Evaluation of Ivy Tech's Pathways to Information Technology: Implementation and Outcomes, Interim Report #2

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CONTENTS

I. INTRODUCTION

In 2014, the US Department of Labor awarded Ivy Tech Community College in Indiana a $2.5 million TAACCCT grant to reform its computing programs. TAACCCT grants aim to strengthen community colleges' ability to meet workforce needs through "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).

This grant sought to strengthen Ivy Tech's Computing and Informatics (CPIN) programs. The grant activities supported a recent reorganization of these programs—which occurred separately prior to the grant—and was motivated by larger efforts centered on better aligning programs with labor market needs and improving the clarity of student pathways. Grant activities included the purchase of supplies to support hands-on learning; faculty professional development; 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 second in a series of three evaluation reports on Ivy Tech's TAACCCT grant. The report discusses the on-going implementation of grant activities and identifies promising practices and areas for improvement. It also provides information on the characteristics of students enrolled in computing programs during the grant period, examines student outcomes in classes affected by supplies and hands-on learning reforms, and provides information on student pathways in computing programs. The final report will examine continued implementation activities and provide an overall assessment of the grant on student outcomes.

The body of the report begins with a section that describes the qualitative and quantitative methods used in the evaluation. Subsequent sections of the report include findings on the following topics: hands-on learning, faculty professional development, advising, employer engagement, student competitions, and student pathways. 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 with multiple sources of data. The EERC evaluation team conducted site visits and telephone interviews, examined existing program documents, administered online surveys, and analyzed administrative records of students enrolled at the college. This section describes each of these data sources and its analysis.

Site Visits and Interviews

The EERC evaluation team conducted one-day site visits in November 2016 at three different Ivy Tech campus locations—Terre Haute, Evansville, and Columbus. During these site visits, EERC conducted two focus groups with students interviewed six faculty members, five faculty chairs or assistant faculty chairs, and three advisors. EERC staff also conducted interviews with two central college staff and five faculty champions via telephone. All interviews were recorded and transcribed. Interview transcriptions and notes were coded using NVIVO qualitative data management software and then analyzed by EERC team members.

Document Review

The qualitative data for this report also includes content analysis of college goals and activities-to-date. This analysis was based on grant reporting to DOL; communication with the campuses; internal presentations and planning documents; notes and minutes from meetings; spreadsheets for tracking supply purchases and implementation; spreadsheets for tracking professional development; and the college website. Documents were coded using NVIVO and analyzed by EERC team members.

Survey Data

The evaluation team developed multiple surveys that were administered to both CPIN students and CPIN faculty members. These included a student survey for all CPIN students, a hands-on learning survey for a subset of students in classes that emphasized use of the supplies purchased under the grant, and a faculty survey for CPIN faculty. Surveys were fielded once for the first evaluation report, referred to as “Round 1” surveys, and a second time about one year later, referred to as “Round 2” surveys. The surveys included many of the same questions included in surveys from the first evaluation report. Appendix A includes a detailed table that summarizes the sample sizes, response rates, timing, and average length of each survey.

The Round 2 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 general survey was fielded in November 2016 and was fielded again among nonresponders in January 2017.

A supplement to the student survey targeted students who, in Fall 2016, were enrolled in ITSP 135, NETI 100, and NETI 105—the classes that were most likely to have been affected by new hands-on learning practices related to the new supplies purchased under the grant. This component of the survey, referred to as the Round 2 Hands-On Learning Student Survey, asked students about their hands-on learning experiences in these classes.

The two surveys were administered in multiple iterations. The first round was sent in two parts—the general survey was sent to students in November 2016 and then refielded to nonresponders in January 2017; the subsample of that group who fit the criteria for the hands-on learning survey received that survey alongside—but separate from—the general one. A second-round survey combined the general and hands-on learning surveys and was sent out as one survey to an additional sample of students in January 2017.

The survey was closed at the end of March 2017. For our final analysis, there was a total N of 1,014 students that provided valuable data across all surveys administered. The students to whom the survey was administered were identified with the assistance of the Ivy Tech institutional research department.

The other survey, referred to as the Round 2 CPIN Faculty Survey, was fielded by the EERC in November 2016 and targeted all faculty teaching courses in the CPIN program statewide. Reminders were sent out three times over the month of December. 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 members' use of supplies and hands-on learning; perceptions of students' information needs; decision-making processes with regard to the CPIN programs and related careers; and experiences with employer engagement. Our final analysis includes a total N of 87 faculty.

This report also refers to survey data collected for EERC's first evaluation report, published in 2016. These surveys, referred to as the Round 1 CPIN Student Survey—fielded in February 2016 and aimed at all students enrolled in any CPIN class—and the Round 1 CPIN Faculty Survey—fielded by the EERC in March 2016 and targeted at all faculty teaching courses in the CPIN program statewide—mirror their Round 2 counterparts with regard to the information they were designed to glean from respondents. Survey data were collected using Qualtrics and analyzed using the Stata data analysis and statistical software. Percentages from survey responses may not equal 100 due to rounding.

Student Administrative Records Data

Student administrative records data were provided by Ivy Tech's Institutional Research Central Office. Data included student demographics, enrollment status, course history, credential completion, and wage record from Fall 2014 through Fall 2016. The EERC 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. HANDS-ON LEARNING

A significant priority of the grant was to increase the amount of hands-on learning in the CPIN programs through an investment in updated supplies. Through the purchase and installation of supplies, the college sought to ensure the programs had proper industry-standard supplies to work with so that faculty could provide students with the skills and abilities necessary for their careers. In addition, through the grant reforms, programs also gained control of a local computing network to use for instructional purposes. This section discusses several aspects of reforms to promote hands-on learning, including the installation of purchased supplies across the campuses, faculty reports of the impact of the supplies and network control on their teaching, student reports of the impact of supplies on their learning experience, and the impact of the supplies on student academic outcomes.

Installation of Supplies

Supplies allocation and installation varied across Ivy Tech campuses. Some campuses needed to build entirely new lab infrastructures, while others needed only minor supply updates, such as equipment racks. Table III.1 summarizes the type of facilities created or modified with grant-provided supplies across campuses. New IT labs included a variety of hands-on supplies for students, monitors with dual-monitor mounts, and computers. Minor IT lab updates included most of the same supplies but not the computers. Foundational data centers included a CISCO router, switches, racks, servers, and a variety of other necessary supplies; intermediate data centers included the same supplies but not the router and switches. Data centers required raised floors that in many cases were time-consuming to install.

Campuses that needed only minor additions were well into implementation during the second year of the grant, while some with more extensive supply lists had just completed their installations and thus were only beginning their implementation activities. Campuses where flooring installation was delayed, for example, experienced late implementation. On most campuses, the bulk of supplies had been delivered during the first year of the grant, and space allocation and remodeling of data labs had been completed during the same period. The second year of the grant, then, was dedicated more to instructor professional development (discussed further in the next section). Specifically, grant activities included training instructors to use the new supplies, providing industry certifications for instructors, and—on some campuses—continuing with the installation and addition of new supplies.

Table III.1. ***Level and Type of Modifications to Labs and Data Centers, by Campus***

Type of Supplies	Number of Campuses
New IT Lab	10
Minor IT Lab	8
Foundational Data Center	7
Intermediate Data Center	3

Source: Ivy Tech program documents

Most campuses reported directly involving students in various set-up and installation activities—running cables, setting up racks and servers, working with the networks, etc. Students involved in this work found it to be highly beneficial, and many received jobs as a result of their experience. Several faculty chairs across campuses mentioned that their student lab techs ended up being so qualified that they were immediately hired by industry.

Ensuring optimal allocation of supplies was a priority and sometimes a challenge. Grant management's central concern relative to the installation of supplies was to make sure the right infrastructure was in place at each campus. After the initial installation during the first year of the grant, management staff traveled to each of the campuses to meet with faculty chairs and visit labs. The focus of those meetings was to understand further supply needs each campus may have as well as to assess their ability to expand. Some campuses, for instance, have extra space in which supplies could be added or capacity could be expanded. With the correct infrastructure in place from the first round of supply allocation, campuses will be able to expand throughout the rest of the grant period and into the future. Some faculty members, however, commented that some of the supplies they received as part of the grant were not needed on their campus, and other supplies that they would have liked were not purchased from grant funds. Other faculty also commented that they had "boxes" of supplies they did not need, or they were sent additional quantities of certain supplies they already had an excess of. Grant staff worked with some campuses to help shift some of the supplies to other campuses where they were more in-demand.

Despite some challenges in the installation of supplies, campus staff were very positive about the investment. Similar to the previous year of the grant, the sites visited during the second year reported some challenges related to supplies. One campus had planned for a larger data center with a glass front so students could see the grant-purchased supplies, but competing space requirements did not allow for this. Although the data center was smaller than they had originally planned—and did not sport a glass front—they still felt the supplies increased the hands-on learning capacity of their programs and positively impacted their students. Another campus reported learning of an industry need to use fiber optics, which was not part of the grant materials. Instead, staff used their own relationships with industry to get donated equipment.

All three campuses visited during the second year of the grant reported an increased ability to offer expanded learning opportunities to students compared to what they were able to offer prior to the grant period; this echoed similar responses from the campuses visited during the first year of the grant. One faculty chair pointed out that campus funding previously did not allow them to purchase the supplies required to offer these opportunities: "I look at it from the standpoint of the equipment; we have a low-funding model—about $1,200-1,300 per student. It helps to have the funding to acquire the equipment." Another said, "The funding itself allows us to purchase the equipment. Otherwise we would [have to] compete with other programs to get the funding."

Some questions exist about how to sustain the updated supplies. Similar to those we spoke to the year prior, interviewees at the second-year site visits raised concerns about the sustainability of the supplies purchased through the grant. Because of the rapid pace of technological change, these purchases can become outdated relatively quickly. Most campuses noted they would have to rely on other funding streams in the future, such as Perkins funding, and that the CPIN programs would have to compete with other programs in order to get what they need. Many faculty members said they hoped that enrollment would continue to increase, which would open up more funding options in the future—funds that could translate into additional equipment and instructors. Nonetheless, some faculty argued that most of the supplies purchased under the grant was technology that does not change much over time, such as servers and racks. Therefore, sustainability was probably less of an issue than it might have been if they'd focused their technological purchases on software, for example. The biggest concern, according to some, is the need to expand to other areas of hands-on learning that were not covered under the grant, such as fiber optics.

Courses Affected Most by Supplies

The supplies provided by TAACCCT funds—including labs and additional materials—did not equally impact all CPIN courses. In conversations with grant staff, we learned that three courses were more likely than others to be affected by these new supplies. As stated above, these courses were Network Communications (NETI 100), Network Fundamentals (NETI 105), and Hardware/Software Support (ITSP 135). As such, these courses were the focus of many questions in the faculty and student surveys and were used as proxies for *enhanced hands-on learning* in the student outcomes analysis that appears later in this report. In addition, the site coordinator suggested a fourth course for inclusion in the student outcomes analysis, Computing Logic (SDEV 120), because of the impact of the dedicated labs on the teaching of that course. To get a sense of the content of these courses that might be impacted by the addition of the new supplies, we reviewed their course syllabi, which was common across all Ivy Tech campuses. Appendix Table B.1 presents selected language from the course syllabi of the four designated Hands-On Learning (HOL) courses.

The first of these classes, Network Communications (NETI 100), introduces students to the components of network systems. The course description and objectives suggest that this course exposes students to network media and hardware (e.g., cables and routers), and the course content list suggests other material supplies like signals and switches. Similarly, the syllabus for Network Fundamentals (NETI 105) states that students will work with network media and devices and features course content on routing, network cabling, and network hardware. In these courses, the additional supplies would substantially increase the amount of hands-on work that could be done in the class to replace work that was previously performed through simulation. The syllabus for Hardware/Software Support (ITSP 135) contains many references to the assembly and maintenance of computers and associated devices. The course prepares students to diagnose, document, and resolve both hardware and software issues. Thus the influx of supplies to this course would increase the amount of manipulable objects available in these classes.

The relevance of the TAACCCT-provided supplies was not immediately apparent with the Computing Logic (SDEV 120) course. The course, which focuses on algorithm development and contains topics like set and number theory, only applies these topics to coding exercises. But discussions with the site coordinator indicated that the provision of additional supplies and dedicated labs had important impacts on instructional practice and students' ability to engage with this course. Since the grant had provided new facilities and allowed CPIN faculty additional control over their hardware and software, students had much more interactive experiences with the applications and demonstrations of programming and scripting. Indeed, the analysis below suggests that these changes made a substantial difference in student outcomes.

Influence of Supplies and Network Control on Faculty Hands-On Instruction

To assess the impacts of these supplies on faculty and on classroom experiences, we examine data from site visits at selected Ivy Tech campuses and surveys of CPIN faculty and students. While the supplies were broadly available to CPIN programs, three courses—NETI 100, NETI 105, and ITSP 135—were most likely to be directly impacted by the new supplies; these became designated Hands-On Learning (HOL) courses[1]. As such, our survey asked responding faculty whether they taught any of these three courses and focused hands-on learning questions on students who took any of these courses. Of the 87 faculty surveyed, 63 percent reported they taught at least one of the three HOL courses since the beginning of the grant.

The supplies had a broad influence on faculty but particularly those who teach courses directly impacted by the supplies purchased under the grant. Of all CPIN faculty, 77 percent reported they had increased access to supplies since the start of the TAACCCT grant. The increase in access is particularly strong among faculty who teach in the three HOL courses. Among these faculty, the majority (85 percent) indicated that access to supplies had increased in these courses since the beginning of the grant period.

Most faculty members reported changing their instructional methods as a result of the supplies purchased under the grant, especially by incorporating more hands-on learning. Table III.2 summarizes the use of supplies among all faculty teaching HOL courses who reported an increase in access to supplies. Among these faculty, 94 percent indicated that they were currently using IT resources in their current courses, and 85 percent felt that the additional supplies had changed their classroom practices. Only 9 percent reported no change in their instructional approach. Further, 83 percent felt that the amount of hands-on learning in their classes had increased. Several stated that you simply can't "tell" students how to do some elements of IT; you have to show them, and better yet, let them do it themselves. One instructor during a site visit said the equipment "makes [learning] easier; I can't tell you how to patch in network cables, but I think having the equipment in place has made the process easier with a hands-on approach to learning." Another instructor reported through the survey positive results since increasing equipment through the grant, stating,

> The equipment we allow our students to use is industry-grade equipment, and these experiences with this material gives them opportunities to learn from mistakes and grow in their chosen professional fields. This experience has increased their knowledge and understanding of the course material.

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[1] SDEV 120 was not included in the surveys.

Another wrote that "it has made it easier to connect and engage with students, and I feel that the more they are engaged, the more they are aware of the field that they are being trained for."

Table III.2. ***Faculty Use of Supplies in NETI 100, NETI 105, or ITSP 135 Classes Among Those with Increased Access to Supplies***

	%
Use of supplies in class	94
Changed instructional approach	85
Plans to change instructional approach	0
No change to instructional approach	9
Increased hands-on learning in class	83

Source: Round 2 CPIN Faculty Survey (N=87)

Across all Ivy Tech campuses, faculty members were extremely positive about the changes in teaching and learning the supplies has afforded them. Faculty felt the supplies made the learning process easier and more efficient for students. One instructor commented that now they simply "get more done." Another instructor said, "The best way I know to learn is hands-on. There are some things you can't teach. I get my students at the computers as soon as possible." Another instructor commented that with the supplies,

> We can show the students how it looks in the real world. I am a very hands-on learner. I think there's limited value in what you read about. Having the data center with appliances, they have a better understanding of how the workplace really works. IT is pretty complex with big, abstract projects. Today, fields are so specialized and narrow; the students have to tell me things beyond that they 'want to work with computers.' You have to show them what an average day at work would look like. They don't really have an understanding of the career before coming here.

Yet another said,

> [Before,] we would talk about things, and we can actually demonstrate them now. It depends on the class. One of my objectives in [ITSP] 135 is to make students comfortable with technology. A lot of students use smartphones, but they have never taken anything apart before. The point is, if they do these things, they can apply those skills to other places.

Control of the local network allowed faculty to change classroom practices. Along with the addition of new supplies, Ivy Tech campuses also installed a separate dedicated network for use by the CPIN programs. This allowed courses within CPIN programs to run on a network that is separate from the campus's Ivy Tech network. In the survey, responding faculty were asked specifically about the changes made to allow CPIN faculty to have independent control over their Local Area Network. 48 percent indicated that they now had control over their LAN. Of those who reported independent control, 86 percent said that this control had changed their classroom teaching practices. Two out of three of the sites visited during the second year of the grant had previous access to a separate network prior to the grant, however, both of those previous network designs were limited to some degree. Faculty members at all three sites mentioned that network control had allowed them to do things in their classes they were previously unable to do. Faculty who taught cybersecurity, for example, were able to show students techniques for ethical hacking and allow students to "play around" on the network without fear of causing harm to the campus network.

Faculty reported a range of impacts from the independent control over their LAN. Table III.3 summarizes the positive and negative impacts of local area network control from the perspective of faculty. About 40 percent of faculty surveyed reported that having local area network control affected how they taught their classes. Of these faculty, 92 percent reported that LAN control gave them flexibility in terms of software downloads and installation and 89 percent said that this control allowed them to run cybersecurity simulations in class. Close to 80 percent indicated that network control allowed them increased autonomy with installation of and upgrades to hardware and software and allowed them to more closely align their classroom instruction with industry standards.

Table III.3. *Faculty-Reported Impacts of Local Area Network Control*

Positive Impacts	%
Autonomy over software downloads	92
Simulations in cybersecurity	89
Software/hardware upgrades	83
Alignment with industry	81
Negative Impacts	
Time-intensive to maintain	36
Access to resources and licensing	31
Poses security issues	22

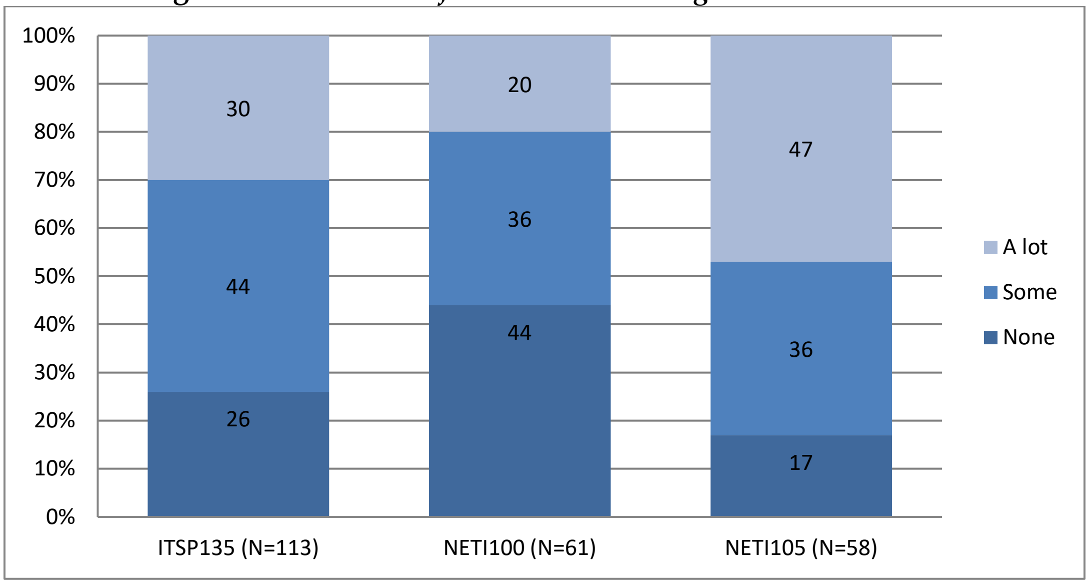
Source: Round 2 CPIN Faculty Survey, (N=87)

On the other hand, faculty reported some negative impacts of having local area network control. Among these, 36 percent of responding faculty reported that the LAN took a lot of time to maintain, 31 percent reported having limited access to resources and licensing necessary for the network, and 22 percent worried that local control over the network poses an information security risk. Indeed, these negative perceptions of the LAN control, though relatively rare, came out in the site visits as well. At Terre Haute, faculty noted that students maintained the network, and faculty had little to do with it. If something went wrong, one faculty member said, "it's on them," and they have to "figure it out." This type of troubleshooting experience was helping students gain real-world knowledge while also taking the burden of the additional work of maintaining the network off faculty members.

Student Experiences with Hands-On Learning

The amount of hands-on learning varied across HOL classes. Of the student survey respondents, 236 reported having been enrolled in ITSP 135 (N=117), NETI 100 (N=61), or NETI 105 (N=58). Nearly three-quarters of students in ITSP 135 and 83 percent of students in NETI 105 reported some or a lot of hands-on learning. In contrast, 56 percent of students in NETI 100 reported some or a lot of hands-on learning. Figure III.4 illustrates the amount of hands-on learning across each of these classes reported by students in the survey.

Figure III.4. ***Amount of Hands-on Learning Included in Class***

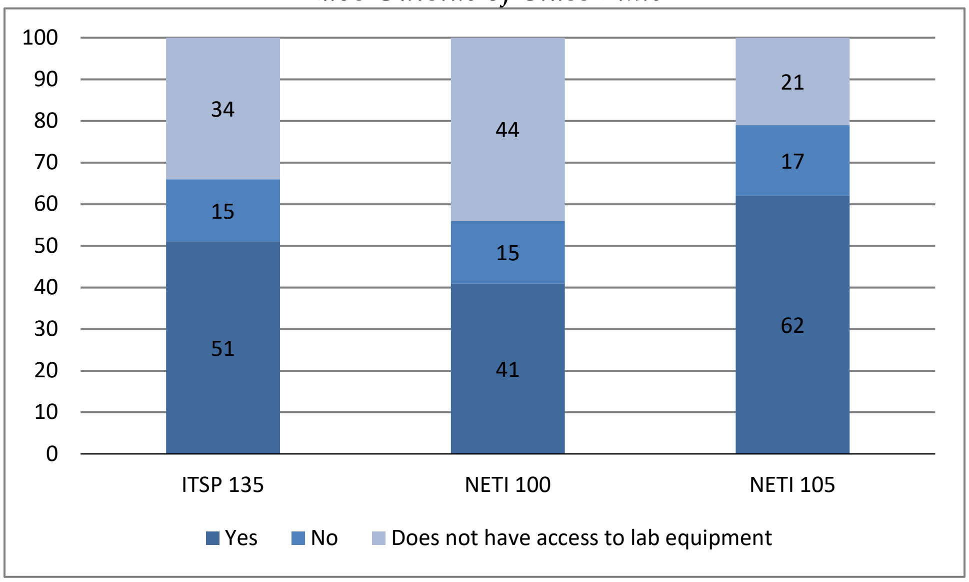


Source: Round 2 CPIN Student Survey, (N=331)

CPIN students in focus groups reported meaningful hands-on learning in their classes. Students expressed that they enjoyed the "hands-on aspect" of their CPIN programs and appreciated having access to the new supplies. Several students told EERC staff in focus groups that they had transferred to Ivy Tech from four-year schools and were astonished at the difference in education offered by the two settings. Ivy Tech's CPIN programs offer many more opportunities for students to engage in hands-on learning, whereas most reported their experience at other schools was "theoretical" and "business-oriented." One student, who had already graduated, had gone on to an internship at a large company. His cohort of interns included several from regional four-year universities. He told EERC staff that he was much further ahead of his fellow interns because he had already used at school the equipment they encountered onsite—he hadn't just read about how to use it. Before the end of his internship, he had already been offered a job at the company. Several students who were also incumbent workers noted that the supplies used in their courses were the same as those used by their employers. This indicates that Ivy Tech's CPIN programs are indeed meeting their target goal: preparing students for seamless integration into the industry.

Most CPIN students in relevant courses had access to and were using lab supplies outside of class time. Figure III.5 indicates that most students participating in these three courses were able to access lab supplies provided by the grant outside of their classes. Students in NETI 105 reported the highest level of access (79 percent), followed by ITSP 135 (66 percent)—however, students simply having access to grant-related supplies did not indicate they necessarily used it. It is likely that many of those who were not able to access lab supplies outside of their classes were taking courses online.[2] A majority of responding students in ITSP 135 (51 percent) and NETI 105 (62 percent) courses reported using available labs, while a considerable proportion of NETI 100 students (41 percent) reported lab use.

Figure III.5. *Percentage of Students Who Report Having Access to Labs Outside of Class Time*



Source: Round 2 CPIN Student Survey, (N=331)

Student Outcomes from Hands-On Learning

The data generated from site visits and by the faculty and student surveys suggests that the additional supplies provided by Ivy Tech's TAACCCT program had noticeable impacts on classroom instruction. But did these changes affect student performance and persistence in their courses? To address this question, we draw upon student course histories from Ivy Tech's student administrative data system. These course histories include information on student characteristics as well as some features of their enrolled courses. We chose four CPIN courses which were identified by the Ivy Tech project manager as being most directly impacted by the additional supplies provided by TAACCCT funding—NETI 100, NETI 105, ITSP 135, and SDEV 120. We further chose four near-term outcomes to assess the impact of the additional supplies in these courses. These are: the student's grade in the course (withdrawals are excluded from this part of the analysis), whether the student passed her course with a grade of C or better (withdrawals are counted as failures), whether the student withdrew from her course, and whether the student enrolled in classes in the semester following the course.

[2] All three of these courses have online-only sections, and a substantial proportion of respondents from each course type reported taking an online only section.

Data and Key Variables

Because the course history data are not detailed enough to ascertain whether a given course was directly affected by the influx of additional supplies, our analysis makes certain assumptions about the timing of implementation. Specifically, since most of the supplies were delivered between the 2014–15 and 2015–16 academic years, we identify as *enhanced HOL courses* those which took place in either the Fall 2015 or Spring 2016 semesters. We compare those to courses of the same number that took place in either the Fall 2014 or Spring 2015 semesters.

To assure that the successes and failures of individual students do not bias our findings, we limit the data to a student's first exposure to any given course (NETI 100, NETI 105, ITSP 135, SDEV 120) within the study period (Fall 2014 through Spring 2016). Thus an individual student can be present in the analyses of all four courses, but only their first exposure to the course in the study period is assessed.

Since other factors are at least as likely to impact student performance and persistence, we also control for a number of student- and course-level characteristics. At the course level, the analysis includes indicators of whether the course was taken in a Spring semester (vs. Fall); and whether the course was taught in a hybrid or online-only format (vs. traditional classroom). At the student level, the analysis controls for gender, race, and age (measured at the time of the course).

Findings

We present the results of a series of ordinary least squares (OLS) and logistic regression models for four course-specific outcomes in Table III.6. While we are most interested in the effect of the hands-on learning enhancements provided by the TAACCCT grant, analysis revealed that course format was a particularly salient predictor of students' success across outcomes. Because of this, we also present the per-course coefficients for the variable 'online-only' instructional format. The first column is an OLS model predicting course grades, which is measured on a four-point scale. The latter three columns are logistic regression models predicting the log likelihood of the outcome. For ease of interpretation, the results of logistic regression models are presented as marginal effects, which—instead of odds ratios—can be read as the percentage-point change in the probability of the outcome.

Table III.6. *Impact of Hands-On Learning Enhancements On Course Outcomes in Selected CPIN Courses*[1]

	Course Grade[2]	Passed Course[3]	Remained in Course to Finish[4]	Enrolled in Next Semester[5]
NETI 100	.05	7.0%*	6.3%*	0.7%
NETI 105	.10	2.4%	2.1%	-0.8%
ITSP 135	-.08	3.7%*	6.6%***	-3.3%
SDEV 120	.10	16.9%***	17.4%***	9.3%***

Source: Ivy Tech administrative records data

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

[1] All coefficients reported in this table refer to models that control for a number of student- and course-level characteristics. Full models are included as Appendix Tables A1–A8.
[2] Ordinary Least Squares (OLS) model used. Incompletes and Withdrawals are excluded from analysis of this outcome. Course Grades are measured on a 4-point scale (e.g., F=0, D=1, C=2, B=3, A=4).
[3] Logistic regression model used; marginal effects reported. Passing is defined as earning a grade of C or better.
[4] Logistic regression model used; marginal effects reported.
[5] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).

Hands-on learning enhancements did not change students' course grades but did increase student engagement. The OLS regression models (column 1) of Table III.6 indicate that the HOL enhancements facilitated by the TAACCCT grant did not measurably improve course grades. But, when we consider course success as the likelihood of passing with a grade of C or better, we see that the enhancements were associated with better outcomes. The probability of a student passing ITSP 135, for example, was raised by nearly 4 percentage points when that student enrolled in an HOL-enhanced version of the course. This advantage increased to 7 percentage points for students in NETI 100 and about 17 percentage points for those who took SDEV 120.

These first two outcomes handle student withdrawals differently. Withdrawals are excluded from the OLS regression models predicting numeric grades, but they are included as failures in the models predicting whether a student passed the course. As such, we treat withdrawal as a separate outcome, but phrase it in positive terms as *Remaining in the Course to Finish*. In these models, we see that students in enhanced-HOL courses were significantly more likely to finish their course, ranging from associations of just over 6 percentage points in NETI 100 to over 17 percentage points in SDEV 120. We also consider a longer-term outcome: student retention, which we define as enrollment in the semester immediately following course completion. In terms of this outcome, only students in enhanced-HOL sections of SDEV 120 were significantly more likely to enroll in courses the following semester, with a positive association of about 9 percentage points.

We also note the potentially negative impacts of online-only instruction in CPIN courses. The other important findings from these analyses concern online-only courses, reported in Table III.7. Course format was a covariate in the models reported in Table III.6, and we show those results here. On nearly every outcome, regardless of course type or the presence of HOL enhancements, students in online-only courses fared worse than their peers in traditional face-to-face courses. This includes significantly lower grades, ranging from 0.15 grade points lower in SDEV 120 to more than 0.4 grade points lower in NETI 105. The negative outcomes associated with online-only course formats are worthy of independent consideration and further exploration as the evaluation proceeds. However, these observed associations raise the question of whether HOL enhancements can be of any consequence in online-only formats. We therefore re-specify the models to exclude online-only course sections.

Table III.7. ***Impact of Online-Only Instruction on Course Outcomes in Selected CPIN Courses*** [1]

Course With Online-Only Instruction	Course Grade[2]	Passed Course[3]	Remained in Course to Finish[4]	Enrolled in Next Semester[5]
NETI 100	- .22**	-9.0%**	-5.8%*	-6.2%*
NETI 105	-.41***	-20.1%***	-17.0***	-5.8%*
ITSP 135	-.21**	-10.2%***	-6.2**	2.8%
SDEV 120	-.15**	-7.4%***	-6.3***	-0.8%

Source: Ivy Tech administrative records data

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

[1] All coefficients reported in this table refer to models that control for a number of student- and course-level characteristics. Full models are included as Appendix Tables A1–A8.

[2] Ordinary Least Squares (OLS) model used. Incompletes and Withdrawals are excluded from analysis of this outcome. Course Grades are measured on a 4-point scale (e.g., F=0, D=1, C=2, B=3, A=4).

[3] Logistic regression model used; marginal effects reported. Passing is defined as earning a grade of C or better.

[4] Logistic regression model used; marginal effects reported.

[5] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).

[6] Throughout this table, the reference category for this variable is traditional face-to-face instruction.

Table III.8 presents revised models that consider only traditional and hybrid-format course sections. Here we see more of a pattern by course than by outcome. There were no statistically significant associations between HOL enhancements and student grades in any of the courses analyzed. In ITSP 135 sections, HOL enhancements were associated with higher average probabilities of course success (7 percent) and course completion (8 percent). In SDEV 120, we see that HOL enhancements were associated with three of the four favorable outcomes—significantly higher probabilities of passing the course (22 percent), finishing the course (23 percent), and enrollment in the subsequent semester (8 percent).[3]

[3] It is important to note that SDEV 120 was not offered in a hybrid format in the time frame considered in this report (Fall 2014 through Spring 2016). As such, the results presented in Table 2 for this course only concern courses taught in a traditional instructional format.

Table III.8. ***Impact of Hands-On Learning Enhancements on Outcomes in Selected Traditional and Hybrid CPIN Courses*[1]**

Course Enhanced By Hands-On Learning	Course Grade[2]	Passed Course[3]	Remained in Course to Finish[4]	Enrolled in Next Semester[5]
NETI 100	.05	3.3%	3.2%	-3.1%
NETI 105	.12	4.7%	4.7%	-0.8%
ITSP 135	.01	7.4%**	8.3%***	-3.1%
SDEV 120	.12	21.8%***	22.7%***	8.7%***

Source: Ivy Tech administrative records data

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

[1] All coefficients reported in this table refer to models that control for a number of student- and course-level characteristics. Full models are included as Appendix Tables A1–A8.

[2] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[3] Logistic regression model used; marginal effects reported. Passing is defined as earning a grade of C or better.

[4] Logistic regression model used; marginal effects reported.

[5] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).

Overall HOL improves the likelihood that students finish their courses. In terms of suggestive evidence, three major findings emerge. The hands-on learning enhancements facilitated by the TAACCCT grant were not associated with better course grades. This makes sense, since those supplies may not on their own increase comprehension of course material—and better assessment scores (e.g., higher grades on tests and papers) rely on increased comprehension. But course grade outcomes were assessed only among students who did not withdraw from their courses, which ties into the second major finding. HOL enhancements show a stronger association with student retention—both through an individual course and into the next semester. Students in HOL-enhanced sections, especially in ITSP 135 and SDEV 120, were more likely to finish their courses, and in general students who finish courses are more likely to pass. In SDEV 120, this retention association also extended to the subsequent semester. Thus it may be that the addition of supplies to enhance hands-on learning in these courses led students to be more engaged and interested in their coursework. Even if this did not improve grades among those who finished, it did keep students engaged for longer and thus increase success rates in these courses. The third finding is related to the difference among courses. The most robust effects emerged in one course—SDEV 120—and to a lesser extent ITSP 135. It may be that the supplies added by the TAACCCT funding were more applicable to these courses or that instructors and departments made better use of them in these courses. It is important to understand whether either of these is the case, and if the stronger effects found in SDEV 120 and ITSP 135 can be replicated in other CPIN courses.

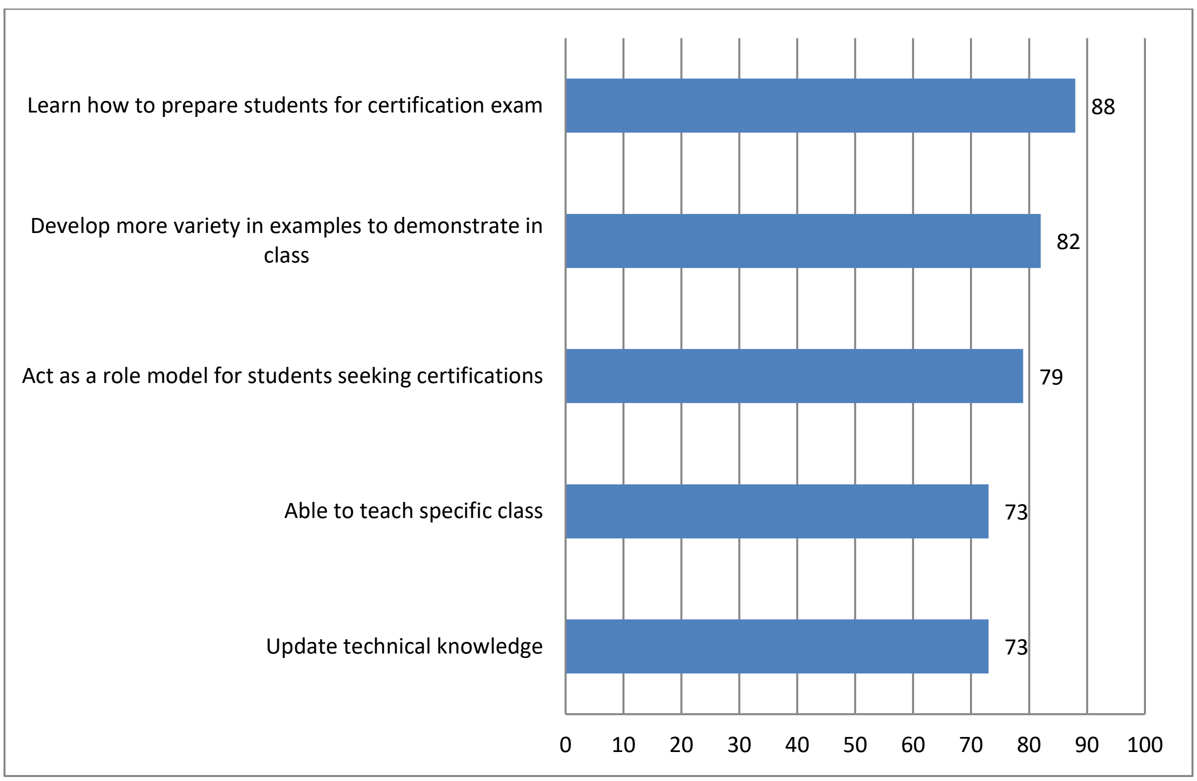
IV. INDUSTRY CERTIFICATION TRAINING

Related to supporting the use of new supplies, another major focus of the grant has been faculty attainment of industry certifications. During the first year of the grant, faculty were surveyed by grant management to understand what certifications they already had and assess which certifications were needed. In the second year of the grant, offering certification trainings statewide became a priority for the grant, and many trainings were offered during the summer of 2016 and throughout the academic year 2016–17.

Faculty Perspectives on Training

Many faculty participated in and reported benefits from trainings. Among faculty who completed the Round 1 CPIN Faculty Survey in November 2016, nearly 40 percent reported they had participated in an industry certification training. Most of the faculty who completed an industry certification training reported that the training was useful in a variety of ways, such as by helping with teaching specific classes, updating technical knowledge, providing more examples that can be used in teaching, learning how to prepare students for the same certification test, and allowing faculty members to be role models for students who might pursue a certificate. Figure IV.1 summarizes the reported benefits of training on each of these potential benefits.

Figure IV.1. *Percent of Faculty Reporting Benefits of Training*



Source: Round 2 CPIN Faculty Survey, (N=87)

Faculty members echoed these benefits in site-visit interviews. Some articulated the benefit of taking the industry certification exam as a way to prepare to teach students to successfully complete the exam—both through knowing the content of the exam and the experience of taking the exam. One faculty member stated,

> I think it offers two things: one, I can tell the students how to study, how I study—and even with the networking class—but going through the same information the students went through. I can tell them what I had to study for hard topics. You can really get in there, how, you know, what is the content, what is presented, and how it's practiced.

Another said,

> If we are promoting them [industry certifications] as embedded in the coursework, it would be hypocritical to not have [faculty take] them. I don't know if it's necessary to teach the content, but it is a bonus. Faculty members can relate to the students taking the exams and help them by sharing their experiences. Sometimes they don't pass the first time.

Other faculty members highlighted the importance of the training to building their technical knowledge and subject-matter expertise. For example, one faculty member stated, "I really need to bring my technical skills up to date for the future. I've been working on it, getting more comfortable. Doing some more hands-on. I'm working toward my A+ certification." Another faculty member similarly observed, "I think faculty will be better subject-matter experts. It can help students know what they need to know. Their expertise will be developed more. I'm not talking about general education techniques, I'm talking about subject matter."

Trainings were given both online and in person. Faculty varied in their preference for the format of the training. Some faculty reported the benefits of the in-person training because they could help each other with questions and work together. One faculty member said, "Sometimes you learn from websites and books, but in person they can explain what it means." In contrast, other faculty members completed online trainings and reported they valued the format of these trainings. They appreciated the flexibility of being able to watch the training when they had time without having to travel to another location.

Despite the benefits of industry certification, some faculty were reticent to engage in training at first, feeling that certifications weren't necessary. At least some of these faculty members have since changed their minds, realizing that having the training has helped them teach their courses. Many have embedded certification training into the courses they teach as well, which has allowed students to receive certifications through their program of study. One faculty member spoke to this:

> I really grumbled about being in the CISCO Academy- I said I don't care about it and don't have any demands. But then we embedded it into the cybersecurity program—NETI 105 and 115 and CISCO 102 are in the program, and the first CISCO class is in the IT support program—so the cybersecurity students have the option of taking the CCENT [Cisco Certified Entry Networking Technician certification] which is very good for them.

Some instructors felt the certifications were too much. Faculty at some site visits reported the training was daunting for some instructors. One faculty member said, "The credentials for these instructors is tricky. We had one instructor quit after the first day. It freaked him out; he couldn't handle the material." Some faculty felt the training was lacking in hands-on learning, and they had to spend extra time in their own labs on campus to fully understand the supplies and material. Others raised concerns about having enough time to fully prepare for the test. For example, with a summer training that ended just before the semester began, faculty reported there was not enough time to prepare for the exam before the start of the semester. However, most instructors felt the industry certifications had empowered them to make the most out of the grant-purchased supplies and to enhance the capacity for students to learn in their classes.

IT Academies and Faculty Champions

To promote industry certifications, the college has designated one faculty champion for each of the twelve key IT Academy vendors that provide industry certification training. These vendors include the following: Microsoft, CompTIA, Cisco, VMWare, Oracle, Red Hat, LinuxAcademy, C++ Institute (new), SalesForce, EC Council (new), Android, and Palo Alto (new). Faculty champions varied in how many certification courses they took, but most took at least one. The faculty champion role involves encouraging and mentoring other faculty, providing leadership, helping faculty if they are having issues, sharing information with other faculty, and generally acting as a resource for faculty. Champions take the lead in promoting and facilitating the industry certification training among other faculty at the college. Champions gain the industry certification themselves and in some cases then lead trainings for other faculty members interested in gaining certification. In other cases, they promote the certifications among other faculty by raising awareness and sharing information about the training opportunities. This system is designed to encourage faculty to take industry certification exams and provide support to those interested in doing so. It also has the potential to sustain industry certification trainings as faculty champions can continue to coordinate these efforts within their specific area beyond the life of the grant.

Faculty champions hold a variety of roles on their campuses and within the college and thus are able to promote certifications in diverse ways. Some are faculty chairs, while others are faculty with a specific interest or expertise in the certification area. Some faculty champions had already developed related courses based on the certifications to be offered as part of their programs. In some cases, faculty used their role as faculty champion to promote certifications as part of their programs, which they viewed as a way to integrate more rigor and innovation into their curriculum. In other cases, particularly with certifications that are relatively new and not yet as well known, faculty champions saw their role as helping to raise awareness about the certification vendor among students, other faculty, and employers (when possible).

Faculty champions have the depth of knowledge needed to guide other faculty who are interested in pursuing training. Rather than fully centralize the coordination of these trainings, this strategy is designed with the goals of scalability and sustainability in mind. Faculty champions can persist in this role beyond the life of the grant. However, the college does need to be cautious about adding too much responsibility to faculty who already have high teaching loads. Some certification bodies, such as Cisco, require substantial time commitments from faculty in this role. This concern is especially relevant in relation to Cisco, in fact, because Ivy

Tech is the lead training academy for faculty in the state—a substantial responsibility. Faculty mentioned the IT vendors are seeking to create more users of their products through trainings. Many faculty members like the idea of integrating vendor products in their classes but also seek to maintain academic rigor within their programs.

In some cases, part of the challenge faculty champions face is fully determining industry demand for the certification(s). Especially for less well-known certifications, faculty champions reported they sought to better understand the local labor market demand for particular credentials. For some certifications, the demand was higher in certain locations, particularly in more urban areas like Indianapolis, than in other parts of the state. Some of this information coming from faculty champions is speculation, so further information is necessary to better understand labor market demands. One faculty member stated,

> I'm just guessing. I know [vendor] demand is out there. It's just about who uses it [industry certification] and doesn't. We just need to figure out what they're using it for, what kind of people they're looking for, skills, all that.

Likewise, faculty have to find ways to convey this information to students to ensure enrollments. One faculty member spoke to this:

> It's about convincing other people. If the students can see that companies want [a certain industry certificate] or use [a certain vendor], or [if students could] see the jobs available for it [the certification], it would help.

Through developing the IT Academies and organizing the trainings, college staff identified additional resources available through the industry certification bodies. In some cases, the colleges already had access to these resources, but because their existence had not been widely known, they were rarely or never used. After this process, faculty at the college became more aware of online resources and tutorials designed to help them and their students prepare for industry certification exams. For example, Oracle provides access to a virtual training environment for practicing on the database systems that the college can freely access and use. In addition, industry certification vendors have given the college additional resources, as these relationships have been further cultivated through the grant. For example, Oracle provided training valued at $120,000 at no cost to faculty through their Oracle Academy, a nonprofit arm of the vendor. Linux is providing training for faculty at a nominal cost. While the college gets free training for their faculty, the vendors benefit by having more trained faculty who can teach students to become competent users of the product. The college identified some additional resources available through Microsoft that had been previously underutilized.

V. ADVISING

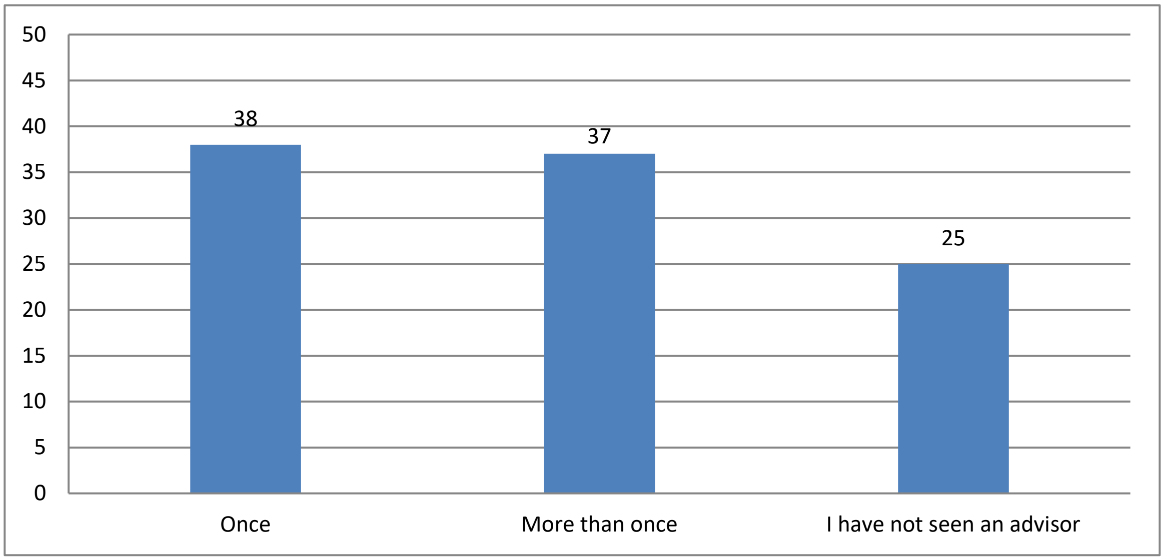
Improvements to the advising model are important for the CPIN programs because of the school's recent change, just prior to TAACCCT, to eight career-path-oriented programs. General advisors did not have the detailed information necessary to understand and advise students regarding the nuances of the eight programs, let alone counsel students about the programs' multiple associated careers. Since the TAACCCT project has expanded the career pathways model relative to CPIN, finding an advising model that encompasses career advisement—and makes sure students are making the appropriate choice relative to the eight available options within CPIN—is imperative. During the second year of the grant, EERC conducted surveys, site visits, phone interviews, and in-person focus groups and interviews to better understand how Ivy Tech's advising reforms and advising tools developed through the grant are impacting students' decision-making relative to education and career paths.

Advising Reforms

During the first year of the grant (through Fall 2015), advising reforms already under way at Ivy Tech were expanded through the TAACCCT project. The first evaluation report detailed the "baseline" model of advising common throughout the state—general academic advising for 15–24 credit hours (depending on the campus), after which students are transferred to a faculty advisor. Faculty advisors then counsel students as to their specific declared program and subsequent program/graduation needs. Students may see multiple general advisors in addition to their faculty advisor throughout the course of their academic career. With the move to CPIN's eight detailed programs, Ivy Tech discovered that a more inclusive and detailed form of advising was necessary. Advising reforms for the state include a decreased student load for general advisors, more "intrusive" advising by faculty members, and a piloted model that integrates general and faculty advising, therefore eliminating the need for students to be "handed off" to multiple people during their education. One of Ivy Tech's challenges historically has been how to offer advising to high numbers of students with limited numbers of advisors (and funding). Over the last five years, the school has made a concerted effort to decrease the advising load of general advisors by increasing hiring and restructuring. The caseload of advisors has dropped across the state, from an average of 1,200:1 to around 400:1.

Many faculty members report being involved in advising. Nearly two-thirds of faculty surveyed (64 percent) reported that they were involved in advising students on their education and career-path decisions. Among those faculty, 59 percent reported they were currently advising 25 students or more, and 30 percent reported they were currently advising at least 50 students. This indicates that faculty are regularly involved in advising students about some issues, though based on official policy on most campuses, students do not begin to see faculty advisors until later in their enrollment at the college (typically after they have attained 15–24 credits; prior to that, students are supposed to see general advisors). Based on our CPIN Student Survey, three quarters of student respondents reported seeing a general advisor at least once; 38 percent of those saw an advisor only once, and 37 percent saw an advisor more than once. (See Figure V.1.) Taken together, it is possible to infer that many students are taking advantage of general advising, but many are still seeking more information about education and career pathways on their own or are waiting until later in their enrollment—presumably after they've earned 15–24 credits and can see a faculty advisor.

Figure V.1. *Students' Reported Frequency of Advising by Percentage*



Source: Round 2 CPIN Student Survey, (N=1014)

Advising Tool Implementation

A major focus of the TAACCCT grant has been helping students make informed decisions about the CPIN programs by improving the advising model. To meet student information needs earlier, grant administration sought to create a virtual advising tool to assist general and faculty advisors with disseminating information about CPIN programs to students. A 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. In response to this directive, grant management created an advising tool that will help general advisors understand the differences between the eight CPIN programs and their associated career pathways. Modeled after Arizona State University's e-advising tool, 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 envisioned the tool as offering an overview of careers in the computing field, a look at 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. The tool was designed to 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 tool was envisioned to be used by advisors, largely to take pressure off them regarding 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 then work with an advisor (whether a general advisor or faculty advisor) to ask questions and receive guidance.

The advising tool was designed to be created in four phases. The first phase of the process was to collect data to understand which programs were offered at which campus. The second phase was to map the program requirements for each program, including math requirements. During this phase, it was discovered that math requirements for some programs needed to be reworked. In each case, new math requirements have been put in place that better align the requirements with course and career expectations. Phase three of the advising tool implementation process was to create a series of videos for the website that would better advertise the eight CPIN programs and discuss career paths associated with each one. The fourth and final phase of the advising tool will be the creation of an assessment tool that will help students—working with an advisor--to understand each of the eight programs and their associated careers, and to make decisions that will help them choose which program and career is best for them. The final phase is slated to be completed throughout the remainder of the grant period. This phase is currently in its conception phase, modified from a Cisco pre-assessment. Grant management envisions the assessment as a tool that will allow advisors to give students a targeted assessment asking a series of questions and then return top program options for them based on their responses to the questions.

The first three phases were completed by November 2016. Training for advisors was held throughout the second year of the project and has focused on helping advisors understand the eight programs and associated careers. Predominantly the training focused on the program maps, and since then program maps have gone out to general advisors at each campus. A primary video focusing on an introduction to the eight CPIN programs was rolled out a few months prior to the Fall 2016 site visits. It was designed to be used by advisors and faculty to introduce CPIN programs to prospective students.

Faculty members and advisors were looking forward to the implementation of the fourth phase—the assessment tool. Since advisors have the most difficulty fully understanding the differences between the programs and the careers associated with each, they are eagerly anticipating a tool that will help them guide students in this area. Most faculty members and advisors have mentioned throughout the grant to date that they felt an assessment that helped students choose between the eight programs and associated careers would be the most useful advising tool they could be given. Development of the assessment tool is slated to be completed throughout the remainder of the grant period. Advising Tool Utilization

As mentioned above, implementation of phases two and three of the advising tool—the program maps and video—took place during the second year of the grant. Both parts of the advising tool were created to educate advisors and faculty members and ultimately assist students in navigating the different classes, programs, and possible careers that each program could offer them. To assess the effectiveness of these phases of the advising tool, evaluation surveys included questions for advisors, faculty members and students about their awareness and usage of the advising tools. The following section reflects these survey results.

While many faculty were not aware of the program maps, those that were found them helpful. In response to questions about their awareness and perception of the CPIN program maps and how useful they were in advising students, fewer than half of faculty respondents (43 percent) reported they had seen the program maps. Of those who had seen the maps, 37 percent reported they were very useful, and 47 percent reported they were useful. Few faculty—only 16 percent—reported that the program maps were not useful. Advisors responding to a similar survey (N=9) were split in their awareness of the CPIN program maps—four responded they were aware of the maps, while five indicated they were not. Since the number of respondents is so low, data from this survey should be used for contextual purposes only. It does, however, underscore the information collected during interviews. More advisors we spoke with were aware of the program maps than the video—possibly because advisors attended training about the program maps.

Many faculty were not aware of the video. The CPIN video was largely unfamiliar to faculty and was not widely used by them in advising students. Among faculty respondents to the Round 2 CPIN Faculty Survey, less than one-third (31 percent) had seen the video. Among those who had seen the video, 20 percent reported it was very useful and half reported it was useful, but 30 percent reported it was not useful. Only about one-fifth of the faculty who reported seeing the video also reported using it in advising students. It is worth noting that faculty members are not necessarily the intended audience for the CPIN advising video—it is meant for students at their first contact with a general advisor when they are faced with having to decide which of the eight program pathways to pursue. Thus, although awareness among faculty could be improved, raising awareness among that population likely is not imperative when it comes to reaching students at the critical juncture of their first advising contact. However, the survey administered to advisors suggests that few advisors know about the video. Of the nine respondents, only two advisors indicated they had seen it; this is the population among which raising awareness is likely to lead to more students engaging with the video at their first advising contact.

Students were also largely unaware of the CPIN video. Only eight percent of student survey respondents reported viewing it. Lack of awareness may be attributed to the fact that faculty and advisors were also largely unfamiliar with the advising tool and thus were not using it when advising students. The video was available to students on their campus websites, but most student interviewees and survey respondents reported they had not watched it. At one campus, students were required to watch the video as part of selecting their program; however, students admitted clicking "play" and then either fast-forwarding or closing the video without watching it—a trick that allowed them to skip the required step.

A common theme among faculty at site visits both in the first and second year was the desire to reach students prior to the 15-credit-hour "hand off" from advisors to faculty members. Even with the increase in training and the first three phases of the advising tool complete, faculty continue to feel that general advising is not comprehensive enough to ensure students are selecting the correct program or are taking the proper sequence of courses. One faculty member said,

> I want them before 15 hours. I want them to come to me after the first semester. [One advisor] has been fabulous in trying to understand IT stuff, and if she has any questions, she sends them to me. I get them sorted.

A few faculty members commented that turnover in general advising may also affect how knowledgeable advisors are about the CPIN programs—when someone is trained to understand the programs and sequences and then leaves, it can result in a loss of institutional knowledge until new advisors are trained. In addition, despite restructuring and hiring across the state, there was a general perception among faculty that advisors have too heavy a load to provide in-depth advising to students. One faculty member said, "I think they have too much turnover and too many people down at general advising." She also commented there are too many students to effectively advise them all. She noted she does "remote advising" with students to try to decrease the number of face-to-face students she and the advisors/other faculty members see: "We've streamlined a lot of things by not forcing a face-to-face type of thing. We do more remote advising, and this applies to online students as well."

Student Information Needs

As reported last year, students across Ivy Tech lacked a clear understanding of the differences between the eight nuanced programs and what careers are associated with each. The same seemed to be true during the recent round of site visits; with a few exceptions (such as dual-enrollment and military students), many students still lacked information to help them make informed decisions about their future CPIN career and corresponding educational path. Consequently, it is more important for faculty advisors—who know the differences about programs more thoroughly than the general advisors, who are also seeing students from programs outside of CPIN—to have fully supported access to all the resources, including the CPIN advising tool, that could potentially help students choose the right program.

At most campuses, general advisors lack the time to fully understand the careers associated with all eight CPIN programs. Therefore, each campus deals with this issue differently. At Evansville, students are sent to the campus career center for a career assessment that can help them narrow down what they would like to do in a future computing career. Advisors commented, however, that students do not visit the career center as often as advisors would like. Students are also exposed to intrusive advising through their classes; faculty members spend time during classes helping students understand the different computing careers and education pathways. At Columbus, students are not sent to the career center but instead to the department's faculty chair, who has them answer questions and describe their interests. An advisor at Columbus commented that the career assessments are "not always reliable," so instead she sends students to the faculty chair, who can tell them about "the marketability of the degree, the day-to-day tasks of the job, certifications, etc." For her own role, she stated that she can "answer more general questions" and do "base-level advising." Her statements are representative of most Ivy Tech general advisors, who find their jobs most often focus on "base-level" advising and not on career exploration. An advisor at Evansville said,

> I talk to them about their specific interests and then refer them to someone in a particular program, because I'm still figuring out and learning what each one of these degrees does and the careers they lead to. I have a general idea, but I am learning myself.

Choosing a program is a challenge for students. Consistently, faculty, staff, and advisors felt that students are most confused about which program to pick, especially in terms of deciding between hardware and software programs. Faculty advisors or the faculty chair seem to be the most common problem-solvers for this issue across campuses. A common problem mentioned during the first round of site visits and again during the second round is that students often say they want to pursue the computer sciences program when they actually do not. Computer sciences is a highly theoretical program, heavy on math, which leads to a transfer degree. Many students are not looking to transfer and are more interested in software, hardware, programming, or other elements of computing. But because media and advertisements are often geared toward "computer science" degrees, students are unaware of alternatives.

Another CPIN program that tends to cause some confusion among students is the ITSP major. Depending on the region, this program can be limited to entry-level work and pay. ITSP trains students to perform work that is generally considered "basic IT help-desk work": positions that tend to offer limited—or no—ability for students to advance. As mentioned, this appears to depend on the region; staff in some areas have had success in moving students up a career ladder, while staff in other areas reported no upward mobility at all and limited pay. Confusion among students is further compounded by a general belief among them that "anything IT" is going to give them healthy pay and a career ladder. Students who choose this program in areas where upward mobility is limited need to be counseled about why this career may or may not be a good fit for them, according to staff. This requires advisors to have knowledge about the career options associated with the program.

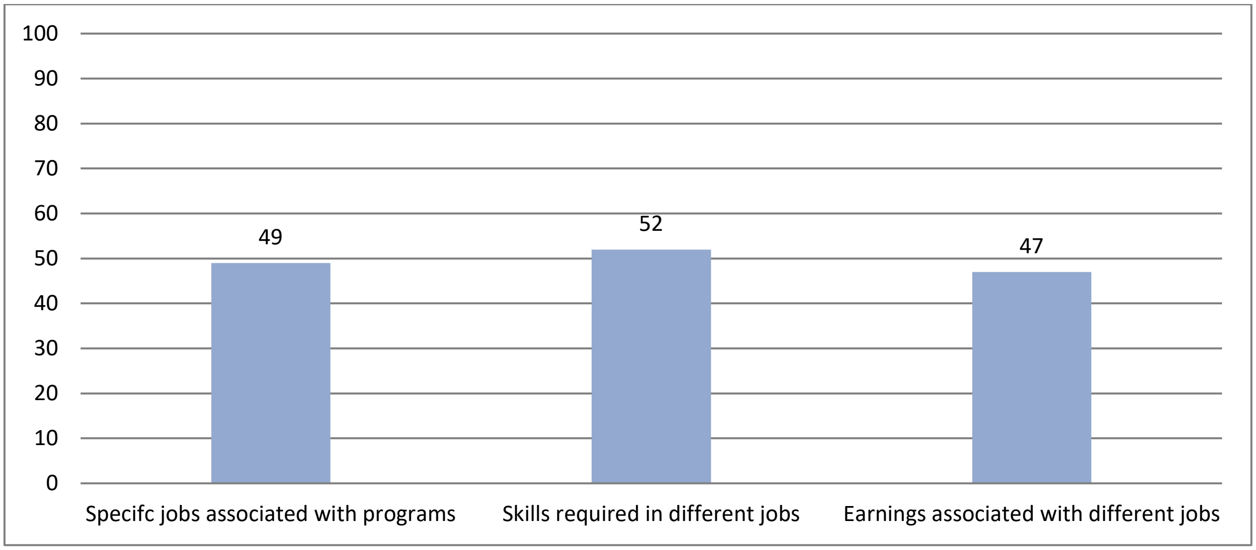
Some faculty commented that students seem to be coming in with unrealistic expectations relative to careers in this field. One faculty member said helping students create real expectations is important in her work as an instructor: "You have to get the know the student, see what they do well in class, and go from there." Another instructor said,

> At the beginning of the semester, I tell them to think about their average work day and if it is what they want to do for the rest of their lives. A lot of them think there's an "end;" they get the diploma and the work is over. I tell them my goal is to give them a foundation for knowledge.

Students' lack of math skills is an issue when entering the CPIN programs. Most advisors counsel students to visit their campuses' math tutoring services and/or take courses such as the Ivy Prep course, which is free. These tools can help students brush up on math skills to better prepare them for their CPIN courses. However, if students are severely behind in math or need more than just a brush-up, advisors at several campuses reported they sometimes must tell students that perhaps courses heavy in math are not for them. One advisor said, "Sometimes you have to be realistic and tell them they're not cut out for something."

Overall, student confusion about career path options and the differences between the eight CPIN programs is still a prevalent issue at Ivy Tech campuses. Student survey respondents were asked whether they had seen a general advisor and what their information needs were after seeing one. Students could select multiple answers. Although most students (n=686, N=920) reported seeing an advisor at least once (Figure V.1), it is also apparent that after advising they still needed more assistance on some key career issues (Figure V.2), such as earnings associated with different jobs (24 percent), skills required in different jobs (24 percent), and specific jobs associated with programs (25 percent).

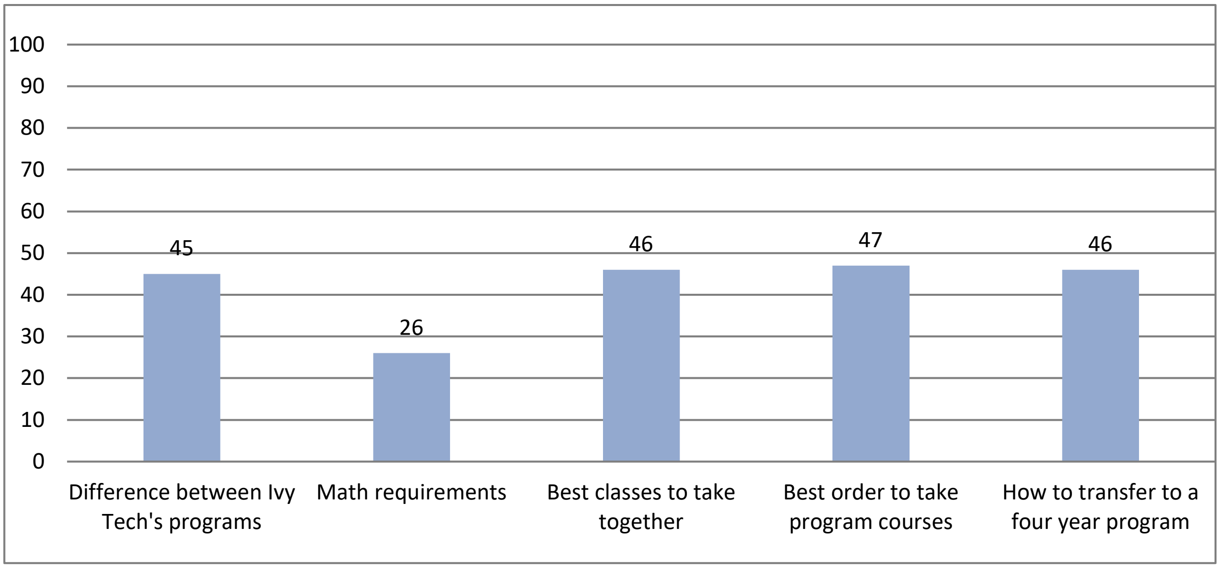
Figure V.2. ***Student Career-Related Information Needs upon Program Selection: Percent CPIN Students Reporting More Information Was Needed***



Source: Round 2 CPIN Student Survey, (N=1014)

Students also reported that after advising they still needed more information on academic issues, such as how to transfer to a four-year university (25 percent), the best order to take program courses (23 percent), and the best classes to take together (23 percent). Only 11 percent of students reported needing more information about the math requirements of CPIN programs, while almost 60 percent reported they received enough information. See Figure V.3.

Figure V.3. ***Student Academic Information Needs Upon Program Selection: Percent of CPIN Students Reporting More Information was Needed***

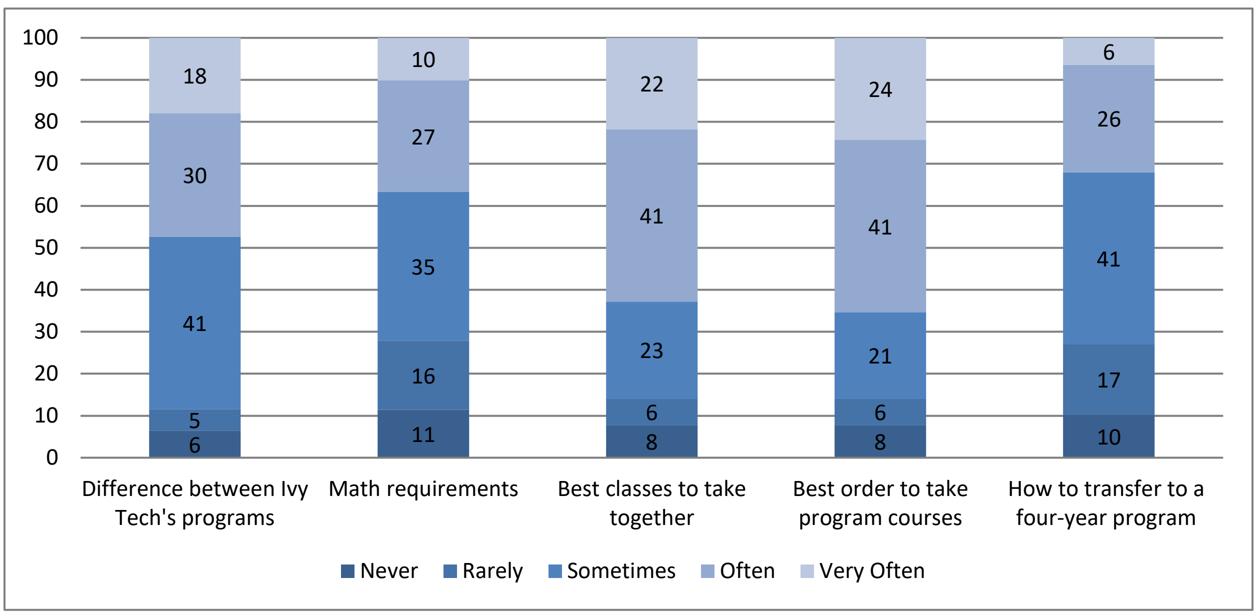


Source: Round 2 CPIN Student Survey, (N=1014)

It is important to note that despite the effort to reform advising and implement the advising tool, 20 percent of student respondents still reported needing more information on the differences among the eight Ivy Tech CPIN programs, while 25 percent said they received some information but needed more. In other words, 45 percent of student respondents left advising needing more information, despite recent efforts.

Faculty survey respondents were also asked about how often students need advising on those same eight issues: the difference between the eight CPIN programs, math requirements for the programs, the best classes to take together, the best order in which to take program classes, how to transfer to a four-year university, the specific jobs associated with specific programs, skills required for specific jobs, and earnings associated with certain career types. Faculty could select multiple categories representing student needs. It is useful to note that on most campuses, by the time students reach faculty for advising they have already likely seen a general advisor and have completed at least 15 to 24 credit hours. Thus, students have had several opportunities to receive information by the time they see a faculty member for advising. Still, 65 percent of faculty indicated that students needed advising often or very often with regard to the best order in which to take program courses. Similarly, 63 percent indicated that students needed help often or very often in choosing the best classes to take together. This indicates that students still need help on program-specific issues after having seen a general advisor. See Figure V.4.

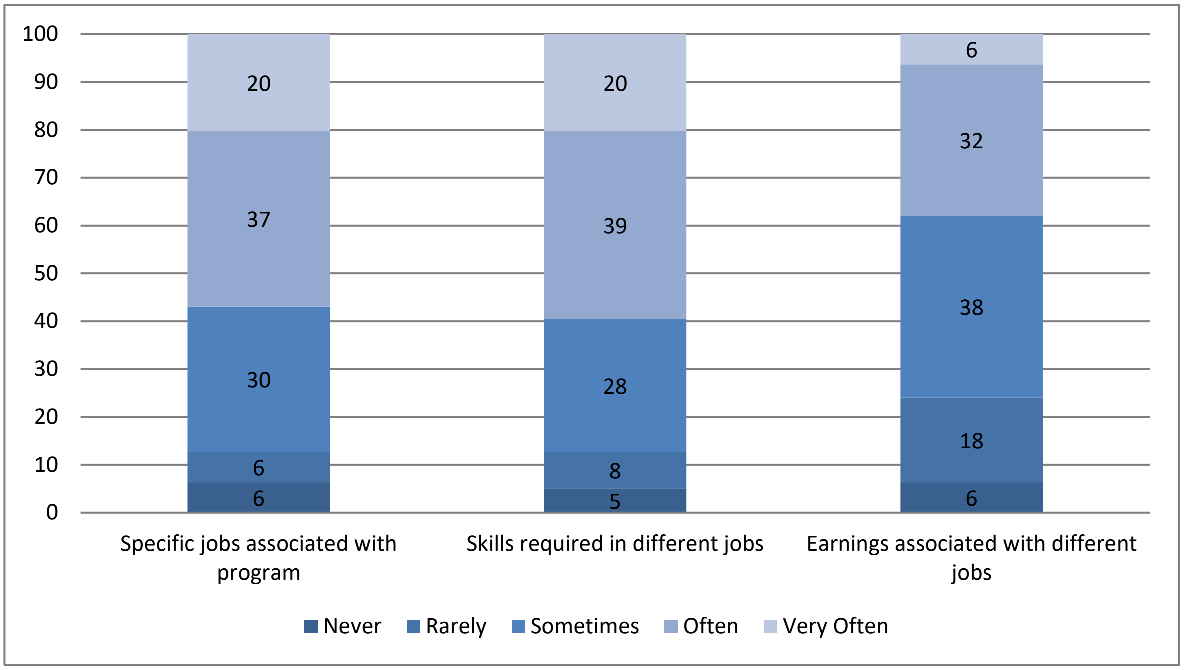
Figure V.4. ***Percent of Faculty Reporting Frequency of Advising by Topic: Academic Issues***



Source: Round 2 CPIN Faculty Survey, (N=87)

Additionally, students sought out more information on potential careers. Faculty reported that skills required in different jobs was a common advising need among students—60 percent indicated students need information on this either often (40 percent) or very often (20 percent). Almost 50 percent of faculty responded that students needed more information about the differences between the eight programs often or very often, and 41 percent felt they only needed it sometimes.

Figure V.5. *Percent of Faculty Reporting Frequency of Advising by Topic: Career Issues*



Source: Round 2 CPIN Faculty Survey, (N=87)

Taken together, according to both students and faculty, students seem to be receiving information about the differences between programs, but there are still some needs around that issue that are not being fully addressed for all students. For example, almost half of students reported needing at least some more info on the earnings associated with different jobs, but 18 percent of faculty respondents reported that students rarely came to see them for advising regarding this issue. Comparatively, 20 percent of faculty respondents stated that students sought out advising very often for both specific jobs associated with the programs as well as the skills required for jobs in the field. Moreover, faculty reported that the three most common issues they were advising students on were the best classes to take together, the best order in which to take them, and how to transfer to a four-year program. Yet many students may still be confused about some academic issues—as noted above, almost a quarter reported needing more advising on these same three issues, further raising concerns over whether the students who need extra advising are receiving it.

According to student focus groups at Evansville, Columbus, and Terre Haute, students were largely happy with their general advising experience. Most, however, reported learning about CPIN programs through their faculty advisors. Students who already knew some information about IT (either from working in the field or through dual-enrollment while in high school) felt they could "figure out a plan" after just meeting with general advisors, but these students were in the minority. Several students described their advising experience as a sequence of steps: First they looked up information on the campus website, then they went to general advising to get "more in-depth information," then if they had further questions they asked faculty members or the faculty chair. Some students said their general advisors could help them with career decisions. One said, "They explained what careers to go into, what courses you actually take; you have to dig for that information on the website." Most students, however, said the faculty chair was the best source of information regarding the programs, and they would recommend a friend go straight to the faculty chair if they were interested in the program.

Despite the findings from focus groups at the three campuses that students received the most information about CPIN programs from faculty advisors, it is still unclear according to the more wide-reaching survey data whether students are seeing faculty advisors more than general advisors at all other campuses. It is also still apparent that the intrusiveness of this type of advising could be improved since a quarter of students reported never seeing any advisor at all (Figure 1). Furthermore, neither the CPIN program maps nor the CPIN video are being fully utilized by advisors or faculty, and their use is even more uncommon among students—mainly due to lack of awareness. However, since advising has made significant improvements at the three campuses examined in this report—Evansville, Columbus, and Terre Haute—other campuses can look to them for examples of best practices, especially involving intrusive faculty advising and reducing general advisor workload, to improve advising across all of Ivy Tech.

VI. EMPLOYER ENGAGEMENT

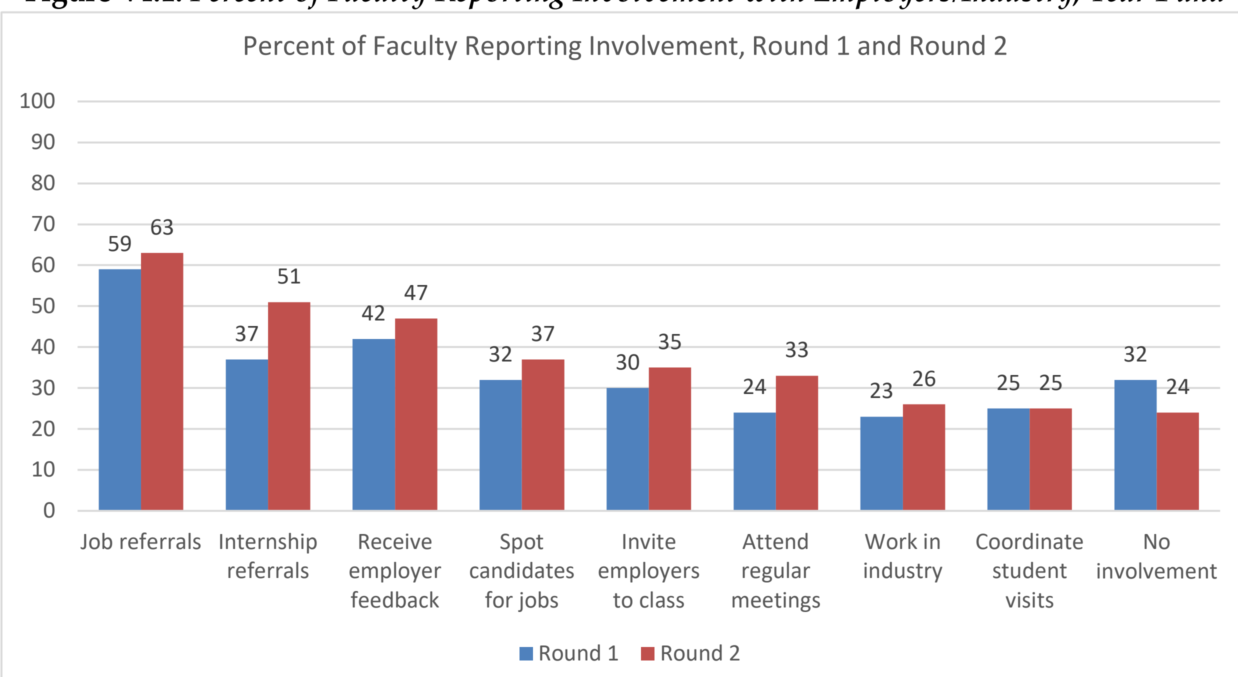
To better prepare students for employment, the grant sought to expand employer engagement with the new CPIN programs. The primary means for accomplishing this goal has been the development of advisory boards designed to promote employer involvement in curriculum reviews, the provision of internships and capstone projects, and job placement. In addition to developing relationships with specific employers, the grant also sought to promote engagement with the workforce system as a whole. Over the course of the first year of the grant, all campuses either created or revamped existing advisory boards, worked with employers to identify which supplies to purchase for programs, and began building relationships that would help them place students in employment upon graduation. At the end of the first year, employer engagement was increasing, but was not to the level grant administration had envisioned.

During the second year, employer engagement became a more central part of grant activities. Based on site-visit interviews and a survey fielded during the second year, activities related to industry involvement increased during year two, as did activities that brought together students and employers. Campuses focused on local advisory boards, while grant management organized and rolled out a statewide advisory board. Faculty reported focusing predominantly on involving employers by 1) engaging in job referrals for students, 2) engaging in internship referrals for students, and 3) receiving feedback from employers relative to coursework. As was mentioned in the first-year report, employer engagement has the goal of improving labor market alignment. This was accomplished through advisory boards, internships, job placement, and other activities such as project-based learning, class visits by employers, and worksite visits for students and faculty.

Faculty member's reports of employer outreach increased over the past year. A faculty survey fielded during the second year of the grant revealed ramped-up efforts by faculty members relative to employer engagement. See Figure VI.1. Nearly two-thirds of faculty (63 percent) responding to the survey reported engaging in job referrals for students, and close to one half reported engaging in internship referrals for students (51 percent) and receiving feedback from employers for their courses (47 percent). This compares favorably to 58 percent, 37 percent, and 42 percent, respectively, in the previous year. Faculty reports of referring students for internships had the highest increase—14 percent over the previous year—in employer-engagement activity. During the second year, faculty were also engaging employers more in the classroom; 35 percent of faculty respondents said they had invited employers into the classroom during the second year of the grant compared to 30 percent last year. About the same number of faculty indicated they had coordinated worksite trips for students (25 percent).

Likely because of increased interactions with employers, faculty were also helping employers more often by identifying strong candidates for employment: 37 percent indicated they had done so this year compared to 32 percent last year. Another significant increase was in the proportion of faculty attending regular meetings with employers, which went up about 3 percentage points (33 percent compared to 30 percent the previous year). More telling is the number of faculty members not involved in employer engagement; this number decreased by almost 8 percentage points from year one to year two (32 percent during year one; 24 percent during year two). These numbers reveal that overall, employer involvement from faculty is increasing at Ivy Tech.

Figure VI.1. ***Percent of Faculty Reporting Involvement with Employers/Industry, Year 1 and***



Source: Round 1 CPIN Faculty Surveys, N=83; Round 2 CPIN Faculty Survey, (N=87)

Along with an increase in employer engagement, faculty also reported a variety of useful involvement with employers. Table VI.1 represents faculty responses to types of employer involvement that they find either extremely useful or very useful. The majority of faculty members (84 percent) reported they find internships for students to be either extremely or very useful. This is higher than the number of faculty who actually referred students for internships during the second year (about 51 percent made referrals) but indicates that faculty recognize the benefit of the activity. Likewise, while 81 percent of respondents said they believe that seeking employer input about skills sought in potential employees was a useful activity, only 42 percent of faculty responding to the survey indicated they had done so. Over three-quarters of faculty respondents (76 percent) indicated that featuring employers as guest speakers in classes was a useful activity, but only 35 percent indicated they had done so in year two. Since faculty had increased these activities in year two over year one, it is likely that their recognition of the activities as useful will eventually translate into action.

Table VI.1. *Faculty Reports of the Utility of Employer Engagement*

Type of Involvement	Percent Reporting Very or Extremely Useful
Employer input about skills sought in potential employees	80
Employers as guest speakers in classes	76
Job shadowing/visits to job sites for students	70
Internships for students	84
Share information on job opportunities with students	76

Source: Round 2 CPIN Faculty Survey, (N=87)

The majority of student are interested in internships. In a survey fielded by EERC during the second year of the grant, students were asked about their interest in CPIN program-specific internships. About two-thirds of students responding to the Round 2 survey indicated they were interested in internships. This number remained about the same as the first year of the grant.[4] The majority of students who wanted to be placed in an internship hoped the internship would lead to permanent employment within the same organization upon completion; 81 percent of students indicated this was very or extremely important to them. As the college works to develop more internships opportunities, student interest in them remains strong.

VII. COMPETITIONS

Student competitions have also been an important part of grant activities. The competitions are meant to have the dual goals of 1) providing additional hands-on learning activities to students around the state and 2) creating another avenue for employer engagement. During competitions, students compete to showcase knowledge and skills accumulated as part

[4] Note this is a correction to the 1st Interim Evaluation Report, which mistakenly reported that only one-third of students were interested in internships.

of their program of study. During the 2016–17 school year, one large event with several competitions took place in April. According to grant staff, the event highlighted the fact that students have the skills they need and thus served as a "huge morale boost for faculty." Further, the event highlighted the camaraderie between faculty and students involved in the competitions. Additionally, the event brought to light the possibility for more employer engagement through sponsorship opportunities; in the future, employers may choose to fund these activities, allowing for more competitions to be held and for more students and faculty to participate.

More competitions are planned for the future. These events will be structured so that students can come together for a day from all parts of the state to participate in hands-on training. Competitions also garner interest in the CPIN programs and act as a form of marketing for student enrollments.

VIII. STUDENT PATHWAYS

To assess student pathways through CPIN programs, we examined Ivy Tech's student records data. First, to provide a general picture of TAACCCT students, we examined the demographic characteristics and credential attainment of all students enrolled in CPIN programs as part of TAACCCT. Then, to better understand students' progression through the program, we examined first-time enrollees majoring in CPIN programs including their characteristics and their progression over time through various milestones.

All CPIN Students

Students served by the Ivy Tech TAACCCT program are representative of relevant broader populations. Table VIII.1 describes the characteristics of students who were served by Ivy Tech's TAACCCT grant. The broadest category (Columns 1 and 2, N=13,892) consists of students who took at least one CPIN course during the grant period. Students served by the grant were on average 26 years old, which is similar to community college students nationally. Twenty-two percent of grant students are female, which is similar to national figures for computer science and technology programs. In terms of ethnicity, students were approximately 70 percent white and 12 percent African American, with the remaining 18 percent distributed among other ethnic groups. In this regard, students served by the grant are similar to Ivy Tech students in general. About half of the students surveyed were eligible for Pell grants, two percent were classified as having a disability, and eight percent were classified as veterans. 61 percent of students served by the grant were identified as part of the 2014 cohort; 29 percent were part of the 2015 cohort, and nearly 10 percent as part of the 2016 cohort. This is to be expected, as the first cohort year includes far more continuing students than the second or third.

Table VIII.1. ***Characteristics of Students Affiliated with CPIN Programs***

	Any CPIN course	%	Two or more CPIN courses	%	Ever a CPIN major	%
Age mean (Std. Dev.)	26.1 (10.1)	N/A	26.7 (10.0)		26.6 (9.4)	

Gender*						
Male	10,811	77.8	8,351	80.2	6,619	81.6
Female	2,816	20.3	1,932	18.6	1,522	18.5
Missing	265	1.9	129	1.2	77	0.9
Ethnicity**						
White	9,986	71.4	7,803	74.9	5,929	72.1
Black/African American	1,687	12.1	1,146	11.0	1,079	13.2
Asian/Pacific Islander	432	3.1	306	2.9	258	3.1
Hispanic	515	3.7	354	3.4	306	3.7
American Indian/ Alaskan Native	54	0.3	45	0.4	37	0.5
Multiracial	533	3.8	369	3.5	331	4.0
Other	79	0.6	49	0.5	10	0.1
Missing	606	4.4	340	3.3	268	3.3
Pell Eligible						
Yes	6,991	50.3	5,569	53.5	4,751	57.8
No	6,901	49.7	4,843	46.5	3,467	42.2
Disability						
Yes	295	2.1	251	2.4	188	2.3
No	13,597	97.9	10,161	97.6	8,030	97.7
Veteran Status						
Yes	1,085	7.8	919	8.8	756	9.2
No	12,807	92.2	9,493	91.2	7,462	90.8
Cohort Year						
2014	8,475	61.0	6,643	63.8	4,743	57.7
2015	4,082	29.4	2,943	28.3	2,770	33.7
2016	1,335	9.6	826	7.9	705	8.6
N	13,892		10,412		8,218	

Source: Ivy Tech administrative records data

The distributions of characteristics do not dramatically change when we restrict the definition of a *program participant* to those who took two or more CPIN courses (N=10,412) or to those who were part of a CPIN major area of study (N=8,218). In the latter, most restrictive definition, there was a slightly larger proportion of male students (82 percent), and a noticeably larger proportion of students were eligible for Pell grants (57 percent). In general, these figures show that CPIN students served by the TAACCCT grant at Ivy Tech were representative of the school and of relevant national trends.

Ivy Tech's IT students earned a mix of degrees, certificates, and certifications. Table VIII.2 presents the number of credentials earned by CPIN students impacted by the TAACCCT program. In all, 3,483 credentials have been earned by these TAACCCT students. In terms of credential type, associates degrees were the most common credential type earned (41 percent), followed by technical certificates (28 percent). Combined, however, Ivy Tech's TAACCCT students earned more certificates and single-course certifications than degrees. The overwhelming majority of credentials of any type were earned by the Fall 2014 cohort. This is to be expected both because this cohort included many continuing students and because even the new students in this cohort have had the longest time period in which to earn credentials.

Table VIII.2. ***Credentials Earned by TAACCCT Students, by Cohort and Credential Type***

	Associates Degrees	Certificates	Technical Certificates	Single Courses	Total
2014 Cohort	1,315	589	809	419	3,132 (90%)
2015 Cohort	92	36	143	23	294 (8%)
2016 Cohort	27	6	24	0	57 (2%)
Total	1,434 (41%)	631 (18%)	976 (28%)	442 (13%)	3,483

Source: Ivy Tech administrative records data

Students earned credentials of all types throughout the academic year. Table VIII.2, above, arranges the same earned credentials by the academic term in which they were earned. In contrast to traditional higher education programs, which tend to conclude in the spring semesters, we find that Ivy Tech's IT students earn credentials during all terms; these results are shown in Table VIII.3, below. While the spring terms accounted for higher numbers of earned credentials than their respective fall or summer terms, we find a relative balance in the proportion of credentials earned across terms. This makes sense given the diverse array of certificates and certifications offered at Ivy Tech.

Table VIII.3. *Credentials Earned by TAACCCT Students, by Award Date and Credential Type*

Term	Associates Degrees	Certificates	Technical Certificates	Single Courses	Total
Spring 2014	48	112	66	0	226 (6%)
Summer 2014	22	44	40	4	110 (3%)
Fall 2014	196	63	97	93	449 (13%)
Spring 2015	299	71	140	131	641 (18%)
Summer 2015	98	34	49	82	263 (8%)
Fall 2015	181	58	109	42	390 (11%)
Spring 2016	307	116	131	37	591 (17%)
Summer 2016	110	34	69	34	247 (7%)
Fall 2016	173	99	275	19	566 (16%)
Total	1,434	631	976	442	3,483

Source: Ivy Tech administrative records data

First-Time CPIN Enrollees

To assess students' progress through IT programs, we selected a group of TAACCCT program participants who were first-time Ivy Tech students in either Fall 2014 or Fall 2015 and who indicated that they were pursuing IT degrees. As such, this analysis is limited relative to the range of potential options for students entering Ivy Tech with an interest in computing programs. Our choice was made with the intention of assessing students who share at least their starting and ending goals.

The majority of our analysis is broad and descriptive. We measure students' progress through their programs in a number of ways that qualitative analysis has suggested are critical to retention through and completion of IT-degree programs. To avoid problems of low sample size within particular IT programs, we adopt broad definitions of IT-program progress—e.g., completing a 'level-1 milestone' course or a 'required math' course—to allow students pursuing any particular IT credential to be counted as making progress relative to their stated goal(s). Table VIII.4 below provides specific definitions of our milestone outcomes.

Table VIII.4. *Definitions of Dichotomous Outcomes*

Outcome	Definition
Level-1 Milestone	Completion of one or more of the following courses: ITSP 135, INFM 109, DBMS 110, SDEV 120, NETI 100, NETI 105
Level-2 Milestone	Completion of one or more of the following courses: INFM 209, INFM 219, CSIA 105, CSIA 106, SVAD 111, SVAD 112, NETI 120, NETI 205, DBMS 210, DBMS 230, DBMS 240, DBMS 250, DBMS 255, ITSP 136, ITSP 135, CSCI 101, CSCI 102, CSCI 105, SDEV 140
IT-Required Math	Completion of one or more of the following courses: MATH 123, MATH 135, MATH 136, MATH 137, MATH 211, MATH 212
Continuous Enrollment	Credit-earning in both the Fall and Spring terms of a student's first year.

Source: Ivy Tech program documents, interviews with college staff

The following analysis examines credit accumulation in general, IT-credit-earning in particular, completion of IT milestones and required mathematics courses, and continuous enrollment. We selected two points in time—two and five terms after students' initial enrollment—to assess their progress.

Between 2014 and 2015, the number of distance education students increased while computer science majors decreased. Table VIII.5 describes first-time, IT-degree-seeking students' characteristics by cohort year. The two cohorts are generally similar in terms of composition by gender, ethnicity, and age; as well as socioeconomic, veteran, and disability statuses. The first notable difference concerns distance education; nearly half of the Fall 2015 cohort indicated pursuing their degree via distance education, up from one third among the Fall 2014 cohort. The other notable change is the composition of IT students by subfield; while one third of the Fall 2014 cohort were pursuing computer science credentials, that figure dropped to 25 percent among the Fall 2015 cohort. Larger proportions of Fall 2015 students opted to pursue credentials in cybersecurity, informatics, and software development.

Table VIII.5. *Demographic Description of Cohorts: First-Time, Degree-Seeking Students in IT Programs*

	Fall 2014 Cohort 1	Fall 2015 Cohort 2	Combined
Gender			
% Male	83.8	80.0	82.0
% Female	15.8	18.4	17.0
% Not Reported	0.4	1.6	1.0
Age			
Mean	25.1	24.3	24.7
Race/Ethnicity			
White/Asian	72.1	72.4	72.2
Black/Hispanic/Native American	25.7	21.8	23.9
Other/Unknown	2.2	5.8	3.9
Socioeconomic Status			
% Pell Recipient	65.5	60.8	63.2
Other Characteristics			
% Veteran	8.1	7.5	7.8
% Disabled	2.6	3.4	3.0
% Distance Education	33.4	49.9	41.3
IT Program of Study at Entry			
Computer Science	33.5	25.0	29.4
Cyber Security/Info Assurance	10.8	16.4	13.5
Database Management	3.6	4.1	3.8
Informatics	4.2	5.9	5.0
IT Support	17.2	17.5	17.3
Network Infrastructure	4.6	4.2	4.4
Server Administration	4.6	3.6	4.1
Software Development	21.4	23.4	22.4
N	692	641	1,333

Source: Ivy Tech administrative records data

Students show steady (but qualified) progress after two terms. Table VIII.6 assesses IT students' progress two terms after their initial enrollment. About two-thirds of these first-time students were continuously enrolled in the Fall and Spring terms of their first year. Across these two terms, IT students earned an average of 17 credits. On average, students in the second (Fall 2015) cohort earned more of their credits in IT courses than their Cohort 1 (Fall 2014) counterparts did; after two terms, Cohort 2 students had earned about five IT credits versus the four IT credits earned by Cohort 1. Similarly, a higher proportion—about half—of Fall 2015 cohort members had completed a Level-1 IT Milestone course, whereas only about 44 percent of Fall 2014 cohort members had done so. Predictably, since Level-2 Milestone courses are more advanced, only a small proportion—about 7 percent—of IT students in either cohort had completed any of those courses. This low completion rate could be explained by the fact that only 17–18 percent of each cohort had completed any of the required math courses that serve as prerequisites for the more advanced IT courses.

Table VIII.6. ***TAACCCT Pathways: Outcomes After Two Terms***

Outcome	Fall 2014 Cohort 1	Fall 2015 Cohort 2	Combined
Continuous Outcomes—Means Reported			
Total Credits Earned	17.3	17.2	17.2
IT Credits Earned	4.1	4.9	4.5
Dichotomous Outcomes—Proportions Reported			
% Any Level-1 Milestone	43.6	49.8	46.6
% Any Level-2 Milestone	6.9	7.0	7.0
% Any IT-Required Math	17.3	18.3	17.8
% Continuous Enrollment	67.5	64.3	65.9
N	692	641	1,333

Source: Ivy Tech administrative records data

After five terms, however, student progress had slowed considerably if not stopped altogether. Table VIII.7 extends the time frame for outcomes to five terms after initial enrollment. Here, we see that many students either temporarily stopped taking courses or left school entirely after only a few terms; the average first-time IT student attended only about two and a half of their first five terms. Students earned an average of only seven additional credits over the three terms immediately following their first academic year, about three of which were in IT courses. While the proportion of students completing a Level-1 Milestone course rose by only about five percentage points, the proportion completing a Level-2 Milestone course rose significantly to over 15 percent, as did the proportion completing a required math course. These two findings suggest that those who do persist are making progress toward degrees. Nonetheless, relative to the ultimate goal of an Associate degree (or about 60 credits), average student progress seems to taper off after the first year.

Table VIII.7. *TAACCCT Pathways: Outcomes After Five Terms*

Outcome	Fall 2014 Cohort 1	Fall 2015 Cohort 2	Combined
Continuous Outcomes—Means Reported			
Total Credits Earned	24.4	25.2	24.8
IT Credits Earned	6.8	8.3	7.5
# of Terms Enrolled	2.5	2.6	2.6
Dichotomous Outcomes—Proportions Reported			
% Any Level-1 Milestone	48.6	54.8	51.6
% Any Level-2 Milestone	13.5	17.2	15.3
% Any IT-Required Math	25.0	26.6	25.8
N	692	641	1,333

Source: Ivy Tech administrative records data

Distance education may slightly hinder student progress. Our finding that students' progress tapers off after the first year prompted additional investigation. One hypothesis was that students pursuing degrees via distance education (DE) might be more likely to leave sooner. This does not appear to be the case, as traditional and DE students enroll in the same average number of terms. As shown in Table VIII.8, however, we do observe that students classified as pursuing credentials in a traditional format, on average, earned both more credits and more IT credits, and made more progress in terms of milestone completion and required math completion, relative to DE students.

Table VIII.8. *TAACCCT Pathways: Outcomes after Five Terms, Traditional Classroom Instruction vs. Distance Education*

Outcome	Traditional	Distance Education	Combined
Continuous Outcomes—Means Reported			
Total Credits Earned	25.4	23.8	24.8
IT Credits Earned	8.3	6.5	7.5
# of Terms Enrolled	2.6	2.5	2.6
Dichotomous Outcomes—Proportions Reported			
% Any Level-1 Milestone	54.2	47.9	51.6
% Any Level-2 Milestone	17.3	12.5	15.3
% Any IT-Required Math	27.2	23.7	25.8
N	782	551	1,333

Source: Ivy Tech administrative records data

Faculty members across Ivy Tech have raised concerns about the above-mentioned attrition among students. In interviews and focus groups over the first two years of the grant, faculty members told EERC staff that students disengage from programs for various reasons. Many students do not understand the workload required to succeed in IT programs, including the difficulty of their math requirements. Several faculty members said students enroll without truly understanding how much work will be required of them to graduate. Some faculty also think many students are simply unprepared for any college-level work. Others felt some students wanted to be there, and thus were more engaged, compared with students who were there simply because their parents wanted them to be, or because it's "what you do" after high school. Many also mentioned that some students have chosen an IT path because they believe it will lead to a lucrative career, without realizing how difficult the curriculum can be. Finally, some faculty members noted that students who already work in IT are often more "interested and motivated" than students who do not.

A few faculty members also commented on distance education students, saying that students often thought online courses would be easier than traditional classroom courses, only to be disappointed later. In fact, online courses are often more difficult, faculty members said, because the hands-on portion of the classroom instruction does not exist, and students have a harder time working through the material if they cannot see—or touch—industry-standard equipment. These faculty members felt students were in many cases more apt to drop the online versions of the class than they would be if they had taken the in-class version. Our hands-on learning analysis in Section III supports this last faculty observation.

Differences in progress among IT subfields are complicated. Based on conversations with grant staff, we also investigated differences in student progress by subfield, hypothesizing that students in more specific IT programs—software development (SDEV) and IT support (ITSP)—would make more substantial progress toward their degrees than students in Computer Science (CSCI) would make. Table VIII.9 reports on these subfield differences. We find some support for this idea. While students in all three programs earned similar numbers of credits by the end of five terms, those in SDEV and ITSP earned a greater share of their credits in IT courses. This finding could be driven by the fact that computer science courses have much more rigid mathematics prerequisites. It should come as no surprise, then, that the highest proportion of students who had fulfilled at least one IT-required math course were CSCI majors. At the same time, students in SDEV and ITSP made greater progress in their milestone courses. This finding should be interpreted with caution, however, since the lists of milestone courses have different implications for different programs. Very few Level-2 Milestone courses are part of the SDEV sequence, while both introductory CSCI courses are counted as Level-2 Milestones. In sum, by-program findings suggest students in more targeted IT programs may make better progress than those in the more general, transfer-oriented computer science program.

Table VIII.9. *TAACCCT Pathways: Outcomes after Five Terms, Degree-Seeking Students, Computer Science, Software Development, and IT Support Programs*

Outcome	Computer Science/ CSCI	Software Development/ SDEV	IT Support/ ITSP	All CPIN Students
Continuous Outcomes—Means Reported				
Total Credits Earned	25.7	25.7	22.5	24.8
IT Credits Earned	5.4	7.9	8.0	7.5
# of Terms Enrolled	2.7	2.6	2.4	2.6
Dichotomous Outcomes—Proportions Reported				
% Any Level-1 Milestone	38.0	54.7	55.4	51.6
% Any Level-2 Milestone	11.7	2.7	22.9	15.3
% Any IT-Required Math	29.3	24.2	24.7	25.8
N	392	298	231	1,333

Source: Ivy Tech administrative records data

Student enrollment patterns suggest tenuous attachment. Finally, we investigated students' term-by-term enrollment over a period of five consecutive terms; our results are reported in Table VIII.10. We observe that much of the stalled progress happens within the first year. One-quarter of first-time IT students were only observed in the first of the five terms we analyzed. Another quarter (24 percent) were only present in the first two terms. Only about 30 percent of students were present in terms four or five. This suggests that much of the tapering of average credit accumulation is a result of stop-out rather than decreased course-taking intensity. A different interpretation of these findings is that students might not be accurately classified in terms of degree intentions; in the overall analysis of student credential-earning (see Table VIII.2), we observed that a majority of the credentials awarded to Ivy Tech's TAACCCT students were short-term certificates and certifications.

Table VIII.10. *Credit-Earning Semesters Among First-Time IT-Degree Students (N=1,333)*

Proportion of first-time IT-degree students starting in the Fall term who earned credits in:	
The first Fall term only	25.3%
The first Fall and first Spring terms only	23.5%
The first Fall, first Spring plus one additional term	11.9%
Any three or more terms	44.6%
Four or five consecutive terms	30.6%

*Some overlapping categories; not intended to add up to 100%
Source: Ivy Tech administrative records data

VIII. RECOMMENDATIONS

Based on these findings, we offer several recommendations for the final grant period and beyond. As the grant winds down, it is essential the college consider ways to make its efforts sustainable beyond the grant funding.

- **Consider ways to expand hands-on learning to a broader group of faculty.** Lessons from faculty who have increased their use of hands-on learning would be useful to share across the state. These efforts would help promote more meaningful learning experiences among students.
- **Plan for ongoing upkeep and maintenance of supplies, as well as for future upgrades.** Given the positive effects of grant-purchased supplies on student engagement, it is important for schools to continue to search for ways to keep up-to-date equipment in the classroom and promote active hands-on learning strategies.
- **Promote more faculty involvement in trainings for industry certifications.** Some faculty members had reservations about trainings; they might feel more comfortable after learning about other faculty members' positive experiences with these trainings.
- **Continue to develop the faculty champion role to expand and maintain efforts to promote industry certifications.** Faculty champions have a potentially important role in maintaining relationships with vendors to better utilize their training resources and in keeping a focus on the certifications that are available within their programs.
- **Increase efforts to share and promote the use of the advising tools among faculty, advisors, and students.** The tools developed through the grant have the potential to help inform students. Since these tools have not been widely shared yet, more efforts to promote their use are essential.
- **Identify and change/eliminate any courses that are impeding student progress and may be unrelated to their career goals.** IT programs necessarily involve course sequences that go from more general introductory material to specific applications. But certain prerequisites, particularly in mathematics, may be keeping students from moving on to their advanced coursework. This does not necessarily mean eliminating math requirements altogether, but math course content may need to be evaluated for the extent to which it relates to students' intended programs of study.
- **Continue to promote faculty and student involvement with industry.** Efforts to broadly increase engagement with industry have led to increased faculty contact with employers; these contacts took many forms, including the offering of internships. These efforts should be supported and maintained beyond the grant period.

APPENDIX A: SURVEY RESPONSES

Table A.1: *Summary of Survey Responses, Year 1*

	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 A.2: *Summary of Survey Responses, Year 2*

	CPIN Student Survey	Hands-on Learning Student Survey	Faculty Survey
Sample/Audience Size	25,026	5,530	190
Final response rate	4%	6%	55%
Final analysis N (excluding those who refused to participate, duplicates, and incomplete responses)**	N=1,014	N=331	N=87
Date of initial launch	11/29/16	1/31/17	11/29/16
Note: The Round 2 CPIN Student Survey was originally sent out in two parts—the first was the general survey sent out to a student sample, and the second was the HOL survey sent afterwards to a smaller subsample of the general survey. A second reminder to take the general survey was sent to the noncompleters. There was also a second round of surveys fielded, which combined the general survey and HOL survey, and was sent out as one survey to an additional sample of students. For much of our analysis, we combined all of the valuable data from each fielded survey (excluding missing or incomplete responses) for a total, final-analysis N of 1,014. The faculty survey was sent out once to a sample of faculty. **Students and faculty were able to skip question categories and any question they did not want to answer; therefore respondent sizes differ across individual questions in the surveys.			

APPENDIX B: SUPPLEMENTAL HANDS-ON LEARNING TABLES

Table B.1. *Hands-On Learning Aspects of Ivy Tech CPIN Courses Drawn from Course Syllabi*

	Course Description	Course Objectives	Course Content
NETI 100: Network Communications	"basic components of a communications system . . . the functions of network systems"	"Identify media and methods of data transmission" "Discuss network topologies and hardware" "Describe network operating systems"	"Signaling and switching" "Physical transmission media" "Local area network basics" "Network transmission methods"
NETI 105: Network Fundamentals	"Covers the fundamentals of networking" "Various network devices . . . types of media used to carry data across the network"	"Identify various network hardware and their basic functions" "Identify media and methods of data transmission, including Ethernet standards for both copper and fiber implementation" "Build/configure a simple wired/wireless LAN and VLAN"	"Maintaining and upgrading" "Network cabling" "Network hardware" "Physical and logical topologies" "Routing" "Transmissions basics and networking media"
ITSP 135: Hardware/ Software Support	"Delivers necessary competencies with hands-on experience in a lab for an entry-level Information Technology professional" "assemble components based on customer requirements, install, configure, and maintain devices/software for end users" "diagnose, resolve, and document common hardware and software issues"	"Differentiate between motherboard components and various CPU types" "Identify various connection interfaces, connector types, associated cables" "Compare, properly install, and configure various peripheral devices, expansion cards, storage devices, and memory" "Compare and contrast various types of networks, network devices . . .	"System assembly" "Device installation and maintenance" "Operating systems" "Networking basics"
SDEV 120: Computing Logic	"Introduces the student to algorithms, logic development, and flowcharting as tools used to document computer logic" "Concepts will be demonstrated using basic scripting and	"Identify the standard documentation tools of displaying algorithms . . ." "Apply basic logical structures, file handling, matrices, and arrays to program algorithms" "Develop algorithms using tools such as data flow diagrams, flowcharts…"	"Algorithms and algorithm development" "Basic programming control structures" "Flowcharting and pseudocode" "Scripting"

	simple programming code"	"Identify the uses of various programming and scripting languages in computer systems" "Develop a simple program and/or script"	

Table B.2. *Regression Outcomes for NETI 100, All Sections*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'4
Enhanced HOL	.048	1.420*	.677*	1.031
	(.078)	(.212)	.113	(.147)
Spring Semester (ref. Fall)	-.208**	.849	1.058	.570***
	(.073)	(.115)	(.160)	(.075)
Instruction Method (ref. Traditional)				
Hybrid	-.839***	.441	.702	.755
	(.226)	(.188)	(.448)	(.330)
Online Only	.221**	.630**	1.442*	.742*
	(.081)	(.097)	(.247)	(.110)
Gender (ref. Male)				
Female	.283**	1.321	.958	1.334
	(.089)	(.229)	(.180)	(.220)
Unknown	.074	1.496	.766	2.077
	(.362)	(1.042)	(.613)	(1.652)
Ethnicity (ref. White)				
Black	-.190	.478**	1.761*	.633*
	(.131)	(.108)	(.427)	(.137)
Hispanic	.265	.760	1.426	1.824
	(.218)	(.284)	(.578)	(.795)
Asian/Pacific Islander	-.143	.874	.602	1.549
	(.272)	(.486)	(.463)	(.902)
Multiracial/Other	.055	.778	1.526	1.350
	(.187)	(.260)	(.542)	(.459)
Unknown/Not Reported	-.001	.778	1.164	1.371
	(.107)	(.155)	(.266)	(.274)
Student Age	.032***	1.053***	.964***	.993
	(.004)	(.009)	(.009)	(.007)
Pell Recipient	-.143	.702*	1.531**	.974
	(.074)	(.100)	(.247)	(.133)
Model N	883	1,121	1,121	1,121
Model R^2	.113	.049	.033	.027

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0,

D=1, C=2, B=3, and A=4.
[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.
[3] Logistic regression model used; odds ratios reported.
[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data

Table B.3. *Regression Outcomes for NETI 100, Traditional and Hybrid Sections Only*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.045	1.187	.801	.854
	(.133)	(.309)	(.239)	(.215)
Spring Semester (ref. Fall)	-.206	1.082	.806	.679
	(.123)	(.259)	(.225)	(.157)
Instruction Method (ref. Traditional)				
Hybrid	-.848***	.477	.654	.913
	(.235)	(.211)	(.429)	(.412)
Gender (ref. Male)				
Female	.515**	1.649	.865	1.319
	(.163)	(.566)	(.323)	(.421)
Unknown	.391	1	1	1
	(.486)	(empty)	(empty)	(empty)
Ethnicity (ref. White)				
Black	-.169	.895	.952	.585
	(.180)	(.305)	(.372)	(.188)
Hispanic	.590	.664	2.594	1.180
	(.350)	(.364)	(1.450)	(.714)
Asian/Pacific Islander	-.074	1.149	.406	1.265
	(.320)	(.801)	(.432)	(.865)
Multiracial/Other	.116	1.608	.753	.928
	(.256)	(.943)	(.495)	(.453)
Unknown/Not Reported	.057	.920	1.055	1.163
	(.191)	(.347)	(.483)	(.436)
Student Age	.027***	1.034*	.980	.995
	(.007)	(.017)	(.018)	(.013)
Pell Recipient	-.118	.669	1.643	1.103
	(.125)	(.164)	(.471)	(.263)
Model N	319	385	385	385
Model R^2	.155	.033	.024	0.017

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale (e.g., F=0, D=1, C=2, B=3, A=4).

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.
[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data

Table B.4. *Regression Outcomes for NETI 105, All Sections*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.095	1.110	.911	.968
	(.085)	(.113)	(.094)	(.099)
Spring Semester (ref. Fall)	-.129	.950	.991	.697***
	(.080)	(.090)	(.095)	(.066)
Instruction Method (ref. Traditional)				
Hybrid	-.419***	.810	.818	.977
	(.094)	(.091)	(.101)	(.117)
Online Only	-.406***	.425***	2.034***	.780*
	(.098)	(.048)	(.229)	(.088)
Gender (ref. Male)				
Female	.172	1.047	1.003	1.182
	(.110)	(.137)	(.131)	(.157)
Unknown	-.430	.458	1.650	1.042
	(.395)	(.214)	(.699)	(.450)
Ethnicity (ref. White)				
Black	-.776***	.437***	1.546**	.672*
	(.153)	(.080)	(.259)	(.112)
Hispanic	-.195	.641	1.334	.956
	(.234)	(.176)	(.353)	(.253)
Asian/Pacific Islander	-.167	1.399	.393*	1.395
	(.275)	(.522)	(.182)	(.561)
Multiracial/Other	-.229	.732	1.209	1.075
	(.224)	(.192)	(.313)	(.285)
Unknown/Not Reported	.112	1.039	.975	.977
	(.119)	(.150)	(.144)	(.142)
Student Age	.027***	1.020***	.993	1.007
	(.004)	(.005)	(.005)	(.005)
Pell Recipient	-.320***	.742**	1.121	1.140
	(.080)	(.071)	(.109)	(.110)
Model N	1,211	2,003	2,003	2,003
Model R^2	.092	.040	.035	0.013

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.

[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).

Source: Ivy Tech administrative records data

Table B.5. *Regression Outcomes for NETI 105, Traditional and Hybrid Sections Only*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.121	1.214	.803	.965
	(.101)	(.154)	(.108)	(.126)
Spring Semester (ref. Fall)	-.125	.961	1.018	.668**
	(.098)	(.115)	(.128)	(.082)
Instruction Method (ref. Traditional)				
Hybrid	-.408***	.824	.807	.987
	(.094)	(.096)	(.100)	(.119)
Gender (ref. Male)				
Female	.190	1.149	.950	1.301
	(.134)	(.194)	(.170)	(.233)
Unknown	-.734	.363	1.475	1.873
	(.431)	(.199)	(.744)	(1.091)
Ethnicity (ref. White)				
Black	-.611**	.538**	1.354	.838
	(.179)	(.118)	(.295)	(.184)
Hispanic	-.120	.504*	1.872	.849
	(.294)	(.172)	(.609)	(.279)
Asian/Pacific Islander	-.180	1.534	.196*	1.581
	(.300)	(.673)	(.146)	(.764)
Multiracial/Other	-.104	.812	1.341	1.055
	(.270)	(.259)	(.439)	(.357)
Unknown/Not Reported	.169	1.075	.979	.981
	(.141)	(.192)	(.189)	(.180)
Student Age	.027***	1.021***	.993	1.006
	(.005)	(.006)	(.006)	(.006)
Pell Recipient	-.369***	.679	1.107	1.182
	(.095)	(.080)	(.139)	(.144)
Model N	847	1,251	1,251	1,251
Model R^2	.085	.021	.014	0.013

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.
[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data

Table B.6. *Regression Outcomes for ITSP 135, All Sections*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	-.077	1.191*	.645***	.860
	(.059)	(.107)	(.069)	(.076)
Spring Semester (ref. Fall)	.069	1.015	1.035	.571***
	(.055)	(.086)	(.103)	(.047)
Instruction Method (ref. Traditional)				
Hybrid	.048	1.134	.745*	2.078***
	(.070)	(.127)	(.102)	(.226)
Online Only	-.209**	.628***	1.460**	1.131
	(.072)	(.068)	(.184)	(.118)
Gender (ref. Male)				
Female	.076	1.077	1.011	1.205
	(.074)	(.123)	(.134)	(.137)
Unknown	.045	.285***	4.730***	.943
	(.294)	(.095)	(1.547)	(.309)
Ethnicity (ref. White)				
Black	-.137	.578***	2.152***	.542***
	(.110)	(.090)	(.371)	(.084)
Hispanic	.046	.762	1.572	.917
	(.166)	(.181)	(.422)	(.225)
Asian/Pacific Islander	.115	.823	1.325	1.506
	(.213)	(.267)	(.507)	(.524)
Multiracial/Other	.124	.974	1.124	1.014
	(.139)	(.213)	(.293)	(.221)
Unknown/Not Reported	.004	.877	1.336*	.711**
	(.077)	(.104)	(.190)	(.081)
Student Age	.023***	1.025***	.989*	1.010*
	(.003)	(.005)	(.005)	(.004)
Pell Recipient	-.120*	.833*	1.191	1.312**
	(.056)	(.073)	(.124)	(.111)
Model N	2,247	2,784	2,784	2,784
Model R^2	.032	.027	.035	0.053

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.

[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).

Source: Ivy Tech administrative records data

Table B.7. *Regression Outcomes for ITSP 135, Traditional and Hybrid Sections Only*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.009	1.448**	.537***	.860
	(.072)	(.170)	(.078)	(.099)
Spring Semester (ref. Fall)	.160*	.955	1.299	.547***
	(.067)	(.106)	(.176)	(.059)
Instruction Method (ref. Traditional)				
Hybrid	.055	1.153	.732*	2.015***
	(.069)	(.132)	(.103)	(.225)
Gender (ref. Male)				
Female	.234*	1.498*	.851	1.351
	(.095)	(.256)	(.170)	(.221)
Unknown	-.003	.246***	5.190***	1.131
	(.335)	(.095)	(2.113)	(.433)
Ethnicity (ref. White)				
Black	-.119	.694	1.697*	.555**
	(.123)	(.135)	(.382)	(.107)
Hispanic	-.181	.622	1.640	.912
	(.201)	(.187)	(.585)	(.293)
Asian/Pacific Islander	.086	.953	.955	1.968
	(.240)	(.401)	(.523)	(.924)
Multiracial/Other	.135	.971	1.179	.878
	(.160)	(.261)	(.379)	(.231)
Unknown/Not Reported	-.038	.877	1.307	.571***
	(.092)	(.135)	(.249)	(.082)
Student Age	.021***	1.017*	0.998	1.013*
	(.004)	(.006)	(.007)	(.006)
Pell Recipient	-.089	.776*	1.394*	1.279*
	(.067)	(.088)	(.195)	(.140)
Model N	1,477	1,771	1,771	1,771
Model R^2	.038	.023	.037	0.079

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.
[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data

Table B.8. *Regression Outcomes for SDEV 120, All Sections*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.096	2.172***	.396***	1.553***
	(.052)	(.177)	(.036)	(.127)
Spring Semester (ref. Fall)	.179***	.834*	1.535***	.381***
	(.048)	(.062)	(.122)	(.028)
Instruction Method (ref. Traditional)				
Online Only	-.147***	.707***	1.394***	.962
	(.053)	(.058)	(.123)	(.079)
Gender (ref. Male)				
Female	.221***	1.139	.881	.940
	(.062)	(.113)	(.094)	(.092)
Unknown	.004	.144***	7.997***	.198***
	(.234)	(.036)	(1.900)	(.057)
Ethnicity (ref. White)				
Black	-.470***	.553***	1.503**	.611**
	(.093)	(.076)	(.214)	(.084)
Hispanic	-.239	.776	1.009	.976
	(.131)	(.147)	(.204)	(.190)
Asian/Pacific Islander	.106	3.095**	.206**	1.337
	(.167)	(1.162)	(.109)	(.406)
Multiracial/Other	-.031	.665*	1.720**	.554**
	(.125)	(.110)	(.288)	(.097)
Unknown/Not Reported	.070	1.133	.921	.712***
	(.067)	(.121)	(.109)	(.074)
Student Age	.026***	1.056***	.960***	1.040***
	(.003)	(.005)	(.005)	(.005)
Pell Recipient	-.347***	.712***	1.049	1.610***
	(.050)	(.056)	(.088)	(.123)
Model N	2,463	3,603	3,603	3,603
Model R^2	0.073	0.093	0.106	0.119

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.

[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data

Table B.9. *Regression Outcomes for SDEV 120, Traditional and Hybrid Sections Only*

	Course Grade (no withdrawals)[1]	Passed Course (C or better)[2]	Course Withdrawal[3]	Retention Following 'Treatment'[4]
Enhanced HOL	.116	2.986***	.259***	1.569***
	(.066)	(.314)	(.032)	(.164)
Spring Semester (vs. Fall)	.203**	.702***	2.033***	.283***
	(.060)	(.067)	(.212)	(.027)
Instruction Method (ref. Traditional)				
Traditional Classroom	0	1	1	1
	(omitted)	(omitted)	(omitted)	(omitted)
Gender (ref. Male)				
Female	.314***	1.409*	.735*	1.005
	(.079)	(.189)	(.109)	(.132)
Unknown	.300	.116***	11.878***	.181***
	(.294)	(.034)	(3.451)	(.061)
Ethnicity (ref. White)				
Black	-.398***	.675*	1.187	.697*
	(.113)	(.119)	(.228)	(.126)
Hispanic	-.262	.815	.873	1.097
	(.157)	(.186)	(.215)	(.257)
Asian/Pacific Islander	.192	3.035*	.206*	.886
	(.192)	(1.305)	(.126)	(.303)
Multiracial/Other	-.082	.578**	1.927**	.485**
	(.163)	(.119)	(.402)	(.111)
Unknown/Not Reported	.061	1.548**	.594**	.734*
	(.081)	(.216)	(.096)	(.097)
Student Age	.021***	1.067***	.946***	1.060***
	(.003)	(.008)	(.007)	(.007)
Pell Recipient	-.385***	.698***	.980	1.743***
	(.063)	(.071)	(.110)	(.175)
Model N	1,660	2,451	2,451	2,451
Model R^2	0.049	0.146	0.193	0.179

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

[1] Incompletes and Withdrawals are excluded from this OLS model. Course grades are measured on a 4-point scale on which F=0, D=1, C=2, B=3, and A=4.

[2] Logistic regression model used; odds ratios reported. Passing is defined as earning a grade of C or better.

[3] Logistic regression model used; odds ratios reported.
[4] Logistic regression model used; odds ratios reported. Retention is defined relative to the semester in which the course was taken (e.g., for a student who took NETI 105 in Fall 2015, retention in Spring 2016 was assessed).
Source: Ivy Tech administrative records data