

# What Can Departments Do to Increase Students' Retention? A Case Study of Students' Sense of Belonging and Involvement in a Biology Department

Journal of College Student Retention:  
Research, Theory & Practice  
0(0) 1–22

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DOI: 10.1177/1521025118788351

[journals.sagepub.com/home/csr](http://journals.sagepub.com/home/csr)



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## Abstract

The aim of this case study was to explore the sense of belonging to and involvement in a biology department for students participating in a biology program designed to create a strong sense of belonging with high levels of involvement and higher student retention rates. The study is based on 10 semistructured interviews with biology majors. Analysis showed that the students have created a strong sense of community among peers and good relationships with specific faculty and staff. However, the positive social environment did not fully translate into sense of belonging to and involvement in the biology department. Analysis also implied a strong focus on careers related to medical school among students and that students not sharing this strong focus might feel disconnected from the group. Taken together, the interviews identify several different aspects for departments to consider as a way to enhance students' sense of belonging and involvement.

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**Keywords**

department, sense of belonging, involvement, biology, retention, higher education

Worldwide, researchers report low student retention rates at universities and colleges (Berger, Blanco, Ramirez, & Lyons, 2012; Kahu & Nelson, 2018; Organisation for Economic Co-operation and Development, 2015; U.S. Department of Education, 2017). In the United States in 2017, the 6-year graduation rate for first-time, full-time undergraduate students who enrolled in public 4-year degree-granting institutions in the fall of 2009 was 59% (U.S. Department of Education, 2017). Apart from potential individual consequences of attrition, low student retention rates cause both large economic loss for the society as well as a shortage of college-educated working adults (Carnevale & Desrochers, 2003; Kuh, Kinzie, Buckley, Bridges, & Hayek, 2007). Research has also shown lower retention rates for minority groups and students from low socioeconomic backgrounds (Devlin, 2013; Gale, 2011), effectively maintaining social and cultural inequities. Thus, an understanding of how to increase student retention rates at universities and colleges is important on several levels.

Regardless of a relatively large number of studies on student retention, the successes in increasing retention rates have been relatively modest (Tinto, 2006, 2012). Previous work on retention has mainly focused on how student variables such as gender, career goals, and family commitments affect whether students succeed in college or not (Tinto, 2012). Although it is important knowledge, these factors are difficult for the institutions to change. Therefore, Tinto (2012) argues that more focus should be placed on what institutions can do to help students stay engaged and ultimately succeed. Furthermore, it is important to consider the students' perspective on what makes them want to persist in college (Tinto, 2017). An institution that understands students' perceptions is more likely to be successful in having students that will want to persist to completion.

Many theories state and previous research has shown that the key factors for students' success include involvement and a sense of belonging or relatedness (Appleton, Christenson, Kim, & Reschly, 2006; Maltese & Tai, 2011; Ryan & Deci, 2000; Smith, Lewis, Hawthorne, & Hodges, 2013; Tinto, 2017). As opposed to students' background variables, students' sense of belonging to and involvement in the institution is something that the institution can change. Involvement such as living on campus, joining social fraternities or sororities, and holding part-time jobs on campus all have shown increased retention (Astin, 1984). In 2006, Kuh, Kinzie, Buckley, Bridge, and Hayek

summarized a wide array of studies concerning the relationships between students' success and institutional conditions. They report that engagement, faculty–student interactions, peer interactions, experiences with diversity, cocurricular activities, and student satisfaction were factors that contributed to student persistence (Kuh et al., 2006). Furthermore, students who have a sense of belonging are more likely to participate in different activities, and students who engage in different activities enhance their sense of belonging (Appleton et al., 2006; Astin, 1984; You, Ritchey, Furlong, Schochet, & Broman, 2011). In addition, the benefits of engagement in educationally purposeful activities at college have shown to have a greater effect for low ability students and students of color when compared with high ability and White students, thus increasing sense of belonging and involvement can have a compensatory effect (Kuh, Cruce, Shoup, Kinzie, & Gonyea, 2008). As attrition is largest during the first year of college, several researchers recommend focusing effort for increasing retention on first-year students (Tinto, 1998; Watkins & Mazur, 2013).

Previous work on involvement and sense of belonging have been focused at specific disciplines, at the larger, institutional level, or at the smaller, individual setting of the classroom (National Academies of Sciences, Engineering, and Medicine, 2016; Trujillo & Tanner, 2014). Although we agree that understanding what can be done at these levels is important, we argue that studies focusing on departments could also be valuable, a focus rarely seen in the literature. Evidence supporting the importance of a departmental focus include students' engagement varying more within any given school or institutional type than between schools and institutional types, and students in different majors experiencing distinctly different academic experiences (Kuh et al., 2006).

### *Aim*

The aim of this case study was to explore the sense of belonging to and involvement in a biology department for a group of biology major students participating in a program called Quantifying Biology in the Classroom (QBIC). The QBIC program deploys several strategies that previous research suggests could create a strong sense of belonging and high involvement among students (QBIC is introduced in more detail in The QBIC Program section). By exploring how this specific group of students discuss their sense of belonging to and involvement in the biology department, we hope to gain a better understanding of how the strategies deployed within the program affect the students' experiences within the department. Ultimately, we hope that our findings can provide guidance to departments on how to continue to move toward better student retention.

## **Theoretical Framework**

Tinto's (2012) model of institutional action was used as the theoretical framework for the study. In this section, we will first define what we mean by involvement and sense of belonging. Then, Tinto's model of institutional action will be conceptualized and described.

Applying Astin's (1984, p. 519) definition of involvement on a departmental level, we define involvement in the department as the amount of physical and psychological energy that the students devote to the academic experience at the department. Involvement is seen as a behavioral construct, "what people do" (Astin, 1984, p. 519).

Inspired by Goodenow's (1993, p. 25) definition of sense of belonging in classrooms, we define students' sense of belonging to the department as students' sense of being accepted, valued, included, and encouraged by others (teachers and peers) in the department setting and of feeling oneself to be an important part of the life and activity of the department.

Tinto's (2012) model of institutional action was used as theoretical framework for understanding different element departments can consider to enhance students' success in higher education. Instead of putting the focus on student characteristics that may increase retention, the theory puts focus on the conditions within institutions that may affect students' success. The theory states that students are more likely to succeed in settings that provide (a) clear and high expectations, (b) social and financial support, (c) frequent feedback, and (d) active involvement, especially with their peers and faculty (Tinto, 2012). Although this theory was developed at an institutional level, we believe that it is valuable to apply at a departmental level to expand our knowledge to not only what institutions can do, but what individual departments can do to increase student retention within the major.

## **Methods**

This study is based on semistructured interviews, conducted with 10 students at Florida International University (FIU), a large R1 university in the southeastern United States. All students participated in the QBIC program. The participating students, the QBIC program, the structure of the interviews, and the thematic analyses used to analyze the data will be described in detail below. The study was conducted in accordance with an approved institutional review board protocol (FIU IRB-17-2084).

### ***Participants***

During the fall of 2017, an invitation to participate in an interview concerning their interactions with and experiences in the FIU Department of Biological Sciences (hereafter called the biology department) were sent out to three classes

of freshmen and sophomore students within the QBIC program (84 students in total). All students who replied within the given time frame were selected for interviews. In total, 10 students participated in the study, 5 females and 5 males. All students were biology majors, and all said that their goal was to enroll in medical school. One student was a double major. Three students were freshmen and seven students were sophomores. We believe that freshmen students were appropriate subjects due to the 6-week summer workshop designed to introduce them to the department (The summer workshop is further explained in The QBIC program section). Freshmen's perspectives are further valuable because attrition is largest during the first year of college. Three students were first-generation college students. Four students lived on the university campus. Eight of the students identified themselves as Hispanic, one as Asian, and one student preferred not to report ethnicity. Students who participated were given a \$25 Amazon gift card.

### *The QBIC Program*

QBIC is a 4-year program within the biology department at FIU (Weeks et al., 2011; <http://qbic.fiu.edu>). It is one of several interdisciplinary programs in quantitative biology offered in higher education in the United States (see, e.g., <http://www.hunter.cuny.edu/qubi>; <https://ubm.umbc.edu/>; <http://www1.udel.edu/qbio/>; and <https://www.ohio.edu/qbi/>). The program was implemented in 2007 and has had one or two cohorts entering the program each year since. The overall objective of the program is “to establish an integrated program of biology, physics, chemistry, statistics, and mathematics to prepare undergraduates to understand how things fit together and to provide them with the skills to do research in biological sciences” (Weeks & Koptur, 2013, p. 1). The program also has a goal of developing a community of learners: students/student, professor/students, and professors/professors, and to enhance a sense of community among participants (Weeks & Koptur, 2013).

One strategy for developing such a community is to block schedule the students so that during their first 2 years, they move through the program in a cohort; taking most of their courses with the same group of students. QBIC provides smaller classes resulting in greater support and bonding among students (Weeks et al., 2011). Students also have access to a study room only for QBIC students in the library. All these strategies represent the element *social support* in the model of institutional action which is the foundation for a good learning community and facilitates involvement.

Teaching in the QBIC program is organized around a teaching pentagon; a teaching design which in several aspects aligns with previous research suggesting a strong sense of belonging and high involvement, that is, courses are integrated with each other, active and cooperative learning techniques are employed, and both problem-based and peer-led team learning is utilized (Appleton et al., 2006;

Tinto, 2012). One concrete example is that all QBIC students participate in weekly journal clubs where groups of 8 to 10 students and a professor discuss research papers connected to concepts in their other courses (Weeks et al., 2011). The teaching pentagon touches on all the institutional elements in the model of institutional action. It encourages active *involvement* and creates several opportunities for *academic and social support*. Active learning promotes continuous *feedback* which also clarifies *expectations*.

Furthermore, the program also offers a summer workshop for incoming freshmen. It gives an extended opportunity to get acquainted with the course expectations and to develop relationships with both peers and the biology department faculty, giving students early *academic and social support*. The summer workshop can be considered as equivalent to freshmen seminars that have shown to be important for success in higher education (Hoffman, Richmond, Morrow, & Salomone, 2002).

The QBIC students have access to a program coordinator devoted entirely to the QBIC program. The coordinator handles the day-to-day running of the program office and helps the director in many of the program tasks such as recruitment, record-keeping, scholarships, special events, admissions, orientation, and graduation celebrations. The QBIC students are able to directly contact the program coordinator with questions and concerns.

In summary, the QBIC program deploys several different strategies that, according to the model of institutional action, should be applied by institutions to enhance students' success. Preliminary studies have shown that QBIC students are more likely to finish their degree program in 4 years and perform better overall compared to conventional biology majors (matched for SAT scores or grade point average, gender, and ethnicity; Weeks & Koptur, 2013). However, there is no previous study exploring the possible underlying mechanism for this increase in performance.

### ***The Interviews***

Interviews were conducted in late September and early October 2017. The aim and structure of the interviews were clearly explained to the students with special emphasis on the fact that the interviewer had no connection to the QBIC program or classes the students take through the biology department. Informed consent was obtained from all students. The first author conducted and recorded all interviews. Interviews lasted between 37 and 60 minutes and included questions about students' interactions with and experiences in the FIU biology department, as well as cognitive interview questions (Willis, 2005).

The interview guide was developed around the two key concepts in our study; sense of belonging and involvement. Specifically, the students were asked a few background questions. Next, the students were asked to talk about their experience and interaction with the biology department, allowing them to talk

relatively unprompted about their relationship to the biology department. The four subsequent questions aimed to cover different aspects connected to sense of belonging and involvement. To encourage students to talk about the aspects included in our definition of sense of belonging (e.g., being accepted, valued, included, being an important part), the students were asked how they feel when they are at the biology department and if they feel like a member of the department. To get a sense of the students' involvement in the department, the students were asked what they know about research and other activities within the department, and what activities within the department they have attended or would like to attend. Different probes were used to encourage the students to elaborate on each question. The interviews ended with cognitive interview questions elaborating on how the students understood items in a survey they had completed earlier in the semester. The survey was developed to measure sense of belonging as conceptualized by Goodenow (1993) as well as departmental involvement (Knekta & McCartney, Unpublished). This discussion allowed the students to get into more detail about their sense of belonging to and involvement in the biology department.

### *Thematic Analysis*

Interview data were analyzed using thematic analysis (Braun & Clarke, 2006) and Nvivo software. First, each interview was transcribed verbatim using a common online transcription service. The first author read all transcripts while listening to the interviews to account for any errors in the transcription. In the first round of coding, attributional coding was applied to identify demographic information for the students (Saldana, 2013). In the second round of coding, inductive coding was applied to search for themes in the data (Saldana, 2013). Coding focused on the semantic content of the interview excerpts, that is, focusing on the explicit meanings of the data. All data were coded by the first and the second author. Each author individually organized the codes into groups of similar codes, which in turn were organized into subthemes and themes. The themes were discussed and compared, and a common thematization was agreed upon. Based on that thematization, the first author recoded all interviews resulting in further refinements of the themes. Finally, both authors listened to all interviews again to validate the final themes.

Per definition, inductive coding is free from theoretical frameworks. Instead, inductive coding is completely driven by the students' responses (Braun & Clarke, 2006). Therefore, the model of institutional action was intentionally not considered when identifying themes. The theoretical framework was also not considered when developing the interview guide. Instead, we wanted to have an authentic account of the students' perspective of their sense of belonging and involvement to the department that we could contrast to the elements described in the model of institutional action.

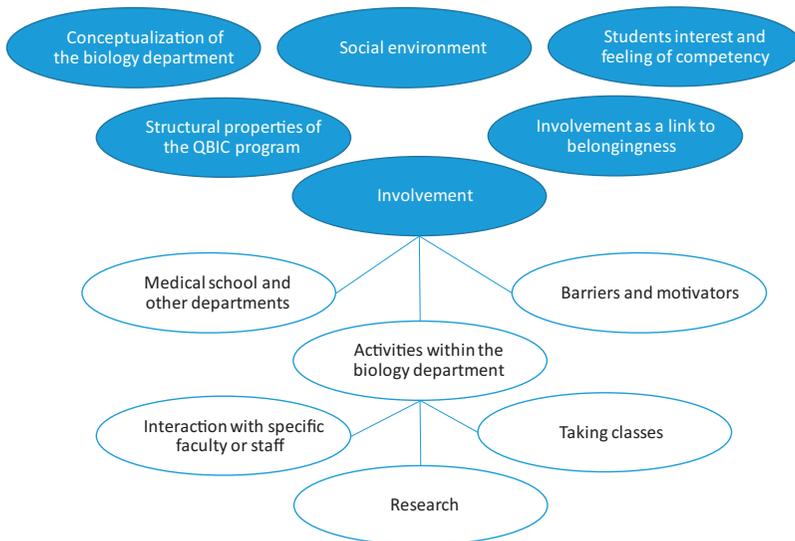
## Results

The inductive coding resulted in six main themes: (a) conceptualization of the biology department, (b) social environment, (c) students interest and competency, (d) structural properties of the QBIC program, (e) involvement as a link to belongingness, and (f) involvement (Figure 1). Each of these themes will be described and illustrated with quotations. Each of the interviewees is represented by at least two quotes.

### Conceptualization of the Biology Department

Although it was clear that the students identified themselves as biology majors, and as participants in the QBIC program, their feelings related to and interactions with the biology department did not seem to be something they actively considered before participating in this study. That is, not to say that students did not have feelings related to or involvement in the biology department, but rather that the biology department is not something students actively relate to on a daily basis.

Students did talk about the biology department differently. People (faculty, instructors, and staff) working within the department were the most common way for students to describe the department. Some students also included their student peers in their description of the department: “Well, um, it’s a



**Figure 1.** Thematic map. Blue ovals correspond to the seven main themes and white ovals correspond to subthemes within the main theme, *involvement*.

combination, I guess, of the professors that are conducting research and working with the department and the counselors that help the students and the students that are studying” (Student 3).

The physical buildings were another way for students to define the department. Students had vague and diverging perceptions of where the department really was and provided a range of different buildings and places that they considered as being the physical home of the biology department: “Uh, to be honest, I don’t really know where it is” (Student 2). Considering that the biology department is spread over two campuses and more than five buildings, this is not surprising. Also, the students are assigned their own workspace in the library which might further distance them from the physical spaces of the biology department.

Three students mentioned that the physical environment of the biology department is not very inviting: “I, I just like the department, the physical place is just more comfortable in the chemistry area” (Student 2) or “I think the buildings are . . . They’re kind of like old fashion in a way? [. . .] I would- I don’t think it’s very like, inviting or homey” (Student 5).

### **Social Environment**

Overall, the students said that they feel good within the biology department. Students found people connected to the biology department to be friendly and easy to approach: “It’s really just like an extension of my family . . . everyone’s so friendly and willing to help again” (Student 1). They also felt accepted, valued, and respected: “So, like, when we’re in our groups, I would, I’ll say something about genetics, and they’ll take my opinion seriously about what I have to say” (Student 9). Students did also talk about FIU as a whole as being a very accepting and diverse community: “. . . FIU is a very broad community . . . and they accept most everybody” (Student 8).

Continuously throughout the interview, the students talk about positive interactions with a specific faculty member, instructor, or staff member when reflecting on the biology department. Students describe them as being helpful and providing support: “My, my professor, was also very open to me, and he would, you know, allow me to come to his office hours and ask him many questions” (Student 5) and “She’s [the QBIC coordinator] very understanding, so she’s really nice. And she’s like, “Oh, come over whenever you want, and we’ll just talk” (Student 7).

In general, students indicate good relationships among peers. There seems to be a close connection among QBIC peers within the same cohort and also between lower- and upperclassman at the program. One student explained:

Like, for my Biology final last year, we all got together at our friend’s house and we all slept over because we all knew each other. So, we all did a sleepover and studied

all night together and we slept and then, we woke up and we kept studying. So, like it was voluntary. We planned it, but it's because we were such close friends, because we were part of a program. (Student 6)

Additional quotes illustrating a good community among peers can be found in "Structural properties of the QBIC program." The general picture received is that the students experience a good social environment at the biology department. However, two stories did not follow this pattern. One student said:

Like everybody just studies and gets good grades and like, there's a lot of competitive like-ness in QBIC like there's a lot of benefits, but the people in QBIC is just like, it's hard to interact with some of them. (Student 10)

The student continued to mention other students cheating to receive better results on tests. Another student highlighted that not having a decided career goal, and specifically hesitating about a career in the medical field, was not really socially accepted within the QBIC community. When explaining why she sometimes feels like she does not belong to the biology department, she said:

I don't really know what I want yet. So. When people are asking me, and like, people interrogate you sometimes, they're like, "Oh, why don't you want to be a doctor?" It's like, right on the spot. And if they don't like your answer, like, I don't know. I, I hear that some people will, like, tear you down if don't like your answer. [...] But... So I don't know if I really want to be here, because I don't, I'm too young, I feel like, to know what I really want in life. [...] I feel like everyone else tells you that you have to, like, pick now, and stick with it forever, and, like. That really intimidates me. (Student 7)

### *Student Interest and Feeling of Competency*

The two main student characteristics mentioned were competence and interest. Students felt good or felt that they belong as biology majors because they consider themselves as competent when it comes to biology-related issues: "I feel good, like my biology teacher he's pretty good. I took a test, like, last week, and I did pretty well" (Student 8) or "Because I mean biology, it's basically the basis of medicine, so I feel like I belong because that's what I want to be. I feel like I understand it and I do well" (Student 9).

Some students talked about how not feeling competent made them feel less like they belonged. When explaining why he did not strongly agree that he belonged to the biology community, one student said: "cause sometimes, I don't know, when you're in class or something like that and you feel like you don't know what you're doing" (Student 1253).

Many of the students mention that they love or like biology and that makes them feel good. Some students emphasize that they feel a sense of belongingness because they are in a community with people sharing their interest: “I feel good. I feel at home when I’m around other people who are interested in what I’m interested in” (Student 1) or

And I would say like, I love being a bio major. That’s my favorite thing. I like biology more than any subjects on this planet. Um, probably even more than chemistry. Um, and I’m happy being a bio major. I don’t think I would ever change my major. And I’m very passionate about it. (Student 10)

### *Structural Properties of the QBIC program*

Repeatedly during the interviews, students explicitly mention structures of the QBIC program that facilitates their interaction with faculty and other students and contributes to their sense of belonging: “Um, well, I’m in QBIC, so I have a lot of, like people that I can go talk to” (Student 7) and

It’s a little . . . I feel it’s like a high school in a college is what I feel like from the program. So, I kind of like feels different I guess from than a normal university student, because they make us involve each other with each other. (Student 6)

They also mention the small class sizes as something positive: “Cause in a normal biology class, it’s hundreds of kids and one teacher. And then, my-my biology class is maybe 25, 30 of us . . . So it provides for, like, a closer bond with you and the teacher” (Student 8).

The summer workshop is mentioned by students as an opportunity to get to know more about research at the biology department as well as an opportunity to get to know peers: “like I’ve gone to some departments and seen their labs and what they’re doing, ’cause QBSS, we did like, I guess, field trips and went to like the labs” (Student 4) and

I would say that because during the summer session where we had our little orientation, all the QBIC students, uh, got together and basically had their orientation for 6 weeks so I got to know a good majority of them and I would say that they like . . . that they like me the way I am because I made friends almost instantly. (Student 1)

The journal club is mentioned by several students during the interview, both as a forum for getting to know research at the biology department and for actively participating in discussions.

Uh, yeah. I, I mean, also we had some projects like centered around the FIU professors, look up their papers and do like, um, a review paper on it, or things like that. So QBIC really encourages you to, to go talk to them, the professors that do research. (Student 2)

When asked about contributing to discussions in their biology courses, one student said:

And it's most likely due to journal club. [. . .] Like I like journal club, because we really do get to discuss our thoughts on like on the papers and try and get to like, behind like what the researcher was trying to like . . . You know explain, with their paper. (Student 5)

Positive experiences with the QBIC program coordinator are mentioned by several students: "like the director of QBIC? Or secretary, something like that, I'm she's been really nice. I've had, like, multiple conversations with her. So I have a pretty nice bond with her" (Student 8).

### *Involvement as a Link to Belongingness*

When specifically talking about being a part of or belong to the biology department, most students mention involvement or "giving" to the department. When students were asked if they felt like a real part of the biology department, two of them answered: "I think more so now that I've joined the research lab" (Student 7) and "Yeah I would say strongly agree. . . . Just due to the fact that like, I've interacted with the professors and I, you know I have been there, I've taken classes as part of the biology department" (Student 5).

Less involvement in the department seemed to correlate with less of a sense of belonging: "Well, because I haven't been too involved with the department. So I wouldn't say strongly agree [that I belong] until I do, you know" (Student 3) and "Because like . . . I would want to [be a part of the department], [. . .] I'm not at that, like, I'm not involved yet, but like, I would want to be involved" (Student 8).

### *Students Involvement*

The last main theme, *involvement*, could be divided into three subthemes: (a) involvement in the biology department, (b) involvement in medical school and other departments, and (c) barriers and motivators.

### *Involvement in the Biology Department*

Taking classes, undergraduate research and individual interactions with faculty and staff were the dominating activities mentioned when it comes to

involvement in the biology department. Although not as prevalent, students do also talk about interactions between peers. They are members of biology clubs, study together in groups, are mentoring other students, or are being mentored by upper-class students. Departmental activities such as volunteering in a biology-related field, in nature preserves, or attending research seminars and poster sessions were mentioned by only a few students. In fact, most students did not even seem to be aware of these opportunities. We will elaborate some more on the three most dominating activities in the following:

*Taking classes.* All students interviewed have taken classes offered through the biology department. Some students mentioned the classes they take or have taken as their only or main interaction with the department; “I’ve, um, I’m just taking classes” (Student 4), “I really only interact with like the teachers” (Student 2), and “the only interactions I’ve had with the biology department as of now would be just classes” (Student 9).

*Undergraduate research.* Participating in research is something the students perceive as very important:

And everybody I talk to, like, upperclassmen, teachers, everybody’s like, Oh, um, make sure that you go around and ask biology faculty if you’re, if they have a spot for you in research, because getting yourself involved in research is probably one of the biggest opportunities that FIU offers you. (Student 8)

and

Because usually a lot of biology students, they have to get into a research lab, right, to be able to do what they want to do and especially, the pre-med students. They—they need to get into a lab, because it has to get put on their resume. (Student 6)

Most students say that they are planning to do undergraduate research while some are already involved or have previously been involved with undergraduate research.

*Interaction with individual faculty and staff.* Each student mentioned one or several interactions with individual faculty and staff. Visiting teachers office hours or meeting administrative staff to discuss course management are two common interactions. But several students did talk about more informal interactions: “I usually like go to [the professor] and like catch up and [the professor] is like, Okay, what are you doing?” (Student 6). Most students mentioned only faculty that they have met through biology courses, they have not yet expanded their social network to additional faculty within the biology department.

Worth mentioning is that some students indicated minimal interaction with faculty because they do not feel like they need to interact: “I don’t think it’s likely. I think I do pretty well, and so I, I usually don’t really go to office hours or anything, because I, I like to just get it done” (Student 2).

### *Medical School and Other Departments*

Many students talked about involvement in activities in other departments. For example, one student did research within the psychology department, one was a learning assistant in the math department, and one student connected more to instructors within the chemistry department. However, the majority of activities outside the biology department are connected to the students’ goals of attending medical school. Students participate in seminars concerning medical careers, volunteer at hospitals, participate in “STEM Saturdays” organized by the medical school, and join student clubs related to medical schools. When asked about if it is hard to be accepted at the biology department, one student said:

I put disagree, just flat out disagree, because a lot of kids that are in bio are also pre-med. So, the biology department already knows that we have a different goal in mind. [...] So, they try and help us and work it out with us. (Student 6)

Another student said:

It, uh, I wouldn’t particularly go to the FIU, um, department, like the biology department to ask for advice. Uh, I would probably ask the people who help with like medical schools and all of that, just because of planning for the future. I don’t know what I can get at the biology department. (Student 2)

### *Barriers and Motivators*

Students mention several different reasons for why they do or do not become involved in different activities. The two main barriers mentioned are time and lack of knowledge. Students state that all their available time is dedicated, their courses and that activities, such as seminars, are often scheduled the same time as their courses. Few students seemed to have knowledge about any biology-related volunteer opportunities not related to the medical field, or biology-focused research seminars or poster presentations. Students mention that they receive e-mails from several different sources (the biology department, QBIC, clubs, and FIU) containing information on research opportunities, conferences, meetings, clubs, and so on, but most students do not really seem to read them: “I think I’ve seen e-mails . . . I haven’t really read them, but I know that they’re there” (Student 8). One source of information the students did mention that they

use are the departmental webpage. However, the students do not always find what they look for at the webpage:

I don't really know. The website for research, the biology FIU website... is not updated. [...] Like, it has old labs that are not working anymore, and then it doesn't have the new ones. Like, the, the lab that I'm in is not on the website. [...] So, when I was looking for labs, I didn't see it, and like, I saw a couple that I wanted, but they're not even there anymore. (Student 7)

The overarching motivator for student involvement in different activities was to achieve their future goal of getting accepted to medical school: "So basically it's ... it's another club for students who want to join, like, medical school so they help you, like, build up your resume, uh, do your volunteering hours" (Student 1). Some student activities may have a more directed purpose. For example, students may go to office hours to manage their courses. Similarly, some students might consider going to research seminars as a way to interact with faculty in order to get into research labs.

Another main reason why students become involved in activities is because it is part of their class. Through journal clubs, students get to visit the webpage and read research papers from biology faculty members, their instructors take them to a biology research seminar as a part of a class, or they become informed about ongoing research in class. In certain classes, students interact with upperclassmen who are serving as biology tutors or learning assistants.

## Discussion

Regardless of a relatively large number of studies on student retention at universities and colleges, successes in increasing student retention have been relatively modest. The aim of this case study was to explore the sense of belonging to and involvement in a biology department for a group of students participating in a biology program (QBIC) designed to create a strong sense of belonging with high levels of involvement and, in the long term, higher student retention rates. We hope that a better understanding of student experiences with QBIC will provide guidance to departments on how to continue to move toward better retention.

Overall, students describe a strong social environment within the biology department. Students feel accepted, valued, and respected within the biology department and describe positive relationships between peers and with faculty and staff. This aligns well with the first part of our definition of sense of belonging: "sense of being accepted, valued, included, and encouraged by others (teachers and peers) in the department setting."

Several key properties of the QBIC program were mentioned by the students as something positive. The support and orientation provided through the

summer workshop and by the QBIC coordinator align well with the elements *expectations* and *support* in Tinto's (2012) model of institutional action. Students described that they got an early orientation of research happening in the department, what it means to study biology, and advice on how to successfully manage the QBIC program, which, according to the model, will increase the likelihood of student retention. The structure of the QBIC program also seems to create what Tinto (2012) calls a learning community. Specifically, the small class size is described as creating close bonds and interactions among peers and faculty. The students also reported that peer-led learning, journal clubs, and the summer workshop facilitated discussions and relationships among peers. Learning communities yield a number of important benefits for the students, such as supportive peer groups, and higher involvement in learning activities (Tinto, 2012). The institutional element *assessment and feedback* in the model of institutional action was not directly mentioned by the students. However, students talk about active learning and how they think people notice when they are good at something, indicated that they receive continuous feedback within courses.

The model of institutional action mentions a range of student properties not considered as being immediate objects of institutional actions (e.g., gender, abilities, attitudes, social skills, family commitments; Tinto, 2012). Students talked about two of these properties in connection to sense of belonging, interest, and feelings of competency. Although not considered primary targets for action by the models, interest and feelings of competency are beliefs the department likely could affect through the elements of *support, expectations, assessment and feedback, and involvement*.

Although most students feel accepted, valued, and respected within the biology department and express a strong interest and competence in biology, they did not consider themselves as an essential part of the biology department. Thus, the second part of the definition of sense of belonging "feeling oneself to be an important part of the life and activity of the department" does not seem to be successfully fulfilled. Specifically, most students described themselves as "taking" from the department, most often in the form of courses, instead of "giving" to the department in the form of research or volunteering. Considering that the interviewees were freshmen and sophomore, these results might be expected. Most students further described their lack of involvement as resulting from either being too new to the biology department, not having enough free time, or lack of knowledge about available opportunities. This lack of involvement in or "giving" to the biology department was the most cited reason students gave for a lack of a sense of belonging within the biology department. In that sense, our results agree with previous work showing that students' behavioral engagement affects their sense of belonging (Appleton et al., 2006; Astin, 1984; You et al., 2011).

Students at the QBIC program seem to be situated in a peer context where the shared common values strongly relate to a medical-centered career. These common shared values are likely to affect students' sense of belonging and involvement (Appleton et al., 2006). The strong focus on medical school might restrict students' thinking of possible careers outside of medicine. Furthermore, the intimacy built on the common goal of getting into medical school might disconnect students who do not share this strong focus from the group (Wenger, 2008).

Upon analyzing all the interview data together, it seems that some students may only join the QBIC program because they think it will increase their chances of getting into medical school. This intense focus on medical school extends to where students choose to become involved, with most interviewees seeking research and volunteer opportunities outside of the biology department. Taken together, it seems like the students at the QBIC program have constructed what Wenger (2008) calls "a community of practice" centered on a medical-centered career. In other words, they are a group of students sharing activities, discussion, interaction, ideas, and strategies centered on a future medical-related career. As a result, the goals of the QBIC program are in a sense acting against the biology department as the QBIC students, who the biology department has invested in and developed a community around, are seeking involvement opportunities elsewhere. These students know that they need to be involved, and they want to be involved, just not with the biology department.

In summary, the QBIC program has been successful in creating a strong sense of community among their students, but there is still room for improvement. The strong social environment does not fully seem to translate into sense of belonging to and involvement in the biology department and the strong focus among peers on medical school might be excluding for some students. For a learning community to be successful, faculty and staff must work together to ensure that students' experiences are tailored to the needs of the students that the community serves (Tinto, 2012).

### ***Suggestion on Possible Departmental Action***

In our particular context, faculty and staff can serve as important factors in balancing the unintended prevailing focus on medical school. We have some suggestions on how faculty and staff can do this. First, faculty and staff could actively highlight and encourage alternative biology careers both within and outside the university, starting in the intro courses. This might help alleviate two issues: (a) a more inclusive environment for students who do not have careers related to medical school and (b) students aiming for medical school who do not reach that goal will be primed on alternative biology-related career pathways. Although this may seem like a relatively small adjustment to make in

intro courses, it follows Tinto's model of institutional action giving academic support for students regardless of career goals.

Similarly, departmental instructors and faculty have the important and challenging task of meeting the interest of the students having a strong interest in medical-based biology while still including and encouraging students with other interests when teaching general biology courses. Although it may seem reasonable to connect coursework to medically related examples (i.e., a topic in genetics connected to a human disease), there is value in connecting to a broader view of biology (i.e., a topic in genetics connected to a plant or animal disease). In this way, instructors and faculty can frame the inclusion of nonmedical examples as a way to make pre-med students more well-rounded biologists.

A second way to balance different students' interest is by providing students an opportunity to reflect on their personal utility-value of course topics for their life. Previous research has shown that having students reflecting on their personal relevance and utility value of introductory biology courses increase students grades and the likelihood of retention (Canning et al., 2017). By discussing multiple values together, that is, some students may see utility for future studies in human biology, while others will see the utility for their future plans of saving coral reefs, the classroom environment might become more inclusive.

All students in our study saw value in participating in undergraduate research. How do we convince medically oriented students that there is value in research in the fields of ecology or botany? Similar to the previous example, gaining a more complete understanding of the various fields of biology can be framed as developing students as more well-rounded biologists. In addition, research experiences can be further defined in the introductory courses as more of an emphasis on acquiring a set of critical thinking and analysis skills that are attractive to medical school, regardless of the lab where the research took place. Taken together, these small changes may result in students seeing a larger value in participating in non-medical-related research.

Finally, our results indicated a low awareness of and involvement in research seminars, poster presentations, and volunteer opportunities arranged by the biology department. Nevertheless, these activities could also provide a means for interacting within the department. Our results suggest that classes and the department's webpage could provide effective means for reaching out to and engaging students in these kinds of activities. Relating to classes, we suggest connecting course content to examples of research happening within the department if possible. For example, through their QBIC journal clubs, the students already seem to become aware of some of the research within the department because they were assigned papers to read that were authored by departmental faculty. Relating to the department webpage, a more specific page guiding and encouraging biology majors toward a plethora of different activities might facilitate involvement. Students in our study reported knowing how to use the

website to find a faculty member, but they did not know how to find information beyond that.

### *Limitation and Future Research*

This is an explorative study including 10 students participating in the QBIC biology program. As such, it can provide a more in-depth description of these students' experiences of participating in the program. The results, however, are not generalizable to all QBIC students or other biology majors. Still, these students' perceptions could help us better understand how different strategies deployed by departments for increasing students' success are received by students.

In future studies, it would be valuable to interview biology students participating in programs similar to QBIC. It would be interesting to compare the structural differences with these initiatives and how they may, or may not, affect student's sense of belonging and involvement.

In addition, we are planning to replicate this study with students participating in more conventional biology programs and will compare/contrast this data to that of the QBIC students. It would also be interesting to apply a longitudinal mixed methods design, first collecting quantitative data (survey currently in development) concerning sense of belonging, involvement, and success in their studies for both QBIC and non-QBIC students during the students' first 3 years. By the end of the third year, researchers should follow up with retrospective interviews designed to determine possible events that the students consider as important for their sense of belonging to and involvement in the biology department during their studies.

Finally, we have to ask ourselves if it is essential from the students' perspective to become involved in the department of their major or if involvement in any part of the institution is equally good. We believe that departments can play an important role in involving the students both within the department and the institution as a whole. Also, for successfully completing the first 2 years of university, a sense of belonging to and involvement in a specific department might be more beneficial than a sense of belonging and involvement on a more general institutional level.

### **Acknowledgements**

The authors are indebted to Monique Ross, Sarah Eddy, Suzanne Koptur, and Zahra Hazari for their valuable comments during our work with this article.

### **Declaration of Conflicting Interests**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

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