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ABSTRACT

Ongoing need for adjunct instructor support is a critical aspect for institutions to consider. Through research focused on full-time and part-time faculty job satisfaction, a number of practices for supporting faculty and improving job satisfaction have been suggested. In this article, we present an innovative model of instructor resources and supports within a mathematics department. We focus on how these various resources and supports have benefited our part-time adjunct faculty job satisfaction and describe how the supports and challenges experienced by our Precalculus adjunct faculty are related to variables impacting job satisfaction found in literature. We also present some additional factors that were missing in prior studies in literature but were found important for our adjunct instructors' job satisfaction. Our findings can inform other institutions' and mathematics departments' efforts to support their own part-time faculty teaching introductory courses such as Precalculus.

KEYWORDS

Undergraduate mathematics education; adjunct instructors; job satisfaction

1. INTRODUCTION

Current research points to a need to improve undergraduate education, especially in introductory mathematics courses, in order to increase student retention in science, technology, engineering and mathematics (STEM) majors [19, 25, 26]. This situation is further complicated by the fact that adjunct instructors are playing an increasingly important role at many institutions teaching introductory courses [3, 6]. Between 1991 and 2011, the number of part-time faculty employed in degree-granting institutions increased by 162% [15] and approximately 70% of instructional faculty are non-tenure track [18]. Therefore, in order to improve undergraduate education for STEM majors, universities should develop specific programs to cater to adjunct instructors' unique and diverse professional growth challenges, given that no single model can (or should) fit all institutions [1].

One critical aspect for institutions to consider is the ongoing need for instructor support [10, 17, 20]. Through research focused on full-time and part-time faculty job satisfaction, a number of practices for supporting faculty and improving their

job satisfaction have been suggested: a thorough orientation to the institution, adequate training in fundamental teaching and classroom management skills, initial and ongoing professional development (PD), mentoring, recognition for quality work, and access to office space and personal computers [3, 8, 13, 15]. In this paper, we report on how our model of course coordination has impacted our adjunct instructors' job satisfaction.

2. BACKGROUND

2.1. Context

This project takes place in a mid-sized, Hispanic-Serving public institution in the northeastern United States with over 20,000 undergraduate and graduate students. According to the 2013 CIRP Freshman Survey, 30% of first-time, full-time freshmen report they are the first generation to attend college. Historically, the institution had been primarily an undergraduate-serving teaching institution. However, in 2016, it was recognized as a Research Doctoral University as a result of the substantial growth in its doctoral-level education and research activities. The institution has 300 academic programs within 11 colleges and schools.

Our work is situated within the College of Science and Mathematics (CSAM). The reach of CSAM extends beyond the campus with regional, national, and international collaborations with academia, schools, state, and national labs and industry. CSAM works to uphold a philosophy of a “small college” within a larger university by providing high quality and personalized education through relatively small class sizes (about 32 students) complemented by a growing number of faculty members with in-class and laboratory resources to support student learning. The student population of CSAM is highly diverse with 45% of the undergraduates being of underrepresented minority groups and 50% female-identifying students during the 2017–2018 academic year.

Within CSAM, we work in the Department of Mathematical Sciences. The department offers a variety of degrees and concentrations, including undergraduate and graduate degrees in mathematics and mathematics education. The department retains close to 25 full-time faculty, including instructional specialists, and routinely hires approximately 20 part-time adjunct faculty members each semester. The adjunct faculty mainly teach introductory courses including general education, mathematics education, Precalculus, and occasionally Calculus.

With respect to Precalculus, adjunct instructors have historically taught over 90% of the sections, each with an average of 32 students, serving over 600 students per academic year. Students are placed in Precalculus through a college placement exam administered by the university to incoming students. If students do not score within a particular range, they take a college algebra course that is taught in the university's mathematics emporium. The emporium model includes weekly focus groups led by professional tutors or graduate teaching assistants and include mini-lectures on new content, review sessions for assessments, and problem-solving in small groups.

After receiving a C- or above in the algebra course, students are cleared to take Precalculus.

2.2. Motivation

Prior to the 2016–2017 academic year, there had been no coordination of the Precalculus sections and thus a great deal of inconsistency emerged in how the course had been taught. Instructors were provided with a suggested textbook and outline of appropriate topics but were not required to follow either. As a result, the content was not uniformly covered and students were entering their calculus courses with sometimes vastly different experiences. Not surprisingly, the Calculus instructors found it challenging to cater to the needs of students with varying learning experiences in the Precalculus course. This inconsistency was also conflated with a higher than desired failure rate ($\sim 30\%$ in Precalculus and $\sim 40\%$ in the first Calculus course). These issues were discussed by the department's Calculus committee, who then decided to recruit a Precalculus course coordinator moving forward.

2.3. Our Approach

To better address the above-mentioned challenges, two full-time faculty members (second and third authors) in our department partnered as precalculus course coordinators. The charge was to create a more uniform experience for precalculus students, and we decided to do this by creating a model that would serve as a strategy for implementing best practices for learning and instruction through adjunct instructor development and support. As a result, the *Adjunct Mathematics Instructor Resources and Support* (AMIRS) project was established in spring 2016 for implementation for the 2016–2017 academic year (see [Figure 1](#)).

To design the scope of resources and support and create a model within the Precalculus course, we started by delving into research on factors influencing the job satisfaction of industry employees, led by Herzberg [12]. Then, we expanded our literature review to related job satisfaction research in academia, understanding job satisfaction among faculty deserves particular attention because of its relationship with retention, productivity, and organizational commitment [8]. Research has shown job satisfaction to be one of the strongest predictors of faculty's determination to leave an institution [7, 9, 29], which is important because of the negative impact of high rates of faculty turnover in institutions of higher education [11, 24].

Herzberg [12] reported on factors associated with job satisfaction and job dissatisfaction by distinguishing between two factors: (a) *hygiene* factors that extrinsically bring dissatisfaction and (b) *motivator* factors that are intrinsically motivating. According to Herzberg, hygiene factors in an industry setting are “company policy and administration, supervision, interpersonal relationships, working conditions, salary, status, and security” (p. 57). In contrast, motivator factors, or simply motivators, include “achievement, recognition for achievement, the work itself, responsibility, and growth or advancement” (p. 57). Herzberg found that

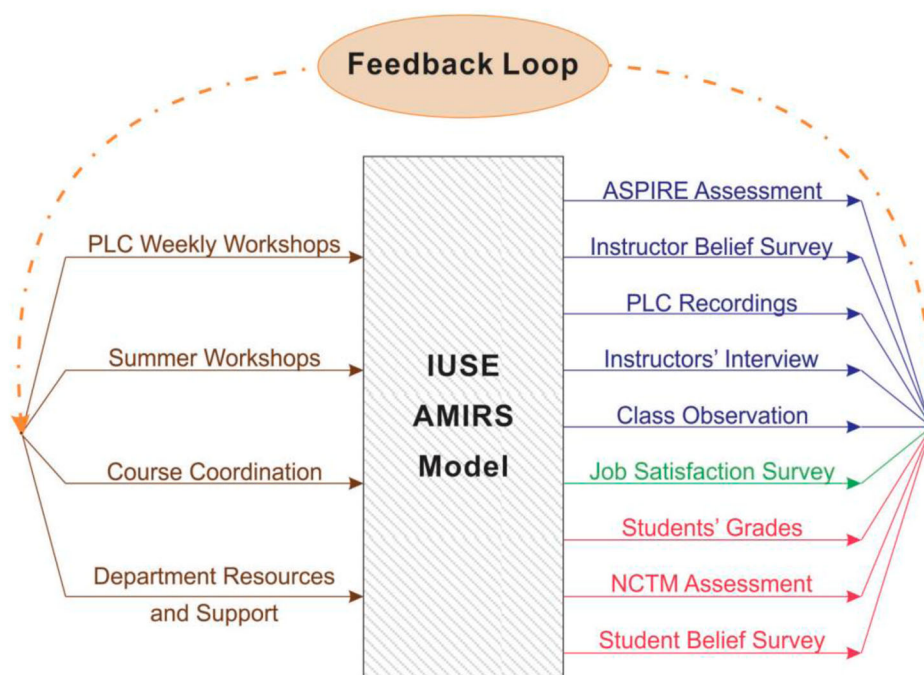


Figure 1. Model of supports provided, data collected, and ongoing improvements.

motivators positively influence employees' attitude in the long run as opposed to hygiene variables, which are the primary factors that result in employees' discontent.

As we learned about Herzberg's motivator-hygiene model of job satisfaction [12], we discovered follow-up studies by Hoyt and colleagues [14] who mapped the model from industry to academia. In an academic setting, Hoyt's team developed an equivalent survey for part-time faculty to understand their job satisfaction. Hoyt's team proposed hygiene factors which included: autonomy (associated with supervision in the Herzberg model, measuring how closely part-time faculty members are supervised or given greater independence); faculty support (associated with interpersonal relationships); classroom facilities, quality of students, and teaching schedule; and pay, status, and job security. Hoyt and colleagues [14] also considered positive motivators such as achievement and challenge (associated with achievement and recognition for achievement); work preference, e.g., teaching over other types of work (associated with the work itself); and responsibility and advancement (associated with responsibility and growth). For us, this research supported our development of the model for Precalculus resources and support, as we considered these identified factors for job satisfaction in our design.

We also worked to understand best practices around supporting part-time adjunct faculty in terms of their unique needs, which included understanding how to provide proper training that could help maintain instructional quality [16]. According to the research, adjunct faculty members can benefit from support efforts

including a thorough orientation to the institution, its culture, and practices; adequate training in fundamental teaching and classroom management skills; a sense of belonging to the institution; initial and ongoing PD; and recognition for quality work that is perceived as appropriate and adequate [3]. These supports align with the aspects of the job that can improve job satisfaction for adjunct instructors. Improving job satisfaction is critically important to the health and well-being of the department, as the number of classes assigned to adjunct instructors grow, so does our dependency on this population for the academic quality of the teaching and learning of the STEM student population. In particular, “If good teaching that produces evidence of student learning is to be anything other than random, then institutional policies must deliberately support the development of all instructors” ([3], p. 4), including adjunct faculty.

Based on the research and literature focused on job satisfaction and adjunct support, we created AMIRS model by incorporating specific resources and supports. In particular, our course coordination provided the following *resources* to the adjunct instructors teaching Precalculus: (a) new textbook for all sections, (b) standardized content coverage and pacing, (c) standardized syllabus and grading policies, (d) common assessments and rubrics, (e) course template on our learning management system (Canvas), (f) online homework templates, and (g) discussion questions, reading guides, exam reviews, big ideas, and suggested problems (known as investigations) for each part of the course.

In addition, we provided the following *supports*: (a) yearly summer workshops onboarding instructors for new curriculum and course design, (b) weekly professional learning community (PLC) meetings held on Canvas, (c) periodic in-person meetings with instructional team to discuss instruction, content, and instructor experiences, and (d) a dedicated instructor page on Canvas containing the resources above.

In this article, we focus on how these various resources and supports have benefited our part-time adjunct faculty job satisfaction. In the following sections, we describe how the supports and challenges experienced by our Precalculus adjunct faculty are related to variables impacting job satisfaction found in literature. We also present some additional variables/factors that were missing in prior studies in literature but were found important for our adjunct instructors’ job satisfaction. We have used these findings to continuously improve our resources and support and to inform other institutions’ and mathematics departments’ efforts to support their own part-time faculty teaching introductory courses, such as Precalculus.

3. METHODS

Our project focused on building a model of adjunct instructor resources and support. To that end, we incorporated instructor supports backed by research [12, 13, 27] and provided resources to Precalculus adjunct instructors teaching a research-based curriculum, *Precalculus: Pathways to calculus: A problem solving approach* [4]. For the research reported here in an effort to formulate recommendations for

departments experiencing similar increase in adjunct faculty and looking for ways to best support them, we focused on the following question: How do departmental resources and instructor support impact adjunct instructors' job satisfaction?

3.1. Participants

The participants in our study were five adjunct instructors teaching a total of 16 Precalculus sections during the 2016–2017 academic year. (Given that the size of our adjunct cohort per semester is limited, our goal is not to make statistical claims but to provide nuances of our adjunct instructors' experiences in responses to the supports our model provided). All participants had experience teaching mathematics at the K–12 or undergraduate level, including undergraduate Precalculus (zero to over 10 years). The instructors attended the summer workshop (two and half day) and weekly online PLC meetings, although attendance and participation in the meetings varied.

3.2. Data Collection

To answer our research question, we conducted semi-structured interviews at the beginning (pre-) and end (post-) of the Fall and Spring semesters to learn about specific needs, challenges, and supports as perceived by the instructors. The interviews were audio recorded and transcribed for the work reported here.

3.3. Data Analysis

Using thematic analysis [2], we created categories that stemmed from Herzberg's motivator-hygiene theory of job attitudes [12] and Hoyt's job satisfaction survey [14, 13]. We began with the notion of supports and challenges to unpack what the adjunct instructors were experiencing. The semi-structured interview questions focused on faculty support, development, satisfaction, and loyalty. Reviewing the collected data for how instructors viewed their support and experiences in the department provided us a way to determine which, if any, of the factors identified by Herzberg and Hoyt would be relevant to our instructors' job satisfaction. In order to make the thematic analysis more meaningful, we used interpretation [28] as a way to connect our themes to a larger theoretical structure, which allowed us to extend our analysis to the existing literature.

3.4. Coding Scheme

Each member of our research group read the interview transcripts using semi-open coding to identify segments of the talk focused on supports and challenges. The scheme was semi-open as we were aware of the supports and challenges described by previous researchers [12, 13] but also wanted flexibility to capture possibly novel categories based on the specific context of mathematics instructors teaching a new,

research-oriented, curriculum. After coding the transcripts individually, we met to discuss our codes, which led to a set of codes aligned with the job satisfaction survey variables [14, 13] as well as new codes not characterized by Hoyt. We also connected the supports and challenges we identified as motivators or hygiene factors from Herzberg's theory [12].

Through this process, we identified the *main object or subject of the support or challenge*, which resulted in over 15 categories (Level 3). We organized these categories by providing details about the *main point* having to do with the category, which resulted in four categories: "curriculum," "instructional resources," "departmental resources," and "human resources" (Level 2). Finally, we organized these into two *main themes*: "instruction" and "institution" (Level 1). Our codes allowed us to associate instructional factors related to the adjunct instructors' teaching practice and institutional factors like mentoring and teaching schedule with the resources and supports as they pertained to the instructors' job satisfaction. Table 1 shows our final coding scheme and the connection between our codes, Herzberg's [12] motivation-hygiene theory, and Hoyt's [13] job satisfaction survey.

4. RESULTS

In this section, we describe our findings related to the various departmental resources and faculty support that had an impact on our adjunct instructors' job satisfaction. Through our pre- and post-semester interview data analysis, we present the supports and challenges shared explicitly or implicitly by our adjunct instructors. We also discuss how these supports are (or are not) related to part-time faculty job satisfaction as mentioned in the research literature [13].

4.1. Supports and Challenges Related to Existing Job Satisfaction Variables from Hoyt's Survey

We found several instances in which the instructors mentioned departmental resources as impacting specific aspects of their job satisfaction. The departmental resources were mentioned in terms of both instruction and institution. Many of the instructors' comments were around mentoring and interactions with other faculty members and staff in the department, including the course coordinator. These instances occurred mostly as the instructors discussed their teaching practice. Other comments focused on mentoring and informal conversations or interactions with other adjuncts, including the online meetings, and generally came up in terms of the departmental culture or climate. All of these instances connected to the job satisfaction variables of relationships, supervision, faculty support, and sense of belonging [13].

Table 1. Final coding scheme.

Level 1	Level 2	Level 3	MHT	JSSV
Instruction	Curriculum	Implementing discussion problem-based lessons	Motivator – work itself	Not addressed
		Type of problems	Motivator – work itself	Not addressed
		Philosophy/nature of curriculum	Motivator – work itself	Not addressed
		Student resistance to engaging in problems	Motivator – work itself	Not addressed
		Language	Motivator – work itself	Not addressed
		Planning for discussion/problem-based lesson	Motivator – work itself	Not addressed
	Instructional resources	Technical Issues	Motivator – work itself	Not addressed
		Course materials	Motivator – work itself	Not addressed
		Summer workshop and Curriculum developers	Motivator – work itself	Not addressed
	Departmental resources	Classroom/technology	Motivator – work itself	Classroom facilities
		Professional learning community	Hygiene – relationships	Faculty support and sense of belonging
		Informal conversations and interactions with other adjunct instructors	Hygiene – relationships	Faculty support and sense of belonging
		Mentoring and interactions with other faculty members/staff in department	Hygiene – supervision	Faculty support and sense of belonging
Institution	Department	Mentoring	Hygiene – relationships	Faculty support and sense of belonging
	HR		Hygiene – work conditions	Honorarium and teaching schedule

Note: MHT, motivation-hygiene theory [12]; JSSV, job satisfaction survey variables [13].

4.1.1. *Mentoring, Guidance, and Interactions*

Based on our data, instructors reported that they found having access to a course coordinator beneficial. We had hypothesized that the hygiene variable of “supervision” would be coded with instructors mentioning access to a course coordinator. This turned out to be a support much appreciated by the instructors. The course coordinator provided a common syllabus, pacing guide, and exams which provided the instructors more time to focus on planning for instruction. As one instructor shared:

With [course coordinator], and coordinating . . . it really gave me the opportunity to use that time for other portions of the class like thinking about problems, making sure I have work for class you know with radians and stuff like that.

In addition, instructors appreciated having access to someone to ask questions and seek guidance. For example, one instructor stated, “I was able to talk to [course coordinator] anytime I needed her. I was able to find her, so I just feel like reaching out to others was very easy!” Our findings suggest that instructors responded to the

hygiene variable of “supervision” in the form of a course coordinator as a support they found beneficial.

4.1.2. Professional Learning community

One of the resources provided to the instructors was optional weekly online meetings where they had a chance to share their experiences with the curriculum both inside and outside the classroom and ask questions. Instructors reported that they found these meetings beneficial. As one instructor elaborated, “The weekly meetings were kind of helpful in terms of seeing what the university wanted in terms of the big ideas that were coming across.” Here the instructor is referring to the weekly meeting facilitator guiding the participants to focus on the big ideas within each section. The same instructor added that while the summer workshop was beneficial, as they moved further into the semester, “it was more the conversation that happened in the weekly meetings that were a better support because a lot of time had passed . . . and we kind of refreshed ourselves.” The instructors found their interaction during weekly meetings to be a source of support that helped them with their instruction and planning.

While the instructors felt supported by the weekly meetings, the online format of the weekly meetings was challenging. The weekly meetings were facilitated through our institutional learning management system that allowed the instructors to hear the facilitator, see notes on their screens, and type responses. Several instructors expressed that they had a difficult time typing out their thoughts while keeping track of the group’s conversation during these meetings. A common sentiment about the nature of the platform is captured in the following comment: “I would re-write things in my head three or four times and I’m supposed to be in a chat room where I’m going very quickly, I just don’t type very quickly.” This frustration was expressed by several instructors. However, despite the challenges of the online format, most adjunct instructors preferred that option over an in-person meeting, mainly due to their busy schedules.

The instructors found departmental resources like course coordinator and the weekly online meetings as supportive and explicitly mentioned them in the interviews. The instructors’ response to institutional and instructional resources is related to “faculty support and sense of belonging,” but there were some supports mentioned by the instructors that were not reflected in the job satisfaction survey used by Hoyt [13]. In the following section, we describe other factors self-reported by the instructors that they found impacted their work at the university. These factors, while aligned with Herzberg’s motivator-hygiene theory, were not addressed in Hoyt’s part-time faculty job satisfaction survey.

4.2. Supports and Challenges Adding to Existing Job Satisfaction Variables from Hoyt’s Survey

Through our analysis of the interview data, we found possible influencers of job satisfaction that were not included in Hoyt’s job satisfaction survey [13]. We found that

as the instructors discussed instruction, their comments focused on the curriculum (e.g., types of problems, implementing problem-based lessons, student resistance to engaging in problems) and instructional resources (e.g., course materials, summer workshop). Since these factors were not included in Hoyt's list, we associated these particular supports and challenges with Herzberg's motivator of "work itself," which can in fact influence job satisfaction [12].

4.2.1. Curriculum

Our data show that instructors found many of the supports we provided to be beneficial, as we had intended. However, they also mentioned supports and challenges that we had not perceived as having an impact on their practice. An unintended benefit that influenced our adjunct instructors' job satisfaction was their experience implementing a curriculum centered on problem-based lessons. Several instructors reported that the focus on conceptual understanding (types of problems and nature of curriculum) was a form of support for their instruction. The problems in the curriculum facilitated deeper learning of mathematics. Additionally, the curriculum contained thought-provoking questions for the students, which were challenging for instructors as they planned their lessons, but provided an opportunity to have meaningful discussions in the classroom. One instructor shared, "I also like the fact that the curriculum is not a drill and kill curriculum . . . it forces critical thinking." If the instructors wanted to provide their students with opportunities for conceptual understanding, the curriculum provided the resources to do so.

While the curriculum emerged as a resource for the instructors, they also faced challenges when implementing it. We found that navigating through these challenges, the instructors reflected on their teaching practice with a possibility of learning and improvement. For example, one instructor said:

I think it [curriculum] required that I had to do a lot more thinking before my lessons, just in terms of how am I going to present this content. Because in the past, I understood traditional philosophy of how things were supposed to be done, and I could look over a lesson, kind of formulate it, and then just walk in and go. [but here,] just because of the different philosophy, I had to sit down and think about it a little bit harder.

This comment points towards the instructor making sense of the new curriculum and reflecting on their teaching practice. The challenges instructors face when implementing a research-based mathematics curriculum provide opportunities for their own learning [21]. The instructors worked through their problems and shared their concerns about the curriculum with each other. During a PLC meeting, one instructor explained how he drew on his experiences from the past semester to pay careful attention to student misconceptions and planned his lesson around them:

One of the things I try to do is [. . .] to recall some of the pitfalls that students went through in the first semester and try to prepare the students . . . Some pitfalls, you want the students to go through because you want them to figure out a way to get out of it.

This comment reflects how the instructor was attempting to work through the challenge of effectively implementing the curriculum by leveraging his experience

during the first semester when he faced challenges with the pacing, specifically making sure that he would be able to get to all of the important content while honoring student contributions. This sentiment was shared with other instructors as they worked to better understand the overarching philosophy of the curriculum and the pacing. As mentioned earlier, these challenges allowed the instructors to reflect on their own content knowledge and practice leading to possible learning opportunities for instructors themselves [21].

4.2.2. Student Resistance

Another curriculum-related challenge faced by instructors was student resistance to engaging with the material. Engagement with the students is an important factor influencing the instructors' work experience. The instructors found it challenging to motivate students as they struggled with the problem-based nature of the curriculum focusing on conceptual understanding. In the words of one instructor:

[M]ost students identify with an aversion to the word problems. That's to say an aversion to context . . . They just have that natural fear of context and word problems. Definitely, makes it harder to teach when my role becomes beyond that of just conveying concepts, you know, overcoming the fears, beliefs, right!

This comment indicates that the instructors were not only dealing with making sense of the curriculum itself but also figuring out how to allay their students' concerns. Their students struggled with the language of the problems as well as the investigative nature of the curriculum. The weekly meetings provided ongoing support to the instructors, while other supports directly aligned with the instructors' challenges assisted them with addressing student struggles and concerns. For example, the supports embedded within the summer workshop and weekly PLC meetings focused on classroom instruction were geared towards helping instructors in developing their pedagogical skills.

4.2.3. Instructional Resources

The instructors also talked about how various instructional resources impacted their work. In particular, the course coordinator provided many course materials to them, including a pacing guide, syllabus, common assessments, and rubrics. While the instructors repeatedly expressed gratitude for having these materials, they also faced some challenges. For example, the instructors found it challenging to stay on track with the pacing schedule, because of the desire to provide students ample time to work on investigative problems for deeper conceptual understanding. Therefore, while having a pacing schedule was considered as a support, the implementation was a challenge.

The instructional resources also included course materials from the textbook developers themselves, such as lesson presentations, an online homework system, and solution manuals. The online homework system was one of the resources that the instructors found challenging to navigate, both for themselves and their students. As one instructor explained:

It [homework] was a process to get through . . . The simplest thing is the effort you have to go through to actually look at the problems before you post them, is a lot more. So, the interaction with the homework site really is not quite as good as it was before [prior to the new curriculum].

In addition, there were other technical issues such as a few errors and typos in the problems and the accompanying presentations in the instructor edition of the textbook. These challenges made it difficult to use the resources.

The resources and supports discussed above are related to the work itself. However, in Hoyt's survey [13], this motivator was not addressed. We hypothesize that this was evident with our adjunct population because of the particular curriculum they had to implement, where the problem-based pedagogy is championed. We also believe this showed up in our data because of the fact that all our instructors were teaching the same course and working together. Hoyt and colleagues surveyed a range of instructors across their university campus. Therefore, the experiences of these instructors in terms of their curriculum and appointments most likely varied a great deal. Additionally, most of our planned resources and supports were created with the *Pathways* curriculum in mind. We knew that implementing a research-based curriculum would be challenging for our instructors, and therefore we purposefully crafted experiences for them to help mitigate any problems.

In the section to follow, we unpack our results and connect these supports and challenges to our adjunct instructors' job satisfaction. We discuss what these findings mean for our department moving forward as well as how our model can inform other institutions' efforts. We conclude with how these differences might inform future work around job satisfaction for part-time faculty.

5. DISCUSSION

The instructors found mentoring and interactions within the department beneficial. This relationship aspect of a job may help instructors to feel more connected to the institution and feel appreciated [23]. Our adjunct instructors appreciated having a course coordinator with whom they could share their course-related concerns. In addition, the weekly online meetings were a place where instructors could discuss their classroom experiences, seek advice, and ask questions. While the online format of the meetings was not optimal for many of the instructors, they found having this venue available to them as a form of support.

Based on our findings, we made an effort to improve these supports and resources. As mentioned earlier, learning about adjunct instructors' job satisfaction was part of a larger research project. We took guidance from the research literature to develop the supports that we initially provided our instructors. Our plan was to embed a feedback loop in our model to inform our efforts (see [Figure 1](#)). Findings from our initial data analysis guided us in two ways. First, we were able to make changes to the supports we provided to better meet the needs of the instructors. Secondly, we can inform the research literature on job satisfaction by sharing our

findings as we ourselves get a better understanding of the influence of supports and challenges on our instructors' job satisfaction.

In terms of the changes we made to the model, we adjusted the pacing schedule, revised common assessments, and provided additional opportunities for the adjunct instructors to collaborate and share their work, not only with the course coordinator but also among themselves. Additionally, we implemented a differentiated approach to the weekly meetings by offering two different types of meetings in one semester: one focusing on the curriculum for new instructors, while the other one was centered around specific pedagogical knowledge for undergraduate teaching of mathematics for returning instructors. While the scheduling of these meetings remains an issue (given the time constraints posed by the nature of adjunct instructors' jobs), we continue finding new ways to accommodate their needs.

We also continue using the research literature to make sense of our findings. For example, we initially employed the findings of Hoyt [13] and Herzberg [12] as we ourselves were learning about job satisfaction and job dissatisfaction. Through analysis of our data and comparing our instructors' feedback to the existing research, we are exploring emergent areas of focus where our efforts can support adjunct instructors. For example, previously we had not considered the curriculum to have any effect on instructors' job satisfaction. However, our findings indicate that implementing a new curriculum, especially one that is based on a philosophy different from instructors' previous experience, can in fact influence adjunct instructors' job satisfaction. Their engagement with the curriculum materials, while planning, enacting, collaborating, and reflecting provided challenges for the instructors as well as opportunities for their learning [21]. When looking at their interactions with the curriculum materials in terms of their job satisfaction (in particular, the "work itself"), we found that the instructors appreciated an emphasis on conceptual understanding for their students. The curriculum provided support for the instructors, as it allowed them to focus on a deeper learning of mathematics. Their students would engage in solving context-based problems, and the instructors recognized the benefits of such problems for their students. Of course, implementing the curriculum brought with it new forms of challenges. The instructors themselves had not implemented a problem-based curriculum previously. In addition, their students were resistant to the investigative nature of the problems. The instructors spent more time planning their lessons, developing a deeper understanding of mathematical concepts, and learning new terminology. Factors such as making sense of the new curriculum, getting students on board, allowing time for students to explore problems while maintaining the pacing of the course are all areas that emerged as important. As we continue to analyze additional data, we intend to incorporate the existing literature into our analysis, which subsequently extends the field's understanding of mathematics adjunct instructors' job satisfaction.

Findings about the challenges adjunct instructors face and the supports they need are important, since many institutions of higher education are looking to provide their students with experiences focused on communication, interdisciplinary application of quantitative skills [5], and conceptual understanding of mathematics [22].

This emphasis has been motivated in part by the MAA's Curriculum Guide [30], which has provided recommendations for undergraduate mathematics, including developing mathematical thinking, communication skills, and interdisciplinary learning of mathematics, among others. To that end, our findings suggest the need to provide further supports within the department to facilitate adjunct instructors' learning, their professional growth, and in turn their job satisfaction. Here we provide three specific examples based on what we observed in our study:

- (1) When instructors found the problem-based investigations beneficial, we assisted them in implementing the curriculum by providing necessary supports and alleviating some of the challenges they face.
- (2) When pacing of the course was a common concern for the instructors, allowing the instructors to focus on the big ideas within each module enabled them to spend more time on fewer questions.
- (3) When instructors were unable to attend in-person group meetings due to their limited availability, we offered other alternative formats (such as online meeting and asynchronous discussion boards on Canvas) to help them share their experiences and concerns, which also served to support them.

6. CONCLUSION AND RECOMMENDATIONS

In this paper, we described our model of Precalculus course coordination (AMIRS project) and explained how the provided resources and supports in addition to perceived challenges were related to our adjunct instructors' job satisfaction. The desire for developing this model was warranted by the need to improve students' performance and retention in STEM majors. It should be noted that the number of adjunct instructors who participated in our research study was limited, and the present work was not intended to be a statistical approach. Instead, we aimed to share with department administrations and course coordinators what supports and resources our adjunct instructors found beneficial and what challenges they faced implementing a new research-based curriculum.

Based on the findings, our recommendation is to develop opportunities for adjunct instructors to have more face-to-face time with other members of the department, including full-time faculty, staff, and graduate assistants. These interactions should focus on various aspects of their job such as mentoring, continuing professional developments, programs and curriculum discussions, students' performance, and social activities. We strongly believe that providing such support will allow the instructors to feel like they are an integral part of the larger departmental community, thus increasing their sense of belonging. Ideally, the above-mentioned interactions should occur on a regular basis, but we recognize the time constraint and availability challenges involved with adjunct instructors. Thus, we suggest offering alternative arrangements such as online meetings and asynchronous teaching and learning opportunities. Finally, adjunct instructors appreciate having a course coordinator with whom they could share their course-related concerns. In addition,

it is important for department administrators and course coordinators to create opportunities for adjunct instructors to collaborate with each other for instructional planning, pedagogical approaches, and grading.

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BIOGRAPHICAL SKETCHES

Zareen G. Rahman, Ph.D., Assistant Professor, James Madison University. Dr. Rahman's research interests are focused on mathematics education reform, specifically the role that teachers play as mediators between instructional resources and their students. Her dissertation work focused on adjunct instructors' experiences as they implemented a research-based Precalculus curriculum for the first time. Through this work, she explored the challenges faced by the instructors as they made sense of the new curriculum and the opportunities for instructors' learning that emerged through these challenges. Findings from this research suggest that while teachers may experience similar challenges, their response to the challenges differs based on their beliefs, their knowledge, and their prior experiences with the teaching and learning of mathematics. Developing supports for teachers require learning more about the nuances of the unique challenges and how they are perceived by the teachers.

Eileen Murray, Ph.D., Assistant Professor, Montclair State University. The core of her research interests is the desire to understand how to best prepare and support secondary mathematics

teachers along their professional continuum. This is important because research has shown that teachers who participate in ongoing professional development are better situated to improve student learning and performance. But as a field we need to more fully develop and understand the aspects of professional development and undergraduate education that help teachers make generative changes in their practice. She believes that as a field we need to more fully develop and understand the aspects of professional development and undergraduate education that help teachers make generative changes in their practice. She has taught middle school, high school, and undergraduate mathematics as well as mathematics methods. She has been trained as a mathematics teacher educator and has engaged in research in several areas directly related to the preparation and professional development of teachers. Her work focuses on the overall goal of preparing and supporting secondary mathematics teachers. To better understand how to do this, she mainly researches the content preparation of teachers through specific content courses that aim to make connections between undergraduate and secondary content.

Amir Golnabi, Ph.D., Assistant Professor, Montclair State University. Dr. Golnabi studied Mathematics and Computer Engineering at the University of Salamanca in Spain. After completing 4 years of coursework, he transferred to Montclair State University where he graduated with a Bachelor of Science in Mathematics in 2007. Thereafter, he started his graduate studies at the Thayer School of Engineering at Dartmouth College, and worked on the “Computational Aspect of Microwave Imaging for Biomedical Applications.” In June 2012, he completed his Ph.D. degree in Biomedical Engineering and joined the Pulmonary Imaging and Bioengineering Laboratory at the Massachusetts General Hospital (MGH) and Harvard Medical School. During his postdoctoral research fellow training, he worked on “Complex Systems Approach to Bronchoconstriction in Asthma.” He is interested in undergraduate mathematics education. He is currently a Co-PI on an NSF funded project entitled “Adjunct Mathematics Instructor Resources and Support: Improving Undergraduate Precalculus Teaching and Learning Experience.” He is very passionate about teaching and is currently with the Department of Mathematical Sciences as an Assistant Professor. He teaches a variety of lower- and upper-level mathematics courses, and is very interested in implementing novel techniques to engage students in classroom, promoting deep learning, and improving students’ learning experience through shifting pedagogical practices.