twitter and other social networking applications, the real question is whether he or she understands the math behind the equations that run the social media. However, because these assessments are used only by faculty, students have already taken 15—or even 24—credit hours of coursework by the time they receive this crucial information about how their abilities match up with CPIN programs. In many cases, the information comes too late; they have already chosen a major. One CPIN student articulated that having assessment tools geared toward CPIN programs at the point of general advising would be helpful when trying to choose between the eight different majors:

> Having some sort of skills assessment would be good because that will help us [students] narrow down the eight programs to what we can do/what we might like. That would give us a good idea of what [a] server is, what [a] network is, what software is. And, like, could we do it. So if I have a mobility issue, and I can't move around all day long, then IT help is not the best for me, but sitting and coding all day long is fine. So a skills assessment that narrows down the options for us would be good. Like, maybe my aptitude is not great in one area, too, so that means I shouldn't do this program, but I could do this program. Like that. Skills and aptitude.

While general advisors might place a student in a program related to computing because the student wants to "do computers," faculty advisors ask more pointed and detailed questions. If faculty feel the student is not strong relative to math skills, they will redirect the student outside the field of computing.

Faculty members are in many cases very direct in their guidance to students. One faculty member repeated a familiar exchange she often has with students: "I say: 'Do you love math?' The student says: 'No.' I say: 'Maybe you need to find something else.'" Another faculty member said sometimes students take strenuous courses together without realizing how difficult and time-consuming the courses will be. He regularly asks students in this position if they have family responsibilities. If they say yes, he tells them, "You shouldn't take this course if you want to see your family." This direct approach was described by faculty in a manner that could be interpreted as "abrupt" or possibly even discouraging to students, one that could potentially make them feel they don't have what it takes to complete a CPIN program. Some faculty members admit they are trying to "weed out" students that may not succeed. They point out that if students enter a program they cannot succeed in, they waste their own time and money along with the time of the instructor.

Students often described their instructor-guided advising in a positive light and recommended instructors over general advisors. One student posited that students want to be "given it [information] straight." Another discussed her experience in a way that set up a clear contrast between faculty advising and general advising:

> I talked to a faculty advisor, which I'm glad I did because the general advisors would have put me in the wrong classes. I didn't know what I wanted, but as soon as I talked to my faculty advisor, he asked me a bunch of questions about what I like and the math I had, and he told me where to go. And I love my program. I would have probably picked wrong.

One student contrasted his advising experiences by saying that he "went to general advisors, and they just seem to be on autopilot. They don't find out what fits you or interests you. The IT department [faculty] advisors though—they are good." Another simply said "I don't think I would have been able to decide [which program to enroll in] without help from the instructors." However, this perception could change as information on the programs and their requirements becomes more widely understood among advisors, and they become better able to advise students.

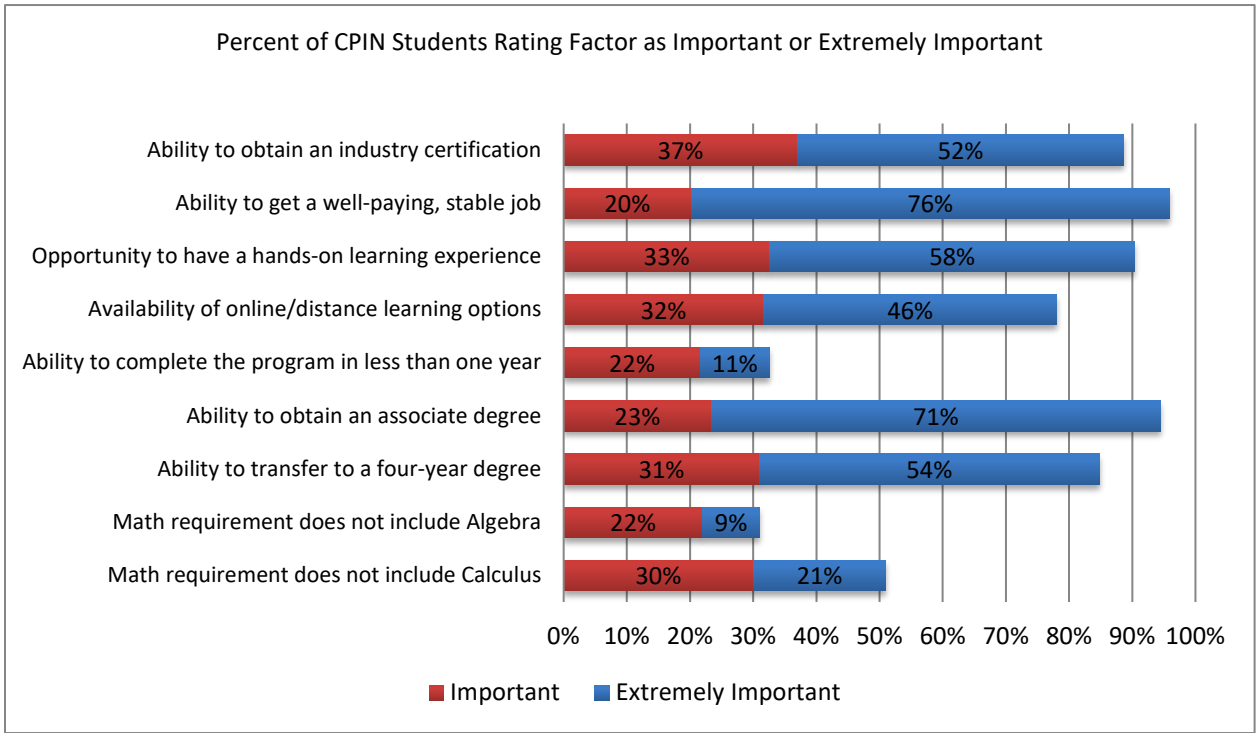
Program Selection

The student decision-making process around program entry is an important part of the advising process that the advising tool seeks to improve. Due to the increase in the number of CPIN programs, this aspect of advising became more complicated. Students considered several factors in their selection among the eight programs, and some of these emerged as particular concerns for students. This section discusses the main factors students considered when selecting programs, their information needs about programs and about careers, and the importance of early selection of a program. This section is intended to assess student needs for information about the CPIN programs before the implementation of the advising tool.

Factors in Selection

Students reported both career and educational factors as important when selecting a program. Figure 1 summarizes the factors that were important to students in selecting a program. Not surprisingly, the vast majority of students (96 percent) reported that the ability to get a well-paying, stable job was an extremely important or important factor in selecting a program. At the same time, the ability to earn a college credential was also a priority for the majority of students. In particular, the ability to obtain an associate degree was an extremely important or important factor for 94 percent of students, and the ability to transfer to a four-year degree program was extremely important or important to 84 percent of students. In contrast, few students reported that a short-term program was a priority in their selection. Only 33 percent reported that the ability to complete the program in less than one year was a significant factor in their selection process.

Figure 2. IMPORTANCE TO STUDENTS OF VARIOUS CONSIDERATIONS WHEN SELECTING A PROGRAM.



Source: CPIN student survey

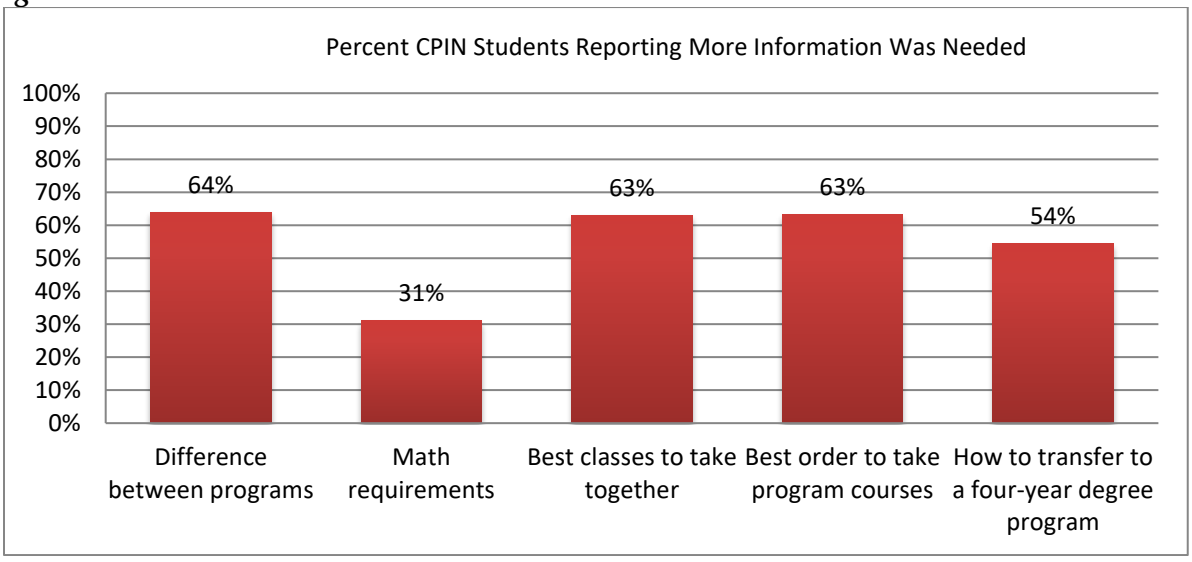
Notably, fewer students reported that math requirements were a factor in their selection of programs. Only about half of students (51 percent) responded that whether calculus was a requirement was either important or extremely important to them when considering a CPIN program. Likewise, less than one third (31 percent of respondents) answered that whether algebra was a requirement was either important or extremely important to them when considering a CPIN program.

Information Needs: Academic

Students needed more information when selecting among the eight programs. Since all CPIN programs are structured in such a way that they may be completed in two years, students are encouraged to choose their program pathway early. While some courses overlap in the first semester—allowing students to take a couple of courses before they choose a program—students are encouraged to choose a program as early as possible. According to the literature on guided pathways, program pathways should be created to simplify the decision-making process for students and to make choosing an education/career pathway easier. The eight CPIN program pathways—perhaps because they are new and processes have not yet been fine-tuned—seem to be confusing to both students and advisors and are making early selection a challenge.

Many students reported that they needed more information on the individual CPIN programs and their requirements at the time of selecting a program. As part of the CPIN student survey, students were asked to think back to when they first decided to pursue a CPIN program and report on what they needed more information about but did not receive. Of the students surveyed, 64 percent reported they needed more information about the differences between the eight programs. (See Figure 2.) Nearly two thirds of students surveyed indicated they needed more information about which classes to take concurrently (63 percent) and the correct sequencing of classes for their program (63 percent).

Figure 3. STUDENT INFORMATION NEEDS UPON PROGRAM SELECTION: ACADEMIC.



Source: CPIN student survey

Often, when students enroll, they come in with only a broad idea of wanting to "do something with computers." Many times, these students are placed into the computer science (CSCI) program by general advisors, as this program seems—on its face—like a good fit. The CSCI program, however, is not a terminal program; it is a transfer program meant for students pursuing a bachelor's degree who plan to transfer to a four-year university. One faculty chair said: "Everything IT has been given this 'computer science' tag" but "eight out of ten of our

students aren't in to go to another school, they're in it to get a job." By the time faculty see these students for advising, they have already taken many courses that won't count toward their degree if they transfer to another program. This misconception—that the CSCI program is the default choice for any student who is inclined to "do computers"—seems to be widespread; many students mentioned that general advisors counseled them to enroll in CSCI, and it was not until they met with a faculty advisor that they realized they were in a transfer program. One student said:

> I knew I liked computers, so I went in and said [to a general advisor] "I want some sort of a computer program." But they put me in computer science, which is a transfer program, and I don't want to get my bachelor's degree. So I ended up wasting some time before my faculty advisor said "this isn't right."

Another student echoed this:

> I came in during the summer, and my advisor told me to go with computer science. They had some confusion or something. They told me to go with computer science, that program, but I looked at the course list, and I could see that was not what I wanted to do. So I had to tell them "this isn't right." And basically I advised myself.

One reason this may be happening is that students are often interested in learning about transferring, or they at least mention to their general advisors that they are interested in hearing about it. In the survey referenced earlier, 74 percent of respondents reported that the ability to transfer to a four-year university was important or extremely important to them when selecting a program. This is vastly different than the perception of the faculty member who posited that "eight out of ten students" are *not* interested in transferring.

The confusion may be further compounded by the reality that even students who think they know what they want are often incorrect. Students may walk into an advisor's office saying they want to study "computer science," when in actuality they do not—at least, not insofar as the CSCI program is defined. They may even think they are interested in a transfer program until they understand the differences between a transfer (AS) program and a non-transfer (AAS) program. In these cases, students may end up investing considerable time, effort, and money in a program before they realize it was not what they thought it was. One faculty member also noted that, while "most students know what they *think* they want," they are often wrong. Because of this, students may tell a general advisor with certainty what program they want, but unless the advisor knows what questions to ask, they could still end up in the wrong program.

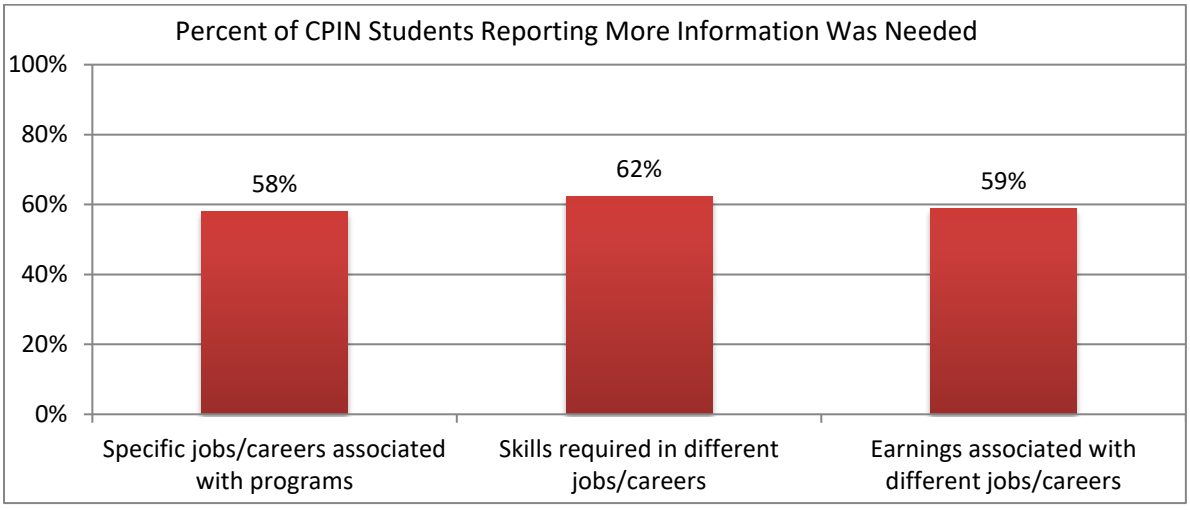
Math requirements are another important component of the CPIN programs advising process. Math requirements for the CPIN programs recently changed at Ivy Tech; different tracks of math requirements are now offered and are tailored to the program of study students choose to pursue. One challenge in having general advisors help students choose a math pathway is that the advisor has to fully understand the CPIN programs in order to correctly

advise students with regard to which math pathway is appropriate for the program they wish to pursue. Many faculty members feel advisors do not fully understand the programs or the math pathways for the programs, and as a result, students are being misadvised about math requirements. During interviews, faculty reported that students are often unprepared for the math required in their CPIN programs. However, students who responded to surveys as well as those who participated in focus groups reported feeling that their math skills were adequate and that they were unconcerned about math. Many students—61 percent of survey respondents—reported that they either did not need any information about math requirements or received all the information they needed at the time they selected their program. These results indicate that it is likely students are unconcerned about math pathways, when perhaps they should be concerned. They may not realize their math skills are not as developed as they should be, or they may not realize the importance of math to their educational and career pathways. Since faculty members report repeated issues regarding students in the wrong math pathway or students unprepared for math in their programs, there may be a disconnect between what students are perceiving and what is occurring.

Information Needs: Career-related

Students felt they lacked information about jobs, skills, and earnings upon selecting a program. Over half of student respondents indicated that when they were deciding on their program they lacked information about careers (56 percent), skills (62 percent), and job earnings (59 percent) associated with the CPIN programs. (See Figure 3.) One student stated: "I feel as though I was not given proper guidance in the beginning to help me choose a viable career path." Another said it would be nice to know "what jobs would be attainable after a certain degree."

Figure 4. STUDENT INFORMATION NEEDS UPON PROGRAM SELECTION: CAREER-RELATED.



Source: CPIN student survey

Job prospects and salaries are a big part of student decision-making about CPIN programs. Much of this information comes from faculty members, who acquire it from their own "experience, e-mails, and colleagues." One faculty member described this as "more [based on] perceptions than hard data." Students in focus groups seemed to be very career-focused. They reported a desire to better understand potential careers, pathways for success in those careers, and salary expectations. They also wanted to know information such as "are employers looking for career-oriented degrees or general IT degrees [such as] computer science?" Through open-ended survey questions and in focus groups, students clearly articulated a desire for more career-specific information, as well as "real world" experience.

Importance of Early Decisions

Students are not required to choose a degree program immediately, but they are encouraged to select one early. Although early selection of a CPIN program may allow students to get straight to work on their degree, there are some consequences to choosing too early—especially if a student is placed in the "wrong" program. In this section, we discuss the consequences of making the wrong decision with regard to which CPIN program to pursue upon enrollment. At a time in which Ivy Tech, on a general level, is actively pursuing more streamlined pathways and easier decision-making for students, expanding the number of computing programs from four to eight was a counterintuitive strategy. Indeed, the consequences we discuss here are compounded by an academic advising structure that is not set up to help students choose from among the eight programs.

Entering into a program of study early in college is a factor associated with completion (Jenkins and Cho, 2012). At the same time, when students enroll in a program that is not a good fit for them, it can result in their dropping the program. The rate of students dropping from CPIN programs is a concern. Faculty feel that the sooner they see students in the advising process, the higher the retention rate of students in CPIN programs will be, and the higher the graduation rate will rise. They feel this is true in large part because students who are advised by a faculty member "have a point of contact to ask questions" and can receive more—and more accurate—information than they can typically receive from general advisors.

Faculty feel that if they see students early they could do a better job of advising them than general advisors can. This is because most students initially come to general advising confused and overwhelmed by the available choices. "The student is so overwhelmed to begin with," one faculty member noted, further commenting that "the advising center is kind of like an express lane." Another faculty member echoed this, saying "I've got 8 programs I care about; they [general advisors] have 200." Most of the faculty members we interviewed said they would like to see faculty advising occur immediately, especially if students are confused about which CPIN program to enter: "We [faculty] should be there from the start, guiding them through our programs and giving them a little bit of insight." Many faculty members echoed this belief, with one saying "We [faculty] don't see students soon enough. For the first 24 [credit hours] of 60 [credit hours total in the program], we don't see them [at all, and after that, we] can't necessarily

help them decide which computer degree they want." At Indianapolis, faculty have suggested to general advisors that "if the person says computing, send him to us."

Faculty members feel general advisors do not understand the nuances of the various CPIN programs: "The general advisors know a lot about everything and less about specifics. We [faculty] know a lot about specific programs here—if you want to know it, come here and talk to us." Faculty want to be able to help guide students "as soon as they come into the college." One faculty member gave a detailed example of how nuanced advising can be and the potential consequences of students being placed in the wrong program:

> Any student that says computer, technology, certain key words—I want to see them right then. Because I've had students in the past on financial aid saying they want to work on computers. They [general advisors] put them in my classes. Sounds good. That's not what they wanted. When they said "on computers" they meant essentially data entry, not 'tear the guts out' [take the computer apart]. Their financial aid wouldn't let them switch degrees. I had to flunk them in every class I [taught] until they lost the [financial aid] grant. And then they could come back and take the right set of classes. That is wasting my time, their time, everybody's money, seats that I could've used for somebody else. It's not efficient. As a faculty person, I think I'm knowledgeable enough to say to a person, "Yeah, you say you want to work on computers, but did you mean 'on' or 'in'? When you say this word, what is your interpretation of that compared to my interpretation? Let's make sure that what you want to do with the rest of your life is what you say you want to do." Because I get too many students that say, "Yup that's what I want to do," and then they have a couple classes—and they'll sit right in my office [and say] "Don't you ever put me in a class like that again" and just pound the desk— [and I'll say] "OK, now we know. I had a feeling when we first met that was true, but at that point you already enrolled, [and] I couldn't have done anything for you." And I don't like that.

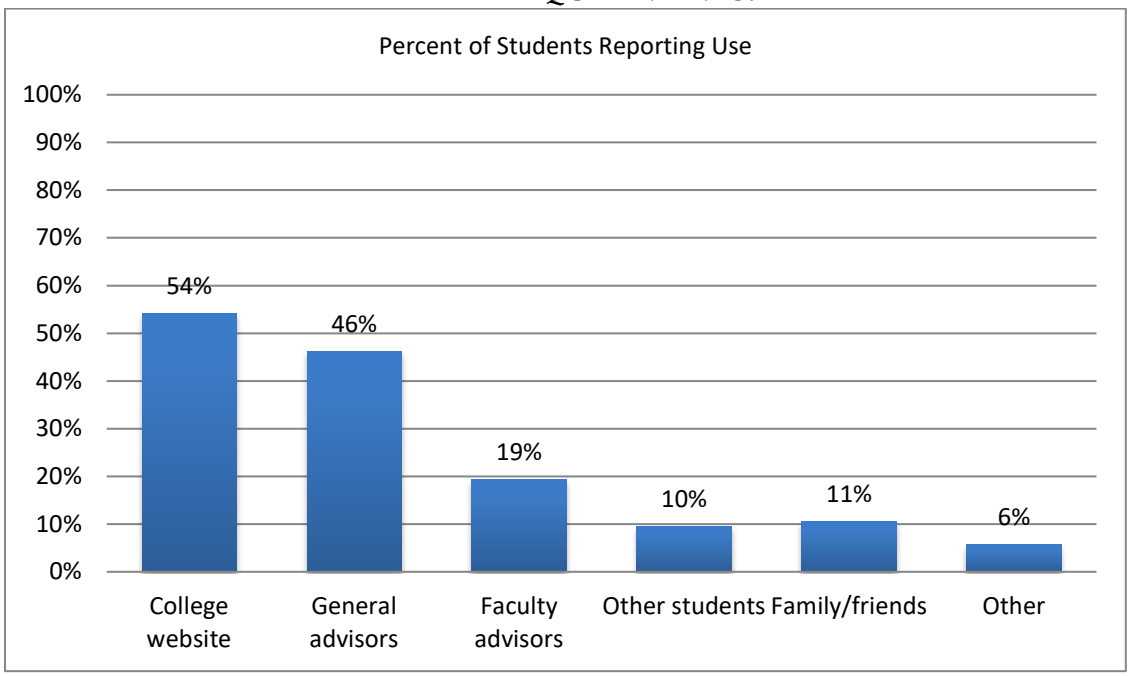
It is not clear, however, whether faculty could handle the workload if all prospective CPIN students were diverted from general advising. Faculty members have office hours and student engagement hours piled on top of their teaching loads in addition to the advising they already do. Adding a higher student advising load may be challenging. Most faculty members we interviewed told us that they would be willing to take on the heavier load in order to avoid what they see as an advising crisis. One faculty member said: "I wish we could get our students earlier. It's a lot more work, but I wish we could get them earlier." Another said: "Being inundated with students for advising is the best thing ever." Faculty did stress, however, that they don't want to "steal" students from advisors or take away the advising element for general education credits. It is not that students need to leave advising completely, faculty feel, but rather that instructors can help with some aspects of advising that general advisors are not strong on, such as the differences between the eight CPIN programs.

Information Sources

While students used a range of information sources to make decisions about CPIN programs and their requirements, the most common source was the Ivy Tech website. Fifty-four percent of CPIN student survey respondents reported they received information about

CPIN programs and their requirements on the college website. Nearly half of students (46 percent) received information from general college advisors, and 19 percent received information from faculty. (See Figure 4.) This indicates that many students are relying on the college website to receive information about the programs, whether in conjunction with advising or on its own. Many students commented, however, that the website was difficult to find information on and was too broad. So although they are using the website, they are unsatisfied with it. One student commented that "right now, what's on the website isn't really better than general advising. There's not much on there." Other students said the website is an "overload" of information. Students overall wished the website had better course information and descriptions, likely because students are trying to use the website as a self-advising tool. Many students conceded the information they are looking for is on there, it is just "not intuitive" to find.

Figure 5. SOURCES OF INFORMATION ON ACADEMIC PROGRAMS AND THEIR REQUIREMENTS.

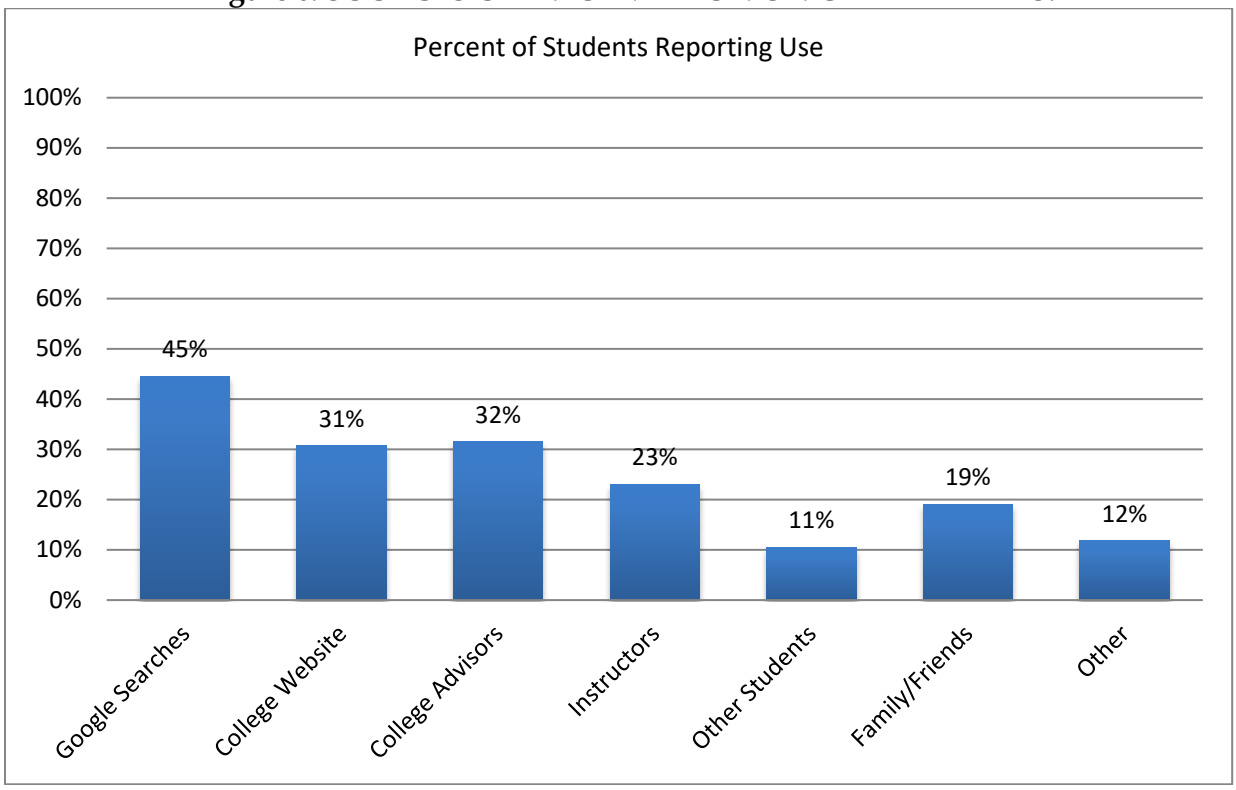


Source: CPIN Student Survey

Likewise, students received the majority of their information on careers from online sources. Students' most commonly reported source of information on career paths (e.g., jobs associated with degree/certificate programs) was the Google search engine (45 percent), followed by the Ivy Tech website (31 percent). Compared with the proportion of students receiving information on academic programs from general advisors and instructors, fewer students reported receiving career-related information from general advisors (only 31 percent), and even fewer received career-related information from instructors (only 21 percent). Given that faculty consider themselves best suited to advise on careers, it is surprising that so few

students sought information on their career paths from their instructors. Figure 5 summarizes the sources students used to get information on careers.

Figure 6. SOURCES OF INFORMATION ON CAREER PATHS.



Source: CPIN Student Survey

Surveys and focus groups indicated that students often combine advising strategies. Over half of all students surveyed (57 percent) reported using multiple sources of information to make decisions about programs. This may be occurring because students are not satisfied with the information they receive from a single source; if they don't find what they need in one place, they seek out a variety of sources to help them make their decision.

Many students rely on self-advising to navigate their programs. Based on responses to the CPIN student survey, about one third of students (34 percent) relied on information from the Ivy Tech website as their only advising resource. In focus groups, some students revealed that they tell new students not to use general advising if they are pursuing a CPIN certificate or degree. In fact, this message was fairly consistent across campuses, and students reported that they are telling friends and fellow students to self-advise for CPIN programs rather than use general advising. While many students reported using the website to help them make decisions about their program, they also reported that the website was difficult to use. Self-advising students who misinterpret information on the website can end up taking the wrong sequence of courses or end up in programs that are not a good fit. Still, many students felt like they were lacking information from their advisor and thus were more or less forced to self-advise:

> I had to do everything myself. I knew what I was looking for. I just looked everything up—what was required—and basically just picked up what I wanted and put that into [a] schedule. I was given a piece of paper and told to create my class schedule. I somehow figured it out.

Faculty and general advisors strongly recommend against students' self-advising. In fact, several faculty members said they feel students sometimes say they are "misadvised" by general advising when in fact they make self-advising mistakes and put themselves in the wrong class. Faculty generally feel that students are ill-equipped to self-advise because "they don't know what they don't know." Because students may not understand the computing industry, for example, they may not choose the correct education path to lead to a specific career. One faculty member noted that students often use job titles when they describe what they want to do, but they do not understand how a program leads to that job. In some cases, a job can fit with multiple programs, or one program can lead to multiple jobs. Understanding these nuances is generally beyond students' self-advising capacity.

To supplement general advising relative to the CPIN programs, some Ivy Tech campuses have come up with specialized tools to convey essential program information. Indianapolis, for example, created a booklet for students that explains all eight programs as well as what is taught within the individual classes that are part of those programs. Similarly, South Bend developed a handout for every CPIN degree explaining what the degree is and what type(s) of jobs a student could expect to qualify for with that degree. If a student is interested in a particular CPIN program, general advisors walk through the handout with the student and then allow him or her to take it home. A South Bend advisor said, "I give them this and say: 'Take this home. You don't have to make a decision right away, but it's important to make the right one.'" Bloomington created posters that are visible around campus reminding students that once they reach 24 credit hours, they should be talking to a faculty advisor instead of a general advisor about program or course questions. At the Muncie campus, three faculty members developed a PowerPoint slide show that presents different types of computing jobs, explains how they relate to the various CPIN majors, and provides their average salary ranges. The PowerPoint presentation is shown to prospective students to help them develop a career path.

In addition to these sources, some students in our focus groups mentioned Ivy Tech's degree audit system. The degree audit system at Ivy Tech is designed to help students track their progress once they are in a program. It also helps them see potential education paths—and which of their classes may transfer—if they choose to change programs. The program did not seem to be very popular among the students in our focus groups, however. One student called it "just the worst program to show you *this is the degree I need, these are the classes I need*."

Another source of this information at the college are Student Success courses. A Student Success course (either IVYT 111 or IVYT 115 depending on the campus and the program) has been redesigned for use in CPIN programs across all Ivy Tech campuses. The course is meant to give students a brief introduction to all eight CPIN programs in a way that connects them to the careers behind them. Students are meant to take the course during their first semester; this way,

if they have not yet selected a program, they are able to do so more confidently after having taken the course, and if they discover they have selected incorrectly, they are (at least theoretically) able to switch programs without "wasting" time or money. Across all campuses, the course has been modified from a generic college-wide course to one that is school-specific. In other words, there is now a Student Success course exclusively for CPIN, rather than a general course meant for all Ivy Tech students.

The course is required as part of the core curriculum of all eight programs, but its usefulness is debated. For example, some faculty feel the course is only beneficial to some students: "It is helpful for the students who are going to listen." Additionally, there is no requirement as to when students have to take the course. Because of this, by the time some students take the course, they have already chosen a major. Although the course is designed to help students make an informed decision between the eight programs and better choose a career path, student's perceptions of the course's usefulness are mixed. One student said: "I took the Student Success class twice, which helped a little bit. It didn't help me make decisions about IT or the programs [CPIN offers], no, but it helped me be a better student and with time management and stuff." Several other students, however, reported that the course was "a waste of time" and "not at all helpful."

Advising Reform

In keeping with Ivy Tech's overarching goals to create clear career pathways and increase labor market alignment, college administration in recent years has focused on redesigning the advising system to better serve students. The first step to reform the advising model across the state was to decrease the ratio of students to advisors. A central staff member said that in 2012 the ratio of students to general advisor was as high as 1,200:1. After several rounds of hiring and restructuring, the current ratio of students to advisor is ≤400:1. Central staff feels this is a "reasonable level," where "true relationship-building and true advising" can occur.

More recently (as of December 2015), the college began piloting a model in Terre Haute and Sellersburg where all students stay in the advising center with a general advisor until the completion of their program, and instead of moving from general advising to a faculty advisor after 15 or 24 credit hours, faculty members "mentor" students alongside the general advisor. Faculty mentors are chosen based on the program the student chooses to enter, and the student has access to both the faculty mentor and the general advisor throughout their entire education. Aside from giving students access to both an advisor and a faculty member throughout their entire time at Ivy Tech, this method has an additional benefit.

Both faculty and general advisors are required to take advising notes when they meet with or "mentor" a student—something that only general advisors are currently required to do. This creates an "advising trail" in the college's Starfish tracking system that more accurately represents the student's advising story. One central staff member discussed this as a huge

positive change for the advising model. As part of this system, faculty are encouraged to enter into the tracking system information on the students they advise. Central staff noted that campus staff who may need to see information to help a student "can't access what we do not record," and "faculty do not universally record" information in the central system. Under the new recording mandate, advising records are consistent throughout the entire advising process and can be accessed by staff members at any time through the Starfish system. The Terre Haute and Sellersburg pilots will be assessed in the summer of 2016. Central staff members are hoping the outcome is positive and that changes can be made to the advising systems on the remaining Ivy Tech campuses.

Advising Tool

The TAACCCT grant has opened up additional possibilities for positive change in the Ivy Tech advising model. The development of an advising tool to help students make better decisions about programs and careers was a core goal of the grant. This section discusses Ivy Tech's development of this concept, the implementation steps taken to date, and perceptions of the tool.

Development

One primary goal of the grant was to develop and implement a "virtual guided pathway advising tool" that will "graphically depict alternative career pathways" for students based on the eight program pathways they can choose from. The advising tool is modeled after Arizona State University's e-advising tool, and it is intended to "serve as a model for expansion to other Ivy Tech programs and serve as a model for computing programs in other states and communities." Grant management envisions the tool as offering an overview of careers in the computing field, specific pathways that link Ivy Tech's eight computing programs to specific careers, and a clear program map that includes critical courses and course sequencing for all eight programs. As it is currently planned, the tool will include custom videos and comparison tools that display career/workplace content, income potentials for specific careers linked to the eight program pathways, and course requirements for each pathway.

The advising tool will incorporate tools specifically geared toward adult learners, such as exploration of previous experience, workplace learning, or prior credentialing that may lead to prior learning credit. Likewise, dual-credit and advanced placement tools will be geared toward students entering Ivy Tech directly out of high school. The tool will incorporate elements already present at Ivy Tech campuses, such as Starfish, Banner, and GoToMeeting. It is hoped that the advising tool will improve supports and resources already available for students, such as their general advising experience.

According to the grant's statement of work, the vision for the advising tool is that it will have an "upscale, energetic, well-presented presentation to be able to describe to students and advisors the eight different pathways specific for Ivy Tech." It will serve as an "essential

introduction for students" as well as an indispensable tool for advisors. The tool is envisioned to be used by advisors, largely to take pressure off them with regard to understanding the nuances and details between the eight programs and helping students decide which program is right for them. Eventually, elements of the advising tool are meant to be released for student use, although the intention is for the tool to be used in conjunction with face-to-face advising. Students will be able to explore the tool on their own and work with an advisor (whether a general advisor or faculty advisor) to ask questions and receive guidance.

Implementation

Originally, full rollout of the advising tool was expected by September of 2015—the end of the first year of the grant project. Shortly after the grant was awarded, however, central staff realized that fast implementation of the tool was untenable. The first step to developing the tool properly was to fully understand which programs were offered at which campus—data that took some time to collect and confirm. The second step was to map the program pathways, including the math requirements and courses, for each program. Math requirements and pathways are a crucially important piece of the eight CPIN programs. Moreover, they are important relative to whether a student chooses an AS (transferable) or an AAS (terminal) degree pathway. One staff member stated: "A big sort for us between transfer and workforce focus is math skills." During the process of implementation for the advising tool, those working on developing the tool came to realize how important math skills are to the eight programs, and discussions began regarding changing some of the minimum math requirements to ensure that students who entered the programs had strong math skills. Those conversations are ongoing, and math requirements are currently being redesigned.

Once the program and course pathway information was collected and confirmed, a PowerPoint presentation was put together that summarized the information for each campus. The presentation was given at a grant workshop for all campuses where plans for the advising tool were announced and discussed. The program pathways information was also made available to general advisors at all campuses in handout form to help alleviate confusion regarding program pathways. The next step was to incorporate the information and embed it in website form, integrating videos that would discuss career paths and specific job information for each pathway. Staffing for this portion of implementation was difficult, as funding was limited. The project director was able to enlist three students from a course he taught, who used the process as part of their coursework. These students used the course pathway information to create a foundation for the advising tool. Currently, faculty members are working on scripting for the videos. Since students are visual, the videos are meant to be animated, well presented, and upbeat. Those words may not describe the process of creating the videos, however; staff members have reported that the process of creating the video scripting so far has been tedious and time-consuming. The tool is currently anticipated to be rolled out by the fall of 2016.

The first step for the tool after rollout will be to introduce it to general advisors, who will use it to gain a better understanding of the nuanced differences between the eight CPIN

programs and to better communicate those differences to students. It will also directly link the programs to guided career pathways, an overarching goal of the TAACCCT reform. Due especially to Ivy Tech's recent focused effort to create clearer pathways for students, advising has had to expand its mission to also encompass career decisions. A central staff member stated this eloquently when she said "I don't know how you do advising without talking career." With the current advising model, general advisors lack the detailed information necessary to fill this need with regard to careers in computing. The hope is that with better guidance and direction, advisors can help prospective computing students make more informed decisions earlier, thus helping them to avoid getting "stuck" in ill-fitting programs or taking courses they do not need. Currently, students may not realize they are in a "wrong" program until they meet with a faculty advisor—a minimum of 15 credits after they have started taking courses. With students sitting in programs that are better aligned with their interests, and getting into those programs sooner, CPIN programs should suffer less attrition. Thus, it is hoped that the advising tool will improve not only the guided pathways, but also the programs themselves.

Perceptions of the Advising Tool

Although the tool has not yet been released for use, advisors and faculty are positive about its potential. Overall, faculty and advisors are aware of central staff's intention to integrate the advising tool for daily use and view the project with optimism, largely because there is a general acknowledgement that the current advising situation is not ideal. There is general agreement that the most important things students pursuing CPIN programs need to understand are 1) the program options, including differences between the eight programs, and 2) the career options for each program. When presented with a number of items to be included in a hypothetical advising tool and asked to rank these items in terms of how important they would be to include, faculty most commonly prioritized information on program options, course requirements, and course descriptions—49 percent of respondents indicated that would be the most useful information to include—followed by maps of recommended sequences of courses, which was ranked "most useful" by 26 percent of respondents. (See Table 6.)

Table 6. PROPORTION OF FACULTY REPORTING GIVEN INFORMATION ITEMS AS "MOST USEFUL" IN AN ACADEMIC ADVISING TOOL

	Percent reporting item as "most useful"
Information on programs, course requirements, and course descriptions	49
Maps of recommended sequences of course-taking	26
Short videos on jobs/careers associated with particular programs	8
Descriptions of a day in the life of a particular job/career	8
None—I'm not sure an online advising tool would be useful	3
Earnings associated with jobs/careers	0
Links to websites with information on jobs/careers	0

Source: CPIN Faculty Survey

Both advisors and faculty members alike feel a resource that helps supplement their work by providing this information directly to students can only be positive. The majority of faculty members and advisors we interviewed, however, tempered this enthusiasm by stressing that students still need face-to-face advising and assistance. They said they hope the tool will not replace their own face-to-face interaction with students. Faculty especially stressed that no advising tool should replace faculty advising:

> Advising tools are great because we have too many students self-advising. Anything that we can do to help them is great, but I still think that anything we can do to get them right here . . . and we as a department and all of our professors fully support that. We want to see the students as soon as we can.

Another faculty member stated: "I think face-to-face contact and maintaining that contact is the best thing to get these students through." Likewise, a general advisor said: "A lot of this [advising] is just a personal interaction . . . 'here's a face that's going to help me.'" In focus groups, students also indicated to us that they would prefer a mix of self-advising and face-to-face interaction.

Faculty and advisors are wary of the advising tool being directly available to students. Although the vision for the tool is that students will use it in conjunction with advising, staff are worried that students will use it as a self-advising tool and try to skip advising altogether. They feel this is especially possible if elements of the tool are available on the college website, which is part of the current plan. Giving students more information is only part of the solution—making sure they properly use that information is crucial. Faculty, advisors, and students alike mentioned more information is needed regarding what the jobs and salaries are for each career path, and what "a day in the life" of people who actually perform a specific job is like. Marketing materials that students can readily access, such as potential salaries for careers and success stories from former Ivy Tech CPIN students, were all mentioned as elements that may help students make informed decisions. But students having direct, self-serve access to this information might compound the problem of students self-advising. Grant management is aware of this and plans to limit the amount of information directly available to students in an effort to encourage students to continue to seek the counsel of a general or faculty advisor.

Summary and Recommendations

The current model for advising at Ivy Tech is too generalized to properly advise students relative to CPIN programs, especially since the recent shift to eight programs has created more nuanced differences between the programs. General advisors simply do not have enough detailed knowledge about the eight programs to successfully guide students in selecting a CPIN major. The fact that students are generally unaware of "where they want to go" aside from a broad interest in "doing computers" compounds this issue. What this means for the CPIN programs, however, is that more intensive advising is necessary to help students tease out which program is right for them. Although faculty advising can certainly be called "intensive," it is occurring too late after students are enrolled to be helpful to them in selecting a

program and career path. Students also indicate that while they are very happy with their faculty advisors, they are still lacking information about careers, skills, and potential earnings. This indicates that although the programs may be aligned with the labor market, students are still missing valuable information about the transition from education to career.

With the absence of intensive advising and the deficiencies identified with general advising, many students are choosing to self-advise or to combine self-advising with general advising. Self-advising is not unusual among college students. Many CPIN students at Ivy Tech indicated they rely on the college website for program and course information and often rely on Google for career information to supplement any information they receive from general advising. There does, however, seem to be an indication that since the change to the eight programs, students have become more frustrated with their experiences at general advising, and are increasing their reliance on self-advising. They are also telling friends and fellow students to self-advise rather than attend general advising. This is an alarming trend that bears attention.

The development of the online advising tool is certainly a step in the right direction to alleviate issues with general advising and students being placed in the "wrong" program. General advisors, faculty members, and students agree that the tool will likely help ease current challenges with advising. All three groups are also in agreement that a combination of online information and face-to-face advising is the most desired model and would be the most beneficial. Literature backs this up; research into online advising models has found that the most successful forms of online advising tools are those that combine technology with face-to-face guidance: a balance of "high tech and high touch" (Giordani, 2006; Shea, 2005).

The guided pathways model that Ivy Tech is currently integrating into its CPIN programs is supported by literature, and will likely create programs better aligned with the labor market that will help students succeed in their education and career. What the model is currently lacking, however, is a strong advising system that will assist students in making informed decisions about their education and career. Central staff is aware of this issue and is currently piloting new advising models, as well as creating an advising tool to help increase general advisors' knowledge about the eight CPIN programs. In addition to this, central staff members should also consider the following goals:

1) better integrating faculty advisors earlier in the advising process
2) formalizing the "assessments" faculty members engage in with students and sharing these techniques with general advisors
3) developing and posting career materials for students to access in a place they would generally go to (such as the Ivy Tech website)
4) educating general advisors on the pitfalls of students getting "off sequence" in CPIN programs and how they can avoid this

5) continuing to develop the advising tool with special consideration toward career guidance, math pathways guidance, and understanding the differences between the eight programs

Based on these findings, some recommendations for Ivy Tech to consider are as follows:

- Faculty members should share with general advisors the "informal assessment" process they use with students. This series of questions faculty ask of students to help them choose a program may be helpful to share with general advisors and to build into the advising tool.

- All course lists and campus marketing materials should be fully updated to reflect the transition to the eight program pathways—this will help eliminate confusion for incoming students interested in CPIN programs.

- More career information should be made available to students. Students expressed a desire for more information about career pathways, jobs, earnings, and necessary skills despite faculty members' sense that they are adequately presenting this material. The online advising tool may have a role in filling this need.

- Conversations should occur at the level of central staff to reassess the advising model for CPIN students in terms of the role of general advisors and faculty advisors, and how to best integrate the online advising tool.

VI. EMPLOYER ENGAGEMENT

Increasing Ivy Tech's employer engagement was a main activity of the TAACCCT grant, with the goal of improving labor market alignment. Since the installation of supplies has been completed at most of the campuses, the TAACCCT project director has begun working to build the statewide advisory board and to support the employer engagement efforts of faculty at individual campuses. The project director has been working with the campuses to share information on new employer partners and gather information on advisory board meetings at local campuses. The statewide advisory board has been meeting regularly and increasing its members. Many of these efforts were just beginning at the time of this report, so the findings discussed in this section provide a sense of the existing level of activity at the time of grant implementation.

This section describes several aspects of employer engagement. First, we discuss the broad goal of engagement and the most common reasons CPIN faculty and college staff sought to improve their relationships with industry. We then discuss key activities that are part of the college's approach to engaging with employers for its CPIN programs, including advisory boards, internships, job placement, and a variety of other activities, along with the role of faculty and other college staff within them.

Goals of Engagement

Faculty and central college staff reported that employer engagement was important for the broad purpose of building the reputation of Ivy Tech and its CPIN programs. They reported a range of views on the reputation of their programs among employers. Some expressed concern about whether employers and students understood the eight CPIN programs, as marketing information on the newly divided programs remained under development. As one faculty member stated: "They don't even know what exists and what programs we've got." Faculty discussed the need to get more information out to employers that was specific to the new programs since much of the college's marketing is more general. "Our marketing is very generic, so I doubt, at the very minimum, employers know that we have a school of computing . . ." However, some faculty reported they thought the college had a good reputation among employers. As one instructor stated: "I'd say we've finally gotten to the point where we've permeated most of the businesses around here, and our students have a good reputation."

A central motivation for faculty-employer engagement was to meet students' employment goals. Faculty recognize that students typically come to Ivy Tech because they want to get jobs. Given this goal, many faculty highlighted the importance of connecting with employers and with labor market needs. In this view, working with employers is a central way to support students' goals at Ivy Tech. One faculty member summarized this sentiment by stating: "We're eventually trying to get our students out into the world. So the more that we can hear their [employers'] voice and work with them, we'll be doing the right things by our students." Another faculty member highlighted previous limitations in preparing students for jobs and, thus, the need for improving connections with the labor market:

> Education has been teaching one thing for a long time. And people went out in the world with no employable skills. Some of them were people that got a degree in hopes to get a good job, but their degree doesn't get them a job. Industry involvement is very important, and it's a win-win if they use it right.

With students in mind, many faculty reported that they value learning about employers' skills needs. In fact, understanding skills needs was the most common reason faculty reported for engaging with employers. (See Table 7.) Nearly two thirds of faculty surveyed (61 percent) reported they received feedback from employers about the skills they seek in potential employees. In interviews, faculty expressed their interest in knowing more about employers' skills needs. One faculty member at a campus that had not previously had active connections with local employers commented that building these relationships would be very welcome. This faculty member stated that more information is needed from employers "to find out what exactly they are looking for in terms of skills and knowledge."

Table 7. REASONS FOR EMPLOYER ENGAGEMENT, RANKED BY PERCENT OF FACULTY RATING THE REASON "MOST IMPORTANT"

	Percent
Employer input about skills sought in potential employees	39
Internships for students	27
Employers as guest speakers in classes	18
Job shadowing/visits to job sites for students	11
Share information on job opportunities with students	3
Other	2

Source: CPIN faculty survey

Current Approach

Despite faculty interest in learning about employer needs, the intensity of involvement faculty reported having with employers varied. Only two thirds of faculty reported having any involvement with industry. The most common form of involvement was passing on job opportunities to their students—an activity that comprised 58 percent of what involved faculty reported doing. Other more active forms of engagement with employers were less common with this group. (See Figure 7.) In some cases, faculty engagement with industry was quite limited and more reactive—it involved waiting for the employer to reach out rather than reaching out to the employer. One faculty described his interactions with employers:

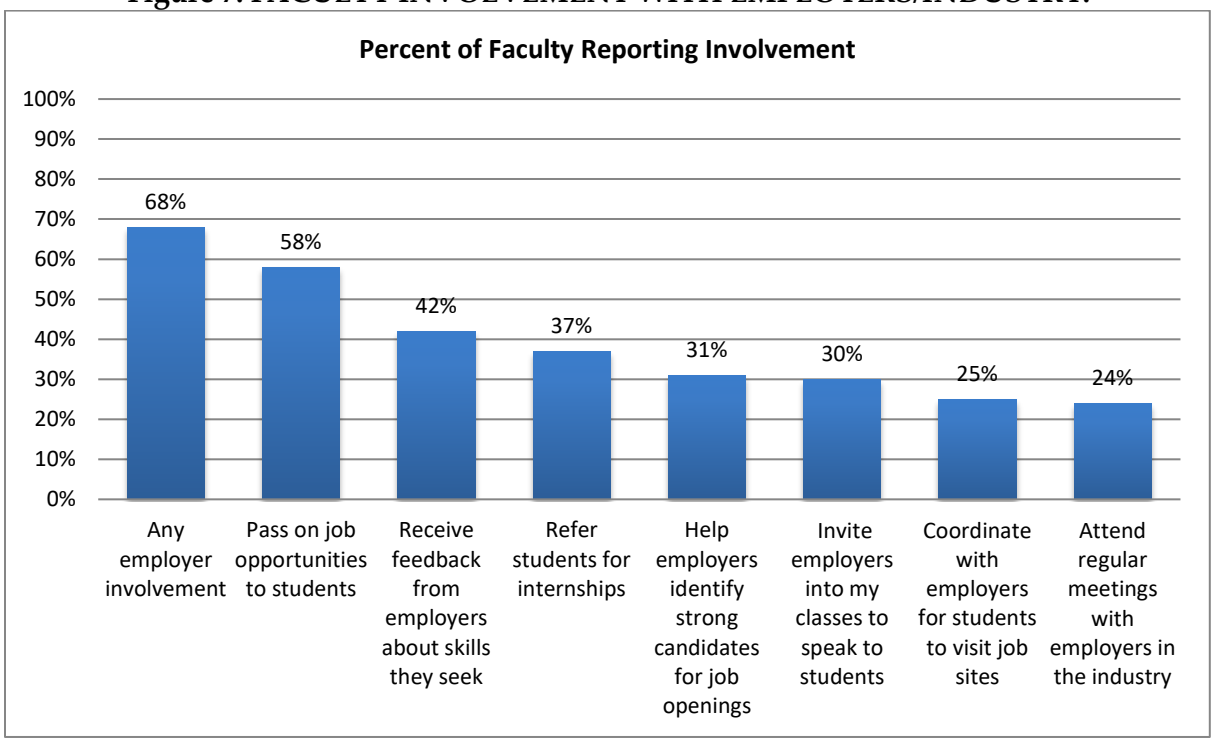
> Pretty limited so far. Maybe just two or three approached me. Usually either they'll call me. We have one company just across the street, and their IT department was one guy. So, he came over, met with us, and we showed him what we have, lab, etc. He told us what he was interested in, and then we talked to some of our students and tried to connect them.

In contrast, some faculty have been very persistent in their outreach efforts, trying many different ways to reach out with a great deal of persistence. When asked about how he approached his interactions with employers, one faculty member stated:

> Frequent calls, occasional visitations to the locations for faculty to actually have a physical look at their environment. You can describe things as much as you'd like, but sometimes going there and seeing their environment, meeting other contacts and departments, and get our name out there. I feel that is something we need. And if they don't want to communicate back—that is fine; I will just try keep [them] on e-mail, and maybe after a while something will match.

One reason some faculty may be less involved with employers than others is because employer engagement has not historically been part of the faculty role. For most faculty, much of what they do in this area is based on their own initiative and network of personal connections with employers. Some notable exceptions exist where campus-wide goals and expectations for faculty include employer engagement.

Figure 7. FACULTY INVOLVEMENT WITH EMPLOYERS/INDUSTRY.



Source: CPIN faculty survey

While many faculty members were supportive of the idea of increasing engagement with employers, they were substantially limited by their time constraints. Most have significant responsibilities that are a challenge to meet. These responsibilities include teaching numerous classes, running programs on a day-to-day basis, managing curriculum, and advising students. Some faculty were quite interested in building these connections, but were simply limited by the amount of time available to them, given their already high teaching loads.

> That [finding time to build connections with employers] is a little tough. That is why it is still ongoing. Teaching classes has to be a priority, but I still try to fit this in. I was supposed to teach four classes, but now I teach six. So teaching fewer classes would help in a sense that I would have more time.

Many reported that increasing their outreach to employers would be challenging unless they had more time in their schedule dedicated to the task. One faculty member reflected these concerns when asked what support could help him do this work: "More time! Extend the day to be 27 instead of 24 hours."

Faculty highlighted the importance of having additional resources to effectively do employer outreach. Some mentioned the importance of other staff who could manage relationships with employers and help students find jobs. In one instance, a campus had a dedicated staff person in this role funded under a previous grant. They reported they benefited from having a person who was embedded in the specifics of their industry handle these

relationships. However, when that grant ended, the position ended, disrupting the campus' ability to maintain these relationships. Reflecting on this, a faculty member stated: "I think that we don't have the bandwidth to do that kind of job as she did it."

Faculty members commonly reported that they relied on personal connections. Many faculty members said they called on friends and former colleagues to engage with the program. For example, when asked how his connections with employers developed, one faculty stated: "It's still who you know." Another faculty, when asked about the source of employer connections in the program more generally, stated: "Basically personal connections. There are a couple of folks we have asked to join our program advisory committee, there were couple of associates and friends of mine, I have a friend who worked in the industry." For faculty members that were not from the immediate area, the reliance on personal connections was a challenge. These faculty members were working to build and increase their local network of employer contacts, but found themselves at a disadvantage in their attempts to do so because of their lack of personal contacts. In addition to their personal networks from outside of Ivy Tech, some faculty members reported they drew on personal contacts from the students in their classes to engage with employers. In one class, for example, several students worked for a particular company in which one student also had family connections. The instructor worked with the students to use their personal ties to the company to build a bridge between that company and the program, which led to an ongoing relationship.

Some faculty and college staff noted the need for a coordinated approach to employer engagement. In some instances, faculty sought to connect with others at the college who were engaged in employer outreach. At Fort Wayne, for example, some faculty saw an opportunity in connecting with the work of Ivy Tech's Corporate College that would allow them to collaborate and build on their industry contacts. Other faculty members pointed to the important role of the central office in coordinating these efforts. Because the individual campuses and their faculty largely did not have enough time to conduct employer engagement, some thought that the central college would be better suited to doing this work. Furthermore, some highlighted the distinct need for these contacts to be made by the institution in a coordinated manner that builds on—but does not end with—the typical faculty contacts, cultivated through informal personal networks. One faculty member stated:

> You have got your contacts, and can we actually go and set up there and approach these organizations more formally. Because there are X, Y, Z corporation, and I am a faculty here—I don't have a contact to approach those corporations. For me to develop that contact will take time. But there are mechanisms that we can use to approach them. This will not only be just one person from a program, but it will be [the] director of marketing or career services trying to open up contacts—it will be more institutional. [A] two-tier approach, in other words. Interpersonal network is still number one, but [a] two-tier approach, where we have [a] more formal approach, would be better.

Faculty who work in the industry provide a unique resource for making connections. One third of faculty reported they currently work in industry. These faculty report the benefits

their off-campus positions bring to students and to their teaching. For example, one faculty member stated:

> I bring in that real-world knowledge and teach to it. The students love it. Plus, I stay up on everything. The industry moves fast, and out there is where you get all the new stuff. Figure out how to make things work when they come at you. In my class, actually even just yesterday, a student asked a question about something, and I remoted into my work system to show students the real-life situation and how to do it.

These faculty members provide a resource for the college in terms of the knowledge they bring to the classroom as well as their direct links to employers and the labor market.

Advisory Boards

The development of advisory boards at local campuses supports faculty interest in learning more about employers' skills needs. Faculty expressed interest in having an organized system to collect this information to inform their instruction. Some reported that this process was done but on an ad-hoc basis. They sought a more organized approach to learn about what employers were seeking in their graduates. At some campuses, advisory boards for computing programs were a new concept, beginning only with the development of the CPIN school. At other campuses, advisory boards had convened prior to the grant, but their business had been conducted at the institutional level and, therefore, the boards included employers with expertise related to a variety of programs outside the scope of CPIN. The new advisory boards were focused specifically on the computing programs. One faculty member on a campus where the advisory board was newly established said he hoped that the board would help gather the kind of information of interest from employers to faculty, such as what they are looking for in entry-level workers, how important certifications are, and what courses to offer.

In addition to gathering information on skills needs, many faculty hoped that the new advisory boards would lead employers to become involved with the college more generally. They are using these newly formed advisory boards to invite employers to participate in other ways, beyond their board-related activities, hoping that the advisory boards will grow into other types of interactions with employers. Some are still tentative about how these relationships will grow. For example, one faculty member stated:

> We really are just developing those relationships. And actually, one out of the seven [on the new advisory board] came back with an internship project. So it depends on the person [the employer]. Some have strong points that they want, some don't. Another one said he would guest lecture, so that's good. But employers, you know, they're busy. And they're not sure of the payoff.

Others had some early experiences that were very positive and led them to be enthusiastic about the benefits of these efforts, such as this faculty member:

> Everyone is energized, and now that is translating to industry. Just like at the advisory meeting, first the employers said "oh that's not helpful to us" and really couldn't articulate what WOULD be helpful, but then after that everyone was talking. And excited! We are excited about what we are doing here. And then employers starting talking, and they were coming up with ideas. It was great. And then the next day, ring ring . . . my phone, and there is this industry guy that was there [at the advisory board meeting], and he's got this internship. Like, he thought about it and was like, "oh I do have something." And that keeps happening. Now the phone is ringing. And the more they hear, and the more they see the quality of the students helping them with these internships and projects, the more it is happening. I think it's only going to go up from here. That's great.

While some campuses are adjusting to advisory boards as a new concept, other campuses have had advisory boards specifically for their computing programs for some time and have historically seen them as quite important to their programs. Advisory boards helped these campuses understand changing skills needs and how their programs were relevant. For example, the demand for hardware technicians declined because of the introduction of cloud-based network infrastructure; as a result, there is now the need for work in data centers. Faculty reported that the advisory boards helped to provide useful information in understanding this shift in skills needs. They also helped faculty understand the skills needs of different employers. For example, smaller and medium-sized companies require different skills—wider, more cross-disciplinary knowledge—than larger companies seek.

While faculty have an interest in understanding skills needs via their advisory boards, some expressed concern about their ability to respond to local employers' needs given the demands of the statewide curriculum. Individual campuses are limited in their ability to tailor their program offerings and their program content to individual employers' needs. A campus is not required to offer all CPIN programs offered by Ivy Tech, but if they do offer a program, the curriculum needs to adhere to statewide standards. While the campuses cannot modify the content of program curriculum, they can instead tailor students' pathways so that they can gain the skills that will be most relevant locally. Some colleges mentioned local needs that were specific to them but were not reflected in the statewide curriculum. For example, some local areas might want to have Linux accepted as an elective, but this change would have to be approved by the statewide curriculum committee. However, faculty recognized that it can sometimes be challenging to refine the statewide curriculum to meet local needs when local needs can vary substantially. As one faculty member stated:

> We're supposed to be a state school—statewide, generic to everybody, specific to nobody—and that creates problems when you have a clientele of companies in this area that need certain things [that are] different than somebody in a different region needing different requirements. We have to teach to everybody, and so we're not teaching to what our companies need.

Internships

Many faculty members agree that internships engage with employers in a way that benefits students. The new programs now offer the possibility of including internships as part

of the students' curriculum. All programs, with the exception of the CSCI transfer program, have an internship as an option, though not as a requirement. In interviews, faculty members were supportive of internships. One instructor commented on the value of internships being incorporated into the eight new program curricula: "One of the great things the new program did was it put in place an internship for credit. We used to say we did internships, but there was no place in the curriculum for them." Faculty reported they saw several benefits to students of completing internships. Many instructors said that the internships would help students "get a foot in the door" and gain employment, as employers were able to see if they were happy with their work before hiring them.

> If they [employers] can start off with an intern, that's a safety valve. They can say "Is this person going to work? Is this person going to work into the organization?" If it does, fantastic, then they're given a full time opportunity. If it's not, then at the end of the semester they say, "Thank you. Next!" You know what I mean?

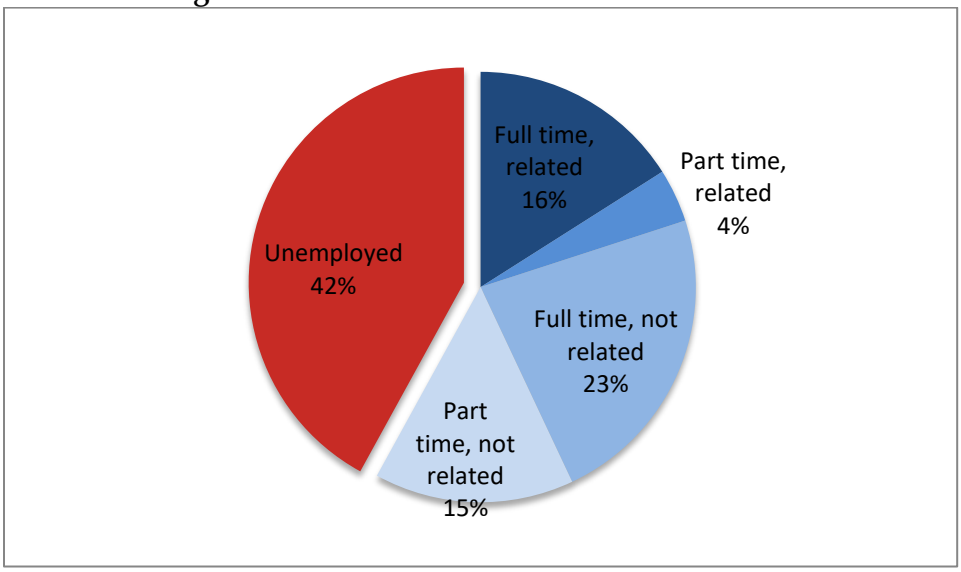
Faculty also saw internships as an important way to "bridge the gap" between school and work. They pointed to the importance of students' learning about the workplace through internship experiences with employers:

> You can talk about ethics, and you can talk about customers and cumbia and all that. Until you put that headset on and get customers screaming in your ear, you really don't understand what it's like to be on that end of things because all the customer wants is it [the problem] to be fixed and it to be right. How are you going to help that person?

In this way students would better be able to understand the demands of the workplace after gaining internship experience. Faculty reported that internships "help get our students a better hands-on experience, so that way they can do better in their field." Thus, internships were also viewed as a way to sell their graduates. Over half of faculty (54 percent) reported they had helped students get an internship.

While many instructors recognize the potential value of internships, interest in them is not widespread among students, partially because many students already work. In fact, only one third of students reported interest in an internship. The most common reason reported by students for their lack of interest in an internship is that they are already employed full time. (See discussion of Table 8, below.) Based on the CPIN student survey data represented in Figure 8, 58 percent of students are working either full time or part time. Notably, of these students who are employed, over one third are employed in a job they report is related to their program. Therefore, of all students, approximately 20 percent are already working in a job related to their program. For these students, instead of separate internships, their existing work experience may provide a similar opportunity to build connections between what they are learning in class and what they already do at work. In addition, these students could be excellent resources both in terms of helping other students learn about the workplace and building networks with local employers.

Figure 8. STUDENT EMPLOYMENT STATUS.



Source: CPIN student survey

Students who were interested in internships reported several factors that were important to them in an internship. When asked to rank several potential benefits of an internship from most to least important, students most often reported the ability to gain real-world skills as the benefit that was most important to them when seeking out internship opportunities. (See Table 8.) The next most important factor was the ability to earn money while working. While the ability to gain academic credit may be important, it was not highly ranked relative to other factors on the list.

Table 8. MOST IMPORTANT FACTOR IN AN INTERNSHIP AMONG THOSE INTERESTED IN INTERNSHIPS, RANKED BY MOST COMMON RESPONSE

	Percent
Ability to gain real-world skills	38
Ability to earn while working	27
Ability to get a job with the employer after the internship	17
Ability to earn academic credit	15
Other	3

Source: CPIN student survey
Note: Column total does not equal 100 due to rounding.

To make internships more accessible for those students who are interested, faculty and college staff reported the need to have a system for structuring and supporting internship opportunities. While many reported that internships would be valuable for students, some expressed concerns about the increase in work that this would entail and referred back to the need for greater investment in building relationships with employers. Some campuses had little experience with formal internships, but some respondents noted that even in these locations students sometimes secured internships on their own and would figure out

how to register for an internship class. Faculty had varying degrees of knowledge about how this process was supposed to occur, however. Faculty from another campus reported that it would be helpful to have a more formal system to get internships in place for their students—some of this would require more staffing resources at the campus. Some felt that the college was well positioned to develop more internships but needed a system to support this work.

> We need to have agreements with employers on a regular basis where they take [interns] from us. Ivy Tech has a good reputation among local employers, so they are willing to take our people, but we must have a mechanism there, when people go out and [pitch] some of these concepts to our local employers.

In other cases, some campuses already had internal systems and procedures established to coordinate internships. For example, some faculty members mentioned the need to have faculty monitor these internships to make sure that students are doing what they are supposed to do and to have an evaluation form completed at the end. Faculty at South Bend described the formal processes involved in determining whether internships are paid or unpaid and the difficulty employers faced in meeting the criteria for unpaid internships. Bloomington reported being very active with internships historically. The programs at this campus have a close relationship with a large local company that regularly takes their students as interns, many of whom they later hire. The college may consider providing central guidance or centralized resources on how to create and monitor successful employer relationships that are based on some of the existing practices from around the state.

Job Placement

The faculty role in job placement was widespread but somewhat limited in its intensity. The majority of faculty (85 percent) reported passing along job openings to their students. Faculty commonly took a more passive approach to sending out information to students about potential job opportunities. "We just send them [employers] our students, and say [to the students] 'yeah somebody's looking for this, you should apply for it.' Jobs are difficult to come by, so you send it to about ten people [students], but you do not know who gets it." Furthermore, the frequency of this activity likely varies across faculty members. When asked whether employers come to them looking for students to fill job openings, one faculty member responded: "No, does not happen often. I have been contacted by one or two of the companies. I think companies go through other resources to recruit people." Other faculty reported being more active in sharing job opportunities with students.

Although it is less common, some faculty engage in intensive efforts to facilitate the matching process between students and employers. Almost half (46 percent) of faculty surveyed reported they help employers identify strong candidates for job openings. Others did not feel comfortable making this assessment about their students. For example, one faculty member stated: "Students are different. Someone could be a terrible student and a great employee. I don't try to filter them." Others mentioned that they did not get involved in facilitating this process because they did not think it was an activity faculty were permitted to

engage in. One faculty member stated: "I can't legally say I'm vetting them, but I'm helping them. Because we are an EEOC [Equal Employment Opportunity Commission], every time an employer contacts me for a referral, I have to turn it in to career services, and they have to post it college-wide." Not all faculty shared the idea that they should be involved in helping students to find employment. One expressed the concern that this might be a conflict of interest.

Some faculty reported they would like to be more involved in knowing about typical job requirements so they can make sure that students are prepared for jobs. "I would like to get more jobs vetted through me to know exactly what they [employers] want, so we can tailor the students going to them." Faculty often do not know the employment outcomes of their students and reported that it would be helpful for their students to have more support with job placement.

Other Activities

In addition to advisory boards, internships, and job placement, faculty may engage employers in a variety of activities that help build connections between the classroom and the workplace.

Project-based learning

Faculty mentioned several other ways that their students would benefit from interactions with employers. One suggestion was project-based learning where the employer provides the class with an actual project to work on that occurs within the context of the class. As one faculty member stated: "If they have a project, it becomes something the students could actually work on, you know, stuff like that. It's a working experience for our students." These types of projects can include a range of employers, including nonprofit organizations, but the common idea is that they provide the students with a real-world, hands-on problem to solve. For example, one faculty noted: "Some of our systems analysis students are working on something for the real world as a part of our 'eight pretend projects.' It's generally somebody at work or somebody at the church, because churches always have projects."

Class visits by employers

Faculty at some colleges mentioned they brought employers into class to present on their work. Among those who responded to the faculty survey, 44 percent reported that they invited employers into their classes to speak to students. This activity was viewed as helpful and sometimes led to further connections between students and the employer. For example, faculty at Lafayette reported they had local employers come into their classes to speak about a "day in the life" in their workplace. Employers also come into classes to do guest lectures on particular topics. One faculty member described a capstone class where employers came in to help the students with mock interviews. In this case, "they ended up hiring students from that! So they are actually real interviews." At times, these types of interactions were complicated by

the class structure; since many advanced classes were online, it was harder to involve those students in these types of face-to-face interactions with employers.

Worksite tours for students

Another way for students to learn about the workplace is through workplace tours. Over one third of faculty (35 percent) reported that they coordinated with employers for students to visit job sites. Some faculty highlighted workplace tours as an important part of their relationship with local employers. Other faculty mentioned that they would like to expand their relationships with employers to include these tours with the hope that they might lead to employment for the students. One faculty stated: "It would be great if the students and I could maybe visit some of the businesses, more businesses. These are potential employers for our students."

Faculty worksite visits and internships

In addition to having students visit the worksite, some faculty reported that they themselves would benefit from more interaction with employers on the job. In Lafayette, faculty members actually participate in internships with employers as part of their continuing education. These more intensive experiences help faculty to develop deeper knowledge of the field, including updates on new developments in the workplace.

> We send our full-time faculty every summer to do internships in industry. So they get, like, eight weeks'—or however it works out—paid internships in industry, and they come back with all the new stuff, and sometimes certifications and stuff too. Perkins funds help with that too. We leverage. It's awesome. So that way they are always trained and current.

Some faculty mentioned that visits to worksites would be helpful to them. By going out to visit employers, some faculty members reported they gained new insights on how to teach students as well as important new skills to integrate into their instruction. One faculty member discussed a specific example of how a worksite visit influenced instruction:

> In my informatics class next week they're [student are] going to be doing a presentation, and they have to be dressed—they have to wear ties. They have been dreading it since week one . . . They have been practicing the skill. "It's IT," they keep on saying, but I don't care because one day someone is going to call you, and your boss tells you, "You need to represent me, and it's a 20-million-dollar deal." . . . So that's one thing we learned there just by going to those organizations, so that has helped. That helped us to see what they [employers] expect from our students. They talked about life skills too. They talked about the fact that we [instructors] need to teach them [students] stuff like that.

Summary and Recommendations

For college staff and faculty, engaging with employers provides a unique opportunity to expand the reputation of their programs and to better serve students' needs. Many recognized

that students were motivated to pursue these programs with the goal of employment in mind and were very interested in learning more about employers' skills needs. Faculty outreach to industry has been quite varied—with some faculty very intensively reaching out and others acting more passively, waiting for industry to reach out to them rather than initiating contact. However, to date, employer engagement has not officially been part of the role of faculty, so this work remains at the discretion of the faculty member and is very limited by time constraints. Furthermore, employer engagement, as it is currently done, relies on personal connections and could benefit from a more coordinated approach that provides some structure to this activity and brings together individuals at the college to coordinate efforts.

The development of advisory boards for the new programs at the local campuses was welcomed by faculty members. Many viewed these as an opportunity to learn about employers' needs and to get them involved with CPIN programs in other ways. Despite this interest, some faculty shared concerns about whether their local campuses would be able to effectively respond to employers' needs, given the constraints of being part of a statewide institution.

Faculty saw internship opportunities as another way that employer engagement would benefit students, helping to bridge the gap between school and work. However, many students were not interested in completing internships, largely because many of them worked already, and of those who worked, many already worked in jobs that were related to their field of study. Still, some students would benefit from an internship, and faculty and college staff alike reported that a more formalized process for structuring and supporting internships would be helpful.

Faculty generally had limited involvement in job placement. They were much more likely to pass on job postings than to engage in more active facilitation of matching students to employers. Faculty expressed interest in learning more about employers' needs so they could better prepare students for jobs, and some also had reservations about their role in this area.

Other activities that some faculty mentioned as useful ways to engage employers in CPIN programs included involving them in project-based learning, inviting them to visit classes as guest lecturers or to conduct mock interviews, bringing students on tours of their facilities, and supporting faculty worksite visits and internships at an institutional level. None of these activities are widespread, but each offers a promising idea that may be shared across the campuses.

Based on these findings, some recommendations for Ivy Tech to consider are as follows:

- Encourage coordination in contacting employers within and across campuses to better leverage existing efforts and develop more structure and institutional support for employer outreach.

- Consider ways to structure the work of employer engagement into the activities of the college, such as by building time into the workload of faculty for employer outreach.

- Share promising practices on how to run advisory board meetings and how to engage employers in additional activities.

- Develop structured guidelines for internships that build on existing models currently in use within the state.

- Consider approaches to recognizing and building on the work experiences of students who are employed in jobs related to their program

VI. EARLY OUTCOMES

Retention at Ivy Tech is an important early outcome of the grant reforms. The analyses below examine student retention in Ivy Tech following CPIN program enrollment. These retention analyses take fall 2014, when the TAACCCT-funded CPIN programs began, as the starting point for assessing retention at Ivy Tech. The central question driving these analyses is: As CPIN students experience a range of TAACCCT-funded services, to what extent are they retained at Ivy Tech? The results are purely descriptive; they do not account for prior retention patterns among subgroups of students, and no comparisons are made to similar groups of students. Future reporting will include a comparative analysis of outcomes.

The analyses focus on students who first enrolled in Ivy Tech in fall 2014 and were enrolled in a CPIN program. The analyses focus on early outcomes for these CPIN majors, for whom some time has elapsed since being potentially impacted by the first year of grant implementation (fall 2014 through spring 2015). Retention rates for students who are new to CPIN as of spring, summer, or fall 2015 are not shown. Future reporting will include these students once more follow-up data are available.

Results show three measures of retention. Fall-to-spring retention for fall enrollees or spring-to-fall retention for new spring enrollees are considered "initial" retention. For fall enrollees, one-year (fall-to-fall) retention is also shown. Continuous retention is also presented to depict the nature of students' enrollment. For fall enrollees, the continuous retention indicator reflects the percentage of students who were enrolled in fall 2014, spring 2015, and fall 2015. The measure of continuous retention does not include enrollment in the summer semester.

For fall 2014 CPIN enrollees, initial (fall-to-spring) retention is high, but retention declines substantially by fall 2015. In general, over 72 percent of CPIN students who enrolled in fall 2014 were retained in spring 2015, but by fall 2015, less than half of those fall 2014 enrollees (45 percent) were still enrolled. (See Table 9 and Table 10.)[2] Still, students in some

[2] The decline in retention is not fully offset by credential-earning, since the overall credential-earning rate is slightly less than five percent.

enrollment subcategories are retained at higher rates than the overall trend, while the retention rates for other groups are far below the general trend. Some notable differences emerge by program, enrollment type, and degree pursued. For example, continuous enrollment from fall 2014 to fall 2015 ranges from a low of 35 percent for DBMS and CSCI to a high of 51 percent for INFM.

Table 9. RETENTION RATES OF CPIN STUDENTS WHO FIRST ENROLLED AT IVY TECH IN FALL 2014 BY ENROLLMENT CHARACTERISTICS

	Fall 2014 Cohort	Enrolled in Spring 2015	Enrolled in Fall 2015	Enrolled Continuously from Fall 2014 to Fall 2015
	count	*percent*	*percent*	*percent*
All students	825	72	45	42
CPIN program				
Computer science (CSCI)	139	71	36	35
Computer security information assurance (CSIA)	109	67	45	44
Database management (DBMS)	43	67	42	35
Informatics (INFM)	49	80	53	51
Information technology support (ITSP)	185	71	44	42
Network infrastructure (NETI)	51	77	49	45
Software development (SDEV)	213	74	46	42
Server administration (SVAD)	36	69	53	47
Enrollment type				
Full time	560	70	43	39
Part time	265	75	47	46
Degree pursued				
Associate of Applied Science (AAS)	493	70	45	42
Associate of Science (AS)	305	76	46	43
Certificate (CT)	17	47	12	12
Technical Certificate (TC)	10	67	42	35

Source: Ivy Tech Student Administrative Records Data

Retention rates are largely comparable across demographic subgroups with the exception of black students. Although they account for a small proportion of this CPIN subsample, black students are retained at a far lower rate, with only 27 percent still enrolled after one year compared to 45 percent of students overall. Given that black students are potentially underrepresented in enrollments, this discrepancy in retention rates is a concern in need of further examination. See Table 10.

Table 10. RETENTION RATES OF CPIN STUDENTS WHO FIRST ENROLLED AT IVY TECH IN FALL 2014 BY DEMOGRAPHIC CHARACTERISTICS[a]

	Fall 2014 Cohort	Enrolled in Spring 2015	Enrolled in Fall 2015	Enrolled Continuously from Fall 2014 to Fall 2015
	count	*percent*	*percent*	*percent*
All students	825	72	45	42
Gender[a]				
Male	675	71	44	42
Female	144	75	45	42
Race/Ethnicity[b]				
White	582	71	48	45
Black	124	69	27	25
Hispanic	48	79	48	48
Age range				
15–19	241	74	48	44
20–29	354	71	40	38
30–39	133	71	47	45
40–49	63	65	48	41
50 and older	34	74	44	44

Source: Ivy Tech Student Administrative Records Data

[a] Gender for six students is unknown.

[b] Only white, black, and Hispanic are shown. All other racial/ethnic categories have counts below 20.

VII. NEXT STEPS

In the coming year, Ivy Tech will continue to implement TAACCCT grant activities with a continued focus on the goals discussed here. With the installation of supplies nearly complete, the activities will now primarily focus on encouraging the use of these supplies through expanded hands-on learning and on continued professional development. A great deal of activity is also planned for the advising tool and expanded employer engagement. The advising tool is being further developed, and plans for its rollout to advisors and eventually to students are being discussed. Employer-engagement activities with both the statewide advisory board and the local campus advisory boards are ongoing, as is the expansion of other types of involvement with employers. In addition, student competitions are planned with the dual goals of providing additional hands-on learning activities to students around the state and creating another avenue for employer engagement. The EERC team will continue to examine and evaluate the implementation of these activities.

As more students move through the new CPIN programs, EERC's evaluation will focus more intensely on examining student outcomes. Using quasi-experimental methods, the evaluation will designate comparison groups of former computing students at Ivy Tech as well

as students from other comparable programs. Using propensity score matching and difference-in-differences approaches, the evaluation will assess the impact of the grant reforms on CPIN students. Future reports will provide insights on the impacts of the grant activities on students' retention and completion rates as well as their employment outcomes.

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Appendix A: Summary of survey responses

	CPIN Student Survey	**Hands-on Learning Student Survey**	**Faculty Survey**
Number of respondents in the sample	8,541	1,373	138
Final response rate	8.7%	11.2%	60%
Number of partial completers	94	5	4
Final response N	N = 746	N = 155	N = 83
Number who did not consent to survey	N = 6	N = 4	N = 0
Final analysis N**	N = 740	N = 151	N =83
Date of initial launch	2/11/16	2/29/16	3/10/16
Date of reminder #1	2/16/16	3/3/16	3/15/16
Date of reminder #2	2/18/16	3/15/16	3/22/16
Average length of time for survey completion (excludes outliers)	7 minutes, 9 seconds	2 minutes, 17 seconds	8 minutes, 46 seconds

Note: Students and faculty were able to skip question categories; therefore respondent sizes differ across individual questions in the surveys.

Appendix B: Deriving key indicators

CPIN program group
The CPIN programs group is identified as any student who took a CPIN course during or after fall 2014. From the CPIN programs group, sub-groups of students were identified. These include students who officially declared a major in one of the new CPIN programs, those who are majoring in one of the previous CPIN programs (see below), and non-CPIN majors who are taking CPIN courses. To identify students who declared a CPIN program as their major, we listed all majors in the data file and flagged those that had a description matching a new CPIN program. Only students who last registered in a new CPIN major between fall 2014 and fall 2015 were ultimately flagged for this CPIN programs sub-group.

Previous computing programs sub-group
For this report, we are examining how the restructuring of Ivy Tech's computing department has generated shifts in the population of students served. We identified a group of students who were enrolled in the preceding computing programs between fall 2014 and fall 2015 and at the time of data collection had neither transferred to a CPIN program nor earned a credential. These students were drawn from the computer information technology (CINT), computer information systems (CINS), the previous computer science (CSCI), and information security (INSE) programs. This approach will allow us to determine, over time, the value added by restructuring computer programs at Ivy Tech. However, for this first report we focus on differences in the populations served.

CPIN program cohorts
Students in the CPIN program group first enrolled in Ivy Tech at different terms. Many transferred from various programs and degree tracks to a CPIN program in fall 2014. Thus cohorts were constructed to reflect the first term that students enrolled at Ivy Tech.

Enrollment type
The original data file received from Institutional Research indicated whether students were enrolled on a full-time or part-time basis for each semester of enrollment. An aggregate-enrollment-type indicator was created. Students who took the majority of their courses on a part-time basis were flagged as part-time, and those who took more of their courses on a full-time basis were flagged as full-time.

Degrees pursued
For some analyses, students' broad degree category is reported. In these instances, *associate's degree* includes AAS (Associate of Applied Science), AA (Associate of Arts), AS (Associate of Science), and AGS (Associate of General Studies). TC (Technical Certificate) and CT (Certificate) were not grouped. The degree associated with students' records in the latest semester in which they enrolled was counted as the degree they are pursuing.

Retention

We examined retention of the CPIN programs group in Ivy Tech. We calculated initial retention to represent whether a student took courses in their second semester after first enrolling (semester-to-semester retention). One-year retention represents whether a student remained enrolled in Ivy Tech within one academic year after first enrolling (here, fall 2014 to fall 2015). Finally, we calculated one-year continuous retention to represent whether a student remained enrolled in Ivy Tech in all semesters between fall 2014 and fall 2015 (i.e., fall 2014, spring 2015, and fall 2015 without interruption).

Appendix C

IVY TECH TAACCCT EVALUATION LOGIC MODEL

Information Technology Pathways in Indiana