ELECTRONIC JOURNAL FOR RESEARCH
IN SCIENCE & MATHEMATICS EDUCATION
VOL. 24, NO. 4, 91-108

Community College Human Anatomy and Physiology Faculty's Professional Growth: The Influence of Prior Knowledge and Experience on Pedagogical Change

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ABSTRACT

This article examines the backgrounds and pedagogical evolution of twelve community college (CC) human anatomy and physiology faculty participating in a larger study known as the Community College Anatomy and Physiology Education Research (CAPER) project. Using qualitative analysis of interviews based on Luft & Roehrig's (2007) Teacher Belief Interview (TBI), this article explores how prior experiences influenced CC faculty's teaching beliefs and practices. Results indicated that despite limited access to professional development opportunities, CC faculty drew on their own experiences as learners, teaching experience, and classroom experimentation to reorient their beliefs toward effective science teaching. To better align their new beliefs with their classroom practice, they joined the CAPER project professional development opportunity. Findings reflect patterns identified in Clarke and Hollingsworth's (2002) Interconnected Model of Professional Growth (ICMPG) highlighting the importance of instructors' prior knowledge and intrinsic motivation. Given that community colleges serve a substantial share of higher education students today, this study has important implications for professional development and classroom research opportunities for CC and other higher education faculty.

Keywords: community college, human anatomy and physiology, pedagogical change, prior knowledge, inquiry-based teaching, professional development, instructional practices

Introduction

Despite the essential role of community college (CC) faculty in providing higher education to U.S. students, little is known about CC faculty members' development as educators. Considering that CC faculty comprise roughly 43 percent of instructors in public nonprofit higher education institutions and teach roughly 50 percent of undergraduate students, it is important to understand how these faculty see themselves as educators and continue to develop professionally (Schinske et al., 2017; Twombly & Townsend, 2008). This article describes a qualitative study of the professional growth of

twelve CC human anatomy and physiology faculty across the United States prior to participating in the Community College Anatomy and Physiology Education Research (CAPER) project (Jensen et al., 2020). The goal of the larger project is to engage community college instructors in educational research in order to promote pedagogical change and improve student outcomes and retention rates in community college (CC) classrooms. Our overall aim in the study described in this article was to explore the influence of prior experience on the professional growth of the twelve CC instructors at the beginning of their engagement with the CAPER project.

Literature Review

Teacher Professional Growth in Higher Education

It has been well-documented in higher education literature that many future faculty receive limited training in teaching methodology or curriculum development during their doctoral studies (Austin & McDaniels, 2006; Gardner & Gail, 2011; Tanner & Allen, 2017), particularly in the STEM fields (Shortlidge & Eddy, 2018). After they are hired as faculty and take on roles as course instructors, several barriers to engaging in teaching-focused professional development opportunities arise. Barriers to professional development in early-career faculty include time constraints due to expectations for tenure, distance between content specialists, and lack of support from colleagues and administration (Andrews & Lemons, 2014; Soto, Gupta, Dicki, & Appelgate, 2019).

In order to address this gap in faculty teaching knowledge, organizations such as the Faculty Institutes for Reforming Science Teaching (FIRST) offer professional development programs for future professors. Derting, Ebert-May, Henkel, Maher, Arnold, and Passmore (2016) compared the teaching outcomes of 201 faculty participants in a FIRST program with professors who had similar teaching experience. The FIRST program included lessons on curriculum development and a teaching practicum designed to develop and apply learner-centered teaching practices in undergrad biology classes. The faculty participating in FIRST and their students reported more student-centered learning activities than the control group, but there was no significant difference in the format of exams, which remained primarily multiple choice (Derting et al., 2016).

Ebert-May, Derting, Hodder, Momsen, Long, and Jardeleza (2011) found through analysis of video footage that while 89% of biology faculty who participated in FIRST summer institutes reported increased active learning instruction, 75% of them continued to use primarily lecture-based, teacher-centered methods. This finding suggests that short-term professional development for faculty is an introductory step in which elements of active-learning and principles of interactive instructional design are taught. The FIRST program thus represents an example of a successful professional development intervention for instructors. The kind of direct practice and feedback provided for instructors via the FIRST program was an important element to help them successfully implement active-learning teaching strategies and practices in their classrooms.

Providing professional development communities of practice which are continuous rather than short-term programs may be important for effectively promoting higher education faculty's professional growth and teacher change over time. Soto et al. (2019) engaged in online lesson study, in which a community of practice was formed over virtual meeting / videoconference software to develop, implement, and analyze a mathematics lesson. Practices such as lesson study have been shown to build collaboration, collegiality, and increased instructional motivation among participating educators. However, in higher education settings, expectations around what qualifies a professor for tenure may put a limit on time or opportunities to participate in such professional development opportunities (Soto et al., 2019). Soto et al. (2019) were able to use online resources to build a remote community of practice. The possibilities for faculty participating in sustained professional

development are clear, but accessing and engaging in continuous professional development is demanding and difficult considering the pressures of tenure and teaching.

Professional Growth for Community College Faculty

Community college faculty represent an essential, and less researched, body of college educators who take on very demanding teaching loads in higher education, at the expense of research and professional development. Two-thirds of CC faculty work part time. Part time faculty cover one-third of all CC classes, while full-time faculty teach the remaining two-thirds of courses (Twombly & Townsend, 2008). Heavy teaching loads and limited funding make it difficult for faculty to participate in professional development or engage in more preparation-heavy active learning (Edwards, Sandoval, & McNamara, 2015). Yet, despite the important and diverse roles that CC instructors play in higher education, there is a dearth of information about the teaching-related background, knowledge, experiences and beliefs of CC faculty in particular.

Considering heavy teaching requirements for faculty at CCs, obstacles to engaging in professional development opportunities are different from those of faculty at research institutions which emphasize research and publications as qualifications for tenure. In terms of professional development, Edwards, Sandoval and McNamara (2015) found that, "Despite their primary mission as teaching colleges, community colleges typically have poor infrastructure and weak culture for supporting professional development about instruction" (p. 467). What professional development did exist came in the form of one-session trainings that appeared to have little long-term benefit, especially in comparison to a structured and institutionalized professional development system that could promote a culture of learning among the CC faculty (Edwards et al., 2015). In addition to inadequate professional development, CC faculty experienced a lack of teacher training and displayed a preference for teacher-transmission methods, rather than learner-centered methods (Edwards et al., 2015).

Given the barriers to faculty professional development and teacher training at community colleges, instructors are left to develop as teachers and professionals on their own. Hardre (2012) studied four professional activities--basic and applied research, classroom action research, faculty professional development, and service to the institution--among CC faculty to identify factors that support or detract from engagement and productivity. While CC faculty motivation has been under-researched, motivation is at the heart of faculty retention, academic failure, mentorship, and leadership. Hardre (2012) found that CC faculty who participated in professional activities were primarily self-motivated and that classroom action research was the professional activity in which most people participated.

Such intrinsically motivated faculty seek out opportunities for improving their teaching without formal support from their educational institutions. They must draw on other resources or experiences to develop and change as teachers over time. In their work creating a model of teacher professional growth, Clarke and Hollingsworth (2002, p. 948) described current professional development efforts as linked most closely with a perspective of 'change as growth or learning.' From this perspective, teacher change is connected with teacher learning, which naturally follows from teachers' professional activities and work within schools. In order for teachers' behavior to change based on such learning, changes in practical knowledge also take place (Witterholt, et al., 2012). This practical knowledge, or experiential knowledge of content, curriculum, pedagogy, and student learning needs; along with teachers' beliefs and attitudes, are essential factors in promoting inquiry-based science instruction (Choi & Ramsey, 2010).

For CC instructors who lack professional development support opportunities, practical knowledge is drawn from other experiences. Focusing on fifty-three STEM faculty in three research institutions, Oleson and Hora (2014) found that faculty tend to model their teaching after previous instructors, prior knowledge, and previous experiences. While faculty are encouraged to take up more

inquiry-based and student-centered teaching methods, they are slow on the uptake for a variety of reasons, including top-down decision-making processes and a lack of acknowledgement of their knowledge and skills (Oleson & Hora, 2014). In terms of past experiences, these faculty develop their teaching methods through classroom experience, evaluations of their teaching, professional development, and interactions with other faculty. Their experiences as students, including how they learned best and memories of effective teaching techniques, also impact how these faculty facilitate their own classes. Finally, faculty identify the teaching techniques they use in research and their familial responsibilities as factors impacting their teaching (Oleson & Hora, 2014). While these findings reflect the experiences of faculty in research institutions, they may also reflect, to some extent, how CC faculty change as instructors and develop their individual teaching strategies.

Teacher Beliefs

Teacher beliefs are often a focus of professional development research; however, beliefs can only be inferred, are difficult to measure, and are not easily defined (Ambrose et al., 2004; Pajares, 1992). Pajares' (1992) lengthy review and discussion toward defining beliefs explained that when researchers refer to teacher beliefs, they mean teachers' educational beliefs. Teachers' educational beliefs encompass teacher efficacy, epistemological beliefs, causes of teachers' or students' performance, perceptions of self, self-efficacy, and discipline-specific beliefs (Pajares, 1992). Recognizing that teachers may resist or have difficulty expressing their beliefs completely and directly to researchers, Pajares (1992) and Ambrose et al. (2004) suggested that data on beliefs be collected through interpreting behaviors and inferring a belief system. According to Pajares (1992), "For this reason, beliefs cannot be directly observed or measured but must be inferred from what people say, intend, and do - fundamental prerequisites that educational researchers have seldom followed" (p. 314). Belief inferences in research on beliefs should include ways that individuals provide evidence of their beliefs, actions that individuals take, and their responses to dilemmas (Pajares, 1992).

In his foundational theoretical work on teacher beliefs, Nespor (1987) developed a complex model of belief systems. While his study did not provide a pithy definition of beliefs, he suggested that in order to understand why teachers run classrooms the way they do, we need to examine "the goals they pursue (which may be multiple, conflicting, and not at all related to optimizing student learning) and their subjective interpretations of classroom processes" (Nespor, 1987, p. 325). In other words, we need to understand teachers' personal beliefs which influence their practice. Nespor's (1987) Teacher Beliefs Study, involving eight teachers who were filmed for a semester and interviewed regarding their beliefs and their responses to their videos, found previous experiences shaped the value teachers placed on their course content and the skills they wanted their students to develop, thereby influencing how teachers approached their lessons.

In their study of six high school science teachers' beliefs around inquiry-based science teaching, Wallace and Kang (2004) collected data about their goals, purposes of teaching, and their beliefs about how students learn science. They found that teachers were influenced by two competing sets of beliefs. "The belief sets that constrained inquiry-based teaching were more public and culturally based, while the belief sets that promoted inquiry were more private and based on the individual teacher's notion of successful science learning" (p. 957). In other words, teachers were influenced by their own educational experiences of learning through non-inquiry teaching methods, but held personal beliefs about effective science teaching that aligned with instructional practices promoting inquiry.

For the purposes of this study, we understand beliefs as constructs that guide how a teacher approaches their teaching (Luft & Roehrig, 2007). We used an adapted version of Luft and Roehrig's (2007) Teacher Belief Inventory (TBI), a qualitative interview instrument which asks teachers to speak about their beliefs about teaching and learning. Individual interview questions asked participants to

comment on course design decisions, how they see their roles as teachers, and how they recognize student understanding. As Pajares (1992) suggests, the TBI collects information on teachers' decisions, behaviors, and beliefs and uses these to infer a set of teacher beliefs.

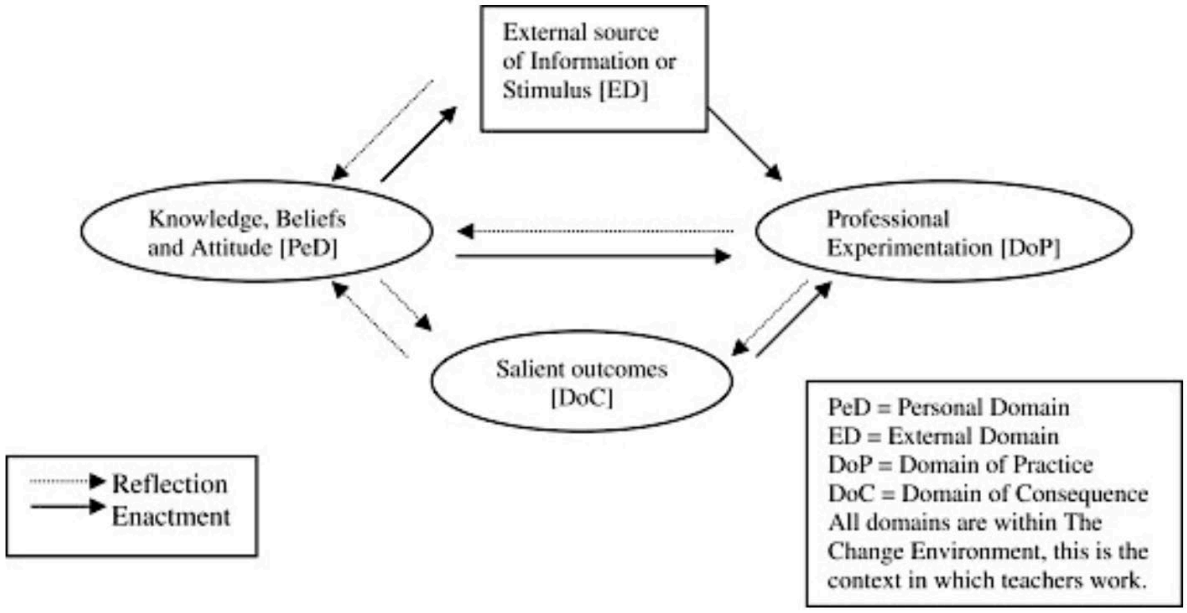
As research on professional development has found, teachers' beliefs are personal to the individual, thus making them more difficult to prove or change through fact than knowledge systems (Nespor, 1987; Pajares, 1992). According to Pajares (1992), "Beliefs are unlikely to be replaced unless they prove unsatisfactory, and they are unlikely to prove unsatisfactory unless they are challenged and one is unable to assimilate them into existing conceptions" (p. 314). Therefore, to promote teacher change, professional development programs must both challenge prior beliefs and provide teachers with a new set of beliefs (Nespor, 1987; Pajares, 1992). Luft (2001) suggests that "continued involvement in professional development activities may foster changes in experienced teachers' beliefs that will alter their views of student learning, pedagogical approaches, or inquiry instruction" (p. 532). The present study is concerned with the origins and foundations of teacher beliefs prior to engaging in professional development designed to promote teacher change.

Conceptual Framework: A Model of Professional Growth

To understand the links between teacher beliefs and teacher change, Clarke and Hollingsworth's (2002) Interconnected Model of Professional Growth (ICMPG) provides a relevant model (see Figure 1). The model charts professional growth as a recurring cycle which occurs through processes of reflection and enactment within four domains: the personal domain (including knowledge, beliefs, and attitude), the external domain (including professional development), the domain of practice (in which professional experimentation takes place), and the domain of consequence (or salient outcomes). While the CAPER project introduces a source of knowledge located in the external domain of the CC teachers' change environment, this paper is primarily concerned with the personal domain and the mediating processes of reflection and enactment through which practice and consequence occur. In other words, this paper examines the background knowledge, experiences, and beliefs that have contributed to CC teacher change in the absence of the direct professional development intervention of CAPER. Our analysis resulted in a modified, contextualized ICMPG grounded in our data on CC teacher beliefs. How have instructors applied practical knowledge and beliefs about teaching based on previous experiences to grow as teachers?

The purpose of this study is to gain insight into this question by examining a snapshot of CC teacher beliefs and practices at the beginning of their participation in the larger longitudinal study and before the 'external' CAPER professional development intervention. In this study, as indicated in the ICMPG (Clarke & Hollingsworth, 2002) described above, teacher change emerged as a recurring process. It is important to acknowledge that CC instructor participants in the CAPER project did not join it as blank slates, but as professionals with a wealth of background knowledge and experience. Given its particular productivity for examining process and change over time, a grounded theory analysis was employed in this study (Merriam & Tisdell, 2016). The participants all have several years of teaching experience, and some have built their entire careers in the community college classroom. Most reported receiving little to no training on instructional practices and having limited exposure to the methods and insights of educational research. Thus, this paper is concerned with exploring CC teacher growth and change by understanding how instructors gathered information and skills to develop as teachers. The research question guiding our inquiry is: How have CC teachers' practical knowledge, beliefs, and practices changed over the course of their careers?

Figure 1. *Clarke & Hollingsworth's (2002) Interconnected Model of Professional Growth.*



Materials and Methods

The findings of this paper draw on interviews conducted as part of the larger study known as the Community College Anatomy and Physiology Education Research (CAPER) project (Jensen et al., 2020). In total, twelve anatomy and physiology instructors at five community colleges located in the United States were interviewed using the Teacher Belief Interview (TBI) developed by Luft and Roehrig (2007). The TBI is a structured interview protocol designed to elicit shifts in instructors' pedagogical beliefs over time. It was originally administered to new teachers or teachers in preparation programs. For the CAPER project, an adapted TBI for human anatomy and physiology instructors was used (Mattheis & Jensen, 2014, see Appendix).

The instructors interviewed for this study represent two cohorts of CAPER participants enrolled in an online Introduction to Educational Research course. Following the course, participants received support from mentors in their field to conduct individual educational research projects in their own classrooms. Table 1 provides an overview of the regional location, educational background, and years of experience of each instructor.

During each year of the project, the CAPER research team collected interview and survey data to track both shifts in participants' beliefs about teaching anatomy and physiology and changes to their classroom practices over time. Interviews and surveys conducted at three time points over the course of an academic year were selected to answer the research question: Can the involvement of CC instructors in a discipline-based education research (DBER) project change their perceptions of their role in the classroom and/or their actual classroom practice? To follow participants' pedagogical change over one year of engagement with the CAPER project, the TBI was conducted at all three time points.

Table 1. *CAPER Instructor Sample*

	Professor	State of Institution	Educational Background	Years of CC Teaching Experience
Year 1	Garcia	New Mexico	M.S. in Biology	9
	Tilak	New Mexico	Ph.D. in Molecular Biology	15
	N. Klein	Utah	Ph.D. in Biological Anthropology	9
	Vogelsang	Utah	Evolutionary Biology	15+
	Dugan	Minnesota	Ph.D.	13+
	Tracy	Minnesota	Ph.D. in Anatomy and Cell Biology	18
Year 2	Griffin	Florida	Ph.D. in Biology	5
	Blewett	Florida	M.S. Biomedical Sciences; Ph.D. Candidate Clinical Psychology	17
	Plum	Utah	MPH	8
	Tabard	Utah	Ph.D. in Physiology	8+
	Fleur	Florida	Ph.D. in Molecular and Cellular Biology	18
	Jones	Florida	M.S. in Physiology	5+

+ Indicates additional teaching experience in other educational contexts

For the purposes of this paper, solely data from the twelve CAPER participants' initial TBI interviews were analyzed as a snapshot of participants' pedagogical growth and change prior to participating in the CAPER project's intervention. In addition to the seven original questions from the TBI interview adapted for human anatomy and physiology instructors (Mattheis & Jensen, 2014, see Appendix), the following interview question was added: How has your understanding of teaching and learning changed over the course of your career? Each of the instructors participating in the study also answered an informal warm-up question regarding their teaching experiences as a way to establish rapport and comfort between the interviewer and the interviewee (Luft & Roehrig, 2007). Rather than asking about experiences as new teachers or teachers in a preparation program; however, participants in this study were asked about their current positions and their experiences as community college instructors. All interviews were administered by the same researcher using video conferencing technology. Interviews were later transcribed and coded separately by both the interviewer and an additional researcher.

Analysis

While Luft and Roehrig (2007) created a deductive qualitative coding strategy for analyzing TBI interviews on a continuum from 'traditional' to 'reform-based' pedagogical perspectives, conducting this analysis alone did not capture the full richness of the interview data. Instructors' previous experience and backgrounds were salient categories not reflected in analysis using the original TBI codebook. Intrigued by these elements of the instructors' experience left unexplored by the TBI analysis, we introduced a grounded theory methodology by assuming an inductive stance to infer meaning from the interview data (Merriam & Tisdell, 2016). We selected an inductive, initial coding process not guided by predetermined concepts or categories. Saldaña (2016) describes initial or open coding as a process of breaking down qualitative data into discrete parts and comparing for similarities and differences. Coding without predetermined categories allows researchers to remain open to possible theoretical directions suggested by the data. In this way, a substantive theory of CC teacher professional growth emerging from our analysis is grounded in the data (Glaser & Strauss, 1967).

Interview transcripts were independently coded by two researchers using codes that emerged from the data. Codes were words or short phrases used to assign meaning to excerpts from the

interviews. The first cycle of coding resulted in over 50 codes drawn from the qualitative data. The second cycle of coding involved the two researchers collaboratively combining and collapsing the original set of codes into subcategories, including, for example, *student characteristics, reluctance to change pedagogy,* and *desire to learn*. Finally, subcategories were organized into four key themes: teacher background, CC A&P teaching environment, perceptions of teacher role, and evolution of teaching. A central explanatory category (Corbin & Strauss, 2008) throughout the interview data was the relationship between prior experience and pedagogical change.

Results

Analysis of CAPER participant interviews showed that despite few formal opportunities for professional development or teacher training before their involvement in the project, instructors had already been engaged in processes of pedagogical change. Participants described a marked evolution in their teaching over the course of their careers. They described their early teaching as highly lecture-based and heavily influenced by their own educational backgrounds and perceptions of teaching. All were interested in growing as instructors and in bringing more inquiry-based and student-centered teaching methods into their classrooms. The degree to which they claimed success in moving away from lecture varied, and many highlighted constraints to introducing new methods including workload, lack of funding for technology aides, and the work-related pressures experienced by the community college instructors. Below, key themes emerging from qualitative analysis are described in more detail.

CC A&P Environment

Given the limited research produced on community colleges (CCs) as educational environments, it is important to highlight the general characteristics of CCs and how they differ from other types of higher education institutions to better grasp the experiences of CC instructors. Participants in CAPER frequently referenced the particularities of their jobs as key for understanding their decision-making process as instructors. Additionally, participants referred to the exacting demands of learning human anatomy and physiology and the sheer volume of information instructors need to cover to best prepare their students, who are primarily taking the course with the intent to enter the field. These details of the change environment instructors occupy are essential for understanding how and to what degree they are able to make changes in their teaching approach (Clarke & Hollingsworth, 2002).

Several professors described the student population at community colleges as representing diverse backgrounds. Community college students are under additional stress external to the academic demands of their courses. Instructors could not assume that students enrolled in their courses had similar academic preparation and understanding of concepts in biology. Professor Tracy described how this challenge plays out in the classroom:

> I guess, you know, as far as working in the community college setting, you get such a wide arrangement, or wide array of students. Some of them that are just right out of high school, some of them that are still in high school- have just had, you know, the- the biology courses they need to, you know, this is their next step. And some of them it's been ten or fifteen years since they've had those biology courses. And so it can be kind of a challenge, finding the level.

In addition to the academic characteristics of students enrolled in CC A&P courses, a number of participants spoke to the responsibilities community college students juggle. Professor Jones

highlighted the difference in profile between the average community college student and their four-year college counterparts:

> I think the pressure is really on the students, it ratchets that up. You add that into all the things that can happen in life, and I have heard just about all of it this semester already--everything, from car accidents to my mother's dying in the hospital, to I have cancer, to, you know, divorces and kids doing this that and the other--it's amazing how much happens, whereas like a nineteen-year-old goes through almost none of that. So it's a very different experience for them.

Instructors related the pressures of life outside of the community college classroom to students' ability to be successful in human anatomy and physiology courses. Anatomy courses are known for demanding a great deal of memorization and study time of students, which creates challenges to success for students experiencing other demands on their time such as children or multiple jobs. Instructors had to be aware of the pressures on students to determine what was achievable for students in A&P classes. Professor Tilak explained this dilemma:

> I have gone as far as to, you know, [pause] tell them to learn the innervation for each of those muscles- -and then lately I don't. Because they don't do very well on that because… most students are holding down, one job, some of them two jobs, they have kids, they don't have time to study. So, I think that, you know, just asking them to learn innervation of muscles will be a little too much on them.

Additionally, professors recognized the emotional toll that the high volume of studying required can take on students who are already spread thin or underprepared for the course. Professor Vogelsang described her efforts to support students while recognizing the challenging nature of the course:

> …The relevant parts about being an A&P instructor, which is that the class is really stressful for students and the success rates are generally lower than we want. I mean, mine are really pretty good. I've changed a lot of things, but it's an overwhelming class and our population of students doesn't seem particularly prepared for the nature of the class....And I don't think there's much we can do about their experiences before they get here, but acknowledging and figuring how to help the students who might not have been very academically prepared or [have] really poor study skills but that still [have] the capacity to be a medical care professional if they can get through this class. That's what I'm really interested in exploring with this project.

Another component of the community college change environment are instructors' heavy teaching loads and lack of time and support for professional development or collaboration. Many participants described designing their courses using a shared set of curricular guidelines, but they had limited opportunities to interface with their colleagues on how to best support student learning in their classrooms. Professor N. Klein describes difficulties bringing new ideas into the classroom from colleagues due to limited time to talk. Instead, Klein sought support from the CAPER project:

> Cause I know, in just even talking to people that I work with, now, that they have ideas that I never incorporate, and we don't always sit down and talk about them. So I'm sure there's people in this group--that are going to have ideas that you should incorporate.

On the whole, CC instructors highlighted the features of the CC A&P environment as important for informing their teaching decisions and practices. Instructors recognized the outside pressures and varied academic preparation influencing students' ability to be successful as well as the high academic demands of human anatomy and physiology course content. Additionally, they found it difficult to engage in learning about teaching or incorporate their colleagues' ideas due to the demands on their own time from the high-volume teaching aspect of their jobs.

Teacher Background: Education and Perceptions of Teaching

The educational credentials and teaching experience held by all of the participants in the study were significant for understanding their experiences of pedagogical change. Intrigued by participants' reporting of long careers as teachers of A & P, the interviewer introduced a spontaneous question at the end of the first interview that was then repeated for all twelve instructors: How have your beliefs about teaching and learning changed over the course of your career? Responses to this question and other comments throughout the interviews revealed one of four key themes explored in this paper: teacher background. This theme refers to instructors' previous educational and professional experiences which have informed their teaching, in addition to their personal process of learning how to teach. Within this category, the concepts *learning how to teach, teaching how you were taught, changing fields*, and *instructor preference* were also included.

Learning how to teach was one of the most salient concepts emerging from teachers' description of their backgrounds. Many participants reflected on their years of teaching and articulated their lack of background or training in teaching and learning. Professor N. Klein described the challenge of an instructor's ongoing commitment to learning to teach:

> Because, as anybody who's taught before realizes that, yeah, you- it's a process of learning throughout the years. I have a total of, like, eight years teaching full time at higher ed, and I don't feel like, oh, I know how to teach. I wouldn't say, [laughs] I would say, no, I'm still learning how to do that.

For Professor N. Klein, learning to teach is a lifelong process that is only beginning when instructors first enter the classroom. Most participants' choice to participate in CAPER stemmed from their desire to improve upon their teaching and practice more effective ways to reach students. Professor Tracy expressed her desire to learn how to teach in a way that creates independent learners who, in effect, teach themselves the material.

> I'm so used to kind of bringing them through, and I know if they can learn it on their own, if they have to figure it out on their own, they're gonna understand it, they're gonna remember it better, it's just- that's not the way I ever learned how to do it, and I need to learn how to teach that way. I need to learn how to help them figure these things out on their own.

Here, Professor Tracy indicates that she has never learned how to teach A & P from a more student-centered perspective. Instead, she is used to 'bringing them through', or providing all of the needed information to students through information transfer. She is not alone in adopting a lecture-dominant style aligning with her own educational experiences.

When asked about the changes in their beliefs about teaching and learning over time, all participants described beginning their careers with a particular approach and realizing with experience that it wasn't the most effective for their students. Professor Tilak, who first taught as a teaching assistant during graduate school, had the realization that relying on lecture as a teaching strategy was not working:

> Professor Tilak: I mean, when I first started, you know, I was the- you know, what do you call- what is the term they use? Uh, the saint, uh, on the stage?
>
> Interviewer: Oh, sage on the stage-
>
> Professor Tilak: -sage on the stage? Yeah. I mean, I used to be like that. And when I first started teaching, uh, as a TA, you know, and during my graduate studies, that's how I thought I was going to be teaching. And then as, you know, I started teaching on my own, I realized that that's not going to work anymore. And when I was a student, the sage out there, in front of the blackboard, was all-knowing, all-powerful, right? But now, students have information at their fingertip. So, I mean, the information could be wrong, but at least they think they're right [laughs]. I am continuously on top of whatever I teach. I even, before going to class, I sit down and look up, uh, try to find the latest information I can on a topic that I would like to teach. So, yeah, my teaching has evolved a lot. I mean, I used to be a straight lecturer at one time, and now I am more interested in participation by the students. In- for the last ten, fifteen years, that's how I've evolved.

Professor Tilak's story of teacher change was echoed by many of the participants in the study, indicating that professors had approached teaching initially from a teacher-centered, 'sage on the stage' perspective. Without targeted training and professional development, community college faculty members found themselves emulating the characteristics of the instruction that was familiar to them as former students of anatomy and physiology. Professor Garcia describes her early experiences of teaching as follows:

> I think when I first started teaching I was young, and I taught in that way that I'd been taught, which was, you know, just a basic lecture. And I thought innovative teaching was, using a YouTube video, [laughs] you know, there was so, so much to learn, and now, my understanding of teaching has changed quite a bit.

Participants described their strategy as early career community college instructors as teaching the way they were taught, but were motivated to change by their experiences in the classroom. Professor N. Klein explained:

> Yeah. It has changed, and it is still changing. Like, I was pretty convinced, even six months ago, that, yeah, anatomy is just information transfer, whatever. Maybe, but, I don't think I can do this entirely, but if we have a little bit more facilitation of thought in my classroom than I was currently doing, or that even I thought was necessary six months ago.

All participants hold advanced degrees in anatomy and physiology or related fields, and many of them began their careers as higher education instructors by emulating the lecture-heavy pedagogies from which they learned anatomy and physiology content. The bulk of their anatomy and physiology coursework occurred in teacher-centered classrooms where information was didactically presented to students. What Professor N. Klein refers to as 'information transfer' recalls Paulo Freire's (2014) banking concept of education. "Instead of communicating, the teacher issues communiqués and makes deposits which the students patiently receive, memorize, and repeat" (Freire, 2014, p. 72). According to this concept, instructors are the absolute authorities and purveyors of knowledge, while students are ignorant and passive recipients. Because of the participants' own educational and teaching backgrounds in which the banking concept represented a prevailing pedagogy, it is not surprising that

they drew directly on these backgrounds early in their teaching careers. They learned through experience; however, that relying on lecture as a sole teaching method was not effective for the students in their classrooms.

Evolution of Teaching: Salient Outcomes and Classroom Experimentation

In addition to linking their early teaching beliefs and practices to their own educational backgrounds, a key theme emerging from interview data indicated that participants saw the need for their teaching to change as they gained more experience in the community college setting. As instructors, they saw that standing in front of a blackboard or lecturing from a Powerpoint day after day was not reaching their students for effective learning. They began to reflect on how they could adapt their teaching to meet students' needs and break free from the familiar banking or sage on the stage methods they tended to fall back on. When asked about how their pedagogical beliefs and practices had shifted over time, nearly all participants noted either significant changes that they made or the desire to make a change.

Through outcomes such as teaching evaluations, conversations with students, and observations of student engagement in class, participants began to see that the traditional teaching methods through which they had learned were not adequate for their students. The realization that not all students could learn effectively from lecture led to a view that multiple forms of instruction and engagement were needed to reach the greatest number of students. For example, Professor Garcia describes how her understandings shifted as she gained more teaching experience:

> So my understanding of teaching has changed quite drastically in that we- students don't learn in just one way, but we have to be able to provide multiple different forms of the same topic and the same information for all of the learners.

Professor Garcia realized through her own reflection that differentiating her instruction could help ensure that all students learn. A self-professed 'early adopter' of technology, she began to experiment more with educational technology in her classroom after her department purchased twenty iPads with the help of a grant. She found that 3D visuals available through iPad applications helped her students to more effectively review material and connect it to the hands-on work they completed in their laboratory sections. She also began using an iPad and cell phone-linked application for clicker-type questioning to check for students' understanding of concepts.

Ultimately, Prof. Garcia found that her efforts to pull from various forms of classroom engagement using technology were rewarded by students' positive response to the changes. She was willing to make these key changes to her teaching practice because of her recognition that lecture was not meeting student needs. She attributed these different needs in part to the technology boom that has resulted in new ways to reach students. Students who have grown up in the information age with cell phones, iPads, and other technologies as part of their daily lives are no longer content to learn through lecture.

> Our students are learning in a very different way than what we've become accustomed to teaching in. And I think there's a lot of power in being able to modify our teaching abilities to meet those needs. Cause I think often times some faculty get frustrated and believing that our students aren't learning, but I- I think they are. And I- well I know they are--our students are just as smart if not smarter, but they're just used to information being able to be delivered to them so quickly that they get frustrated with the [laughing] slow pace of the typical lecture course.

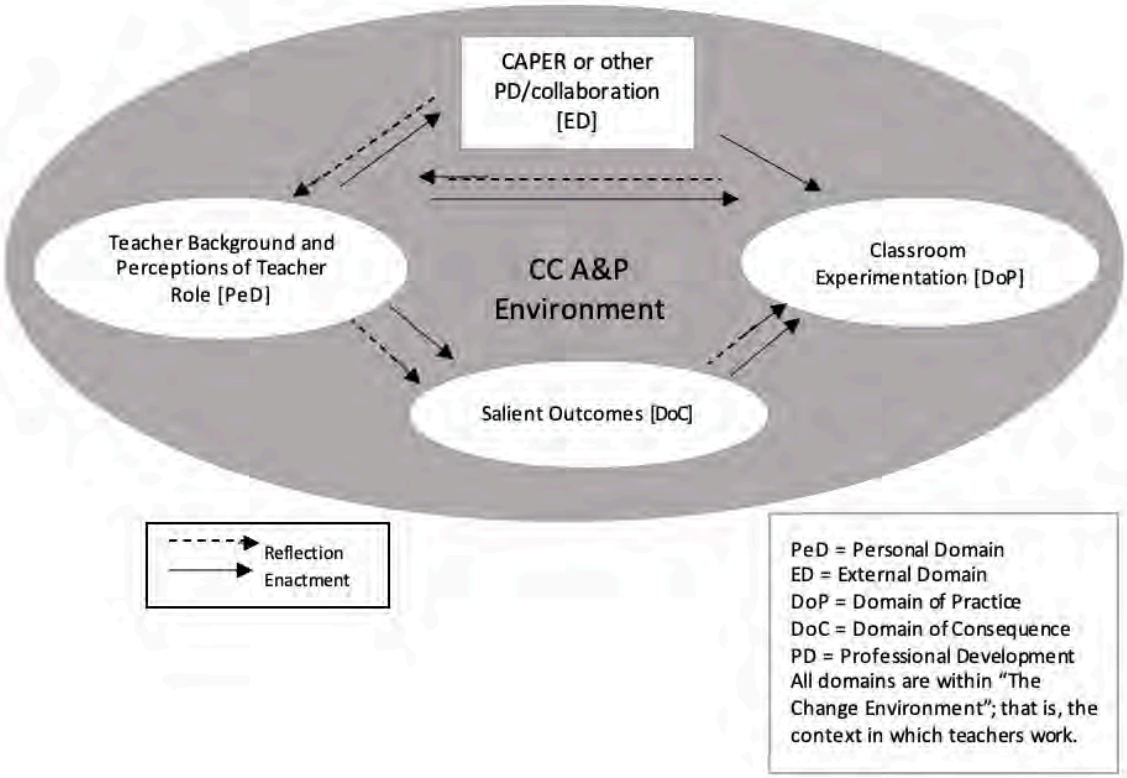
Discussion

This snapshot of CC A&P instructor beliefs and practices shows that instructors care deeply about supporting their students and are making efforts to respond to student needs and engage in processes of instructor change through reflection and enactment (Clarke & Hollingsworth 2002) of their own accord. Many instructors at the post-secondary level lack training in teaching and educational research methods that could help improve their practices and outcomes for students (Austin & McDaniels, 2006; Gardner & Gail, 2011; Tanner & Allen, 2017). However, this research supports the notion that even without such training, CC A & P instructors are finding their own way to inquiry-based and student-centered instruction strategies as they gain experience in the community college context. Our findings echoed the work of Oleson and Hora (2014) in that instructors modeled their teaching off of their own former teachers and identified constraints to their professional development around implementing inquiry-based strategies. Even without the support of targeted professional growth opportunities, the participants in this study drew on a number of personal resources, including practical knowledge and their evolving beliefs around teaching and learning (Choi & Ramsey, 2010; Witterholt et al., 2012), to grow as teachers. Drawing on their educational backgrounds, perceptions of teaching, classroom experimentation, and observation of student engagement and outcomes, CC A & P instructors are looking for ways to improve and are moving toward pedagogical change.

Clarke and Hollingsworth's (2002) ICMPG aligned well with our emerging theory to understand how these threads leading to pedagogical change interact in the CC A & P environment. The key themes of CAPER participants' experiences derived from qualitative analysis support the ICMPG. The model is particularly appropriate for understanding the pedagogical growth of instructors over time *before* the intervention of the CAPER project for professional development, because it allows for processes of change which take place independently of the influence of formal professional development. Because this paper is a snapshot of instructors' backgrounds and beliefs prior to the CAPER project, the *external domain* representing professional development or formal instructor collaboration was not directly analyzed, but findings of this paper could be used to inform its future development and emphasis. Through interview data, the elements of the *personal domain* highlighted by instructors were teacher background and perceptions of teacher role. The *domain of practice* for CAPER participants was represented by classroom experimentation that they undertook on their own to help create better outcomes for students. The *domain of consequence* included the outcomes teachers observed after experimenting with different teaching methods in their classrooms, including grades, teaching evaluations, and subjective observation of student engagement. See Figure 2 below for a visual representation of the ICMPG using themes from the CAPER TBI data.

Our findings suggest an interaction between the personal domain, the domain of practice, and the domain of consequence that allows for pedagogical change without a formal professional development intervention from the external domain. The arrows in the model show how teacher background and perceptions of teacher role can lead to enactment through classroom experimentation. Reflection on that experimentation can influence teacher perceptions as they also engage in reflection on salient outcomes. An awareness of salient outcomes leads to further experimentation, ultimately resulting in processes of pedagogical change over time. While such processes don't represent entirely adequate support for teacher development, they emphasize that instructors, like their students, are capable of undergoing self-motivated stages of instructional development independently of substantial external intervention.

Figure 2. *Adaptation of Clarke & Hollingsworth's (2002) Interconnected Model of Professional Growth.*



Our inductive analysis of participants' responses in Teacher Belief Interviews (TBI) emphasizes the possibilities for teacher beliefs to shift through practical experience. As Nespor's (1987) foundational work on teacher beliefs emphasized, the instructors' experiences as learners in classrooms shaped their initial beliefs as teacher-centered. Their experience as teachers caused them to question the validity of this belief, in particular the effectiveness of information transfer through lecture. Their interest in helping their students succeed led them to develop personal beliefs that successful science learning should be student-centered (Wallace & Kang, 2004). Due to this shift in beliefs, teachers signed on to join the CAPER project with the intent of increasing the alignment between their new beliefs and their classroom practices.

As this study only represents the experiences of twelve community college instructors who have self-selected to engage in the CAPER project in the interest of their own pedagogical development, it only scratches the surface of what remains to be explored in the community college change environment. However, it provides important insights into professional growth in a community college setting and highlights the need for additional research in this environment. Research in the community college setting is especially relevant and needed in the field of A & P, as so many future healthcare professionals enroll in these pre-requisite courses. The CAPER project itself takes an important step in this direction for anatomy and physiology education, as it not only explores CC A & P teacher beliefs and practices over time, but it also invests in educating CC instructors on discipline based education research (DBER) which upholds the effectiveness of inquiry-based and student-centered methods. In addition, the CAPER project supports instructors in engaging in their own educational research to further their professional growth while expanding knowledge in the field on student anxiety and best practices for student success in the community college setting.

Future research should continue to explore the community college A & P change environment, particularly as it is influenced by the needs and challenges of a large and diverse student population. Though few instructors commented directly on the racial and cultural diversity of their classrooms as compared to other higher education institutions in the U.S., it is important to note that the demographics of community college (CC) students and instructors both stand apart from other higher education institutions in terms of diversity, graduation rates, and responsibilities. CC instructors serve 37 percent of all undergraduates, including over 50 percent of Latinx and American Indian students and 40 percent of African American and Asian students (Twombly & Townsend 2008). In addition to serving a large proportion of students of color, there are high rates of first-generation students and other underserved student groups (Flynn et al., 2017; Schinske et al., 2017). The fact that so many American undergraduates, particularly underserved populations, receive their education from community colleges underscores the need for further investment in and promotion of educational research on community colleges, by community college instructors. It is evident from our data on the community college instructors who self-selected to participate in CAPER that many instructors are eager to grow professionally, improve their teaching and be involved in supporting the diverse student populations they serve.

Conclusion

Analysis and findings from TBI interviews with community college A & P instructors before engaging in the year-long CAPER professional development program have important implications for pedagogical transformation of community college classrooms and anatomy and physiology community college instruction. Understanding community college instructors' backgrounds and personal pedagogical evolution provides important insights into the particularities of teaching and learning at the community college level and highlights areas for improvement in professional development and training. Instructors' own descriptions of their pedagogical realizations made prior to the CAPER intervention present further justification for this project and for research investigating teaching, learning, stress, and retention in the community college setting. The findings of this paper indicate that as they gain experience, instructors are moving away from the lecture-based instruction of their own educational backgrounds and toward a more inquiry-based, student-centered teaching practice through a process of reflection and enactment leading to pedagogical change over time. However, the features of the current CC A & P change environment can create obstacles to effective professional growth, indicating that additional funding and promotion of professional development at the community college would provide welcome support for pedagogical change, instructor learning, and student needs in the community college anatomy and physiology classroom.

This work was supported by the National Science Foundation under Grant number 1829157.

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Appendix

Teacher Belief Interview adapted by Mattheis and Jensen (2014) with added question (question 8) for CAPER project.

Warm-up question: Please tell me about your current position and your experience as a community college instructor.

1. How do you maximize student learning in your classroom?
2. How do describe your role as a teacher?
3. How do you know when your students understand?
4. How do you decide what topics to concentrate on in your A & P classes?
5. How do you decide when to move on to a new topic in your classroom?
6. How do your students learn best about anatomy and physiology concepts?
7. How do you know when learning is occurring in your classroom?
8. How has your understanding of teaching and learning changed over the course of your career?