ASSESSING INFORMATION TECHNOLOGY EDUCATIONAL PATHWAYS THAT PROMOTE DEPLOYMENT AND USE OF RURAL BROADBAND

Preliminary Report of Classroom Observations

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Charles R. McClure, PhD
Director and Francis Eppes Professor

Marcia A. Mardis, PhD
Associate Professor, iSchool @ Florida State University

Laura I. Spears
Research Coordinator

Nicole Alemanne
Post-Doctoral Research Associate

Liz Liebman
Research Associate

Jisue Lee
Research Associate

Introduction

A growing body of research demonstrates that using participatory instructional approaches such as active (introducing student activity into the traditional lecture and promoting students engagement), collaborative (conducting collaborative activities rather than individual work), cooperative (guiding students to cooperative activities than competition) learning allows undergraduate students to learn more effectively from courses (Prince, 2014; Knight & Wood, 2005). Particularly when teaching science, technology, engineering, and mathematics (STEM), the importance of using participatory instructional approaches for students to increasingly engage with instructors, peers, and course materials in class is critical in students achieving increased learning gains and performances regarding solving problems and group learning, as well as better conceptual understanding (Knight & Wood, 2005; Allen & Tanner, 2005). However, little research has been conducted to identify the characteristics of STEM (science, technology, engineering, mathematics) teaching practices and how content is delivered in the classroom setting.

The goals of the National Science Foundation Advanced Technological Education (NSF ATE) study are to strengthen the employee pool of information technology (IT)/broadband staffing (including general IT, broadband and network technicians) and to improve educational support related to broadband, telecommunications, and networks for future and current IT employees in non-metropolitan (non-metro) Northwest Florida and to understand how to transfer this competency to other similar non-metro markets. In order to ascertain learning outcomes presented in the IT classroom and understand student and instructor behavior, the Information Institute conducted classroom observations at Chipola College and Tallahassee Community College.

Classroom Observation Literature

In general, classroom observations are a common method for identifying and evaluating teaching practices (Casabianca, et al., 2013; Connor, et al., 2009; Pianta & Hamre, 2009; Praetorius, Lenske, & Helmke, 2012; Wieman & Gilbert, 2014). Most often, classroom observations are used as a way to improve teaching practices by providing feedback to the instructor (Casabianca et al., 2013; Dancy et al., 2014; Grimm, Kaufman, & Doty, 2014; Henry, Murrary, & Phillips, 2007; Pianta & Hamre, 2009; Praetorius, Lenske, & Helmke, 2012; Smith et al., 2014; Wieman & Gilbert, 2014). In other instances, observations are used to predict student outcomes by comparing observation findings to test scores (Connor et al., 2009; Connor, 2013) or to describe how technology is being integrated into classrooms (Hora & Holden, 2013). Most observation protocols are general since they are meant to be applied to any type of classroom.

STEM Classroom Observations

In order to determine how much interactive teaching took place in STEM classrooms on two college campuses, Smith et al. (2013) revised previous observation protocols to create an instrument to “characterize the general state of STEM classroom teaching” (p. 618) as well as give feedback to instructors and identify professional development needs for faculty. This instrument, the Classroom Observation Protocol for Undergraduate STEM (COPUS), describes student and instructor actions in STEM classrooms nonjudgmentally. With the protocol, observers mark down student and instructor actions off a check sheet in two minute intervals.

Purpose

The purpose of classroom observations for this study is to examine IT classroom content delivery of course materials to students to obtain expected learning outcomes. Four questions guided the classroom observations:

> RQ1: How do the IT/broadband skill graduates gain through two-year community college compare to the skill sets new professionals identify they need after they are hired as IT employees in non-metro/metropolitan areas?,
>
>> RQ1.1: What is the instructor's perception of current teaching practices in IT courses?
>
> RQ2: How can two-year community college IT/broadband program curricula are modified to best meet the specific needs of employers and IT/broadband employees in non-metro/metropolitan areas?, and
>
>> RQ2.1: What is the nature of teaching practices used in IT courses?

The classroom observations will help address these research questions by providing more insight into the skills IT students are being taught at two and four-year colleges as well as IT instructors' perceptions of IT teaching practices and curricula.

Method

After reviewing the literature, the research team chose to adapt Smith et al. (2013)'s COPUS as the instrument for the classroom observations. COPUS requires less than two hours of training for observers and has high inter-rater reliability. The advantages of this protocol include that 1) observers can document classroom behaviors in 2-minute intervals throughout the duration of the class sessions which provides granularity and ability to easily verify observations; 2) observers keep track of classroom behaviors in two categories of instructors' and students' behaviors, instead of judging the overall teaching quality to reduce participant resistance; 3) observers can easily be trained with just 1.5 hours of practice and follow-up; and 4) this protocol has been reliably used by observers who range from STEM faculty members without a background in science education research to K-12 STEM teachers to document instruction in undergraduate STEM classrooms (Smith et al., 2013).

The mode for classroom observation is non-participatory which places researchers as outsiders of the group under study to silently watch and take notes through the chosen sample courses. The team completed training sessions with Co-PI's Dr. James Froh and Dean Kate Stewart. The Co-PI's revised the codebook in order to more closely meet the project's needs. Codes referring to clicker activities were removed as that technology was not used at Chipola and TCC in the IT classrooms. In order to make the observation protocol more pertinent to the study, the research team added codes that were relevant to specific IT competencies based on findings from the job posting analysis which come from the Office of Personnel Management's Competencies Model for IT Program Management. The IT competency codes allow for the team to observe how the classroom activities reflect IT and general competencies that were found to be important based on IT job postings.

Classroom Environment

Six male students attended the TCC course (the instructor noted afterward that two students were absent). The instructor stood at the front of the classroom and moved around in that area. The students were spread out across two modular workstations that had multiple computers. At the beginning of the class, the instructor played a YouTube video that was projected at the front of the classroom. After the video, the instructor projected slides, which he referenced as he lectured. At one point, he drew a model on the whiteboard. During the lecture, he would frequently ask the students questions, so it became more of a discussion. Students would answer the questions as well as chime in with comments. One student monopolized most of the discussion, although a few others did participate. The main topic of the lecture was security for radio-frequency identification (RFID), cable fiber, Internet, and firewalls. The instructor approached these topics from a company level rather than a personal one so that the students could view these topics from a career point of view. Twice during the lecture, the instructor asked the students to "Google" a topic and share what they found.

Five male students attended the Chipola class and were seated at the same type of modular workstations as used at TCC. This made observations a bit more difficult as often, one could see that the students were using their computers but it was unclear on what the activity was focused. The instructor moderated a discussion for the entire class from the front of the room. Three students on the right side of the room participated at only one juncture; the students on the left side participated frequently, posting questions, responding to the instructor's comments and questions and also responding frequently to the interactive website posted on the screen behind the instructor. This website live-monitors global cyber-attacks and the instructor used this to justify his focus on the security issues on the agenda for that day. The instructor suggested that the class was a bit more subdued than usual but he thought that once they became accustomed to the observers, they participated as usual. The instructor stated that the agenda, which was focused on the security domains and current topics featuring cybersecurity, is based on the textbook assigned reading for each week. The instructor stated that he prefers an interactive class discussion but he does lecture when he feels certain topics merit emphasis or if he perceives that the students are confused about the topic.

Data Collection

Two classroom observations were conducted for this project: one each at Chipola College (Chipola) and at Tallahassee Community College (TCC). The courses observed included Chipola's Advanced Network Security (CTS 2127) and Introduction to Network Security (CNT 2401) at TCC; the full class time was observed on both occasions. A systematic process was employed for these sessions and two types of observations were conducted: observations of student and instructor activities, and observations of evidence of important technology employee competencies on the parts of the students and the instructor.

Activity and behavior was documented using a measurement instrument adapted from Smith et al. (2013). In the instrument, running course time was delineated in 2-minute block columns (e.g., 0-2, 2-4), with blocks running from minute 0 through minute 80. The codes were divided broken into two categories: “What the Student is Doing” (student) and “What the Instructor is Doing” (instructor) and were included as rows, with space for comments included on each row and on each page. Codes for technology employee competencies drawn from a state department of education framework were included on the observation instrument for the competencies observation. Three coders observed the Chipola class and four coders observed the TCC class. The coders worked separately; at Chipola two coders shared a timer and at TCC all coders worked with their own timers. One coder observed both the Chipola and TCC classes. The observation sessions were followed by semi-structured interviews with the instructors regarding their perceptions of the nature of IT teaching practice that included questions on the instructor’s education and work background, a debrief on the specific observed class experience (e.g., differences from the usual experience), planned and experienced learning outcomes from the state department of education framework, and planned and experienced course learning outcomes.

Training was conducted with six of the seven observers over three sessions. In the training sessions, groups of coders coded videotaped classroom sessions using the Smith et al. (2013) observation instrument and then discussed the outcomes and the usability of the instrument. The observation instrument was revised based on the training session outcomes and to add the technology employee competencies drawn from the Florida Department of Education (FL DOE) Career and Technical Education (CTE) frameworks which guide the IT curriculum development for all two and four-year colleges. No training sessions were conducted with the final version of the observation instrument.

Data Analysis

Code prevalence was calculated for three- and two-coder combinations for the Chipola observation and for four-, three-, and two-coder combinations for the TCC observation. The combinations were analyzed for each coding category (student and instructor) separately. For each combination the total number of instances of each code was calculated and divided by the total number of codes shared by the observers. For example, for a three-coder combination if three observers marked “Listening to Instructor” for 35 2-minute intervals and agreed on marking 81 total student intervals over the course of the class, then that code occurred 43.21% of the time. For this analysis it was not necessary that the same three coders agree on all of the time intervals, just that three coders agree for the overall class time.

Inter-coder percent agreement was calculated for each code (e.g., “Listening to Instructor”), for the coding categories (student and instructor), and for the overall observation (all codes combined) in order to identify the most-observed activities for each observation session. As with the Smith et al. analysis, this analysis was conducted for three- and two-coder combinations for the Chipola observation and for four-, three-, and two-coder combinations for the TCC observation. In this method agreement was calculated for each code by dividing the count of instances of agreement (coders using the code in the same 2-minute time block) by the total possible count. The base for both observation sessions was 36, as each class ran 72 minutes. For example, if coders agreed on a code 10 times percent agreement was 27.78% (Smith et al., 2013).

The prevalence of each technology employee competency was computed for the student and instructor categories as a percentage of the possible instances that the competency could be marked. The total number of instances that the competency was marked by all coders (for Chipola, three coders and 36 possible 2-minute intervals and for TCC four coders and 36 possible 2-minute intervals) was computed and divided by the total possible number of instances (108, or three coders multiplied by 36 intervals for Chipola and 144 or four coders multiplied by 36 intervals for TCC).

Reliability and Validity

Inter-coder percent agreement was calculated for the coding categories (student and instructor), and for the overall observation (all codes combined) in addition to the calculation for each code. Agreement for each coding category (student and instructor) was calculated by including the codes used in that category. The bases for this analysis were calculated by adding the code counts for the category and dividing the outcome by the total number of possible observations for codes used in that category. For example, if the observers used four codes, the category base would be 144 (36 possible observation instances multiplied by four categories). Total agreement (student and instructor) was calculated by combining the category counts and bases.

Two experts examined the observation instrument for face validity. Because this is exploratory research, there are no direct measures of criterion, concurrent, or convergent validity (Schutt, 2006).

As would be expected, the level of inter-coder percent agreement rose as fewer coders were included in the calculations (e.g., 2 coder agreement). Overall, agreement was higher among the TCC coders than among the Chipola coders and for What the Student is Doing than for What the Teacher is Doing (Table 1).

Table 1. Overall Inter-Coder Percent Agreement

	4 Coders Agree	**3 Coders Agree**		**2 Coders Agree**	
	TCC	**Chipola**	**TCC**	**Chipola**	**TCC**
Overall	34.17%	27.78%	46.21%	45.60%	59.03%
What the Student is Doing	45.14%	38.89%	56.94%	58.33%	62.78%
What the Instructor is Doing	27.78%	18.89%	40.08%	36.51%	56.35%

Inter-coder agreement may have been affected by the exploratory nature of study, the alteration of the observation instrument after training, and the lack of training for competency training as a full group.

Findings

Student and Instructor Observation

The students were observed primarily enacting three activities: "Listening to Instructor", "Engaged in Whole-Class Discussion", and "Students Answering a Question Posed by Instructor" (Table 2). In the 3-coder analysis, "Listening to Instructor" constituted 55.36% of Chipola student activities and 43.21% of TCC student activities and "Engaged in Whole-Class Discussion" constituted 37.50% of Chipola activities and 22.22% of TCC activities. "Students Answering a Question Posed by Instructor" was a prevalent activity at TCC, with a 3-coder percentage of 26.83, but it was not a large part of the Chipola activities, with only 5.36% in the 3-coder analysis.

Table 2. Prevalence of Student Codes (Smith et al. Method)

	4 Coders Agree	**3 Coders Agree**		**2 Coders Agree**	
	TCC	**Chipola**	**TCC**	**Chipola**	**TCC**
Listening to instructor	54.69%	55.36%	43.21%	32.38%	32.14%
Engaged in whole class discussion by offering explanations, opinions, judgment, etc. to whole class, often facilitated by instructor	15.38%	37.50%	22.22%	28.57%	25.00%
Students answering a question posed by the instructor with rest of class listening	28.13%	5.36%	26.83%	6.67%	25.89%
Student asks question	3.13%	1.79%	8.64%	2.86%	9.01%
Taking notes on paper or using computer	0.00%	0.00%	0.00%	29.52%	0.00%
Individual thinking/problem solving. Only mark when an instructor explicitly asks students to think about a question/problem on their own	0.00%	0.00%	0.00%	0.00%	8.85%

The outcome of the inter-coder agreement analysis (Table 3) was similar to that of the prevalence analysis. The highest agreement is seen for "Listening to Instructor", with 97.22% four-coder agreement for TCC, 86.11% three-coder agreement among Chipola coders and 97.22% among the TCC coders. Three-coder agreement for "Engaged in Whole Class Discussion" was 58.33% for Chipola and 50.00% for TCC, although four-coder agreement for the TCC coders was only 27.78%. Four- and three-coder agreement for the TCC coders on "Students Answering a Question Posed by the Instructor" was 50.00% (four-coder) and 61.11% (three-coder); three-coder agreement for the Chipola coders was only 8.33% for this code.

Table 3. What the Student is Doing Inter-Coder Percent Agreement

	4 Coders Agree	**3 Coders Agree**		**2 Coders Agree**	
	TCC	**Chipola**	**TCC**	**Chipola**	**TCC**
Listening to instructor	97.22%	86.11%	97.22%	94.44%	100.00%
Engaged in whole class discussion by offering	27.78%	58.33%	50.00%	83.33%	77.78%

explanations, opinions, judgment, etc. to whole class, often facilitated by instructor					
Students answering a question posed by the instructor with rest of class listening	50.00%	8.33%	61.11%	19.44%	80.56%
Student asks question	5.56%	2.78%	19.44%	8.33%	27.78%
Taking notes on paper or using computer	0.00%	0.00%	0.00%	86.11%	0.00%
Individual thinking/problem solving. Only mark when an instructor explicitly asks students to think about a question/problem on their own	0.00%	0.00%	0.00%	0.00%	27.78%

Two student codes showed only two-coder agreement: "Taking Notes on Paper or Using Computer" (Chipola) and "Individual Thinking/Problem Solving" (TCC) (Tables 2 and 3). In both cases the same pairs of coders (e.g., Coder 1 and Coder 3) were using those codes throughout the observation session.

The Chipola coders did not use four student codes: "Working in Groups on Worksheet Activity," "Other Assigned Group Activity", "Presentation by Students", and "Test or Quiz". The TCC coders did not use three student codes: "Group Discussion", "Presentation by Students", and "Test or Quiz". Two student codes were used by Chipola coders but did not reach at least two-coder agreement: "Individual Thinking/Problem Solving" and "Group Discussion". This situation pertained to three student codes for TCC: "Taking Notes on Paper or Using Computer", "Working in Groups on Worksheet Activity", and "Other Assigned Group Activity".

The instructors were observed primarily enacting four activities: "Lecturing", "Asking Question to Students", "Showing or Conducting a Demo", and "Follow-up/Feedback" (Table 3). In the 3-coder analysis, "Lecturing" represented 31.68% of the Chipola instructor activities and 60.00% of the TCC instructor activities. Prevalence of the other activities varied by observation. In the Chipola observation "Showing or Conducting a Demo" represented 20.00% of instructor activity and "Asking Questions to Students" only 11.43%. At the TCC observation "Asking Question to Students" was the more prevalent activity (25.74%), as well as "Follow-up or Feedback on Question" (22.77%).

Table 4. Prevalence of Instructor Codes (Smith et al. Method)

	4 Coders Agree	**3 Coders Agree**		**2 Coders Agree**	
	TCC	**Chipola**	**TCC**	**Chipola**	**TCC**
Lecturing (presenting content, deriving mathematical results, presenting a problem solution, etc.)	49.15%	60.00%	31.68%	27.17%	23.94%
Asking question to students (mark the entire time the instructor is	38.98%	11.43%	25.74%	11.96%	21.13%

asking and answering question, not just when first asked)					
Showing or conducting a demo, experiment, simulation, video, or animation.	6.78%	20.00%	4.95%	33.70%	6.34%
Administration (assign homework, return tests)	3.33%	2.94%	1.98%	2.17%	1.41%
Listening to and answering student questions with entire class listening	1.69%	2.86%	11.88%	8.70%	21.13%
Real-time writing on board, doc. projector, etc. (often checked off along with Lec)	1.69%	0.00%	0.99%	5.43%	2.82%
Follow-up/feedback on question or activity to entire class	0.00%	0.00%	22.77%	0.00%	23.24%
One-on-one extended discussion with one or a few individuals, not paying attention to the rest of the class (can be along with Moving through class/Answering questions)	0.00%	0.00%	0.00%	10.87%	0.00%

The instructor inter-coder agreement analysis supports these findings. The majority of coders agreed on "Lecturing", with 80.56% four-coder agreement for the TCC coders and 58.33% and 88.89%, respectively, for Chipola and TCC three-coder agreement. "Asking question to Student" four- and three-coder agreement was 63.89% and 72.22%, respectively, for the TCC coders but only 11.11% for Chipola three-coder agreement.

Table 5. What the Instructor is Doing Inter-Coder Percent Agreement

	4 Coders Agree	**3 Coders Agree**		**2 Coders Agree**	
	TCC	**Chipola**	**TCC**	**Chipola**	**TCC**
Lecturing (presenting content, deriving mathematical results, presenting a problem solution, etc.)	80.56%	58.33%	88.89%	69.44%	94.44%
Asking question to students (mark the entire time the instructor is asking and answering question, not just when first asked)	63.89%	11.11%	72.22%	30.56%	83.33%
Showing or conducting a demo, experiment, simulation, video, or animation.	11.11%	19.44%	13.89%	86.11%	25.00%
Listening to and answering student questions with entire class listening	2.78%	2.78%	33.33%	22.22%	83.33%
Administration (assign homework, return tests)	5.56%	2.78%	5.56%	5.56%	5.56%

Real-time writing on board, doc. projector, etc. (often checked off along with Lec)	2.78%	0.00%	2.78%	13.89%	11.11%
Follow-up/feedback on question or activity to entire class	0.00%	0.00%	63.89%	0.00%	91.67%
One-on-one extended discussion with one or a few individuals, not paying attention to the rest of the class (can be along with Moving through class/Answering questions)	0.00%	0.00%	0.00%	27.78%	0.00%

One instructor code showed only two-coder agreement: “One-on-One Extended Discussion with One or a Few Individuals” (Chipola) (Tables 4 and 5). A single pairs of coders used this code throughout the observation session.

The Chipola coders did not use “Moving Through Class Guiding Ongoing Student Work”. The code “Follow-up/Feedback on Question or Activity to Entire Class” was used but did not achieve at least two-coder agreement. The TCC coders used all the codes, but the codes “Moving Through Class Guiding Ongoing Student Work” and “One-on-One Extended Discussion with One or a Few Individuals” did not reach at least two-coder agreement.

Technology Employee Competencies Observation

The competency most frequently observed was “Technical Awareness” (22.22% for Chipola instructor coding, 47.22% for TCC student coding, and 42.36% for TCC instructor coding) (Table 6). Other codes that drew more than 15% of codes were “Infrastructure Design” (27.78% for Chipola instructor coding, 20.83% for TCC student coding, and 17.36% for TCC instructor coding) and “Operations Support” (21.53% for Chipola student coding and 20.83% for TCC student coding). Overall, classroom material and activities observed were more related to technical competencies than to general competencies, and general competencies were not observed at Chipola.

Table 6. Prevalence of Competency Codes

	Student Codes		**Instructor Codes**	
	Chipola	**TCC**	**Chipola**	**TCC**
Technical Competencies				
Technical Awareness	9.26%	47.22%	22.22%	42.36%
Infrastructure Design	4.63%	20.83%	27.78%	17.36%
Operations Support	1.85%	20.83%	9.26%	21.53%
General Competencies				
Oral Communication	0.00%	0.69%	0.00%	6.94%
Interpersonal Skills	0.00%	0.00%	0.93%	2.78%
Learning	0.00%	0.00%	0.00%	2.08%
Self-Management	0.00%	0.69%	0.00%	0.69%

Instructor Interviews

Both instructors have been teaching at their institutions since 2012 (the TCC instructor also taught part-time at another institution) and both worked in private industry prior to becoming instructors. They hold advanced degrees—the Chipola instructor holds a master's degree in information systems and the TCC instructor holds master's and doctoral degrees in information studies—and the Chipola instructor also holds several technology certifications. They reported that the presence of observers had some impact on class behavior but that the class atmosphere was not substantially different than usual. Both classes can be used as an elective or as part of the networking AS.

The learning outcomes from the DOE frameworks are more influential on the Chipola instructor's syllabi than on the TCC instructor's syllabi. The Chipola instructor integrates multiple CTE frameworks into a course and reports that learning outcomes from various CTE frameworks are applicable to multiple courses. While the CTE frameworks provide a basis for the learning outcomes in the syllabus, the Chipola instructor uses other resources as well for learning outcomes. He participated in the mapping of the syllabus to the CTE framework for each of the courses in their technology programs to determine where each learning outcome is covered. The TCC instructor reports that the CTE frameworks have a minor influence on the class and that ensuring that all students achieve the outcomes is the challenge. He notes that the frameworks give him "something to fall back on" and are tied to a theoretical interpretation of employer needs and that soft skills should be emphasized more than they are. When asked about resources they use to make the best of his teaching practices in class, the Chipola instructor reports using textbooks, web-based resources, all types of hardware (he maintains an intranet so that he can control the experience), and the TCC instructor reported that he using NetLive, YouTube, class activities, and his phone and tablet, the class textbook.

Critical IT competencies for the Chipola courses include the seven security domains (user, workstation, LAN, LAN-to-WAN, remote access, WAN, and system/application) and networks, the different abilities of technology, technical support for employees, understanding how computers interact in the intranet, understanding the software applications, and understanding the use of Google (at TCC in particular). Both instructors emphasize the importance of understanding security from a business perspective, the importance of policy on security issues, and the importance of soft skills (although the Chipola instructor includes these more in his project management class). Both instructors maintain relationships with individuals in the private IT sector to remain current on latest technology advances, challenges and innovations and to understand employer needs. The Chipola instructor expressed an interest in using expert guest presentations, possibly via remote technologies such as teleconference.

The Chipola instructor relies heavily on discussion and likes when his students pose questions or problems that are new territory for him. He uses the book as a guideline for running his class; he also provides tests so that he can provide an accountability measure although he personally does not place as much emphasis on testing. He uses role play, workplace scenarios, and concept demonstrations of situations they may face on the job, mimicking situations so the students to understand potential environments they may encounter (e.g., help desk problems) in the field.

He also uses hands-on experience such as making cables and troubleshooting non-working cables.

The TCC instructor supports students' learning styles, offering multiple learning opportunities such as lectures, hands on lab activities, YouTube videos and articles (although it's a challenge, he tries to accommodate as much as possible different processes). Chipola requires an A+ certification before students can proceed through the program. The students take the two A+ classes together, because they need to understand the basics of networks—they don't have to acquire certification, although most of them choose to. Chipola uses Transcender for certificate exam preparation; the TCC dean reports that the school uses Test Out for exam preparation, but the TCC instructor offers Measure Up. (The TCC dean reports that the school requires students to take the exam although they don't have to pass it, and pays for it using grant funds. Chipola offers to pay for the exam but does not require students to sit for it.)

The Chipola instructor was not positive about the use of internships in his area; the internships don't exist (there are not enough internships for students to get the hands-on experience that they need) or the students become labor replacements and do not get the training they are promised. The students do find their own freelance work and they transfer those experiences into the class, which he welcomes. TCC students are not required to participate in internships, but the school has an internship coordinator.

Next Steps

The study team has different options to consider for future classroom observations for the ongoing NSF project. The same classroom observation can be repeated for different classes as well as for each IT instructor at TCC and Chipola. This will provide more varied data to get a fuller idea of how IT curricula is delivered at these two institutions. The research team may also observe more lab-based classes rather than the primarily lecture ones observed already in order to perceive more hands-on approaches to teaching IT.

Considerations for improving the method that better assesses the IT content value in class, particularly in comparison to proposed learning outcomes will be pursued when this activity is scheduled to be repeated. The research team appreciated the two minute segments into which observations were split up, as this provided an accurate means of quickly verifying data when coding. The respective collaborators who functioned as the lead observer in each case considered this a valuable exercise for their understanding of curriculum delivery within the classroom and expressed that this activity would impact their interaction with faculty when reviewing and revising future course learning outcomes. Future classroom observation codebooks would be more heavily reviewed by both Dean Stewart and Dr. Froh as they both considered aspects of the classroom experience that they wanted to assess and observe.

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