

AN ANALYSIS OF IMPROVING SCIENCE SUCCESS AT A MULTI-CAMPUS  
COMMUNITY COLLEGE THROUGH MENTORING

by

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## ABSTRACT

This research study examined a mentoring program targeting introductory science students taking Human Biology during the 2013 academic year at a midwestern rural community college, to determine if it had an impact on student success and persistence. The participants in the study included 61 students who were assigned mentors at the beginning of the term of study and the eight to nine mentors that worked with the students each term. The study had quantitative and qualitative elements. Quantitatively, the mentored students were assessed to determine if they had greater success—as measured by completing with a 2.0 or greater—and if they persisted to the next term at a higher rate as compared to students who did not have mentors. This data was cross tabulated and analyzed using the Chi-square test and Phi. Qualitatively, in order to find out how the participants viewed the program, the mentored students were surveyed at the end of the program and the mentors were polled each term.

The data indicated that mentored students taking Human Biology during Spring 2013 succeeded and persisted at a greater rate than those who did not have mentors, but that there was no difference in success or persistence for mentored students in Fall term. The mentors reported students made somewhat greater use of the mentors during the Spring term. The mentored student response rate was rather low, but of those that responded, nearly 90 percent got a 3.0 or higher—which is a far higher grade than the average—and a similar number reported the mentoring program had no impact on their success. The results suggest the respondents may have been students who did not need the mentoring intervention.

The results of this study support the need for continued research into mentoring and other interventions to assist in community college success and persistence.

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## DEDICATION

In honor of

the students it is my privilege to teach, for whom I do this work.

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## CHAPTER 1: INTRODUCTION

### **Introduction**

This research study examines a mentoring program targeting introductory science students—specifically, those taking Human Biology during the 2013 school year at Jackson College. This mentoring program is being evaluated to determine if it has an impact on student success and persistence. This research study establishes a model for student success based on the theories of Chickering, McClenney, and Tinto.

As discussed by Dougherty and Townsend (2006), community colleges have for many years had multiple missions, and there have never been enough resources to meet all of the demands. As more roles have been added, resources have not expanded to cover all of them. But especially with recent economic events, such as shrinking state and federal budget allocations (Rowley and Sherman, 2002), decreasing resources have begun to get more limited. This has led to the question of whether community colleges can continue to try to be all things to all people. Funding could further be impacted if tied to an outcome such as the current student rates for graduation and completion. Rowley and Sherman (2002) discussed the significance of the resource environment, noting that there have been increasing concerns about “issues of accountability and the worthiness of higher education institutions to receive funding above other fiscal demands ...[this] resource environment [has] become more competitive....[and] also shrunk...causing

major fiscal problems for [U.S.] campuses” (p. 8). Accountability standards are only likely to continue to increase in demand going forward.

There is significant focus being placed on poor graduation rates and poor rates of transfer to four-year colleges (Rowley and Sherman, 2002). One area where community colleges experience noteworthy success is in occupational education, especially in the health care area (Dougherty & Townsend, 2006; Pusser & Levin, 2009). As noted by Pusser and Levin (2009), “there are high-performance programs within community colleges that can meet any educational measurement standards of success...including course and program completion rates, degree completion rates, employment rates, and economic return rates... average success rates on nationally certified examinations have reached as high as 98 percent with exceptionally high rates of employment upon program completion” (p. 9). But these programs are also quite expensive, and in order to fund them, colleges may need to “subsidize higher-cost occupational programs from the surpluses generated by less-expensive academic programs” (Dougherty & Townsend, 2006, p. 9). Meanwhile, when the college focuses so much on its occupational programs, this deflects from the transfer mission, and has been associated with less success in that area (Dougherty & Townsend, 2006).

In addition, there are demands for the community college to expand its mission to include offering a baccalaureate degree, especially in high demand fields like nursing. But offering a baccalaureate would further undermine the transfer mission (Dougherty & Townsend, 2006, p. 10), as well as possibly reducing resources—and success—in occupational and remedial programs, which are already “the fastest growing sector of community colleges” (Pusser & Levin, 2009, p.13-14).

One of the biggest challenges faced by community colleges—and related to those already stated—is underprepared students. Many colleges have responded to this challenge by implementing strategies that are best practices for improving success and persistence: mandatory orientation, increased mentoring of students by peers and staff, and increased focus on improving developmental education outcomes (McClenney, 2009). Many community college students “are marginal in that they are so tenuous in their college student role that seemingly minor setbacks are not interpreted as such and could easily throw them off course and back into a re-adoption of a non-college student identity” (Deil-Amen, 2011, p. 78). In part, this is due to the many competing commitments experienced by these students, who must learn how to balance external commitments—home, family, job—with the commitments to succeed at the college. It may take the student a term or two to do this and actually begin fully participating in his/her own learning process (Kazmi, 2010).

### **Background of the Problem**

As noted in the prior section, community colleges need to place a higher priority on improving student success. But there are many areas which need improvement, so perhaps narrowing the focus might help foster success. One area in need of attention is the STEM (science, technology, engineering, and mathematics) area.

The Bureau of Labor Statistics projects employment in STEM occupations will increase by 21.3% from 2008 to 2018 (Malcom, Dowd, and Yu, 2010, p. 3). The U.S. population is projected to shift such that the majority of the population will be members of what is today called “minority” groups (NSF, 2009). Given these trends, it is vital that large numbers of tomorrow’s workers obtain STEM degrees, and that large numbers of

those workers be African-American and Latino. The Obama Administration has placed a high priority on increasing the number of STEM graduates, particularly expanding STEM education and career opportunities for underrepresented groups, including women and minorities (President Obama, 2009). But are U.S. colleges ready and able to meet the demand?

STEM jobs include healthcare careers (Burning Glass, 2014; Carnevale, et al., Healthcare Executive Summary, 2012, p. 12; Health and Life Sciences, n.d.), and these are expected to grow at a fast pace. One study projected one in four jobs created over the next decade will be in healthcare, with “35 percent of them in hospitals” (Health and Life Sciences, n.d.), while another projected growth at “10.8 percent, or 15.6 million, during the decade” (Employment Projections, n.d.). Carnevale, et al. (2012) were more specific in relating job growth to college education, saying that “with or without Obamacare, the United States will need 5.6 million more healthcare workers by 2020. 4.6 million of those jobs will demand postsecondary education and training” (Healthcare State Report, p. 1). This was echoed by The Bureau of Labor Statistics, who said that jobs that “typically require postsecondary education for entry are expected, on average, to grow faster than occupations that require a high school diploma or less” (Employment Projections, n.d.). In Michigan specifically, Carnevale et al. (2012) projected that healthcare jobs will “grow at 25% compared to 15% for all other state jobs” (Healthcare State Report, p. 56). Educational level demanded by employers was cited as the major criterion for including health careers in the STEM fields, according to Burning Glass (2014): “We define STEM jobs as those that have substantial math and science requirements included within the standard course of training or as part of the qualifications that employers specifically

request in postings.....we have included those clinical healthcare roles which require that job seekers undertake substantial coursework in the biological sciences to qualify.”

In most community colleges with allied health and nursing programs, students must complete a series of rigorous prerequisites to qualify for application. A fairly common prerequisite is anatomy and physiology. It is chosen for its relative rigor as a predictor of likely success, as well as for the foundational knowledge it provides in healthcare (STEM skills, n.d.; Burning Glass, 2014). Because there often are no prerequisites required for taking the class, enrollees may be new to the college level or may never have taken a science class at the college level. Some students may not have taken any science since high school, and that science class may have been very basic.

Students entering the community college are often first-generation, meaning that they have not had parents who went to college who can provide them with cultural background on the experience (Crisp & Delgado, 2014; McKillip, Godfrey, & Rawls, 2013; Wohn, Ellison, Khan, Fewins-Bliss, & Gray, 2013). They may come to the college knowing exactly what they want but not how to achieve it, or may have only a general idea. As observed by Davis (2011), “more than 50 percent of the students currently...in the American postsecondary system are first-generation students” (p. 5). Many studies (Barry, Hudley, Kelly, & Cho, 2009; Goldrick-Rab & Sorensen, 2010; Hawley & Harris, 2005; Inman & Mayes, 1999; Jehangir, 2010; Mechur-Karp, 2011) indicate that if a student’s parents did not attend college, that has a major negative influence on success and persistence.

Even for the well-prepared student, entering college for the first time is a difficult experience for many, as it is different from other prior educational experiences. The

student who enters a community college has many hurdles to overcome—and often must overcome them quickly. According to Wohn, Ellison, Khan, Fewins-Bliss, and Gray (2013), the “availability of informational resources, such as relevant deadlines for the application or financial aid process, is especially more challenging for first-generation students,” and “first-generation students do not receive the same levels or kinds of support from their parents around college access processes in comparison with non-first-generation students” because “parents who had not experienced a particular task would be less able to help others achieve it” (p. 424). The student must navigate the maze of financial aid, registration, buying textbooks and other needed materials, finding out where to park and where the classrooms are—and this is even before classes start. Once classes start, the student must organize a study plan and learn how to use resources like the library, tutoring and the testing center. All of this may also need to be done quickly if the student is to succeed in classes. All too often, by the time the student figures much of it out—if he or she ever does—it is too late to overcome poor grades from early in the term (Crisp & Delgado, 2014; Jenkins, Belanger, Connally, Boals, & Duron, 2013).

A student who enters a community college with an allied health or nursing career goal is not necessarily any better off. The student may complete a few less challenging college level courses before attempting the sciences, and may be somewhat college savvy, but not necessarily. A student might plan in advance by examining the prerequisites for his or her chosen program, and decide either to complete them all in one term or spread them over multiple terms with the more challenging ones first. In this case a student may enter college and take anatomy and physiology in the first term with no idea of the rigor or how to study for such a class. Khazanov (2011) observed that

underprepared students “have probably never really learned how to study or complete homework assignments effectively, if at all, while in elementary, middle or high school” (p.108). He went on to state that this was apparent because such students can rarely approach “problems in a systematic, properly organized, manner leading to many calculation errors and inappropriate or erroneous approaches and strategies. Until these organizational skills are developed, the ‘at-risk student’ is unlikely to experience success” (p.108). When compounded with the general lack of familiarity surrounding college in general, the student may become quickly overwhelmed. First-generation status is a major risk factor for attrition in nursing and allied health programs (Batts, 2014).

It is vitally important to improve science success rates. Students need to succeed in the introductory levels of science so they can go on to succeed in the STEM careers where the needs of the future lie, as mentioned above. Anatomy and physiology provides a foundation for all health careers and a thorough knowledge of the subject underpins all fields involving patient care. Unfortunately, many potential students that could be coming to healthcare programs are becoming lost in the foundational classes.

For many health careers educators, this has actually been the desired goal. Prerequisite introductory science classes such as anatomy and physiology serve as “weeders,” or classes that remove the academically weaker candidates from the pool of applicants. And to some extent this is necessary so that at-risk students do not languish in lower level courses with little chance of success. But are 53.9% of all the applicants every term unfit for health careers, as would seem to be the case if one looks only at prior BIO 132 success data? And what about those students who make it through, getting a passing grade, but without mastery of the subject? Passing a class—and even earning a

4.0 in it—does not guarantee mastery of the subject. Students may be admitted to a program but fail because of a lack of both mastery of anatomy and physiology and the study skills needed, among other potential causes for program attrition. It is assumed that a student who successfully completes the prerequisites to a program has mastered the foundational knowledge and has the ability to master material that will be required in the program. But if the student barely passed—especially if to do so they took the class three or four times—then the student may not know how to study effectively. Therefore, it seems logical that the problem of poor success rates in anatomy and physiology should be addressed.

A review of the literature demonstrates that one of the major reasons community college students fail is a lack of familiarity with the college setting, which McClenney says needs to be addressed by providing them a personal connection, preferably within the first three weeks. Mentoring programs address this need (Bucher, 2002; Crisp, 2009; Crisp, 2010; McClenney, 2011; Pope, 2002). Such programs have been implemented in many settings, but the majority of those studied have been in four-year schools (Austin, 2007; Carnoy, 2010; Crisp & Cruz, 2009; DiTommaso, 2010; Senegal, 2011; Stromei, 2000). In addition, the majority are designed for first-generation students, first term students, or developmental students, rather than students in a defined subject area such as anatomy and physiology. If a mentoring program for students in anatomy and physiology could improve success, it would be extremely valuable to students and community colleges, as anatomy and physiology is often used as a gateway to health careers. However, to be certain that a mentoring program has impacted success the outcomes need

to be measured. At present, there is no evidence such a program would help anatomy and physiology students, so this is a gap in the current knowledge.

### **Setting of the Study**

Jackson College (JC) is a degree granting (associate's level) public, rural-serving large (IPEDS, 2013) institution located in Michigan. The college includes one main campus and three extension campuses, two in nearby counties, and the third in Jackson, Michigan near the main campus (About JC, 2014). Of the total enrollment of just over 6000 students, 42% are fulltime (Demographic Enrollment Profile, 2012). JC has a larger population of economically disadvantaged students than the average in Michigan and the amount of aid is nearly double the state average, with slightly lower rates of completion (IPEDS, 2013). There is a 150% completion rate average of 13% (IPEDS, 2013), but when the data are disaggregated; only 3% of black students graduate in that time, as compared to 15% of white students, while the total population of white students is 77% and of black students is 8% (Demographic Enrollment Profile, 2012). The 150% completion rate is commonly used to reflect that students may require more than the typical two years to complete an associate degree, because of the need to take prerequisites, for example. The 150% completion time for a community college is three years (IPEDS, 2013).

At Jackson College (JC) in Jackson, Michigan, the following scenario plays out as it often does at other community colleges. Students enroll in a class that is a prerequisite for many allied health and nursing programs, Biology (BIO) 132, also called Human Biology. This class has no prerequisites. It is a class with a lecture and lab components,

and covers human anatomy and physiology. JC has three possible tracks for completion of anatomy and physiology:

- BIO 132, Human Biology. This class has a three hour lecture and two hour lab.
- BIO 155, Human Anatomy and Physiology. This class has a five hour lecture and two hour lab.
- BIO 253 and BIO 254, Human Anatomy and Physiology I and II. Each class has a three hour lecture and three hour lab.

BIO 132 had a success rate—students who earned 2.0 and greater—of 53.9% for the 2012 academic year (JC Graduation Rates, 2012), which is the lowest in the biology department and one of the lowest in the college. The average success rate for BIO 132 over the past five years—2008-2012—has been 54% (JC Biology Success Rates, 2013). By contrast, for BIO 155, the five-year success average was 70.1%, with 55.3% for BIO 253 and 78% for BIO 254 (JC Biology Success Rates, 2013).

### **Statement of the Research Problem**

As previously noted, the success rate in Human Biology (BIO) 132 at Jackson College is very low—only 53.9%. Students who fail in BIO 132, which is a gateway course for many healthcare careers, often fail to persist at the college and thus fail to enter healthcare programs. Fewer qualified students available to enter healthcare careers means that the college cannot meet increased demand for healthcare workers and STEM graduates (Melguizo and Wolniak, 2012; Starobin and Laanan, 2008), and also fails to meet the needs of the community in accessing entry to better jobs.

This research study is an attempt to address a gap in the knowledge about mentoring programs. As stated in the previous section, mentoring programs have been studied extensively at four-year colleges, but less so at community colleges. This calls

into question the value of mentoring with populations that are so different (Bailey & Alfonso, 2005; Crisp, 2010; Crisp and Cruz, 2009; Pascarella, 1999; Pascarella & Terenzini, 1998). Crisp and Cruz (2009) observe, for studies done at four-year schools, “potential generalizability...for students attending 2-year... institutions is...questionable” (p. 530). In addition, the majority of those studies have been designed to work with different populations than those of science students. An extensive review of the literature by this researcher has found no evidence of studies that examine the impact of mentoring programs on introductory science students in community colleges.

### **Purpose of the Study**

This research study examines a mentoring program targeting introductory science students—specifically, those taking Human Biology during the 2013 school year at Jackson College. This mentoring program is being evaluated to determine if it has an impact on student success and persistence. This research study establishes a model for student success based on the theories of Chickering, McClenney, and Tinto.

### **Significance of the Study**

This study will help to determine whether a mentoring program would improve science success and persistence in the community college setting. This research will further help to determine whether such a mentoring program might prove beneficial for improving science success and persistence in other science areas at this college. It may also prove useful at other community colleges around the country.

### **Research Questions**

This study is intended to explore the following research questions:

- Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?
- Does individual mentoring in BIO 132 at JC improve persistence?

### **Research Design**

A mixed methods design was used. Mixed methods design is a combination of quantitative and qualitative methods (Vogt, 2007, p. 271). In quantitative research the aim is to “determine the relationship between one thing (an independent variable) and another (a dependent or outcome variable) in a population” (Hopkins, 2000), and a quantitative study will try to maximize “objectivity, replicability, and generalizability of findings, and are typically interested in prediction” (Harwell, 2011, p. 149). For the quantitative portion, comparative directional design was used so that a comparison of the sample and control groups could be done, and a direction—improvement or not—could be determined (Hall, n.d.). The groups receiving the intervention were compared to those who did not.

Also, to improve validity, demographic data was collected and compared to students who took the class in other sections in 2013. As noted in the section above on demographic information, this was done to try to confirm that the students reflected typical demographics for the class. A qualitative study such as was used here focuses on “discovering and understanding the experiences, perspectives, and thoughts of participants—that is, qualitative research explores meaning, purpose, or reality” (Harwell, 2011, p. 148). For the qualitative portion of this research study, the mentors and mentored students completed surveys in order to get their impressions of the program and result in a richer analysis.

## **Assumptions, Limitations, and Scope**

**Assumptions.** An assumption is an item that is crucial to a study but beyond the control of the researcher. If the assumption were to disappear the study “would become irrelevant” (Simon, 2011). An assumption is also defined as an item that will be “assumed by researchers and peers” (Stating the obvious, n.d.). In this study, it is assumed that all of the mentors followed the basic guidelines to the best of their ability. It is further assumed that mentors sought help in meeting the needs of their mentees as needed. Also, the resource guide provided to the mentors was assumed to be accurate at the point the mentors received it.

**Limitations.** A limitation is a potential weakness in a study that is beyond the control of the researcher (Simon, 2011; Stating the obvious, n.d.). Whatever might limit one researcher also “limits other researchers” (Stating the obvious, n.d.). In order to reduce threats to validity and reliability, an attempt was made to define all possible threats, and either eliminate or control for them. Essentially, sampling two halves of a class (divided by when its lab meets) for control vs. intervention reduces subject effects, and sampling sections that only meet at the main campus reduces environment effects. Such control in the sampling reduces external validity (generalizability), however, because the real class schedule actually has different meeting times and locations.

Threats to validity included selection bias, subject effects, location/environment, and testing. Attempts to control for these were similar to those already mentioned—drawing the class as it was and arbitrarily selecting one other section for control. Demographic data were collected and compared to students who took the class in other

sections in 2013 to try to confirm that the students reflected typical demographics for the class.

This paper describes both a program—the mentoring program—and a study of that program. Therefore, other limitations were inherent due to this complexity. Some of these other limitations included varying number of and large variation in mentors, issues with mentor training, other factors impacting success and persistence, non-random sample selection, success variable selection, and persistence variable selection

**Scope.** As noted above, this study focused on sections of BIO 132 in 2013 to determine if there was a change in success and persistence between mentored and non-mentored students. In each term in 2013, two to four sections of BIO 132 were selected. Each pair was divided into control and experimental sections, with the intervention of mentoring applied to the experimental sections. Mentors were instructed to contact each student within the first week of class, and the mentoring program then ran for the duration of the term. Data were collected from the college’s institutional research (IR) department at the beginning of the next term. The mentors were asked for their reactions each term, and the students were all asked for feedback at the end of one full year of the program.

**Delimitations.** Delimitations are definitions set by the researcher as boundaries to the research study so the “goals do not become impossibly large to complete” (Stating the obvious, n.d.). This study examined one class, BIO 132, and one college, Jackson College. It examined the terms of the year 2013 only. In each term no more than four sections were studied.

## Definition of Terms

There are many possible definitions for the terms used in this research study. It is therefore useful to define the meaning assumed in the discussion throughout.

- **Success:** defined in most cases to mean that the student passes the class(es) in question with a grade of 2.0 or greater.
- **Persistence:** defined as persistence to the next term (the student enrolls in any class the term following).
- **BIO 132:** one of three possible tracks for completing anatomy and physiology at Jackson College (JC). BIO 132, along with the other two tracks, BIO 155 or BIO 253 and 254, are options for the BIO prerequisite for various allied health programs at JC.
- **Mentoring:** defined as “support provided to college students that entails emotional and psychological guidance and support, help succeeding in academic coursework, assistance examining and selecting degree and career options, and the presence of a role model by which the student can learn” (Crisp, 2009, p. 189) how to be a successful college student.

## Summary

This chapter has provided an overview of the issues facing community colleges regarding success and persistence. In addition, there was an examination of the importance of preparing students for STEM careers, with particular attention to health careers. These two areas were combined to review how success and persistence of science students might be improved, particularly through the use of a mentoring program, and to discuss the proposed study of such a mentoring program. The chapter ended with defining important terms.

The remainder of this study is organized as follows: Chapter 2 provides a review of literature on mentoring and its impact on student success and persistence. Chapter 3 discusses the methodology that was used to gather and analyze the data. Chapter 4 presents the research findings and analyses, while Chapter 5 provides a discussion of the findings of the study, along with possible implications and recommendations for further research on student success and persistence.

## CHAPTER 2: REVIEW OF RELEVANT LITERATURE

### **Introduction**

Completion of college is important for many reasons. College-educated citizens “contribute in multiple ways to the social good and are less likely to engage in harmful behaviors” (Barnett, 2010, p. 193). As observed by Wohn, et al. (2013), college education is also associated with many “financial, social, and psychological benefits” (p. 424) for both the graduates and for society as a whole. This includes incomes for college graduates of 40 percent higher than those who do not complete college, and two thirds greater than those who completed high school only (Wohn, Ellison, Khan, Fewins-Bliss, & Gray, 2013, p. 424). And success in community college in particular has become an increasingly vital concern for “administrators, educators, and policymakers at the federal, state, and local levels” (Crisp, 2010, p. 39), leading to increased scrutiny by accreditation agencies and state regulators of community college outcomes such as persistence, success and completion rates (Bailey & Alfonso, 2005; p. 1).

One reason for this increased attention is the large proportion of all college students that are enrolled in community colleges. More than half of U.S. students are enrolled in community colleges (Barnett, 2010, p. 194; Mendoza, Mendez, & Malcolm, 2009, p. 113). However, success rates for community college students are poorer than for those in four-year schools, which is reflective of the fact that community college students are three to four times more likely to exhibit the “factors that put students most at risk of not

attaining a degree” (Barnett, 2010, p. 194). According to Davis (2011), of students who start at community colleges and identify their goal as a bachelor’s degree, after six years, only 11 percent of first-generation students had earned bachelor’s degrees compared to 55 percent of non-first-generation students (p. 5). Less than one third of all community college students complete any certificate or degree within three years of enrolling (Barnett, 2010, p. 194; Mendoza, Mendez, & Malcolm, 2009, p. 113).

There are many factors that put community college students at risk. They include poor academic preparation for college (Barnett, 2010; Crisp, 2010; Mendoza, Mendez, & Malcolm, 2009; Pope, 2002), needing to work while in college (Bailey & Alfonso, 2005; Crisp, 2010; Mendoza, Mendez, & Malcolm, 2009), attending college part time (Bailey & Alfonso, 2005; Crisp, 2010), being first-generation (meaning neither parent completed college) students (Barry, Hudley, Kelly, & Cho, 2009; Crisp & Delgado, 2014; Davis, 2011; Goldrick-Rab & Sorensen, 2010; Hawley & Harris, 2005; Inman & Mayes, 1999; Jehangir, 2010; McKillip, Godfrey, & Rawls, 2013; Mechur-Karp, 2011; Wohn, Ellison, Khan, Fewins-Bliss, & Gray, 2013), and having significant family responsibilities (Bailey & Alfonso, 2005; Crisp, 2010; Mendoza, Mendez, & Malcolm, 2009). Mendoza, Mendez, and Malcolm (2009) also discussed the high cost of community college for low-income students, observing that despite “low tuition costs.... decreased state funding for community colleges endangers their affordability” and that financial burden “partially explains the high attrition rates in community colleges” (p. 113). The multiple and complex issues that have a negative impact on community college success led Deil-Amin (2011) to observe that many “two-year students are marginal in that they are so tenuous in their college student role that seemingly minor setbacks are not interpreted as such and

could easily throw them off course and back into a re-adoption of a non-college student identity” (p. 78).

### **Improving Student Success and Persistence**

Best practices for improving student learning were identified by the Center for Community College Student Engagement (CCCSE) at the University of Texas at Austin, a leader in the study of community college excellence. CCCSE have established benchmarks of “Effective Practice with Entering Students in Community Colleges” (McClenney, 2009). These benchmarks “focus on institutional practices and student behaviors that promote student engagement early in the college experience—and that are positively related to student learning and persistence” (McClenney, 2009). Using well-defined metrics and benchmarking allows the college to track progress and “to ensure that the metrics used will indeed show that progress is being made” (Ballentine & Eckles, 2009, p. 34-35). Following are the six critically important benchmarks identified by McClenney (2011):

1. **Establishing relationships—personal connections—with students early:** Every student should be intentionally connected to an individual person who feels responsible for that student’s success, and that those connections should be made before completion of the college intake process.
2. **High expectations and aspirations:** Every new student should be clear about the college’s high expectations for his/her performance, and every student should have high aspirations for his/her own success.
3. **Having a plan and a pathway:** Every entering student should define his/her educational goals and develop a plan for attaining them—and before classes start, so the student can enroll in the right classes initially.

4. **An effective track to college readiness:** All academically underprepared students should have an effective, efficient path to completing developmental education and beginning college level work.
5. **Engaged learning:** Engaged learning should be intentional, inescapable, the norm for every entering student. McClenney (2009) defined engaged learning as “active and collaborative learning” where the learner was compelled through various teaching methods to interact with the material, classmates, the instructor, and whatever it took to keep the student involved in his/her own learning process.
6. **An integrated network of financial, academic and social support:** Every entering student should be met with a personalized network of financial, academic and social support.

Similarly Chickering studied best practices for improving student success and persistence. His “Seven Principles for Good Practice in Undergraduate Education” (Chickering, 1993) were contrasted/compared with the work by McClenney for usefulness. Following Chickering’s principles can make teachers more effective (Armstrong, 2009; Bangert, 2008; Ilk, 2007; McClenney, 2009; Wang & Morgan, 2008). These researchers argue that having high expectations of our students and our colleges will lead to better results. Chickering’s Seven Principles are as follows:

1. **Encourage contact between students and faculty:** By doing this, the instructor can get the student to feel comfortable enough to risk asking questions and opening him/herself up to examining deeper questions.
2. **Develop reciprocity and cooperation among students:** Students can often help each other learn in ways that the instructor cannot, because the instructor’s teaching styles will be limited by his/her view of the world and

learning style. And “academic and social integration into college life improves persistence” (Watson, 2009, p. 20).

3. **Encourage active learning:** Students learn best when they are engaged. So activities where the students are doing things—carrying out lab activities, creating quiz questions based on the objectives, preparing tutorials for the rest of the class—are always more effective than simple lecture. Note that this is the same as CCCSE’s benchmark #5.
4. **Give prompt feedback:** Students do not always know what they do not know, so asking them questions right after smaller units of instruction allows the instructor to go back and modify the lesson if needed so that all the students grasp key concepts.
5. **Emphasize time on task:** Mastery of subject matter requires devotion of time. A good instructor will demonstrate how the students can practice, develop skill, get them into groups—or whatever is needed to get students working on the tasks and putting in time. This includes time in class and time outside of class, as needed.
6. **Communicate high expectations:** This is a vital component (Chickering, 1993; McClenney, 2009; McClenney, 2011). Students rise to the level set for them, and if it is set high, and students are told the instructor believes they can reach it, and that the instructor will help them reach it, then the students achieve. If the instructor indicates he/she has doubt, or sets the standards low, achievement drops off. The payoff is great because the students not only achieve great things, but they gain self-esteem in achieving more than they ever thought they could. Note that this is the same as CCCSE’s benchmark #2.
7. **Respect diverse talents and ways of learning:** Students will have different learning styles, and it’s important to encourage students to master the material by whatever method works for them. Wherever possible, allow the

students to come up with methods to be evaluated and let them write a contract for getting the evaluation done.

Finally, Tinto's "Model of Student Departure" (1993) was examined for its utility. The goal of the Student Success Model is to ensure the students succeed, and to that end, it is vital to not only examine what leads to success but also what leads to failure. These are not always related in a direct fashion, and such barriers to success can therefore be easily missed. Factors in Tinto's Model are as follows (Tinto, 1993):

1. **Pre-Entry Attributes:** Family background, skills and abilities, and prior schooling can all influence what happens in college. Numerous studies (Barry, Hudley, Kelly, & Cho, 2009; Goldrick-Rab & Sorensen, 2010; Hawley & Harris, 2005; Inman & Mayes, 1999; Jehangir, 2010; Mechur-Karp, 2011) indicate that whether the student's parents attended college has a major influence on persistence. Many students have failed to persist because they did not have study skills, requisite reading skills or college knowledge to succeed.
2. **Goals/Commitments I:** Tinto (1993) stated that during this stage, students adopt the customs and mores of the college environment and discard those of their past life. According to Palmer, in the "[separation] stage, students create the potential for college success when they are able to physically and socially separate themselves from their previous communities and integrate themselves into the college community." (Palmer, 2011, p. 580).
3. **Institutional Experiences:** The student is trying to cope with the formal (academic performance) and informal (faculty interactions) demands of the academic system, learning to balance them with the formal (extracurricular activities) and informal (peer interactions) demands of the social system. Tinto (1993) noted that "without assistance, many students limit the amount of time spent on campus, which in turn restricts interaction with members of

the college community.....Consequently, students are more prone to drop out of school” (as cited in Palmer, 2011). The notion that limiting time interacting with the college can lead to failure to persist is supported by many authors (Deil-Amen, 2011; Kazmi, 2010; Schmidt, et al., 2010).

4. **Integration:** The student achieves integration, or as Tinto put it, “students seek to become socially and academically integrated...by establishing contact with faculty and students,” and “students who perceive their norms, values, and ideas as congruent with the institution are more likely to become academically and socially integrated” (Tinto, 1993, as cited in Palmer, 2011, p. 580-1). Tinto suggests academic and social integration reinforce and balance each other, just as the external and institutional commitments of the second (and upcoming fifth) stage do. As Deil-Amen (2011) notes, “several studies find the two forms of integration to be interconnected....When both forms occur, students are even more likely to persist” (p. 55).
  
5. **Goals/Commitments II (to persist):** Here the student must reexamine academic goals and intentions along with external commitments, and make the decision about whether to continue or to drop out of school. Even though the student has done the hard work of integrating with the academic environment, he/she must still face the larger world and whether the academic plan that was originally made is still a “fit” given what has happened during the term. Community college students are especially likely to never even have left the external world entirely even while as integrated academically as they can be (Barnett, 2010; Deil-Amen, 2011; Kazmi, 2010; Palmer, 2011, Schmidt, et al., 2010; Tinto, 1993). But because every term comes to a complete end of all classes, the student has space at that point every term to reexamine his/her overall academic goals and whether they are being met at this particular institution, along with rethinking how college fits in with the other demands being made by work, family and other forces.

6. **Outcome:** The student either departs or stays. The outcome is primarily dependent on the factors in Tinto's model up to this point. In other words, the entire model is used to predict whether the student will stay in college to complete or will leave and not complete, and this is the step in which the student makes the decision, based upon all the previous steps.

### **Mentoring Program as a Means to Address Community College Student Issues**

According to McClenney (2011), there are several things that should be done before the student ever begins classes in order to create the framework for student success.

These include forming a personal connection between every student and a designated college support person—faculty, staff, or peer—setting up clear, specific academic plan, clarifying that there are high expectations and support for each student, and establishing an “integrated network of financial, academic and social support” (McClenney, 2011).

One way to get the student connected with support as McClenney discusses is through a mentoring program.

As already noted, interaction with others on campus—faculty, staff and peers—is vital to student success. Bucher observed that “[institutional research] data reveal that the retention rate of students who have been exposed to [the mentoring] support system...is approximately 25% greater than the control group” (Bucher, 2002). There is no widely accepted definition of mentoring in the literature—or perhaps it is more accurate to say there are so many it is difficult to select one (Crisp, 2009; Galbraith & James, 2004).

Therefore, for the purpose of this study, the definition used by Crisp (2009) was selected and included in the Definition of Terms in Chapter 1: “support provided to college students that entails emotional and psychological guidance and support, help succeeding in academic coursework, assistance examining and selecting degree and career options,

and the presence of a role model by which the student can learn from and copy their behaviors relative to college going” (p. 189). But even though the definition of mentoring varies greatly from author to author, there is general agreement about its usefulness in improving student success (Crisp, 2009; Crisp, 2010; Pope, 2002). Crisp (2009) said that mentoring has been shown to help students improve in many areas, including student performance, critical thinking skills, student self-confidence, raising expectations and future aspirations, and student persistence. Retention of high risk students is dependent on integration into the college, according to Pope (2002), who went on to say that one way for “community colleges to achieve such integration is through the mentoring program” (p. 31). This was echoed by Stromei (2000), who said that community college mentoring programs were “well suited to increasing the retention of those students who are typically at risk” (p. 55).

As noted above, early contact is considered vital for success (Freeman 1999; Jaswal & Jaswal, 2008; McClenney, 2011). Students “reported that learning of the existence of the services early minimized the stress of having to locate the services later, when they were managing the multiple demands and time constraints associated with class schedules, class assignments, and family responsibilities” (Austin, 2007, p. 282). As noted by Jaswal and Jaswal (2008), “retention research shows that the earlier a student is connected to the social and academic systems of the college the greater their academic achievement and thus their commitment to graduating” (p. 55).

Given these factors, the mentoring program set up at JC had as a vital component ensuring that each student would be matched with a mentor prior to the start of the term. In order to ensure that the mentors would be prepared to work with the students that

early, mentor training needed to be completed before classes started. Mentor training would need to include training on the factors that were vital about how mentoring improved community college student success, as described below.

### **Practical Application of the Mentoring Program**

Although Tinto (1993) said that pre-entry attributes were significant determining factors in student success, current research suggests other factors may be even more important. Many authors (Barbatis, 2010; Barnett, 2010; Bucher, 2002) agree that the most important factor determining whether a student will persist is college staff-student interaction. According to Barbatis (2010), “Failure to connect with others on campus, including peers, student organizations, faculty, and/or staff, contributes more to voluntary withdrawal than almost any other factor” (p. 20). Those working with students, who still tend to attribute student failure more to student pre-attributes, need to learn about their vital role in student success, so they can begin acting more intentionally to improve student persistence. Tinto (2002) “suggests that faculty should be trained and all those responsible for student persistence and learning should be held accountable.” In order to assist with this, this mentoring model places such training at the forefront, so that it can begin before students arrive, and proposes that such training be continuously made available to allow for continuing improvement. The training must include the important concepts (e.g., critical nature of mentor/student interaction, bonding activities, student self-expression).

Barnett (2010) stated that for community college students, “validation may be more important [than integration] for their success and persistence” (p. 196). She defined validation as “interactions with students, initiated by faculty and others in the campus

community, that engender feelings of self-worth and a belief in the students' ability to succeed in the college environment" (p. 196). She went on to observe that she did not mean to denigrate the significance of integration as Tinto had described it, but rather to offer validation as perhaps an alternative to integration, or perhaps "as a precondition for integration" (p. 196). Deil-Amin (2011) supported this view, saying that "92% [of students] highlighted a college-specific 'agent' or 'agents' who were instrumental to their sense of adjustment, comfort, belonging, and competence as college students" and that this perception held constant "across institutional type and students' race, class, and SES background," and that "in the form of instructors/faculty, other staff, and students as well, [they] were instrumental in how the two-year students integrated" (p. 61). McClenney (2009) went so far as to say the only factor community college students universally cited for their persistence was a personal connection with someone at the college.

### **Need to Improve Science Success and Persistence.**

The Federal Government and educational leaders all over the United States have placed high emphasis on improving success and persistence in science education (Melguizo and Wolniak, 2012; Starobin and Laanan, 2008). Successful science majors are considered vital to the nation's future in order to maintain U.S. global competitiveness and to ensure that there will be a workforce that has the needed technical skills required by occupations dependent on science education (Melguizo and Wolniak, 2012). Community colleges are seen as vital to this effort, as large numbers of those who end up acquiring undergraduate and graduate science degrees started out in community colleges (Starobin and Laanan, 2008).

However, much needs to be done to improve community college STEM success. According to Shapiro and Sax (2011), “only 24 percent of students entering college report an interest in majoring in STEM ... we can expect about half of these students to actually earn a STEM degree, as research has shown that 50 percent or more of the students who enter college with STEM career aspirations either switch to a non-STEM field or leave postsecondary education altogether” (p. 5). The U.S. government also identifies many STEM areas as being not only vital but also having poor college completion rates (Shapiro & Sax, 2011, p. 5). Although no studies of mentoring in a community college science program have been published to date, Shapiro and Sax (2011) propose that mentoring would be beneficial in improving science completion, saying “students who encounter role models within the scientific community are more likely to follow up on their initial science aspirations” and that faculty role models can help students “by bolstering their confidence and encouraging them to see themselves as successful in STEM majors and careers in the future, allowing them to overcome some of the negative stereotypes about having a career in STEM, and encouraging discussion of their own experiences and strategies for working through barriers in STEM fields” (p. 9).

The mentoring program covered by this study is being used to attempt to improve success and persistence. As each of these terms can have many different definitions, depending on context, specific definitions were chosen for this study, as specified in the Definition of Terms in Chapter 1. For the purposes of this study, success is defined to mean that the student passes the class(es) in question with a grade of 2.0 or greater, and persistence is defined as persistence to the next term—in other words, the student enrolls in any class the term following).

## **Issues with Mentoring Research and Literature**

One problem with beginning a mentoring program is defining the term for the parties involved. As observed by Senegal (2011), the term is “widely understood, but not clearly defined” (p. 2). Crisp (2009) found in a review of the literature more than 50 definitions of mentoring. Various programs studied have been formal, and others informal. Some are long-term, and some are totally spontaneous. Some place strict boundaries on training and selection of mentors and matching with mentees, and others are more open-ended with one or more of these. In the end, Senegal’s (2011) definition seems most appropriate for this program: “a formal program characterized by the deliberate matching of a mentor and mentee, the establishment of outcomes for the relationship, and specific programming to enhance the program’s goals” (p. 2). This definition is tempered with understanding the validity of Pope’s (2002) argument that mentoring programs “also cannot be one dimensional... the mentor must provide guidance to the student in academic, personal, and professional areas” (p. 43).

Mentoring programs have been put into place and studied extensively at four-year schools (Austin, 2007; Carnoy, 2010; Crisp & Cruz, 2009; DiTommaso, 2010; Senegal, 2011; Stromei, 2000), but less so at community colleges. Community college students are “10 to 18% more likely to drop out of college than students who attend four-year institutions, even after controlling for background, ability, high school grades, and aspirations toward a college degree” (Crisp, 2010, p. 39). For these and many other reasons, Crisp and Cruz (2009) observe, for studies done at four-year schools, “potential generalizability...for students attending 2-year... institutions is...questionable” (p. 530). Therefore, before expending resources to develop such programs in community colleges,

many scholars are calling for more study into whether mentoring improves outcomes specifically in community college students (Bailey & Alfonso, 2005; Crisp, 2010; Pascarella, 1999; Pascarella & Terenzini, 1998).

Many studies that have been done on mentoring have been flawed, according to Crisp, citing issues that are “definitional, methodological, and theoretical” (2009, p. 177-8). In another paper, he observed that “measurement tools used to quantify students’ mentoring experiences have not been theoretically based” and that many researchers used surveys that “lack evidence of reliability or validity” (Crisp, 2010, p. 41). And in yet another paper Crisp and Cruz observed that many studies were “methodologically weak” due to “reliance of self-reported benefits of mentoring as outcome measures” (2009, p. 530). Issues specific to quantitative studies included “absence of theory guiding the data collection and analysis,” failure “to demonstrate if and how their sample was representative of their study population,” and neglect in examining “the degree to which findings are externally valid beyond the extremely narrow, often departmental or institutional samples” (Crisp & Cruz, 2009, p. 531). Also, many quantitative studies have “failed to control for other variables such as academic ability, grades in high school, and familial support that may influence the impact of mentoring (i.e., independent variable) on the outcome variable of interest (e.g., retention, grade point average)” (Crisp & Cruz, 2009, p. 533-4). Issues with qualitative studies have included methodological flaws “in that they provided a limited description of the methods” and “lack of mention of data or method triangulation, member checking, or efforts to demonstrate data reliability” (Crisp & Cruz, 2009, p. 532). Crisp and Cruz therefore note that there is a need for research that is methodologically rigorous in testing “impact of a conceptually valid mentoring

experience on various student outcomes of interest,” that has findings that are externally valid and more generalizable (especially to community colleges), that pays heed to “mediating effects and/or potentially extraneous variables (e.g., institutional type, school climate, student and mentor attitudes, characteristics of students and mentors),” and that controls “for extraneous variables through use of control groups, matched controls, or by building potentially extraneous variables into the study design” (2009, p. 541).

### **Summary**

The literature review focused on factors related to student success and persistence, with particular attention to mentoring programs. Factors that impact success and persistence include establishing personal relationships between students and college personnel (McClenney, 2011; Chickering, 1993; Tinto, 1993; Palmer, 2011; Deil-Amen, 2011; Kazmi, 2010; Schmidt, et al., 2010; Barbatis, 2010; Barnett, 2010; Bucher, 2002); communicating high expectations (McClenney, 2011; Chickering, 1993); engaging in active learning (McClenney, 2011; Chickering, 1993); and providing an integrated network of financial, academic, and social support (McClenney, 2011; Tinto, 1993; Deil-Amen, 2011; Kazmi, 2010; Schmidt, et al., 2010). Each of these factors can have a significant impact on student success.

The literature review also concentrated on the key elements of a mentoring program, because this was the particular intervention chosen to impact success and persistence. Two major elements were the importance of mentor training (Barbatis, 2010; Barnett, 2010; Bucher, 2002; Tinto, 2002) and the establishment of learning communities (Barbatis, 2010). The potential impact of a mentoring program was related to the factors

that improve success and persistence (Austin, 2007; Bucher, 2002; McClenney, 2011; Freeman 1999; Jaswal & Jaswal, 2008).

A definition of mentoring was established, after examination of the literature on the many possible definitions used. Finally, the literature was reviewed to examine how mentoring in higher education has previously been studied, which has primarily been at four-year colleges (Austin, 2007; Carnoy, 2010; Crisp & Cruz, 2009; DiTommaso, 2010; Senegal, 2011; Stromei, 2000). It was also observed that much of the previous research is flawed (Crisp & Cruz, 2009; Crisp, 2010) so that a sound study of community college mentoring is needed.

## CHAPTER 3: METHODOLOGY

### **Introduction**

This research study was a program evaluation, of the mentoring program designed to improve success in Human Biology at Jackson College (JC). According to Merriam (2009), a program evaluation collects data on the merit or benefit of a program in order to “establish a basis for decision making” (p. 4). Vogt (2007) stated that the “preferred method to evaluate programs is to assess the individuals who have been in the programs to see how the programs have affected them,” and that program evaluation involves “investigating the efficiency, effectiveness, and/or impact of organized interventions meant to bring about change” (p. 263). Vogt went on to observe that it is necessary to evaluate a program to ensure its effectiveness (Vogt, 2007, p. 263). Program evaluation research can be done quantitatively or qualitatively, depending on the situation studied. The mentoring program and the research were developed together. The data collected was then evaluated in order to determine program effectiveness and areas needing modification. This allowed the research to avoid a common pitfall of program evaluation—that it usually planned independent of the program, so that the researcher has little control over the variables—as outlined by Vogt. This research study was planned to follow Vogt’s (2007) recommendation that the evaluator participate in the design process to ensure evaluation instruments are planned from the beginning, and also so that “baseline data can be obtained” (p. 271).

Vogt also recommends that although the focus is often on quantitative measures, that employing qualitative methods can help make sense of quantitative data. In the case of this project, the evaluation was planned before the program started, and quantitative measures were dominant as Vogt recommended. But qualitative data collection was also part of the design in order to add to the richness of the participant views to the results, to increase the understanding of how participants viewed mentoring, and support and provide greater explanation of the quantitative results. Dense description from the interviews and of methodology also increased validity and reliability (Golafshani, 2003). He went on to say that, “Triangulation is typically a strategy...for improving the validity and reliability of research or evaluation of findings” (Golafshani, 2003, p. 603). Triangulation “examines the consistency of findings, such as those obtained through different instruments, and which might include interviews and surveys” (Harwell, 2011, p. 152).

### **Research Questions**

This project was designed to explore the following research questions:

- Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?
- Does individual mentoring in BIO 132 at JC improve persistence?

### **Research Design**

**Specific Focus of the Study.** This research study examined a mentoring program targeting introductory science students—specifically, those taking Human Biology during the 2013 school year at Jackson College. This mentoring program was evaluated to determine if it had an impact on student success and persistence.

**Population and Demographic Information.** Demographic data were collected to assess the extent to which the sample group compared to the control group and to all students enrolled in BIO 132. Using demographic data in this way increases validity and reliability of the study, as described by Wiersma and Jurs (2009): “When two or more intact groups are used, the credibility of the research depends on the extent to which the groups are similar on relevant variables” (p. 185). Hopkins (2000) agreed that this was crucial, saying, “When the sample is not representative of the population, selection bias is a possibility. A statistic is biased if the value of the statistic tends to be wrong (or more precisely, if the expected value—the average value from many samples drawn using the same sampling method—is not the same as the population value)” (para. 14). This demographic data was not used for other purposes in the study.

**Sample Population.** Sections studied were from Spring and Fall 2013 terms. Two sections of BIO 132 selected were from the spring term. These were the only sections offered by the college. Four sections were selected from the fall term.

There were two basic structures for BIO 132 classes. In many sections, there was a lecture class of about 25 students, and all of these students attended the same lab with same instructor. In some BIO 132 classes with approximately 50 students, the group was divided into two labs of approximately 25 students. This situation was ideal for using one half as the control group and one half as experimental because they were alike in almost every respect except the time at which the labs met. This would increase subject and location validity, as mentoring should be the only significant difference between the groups. This was done for all the groups for Fall. For Winter, where the program ran as a brief pilot, this was done for two sections out of four. The total in each experimental

group was limited to approximately 50, as obtaining enough mentors was a limitation. In short, this was based on the assumption that starting out with 15-20 mentors was likely, and that each mentor could handle three mentees optimally.

As stated earlier, only two sections were available in Spring 2013. The lead instructor for BIO 132 taught one section while another instructor with years of experience in that course taught the other. Their classes were used for the pilot in Winter 2013, and it was believed that using these two instructors to teach all sections for the length of the program would yield the maximal consistency and mitigate threats to validity, so it was planned they would also be used in Fall. In Spring 2013, one section was entirely online and one was at a second campus an hour away from the main campus. Therefore the sample populations were potentially quite different from the ones from the fall term, as this was the only term where an entirely online section needed to be included in the study. The lead faculty instructor took an unexpected leave during the Fall 2013 term; so another instructor's class was utilized in the study. This instructor had also taught BIO 132 for many years and he taught in the same off-campus location used in Spring term. Therefore, having different instructors introduced a new threat to the validity of the study. This threat was mitigated by the fact that the BIO 132 instructors used identical learning outcomes, labs, and assessments, and communicated frequently with each other to maximize consistency in course implementation.

**Timeline and Setting of Study.** Mentors were assigned to the students before the term started, in a manner such that each student had an individual mentor, and the mentors each had three to four students assigned to them. The implementation was delayed in the Winter 2013 term when the pilot ran, but the mentors were assigned in

advance in the remaining two terms during the study. Many of the spring term mentors worked with the program during the pilot winter term so that they were well prepared when spring term began. In the winter term, the students were offered the consent form (Appendix A) at the beginning of the first lab, but most did not accept a mentor. The program was revamped in subsequent terms so that all students were assigned a mentor, and consent was moot. This also changed the conditions of the remaining terms to such an extent that the Winter 2013 data was removed from the final study, and this term was used only as a pilot for testing the program setup. The mentors were instructed to contact each student using the student's college email address within the first week of class. The mentoring program then ran for the duration of the term. Data for the quantitative study was collected from the college's institutional research (IR) department at the beginning of the next term in order to gather persistence data. The mentors were asked for their reactions each term via email, and the students were all asked to complete a survey at the end of one full year of the program.

**Design of the Research.** A mixed methods design was used. Mixed methods design is a combination of quantitative and qualitative methods (Vogt, 2007, p. 271). According to Harwell (2011), a strength of mixed methods research is that the researcher collects several kinds of data using different methods “in ways that reflect complementary strengths and non-overlapping weaknesses, allowing a mixed methods study to provide insights not possible when only qualitative or quantitative data are collected” in order to “compensate for inherent method weaknesses, capitalize on inherent method strengths, and offset inevitable method biases” (p. 151). Harwell further observed that using mixed

methods research and gathering qualitative data “could be helpful in enhancing and complementing the quantitative findings” (2011, p. 153).

For the quantitative portion, comparative directional design was used, so that a comparison of the sample and control groups could be done, and a direction indicating improvement could be determined. As was explained by Hall (n.d.), with such a design, there is a greater specificity, so there is less chance to “find...predicted results just by chance....[researchers] can be more confident of research results that are consistent with a causal-directional hypothesis, than is the case of findings that are consistent with a non-directional hypothesis” (para. 6). In addition, as described in the section on program evaluation, Vogt recommends using quantitative methods to gather comparative data and assess the efficacy of a program. This recommendation reflects the “assumption that researchers set aside their experiences, perceptions, and biases in conducting the study and drawing conclusions, data collection that did not treat the researcher as the data collection instrument, and the use of hypothesis testing to make deductive inferences about characteristics of a population” (Harwell, 2011, p. 150).

But Vogt (2007) also recommended gathering qualitative data to enhance a program evaluation. Qualitative research was discussed by Harwell (2011), who described its “focus on discovering and understanding the experiences, perspectives, and thoughts of participants through various strategies of inquiry” which could then be used to “construct explanations of [participants’] views and perspectives” (p. 149). An advantage of adding the qualitative data is using it for triangulation, which uses multiple data sources and methods to view the same situation from multiple angles (Qualitative Research, n.d.; Harwell, 2011). This will help to “improve understanding and/or the credibility of a

study” (Qualitative Research, n.d.) and “improves the chances that threats to inferences will be controlled” (Harwell, 2011, p. 152). Other advantages of adding qualitative data in a mixed methods study are that it may be used to “assess overlapping but distinct facets of the phenomenon under study,” obtain results from one method that may “challenge other results or stimulate new directions for the research,” and “clarify results or add richness to the findings” (Harwell, 2011, p. 152). In this research study, the mentors were polled via email each term (see Appendix I for questions), and the mentored students were asked to complete an online survey (see Appendix C for to view the instrument). Each group was asked for feedback in order to get their impressions of the program and result in a richer analysis, or, as Merriam (2009) described it, to understand the meaning they have constructed, and how they made sense of their experience.

**Research Design Rationale.** This design was appropriate given that the groups were compared based on whether the intervention resulted in improvement in each of the dependent variables, success in the class as defined by the class grade, and persistence to the following term. This research study was a program evaluation done as Vogt recommended, where the program was designed in conjunction with the research that was done to evaluate it, and then it was evaluated in order to determine its utility and areas in need of modification, depending on the findings. This methodology was driven by the literature search as described in Chapters 1 and 2 and also by the research questions.

**Relevant Dependent and Independent Variables.** Variables were limited in order that more focus might be maintained on the research questions. Variables are defined as objects “that can change” (Vogt, 2007, p. 40) during the study, with dependent variables

being those that the researcher is trying “to explain or predict” (Vogt, 2007, p. 41), or the objects that may have been affected by the causal variable, which is how Vogt describes the independent variable.

The selected variables, as shown in Table 1, included the two dependent variables 1) success in the class as defined by the class grade and 2) persistence to the following term. The independent variable was the mentoring program. Demographic data was used solely to determine that the sample group reflected typical demographics.

**Control Variables.** In an attempt to rule out other confounding variables, a number of factors were studied. These were listed in Table 1 as controls, and were analyzed to determine if they affected the dependent variables of success and persistence. Control variables are those that “might influence the relationship you are studying but that, for purposes of your study, you are not interested in....you could ‘control for’ these, which essentially means subtracting any effects they might have” (Vogt, 2007, p. 44). These variables might “influence the outcome of an experiment, though they are not the variables that are actually of interest. These variables are undesirable because they add error to an experiment. A major goal in research design is to decrease or control the influence of extraneous variables as much as possible” (Hall, n.d.).

*Table 1: Variables and Variable Types Selected for Study*

VARIABLE TYPES	VARIABLES SELECTED
Dependent variables	Passing grade in BIO 132 (equal to or greater than 2.0) (actual measures: <2.0, drop: not success; >= 2.0, success) Persistence (enrolled at JC in any class the term following vs. not enrolled)
Independent variable	Mentoring program (in it; not in it)
Controls	Whether the student ever enrolled in a developmental education class Whether first term in college

VARIABLE TYPES	VARIABLES SELECTED
	Total number of credits enrolled concurrently (to determine if full or part time) Whether BIO 132 was taken concurrently with MAT 131 Whether declared program of study was healthcare/science or not Whether student had taken BIO previously
Demographics	Gender Race/Ethnicity

In this research study, it was planned that if the control variables were found to have made any significant impact on increasing or decreasing the dependent variables, they would be analyzed further using logistic regression, in order to be able to analyze the impact of multiple simultaneous variables, and subtract or cancel out their effects, as described by Vogt. All of the control variables were measured at the nominal level. Possible reasons the selected control variables might impact success and/or persistence included:

- **Developmental education:** This might have negative impact on success, as these students tend to complete degrees at lower rates than those who have not taken developmental education. This was coded as “0” for no developmental education, and “1” for having had any developmental education.
- **Whether first term in college:** Being first term students might have a negative impact on success if they had not properly acclimated to the college environment. This was coded as “0” for having been in college in the second term and later, and “1” for being in the first term when the student took BIO 132.
- **Total number of credits enrolled concurrently:** Students enrolled in college full time might be more motivated to succeed and have less outside commitments, or they might have significant outside commitments or

otherwise not be as able to focus on success in the science class. This was coded as “0” for being enrolled in less than 12 credits, and “1” for being enrolled in 12 credits or more during the term the student took BIO 132.

- **BIO 132 concurrent with MAT 131:** If they were taking BIO 132 concurrently with MAT 131, they were taking two difficult classes simultaneously, which could have a negative impact on success, or it could reflect higher ability and likelihood of success. This was coded as “0” for not being enrolled in Math 131 concurrently, and “1” for being enrolled in Math 131 concurrently with BIO 132.
- **Whether declared program of study was healthcare/science or not:** Having a declared program of study—especially one where success in BIO 132 was an important prerequisite—might indicate the students were more goal-oriented. This was coded as “0” for having selected no major or any major that was not in science or healthcare, and “1” for having selected any major that was in science or healthcare.
- **Whether student had taken BIO previously:** Having taken BIO 132 multiple times might indicate that the students were taking it repeatedly and not changing their study habits to gain mastery, or it might mean they were getting a passing grade in earlier attempts but trying to get a higher grade to ensure successful admission to selective programs. This was coded as “0” for having taken BIO 132 before, and “1” for the student never having taken BIO 132 before.

Further discussion of all variables follows in the next two sections.

## **Sampling**

**Unit of Analysis.** Units of analysis are defined by Merriam (2009) as the “segments in...[the] data set that are responsive to...[the] research questions” (p. 176). In this research study, the units of analysis were the students taking BIO 132 in Spring and Fall

2013. Specifics of selection for control as opposed to students receiving intervention are outlined in the next section. There were 61 students in the control group and 58 students in the experimental group.

**Sampling Method.** As described in the section above on Sample Population, in Spring and Fall 2013, at least two sections of BIO 132 were selected. For spring two sections were used and four sections were selected for fall. The selection of which group was control and which experimental was completely arbitrary in each term—a pair of groups was selected, and then one of them was randomly picked to be the control and the other experimental. All students in each experimental group were assigned a mentor. As described in an earlier section, the intervention ran throughout the semester. The quantitative data, which was data on all the variables from Table 1, was collected ten days after the next semester began, so that persistence to the next term could be measured. The qualitative data was collected from mentors just after the semester ended (see Appendix I for poll questions) and from mentored students at the end of the year (see Appendix C for to view the survey instrument).

### **Instrumentation**

**Qualitative Data Collection.** The mentors were polled via email each term (see Appendix I). The questions asked were derived, as noted above in the Research Design Rationale section, based on the research questions and literature search (Hall, n.d.; Harwell, 2011; Merriam, 2009; Qualitative Research, n.d.; Stating the obvious, n.d.; Vogt, 2007). These questions sought to expand on the information gained from the quantitative data analysis and provide descriptive information that supported the quantitative results, allowing for richer analysis.

The mentored students were also asked for feedback, via an online survey (see Appendix C). This instrument was developed because a thorough review of the literature found no qualitative instruments satisfactory to address the research questions (Austin, 2007; Bailey & Alfonso, 2005; Barbatis, 2010; Barnett, 2010; Bucher, 2002; Carnoy, 2010; Crisp, 2010; Crisp & Cruz, 2009; DiTommaso, 2010; Freeman 1999; Galbraith & James, 2004; Jaswal and Jaswal, 2008; McClenney, 2011; Pascarella, 1999; Pascarella & Terenzini, 1998; Pope, 2002; Senegal, 2011; Stromei, 2000). There was a validated instrument that covered closely related areas—the College Student Mentoring Scale (CSMS) developed by Crisp (2009, p. 192)—but it was not specific enough, and would have required too much modification, which could have destroyed its validity. Originally a series of open-ended questions was developed that mirrored the research questions and sought feedback on program implementation, and it was intended that they be asked in direct student interviews. But as the program was totally online and the students had never met their mentors, it was decided that interviewing them did not fit with the way the program itself had run. Also, having the students complete a completely anonymous survey would keep the researcher blind to the student identities and thus avoid bias in the results (Hall, n.d; Harwell, 2011; Merriam, 2009; Qualitative Research, n.d.; Stating the obvious, n.d.; Vogt, 2007). Leaving the interview questions open-ended in an online survey was likely to decrease response rate given the lengthy time it would require (Merriam, 2009; Qualitative Research, n.d.; Vogt, 2007), so the questions were modified to a closed type, and the number was cut from 17 to 10. Each question also allowed for students to add additional comments if desired.

Before the survey was released to the students, the researcher invited expert review of the instrument to ensure it would acquire the desired information. The instrument was presented to the researcher's dissertation committee and a few others with advanced knowledge on the topic. Revisions of the instrument questions were made based on that feedback. The researcher attempted to gather responses from all of the subjects who received mentoring, sending them all an email invitation to request their anonymous feedback.

**Quantitative Data Collection.** The college collects the data to be measured for the independent, dependent, and control variables on a regular basis in its information management system, Datatel (also called Colleague). Queries for the specific measures, sorted by student ID, were made to Datatel by JC Institutional Research (IR) staff, and the resulting data were exported into data tables that were imported into SPSS for analysis. The specific measures were success in the class as defined by the class grade, persistence to the following term, mentoring program participation, whether the students had ever enrolled in developmental education, whether the students were new to college, whether they were full or part-time, whether the students were concurrently enrolled in Human Biology with Math 131, whether they had declared a program of study where BIO 132 was significant, whether they previously took a human biology class, and demographic data. The data were then provided to the researcher electronically. This method of data collection was described in the literature as the typical methodology for gathering data from a college's institutional research system (Hall, n.d; Harwell, 2011; Stating the obvious, n.d.; Vogt, 2007).

## **Data Analysis**

**Descriptive Statistics.** Descriptive statistics are described by Vogt (2007) as “ways to investigate and explore quantitative evidence, usually one variable at a time; that is, they are usually univariate” (p. 11). They are used to determine if changes in the data are large enough to be practically significant (Vogt, 2007). For this research study, data analysis was completed using the IBM SPSS program (version 22, which was the latest version available in 2014 when the statistics were run). SPSS, the Statistical Package for the Social Sciences, is one of several widely used computer programs used for statistical analysis (Vogt, 2007, p. 27). It is the software package used by the JC IR department, which made it easier to transfer the data in a usable format. The data analysis was completed following the recoding of all relevant variables received from JC’s IR department, which provided the data in a SPSS file after having pulled it from the college’s Datatel information management system. Findings from the SPSS analyses are reported in Chapter 4. To determine how the independent variable (IV), the mentoring program, impacted the dependent variables (DV) class success and persistence, cross-tabulations and correlation coefficients were checked to establish correlation.

**Inferential Statistics.** Inferential statistics are used to determine if the data is statistically significant, or unlikely to be a coincidence, and to help determine whether the descriptive statistics could “be generalized to the population from which the sample was drawn” (Vogt, 2007, p. 11). To determine how the independent variable impacted the dependent variables, Chi-squared and Phi were used.

The Chi-squared test is used to determine if differences in data shown by descriptive analysis are “big enough to be statistically significant” (Vogt, 2007, p. 193),

or to evaluate the likelihood that “any observed difference between the [data] sets arose by chance” (Gosall & Gosall, 2012). Phi is “interpreted as a measure of the relative [strength] of an association between two variables” (AcaStat, n.d.). Both tests are needed because the Chi-squared test may show that the difference between two variables is statistically important, but this does not mean that the difference is large enough to be important, which is what the Phi test determines. All of these statistics are run to not only determine whether a result is statistically significant, but also to “help evaluate the relative strength of a statistically significant relationship” (AcaStat, n.d.).

To give an example from the actual data, in Chapter 4 in Table 8, success rates of mentored students in Spring 2013 were compared to non-mentored students, and the data showed the mentored students were 35.6% more likely to succeed. This was an example of descriptive analysis—a simple comparison between variables. But was a variation of 35.6% statistically significant, or unlikely to be due to coincidence? To be certain, inferential statistics needed to be run, so a Chi-square and Phi were run on the data, as shown in Table 9, and Chi-square showed the result was statistically significant, with the Phi indicating this result was relatively weak. All of these tests lent credibility to this study, because it was important to show that any differences found were valid and reliable.

**Qualitative Analysis:** The mentor and student surveys were conducted to examine participant insights into the program. The results were placed into the study in a case study fashion to add richness to the results. Merriam (2009) stated that a case study is an “in-depth description of a bounded system....a single entity, a unit around which there are boundaries....The case could be....a program, a group....or a specific policy” (p. 40).

It has been further observed that the “researcher conducting a case study attempts to analyze the variables relevant to the subject under study ....in the case study, the focus may not be on generalization but on understanding the particulars of that case in its complexity” (Qualitative Research, n.d.). In this research study, the quantitative results could demonstrate that there were some impacts on success and persistence, but these numbers could not tell why there were or were not changes, or what the mentors and mentored students felt the impact of the program was. Without such feedback, the program directors could make changes to the program based on the numbers, but not be certain these were the correct changes. Obtaining this qualitative data from the program participants directly might provide better guidance in the program evaluation. The qualitative results were not analyzed statistically, nor were they correlated with the quantitative results. All the data was collected anonymously so such comparisons could not be made.

**Appropriateness of Statistics for the Selected Research Design.** As discussed above, Chi-square with Phi was used to compare the nominal independent variable and nominal dependent variables. Chi-square was used to analyze each variable individually. Phi was used to establish effect size, or whether there was sufficient strength of association between the variables.

### **Limitations**

For the limitations section, all the types of threats to validity and reliability discussed by Vogt (2007) were examined for relevance to this study. Each needed to be taken into account in planning the study, in order to give the final results the maximum credibility.

**Threats to Validity and Reliability.** In order to reduce threats to validity and reliability, an attempt was made to define all possible threats, and either eliminate or control for them. The process used is described in the following sections. Essentially, sampling two halves of a class (divided by when its lab meets) for control vs. intervention reduced subject effects, and sampling sections that only met at the main campus reduced environment effects. Such control in the sampling reduced external validity (generalizability), however, because the real class schedule actually had different meeting times and locations. But as controlling this way could increase internal validity, it was considered beneficial.

**Reliability (Repeatability):** As is discussed in more detail in the section below on threats to validity, a design that favored reliability over validity was selected—so classes where the same group of 50 meeting for lecture and divided in half for control vs. intervention was selected where possible. To strengthen external validity, a second group of equal size but with one variable different (the instructor was teaching the lecture class online) was selected as well. Demographic data was collected and compared to students who took the class in other sections during 2013 to try to confirm that the students reflected typical demographics for the class. This was accomplished by using the Chi-squared test and Phi to compare the variables of gender and race/ethnicity. As shown in Chapter 4, the demographics for the mentored students showed that they reflected typical demographics for the class.

**Threats to Validity.** Threats to validity were examined, and those that were considered irrelevant to this study (i.e., subject attrition, history effects, and maturation) are not discussed further. For those listed, methods to reduce validity are discussed.

*Selection Bias:* The survey population was not randomly selected, which weakens its external validity, but the researcher accepted this limitation because choosing the population selected allowed for application of the intervention in a controlled fashion while controlling for extraneous variables. There were limitations in being able to set up the mentoring program related to the number of volunteers obtained, as they were all volunteers. They were selected from a limited pool of those who have succeeded in science, and matched to mentees so that they could help effectively, keeping a ratio of approximately four mentees per mentor. This meant that the maximum number of students mentored in any given term had to be kept to approximately 50, given the assumption that starting out with 15-20 mentors was likely. It also turned out to be overly optimistic, as the number of mentors was only 8-9 each term.

A design that favored internal validity over external validity was selected—to keep error due to subject bias to a minimum—so classes where the same group of 50 meeting for lecture and divided in half for control vs. intervention was selected where possible. This was done for all sections in fall term. To strengthen external validity, a second group of equal size but with one variable different—the instructor was teaching the lecture class online—was selected as well. This was done in spring term.

*Subject Effects:* The same two instructors have taught the majority of sections for years, and the population of students taking them should have been typical of the students who took this class every other term. This was tested using demographic data and the populations were found to be typical. The same instructor taught the labs—one of which received the mentors while one did not—as well as the lecture class that mixed the two groups. Since the intervention took place outside the classroom, this should have

minimized bias introduced into the classroom. As described under location/environment threat below, subjects taking the class in alternative class locations may also have been different from those taking it on main campus, or day students may have differed from evening students. Demographic data confirmed that the students reflected typical demographics for the class.

Ultimately, if this project shows successful outcomes, it is expected to be expanded to all students taking any anatomy and physiology class at JC—BIO 132, BIO 155, or BIO 253 and BIO 254. It is possible that it will be expanded further, to other science classes, and perhaps to other disciplines, as this is how the Supplemental Instruction Program evolved at JC. Growth of the program may be limited by success in finding mentors; that remains to be seen at this point.

*Location/Environment:* Because BIO 132 met in different locations (at the Lenewee and Hillsdale campuses) with different facilities, it was possible that this resulted in differences in the manner in which the course was operated. For this study, students from Lenawee were included in some both terms. The fact that they were part of the total demographic enhanced generalizability of the results, which may help with planned expansion of the program over all sections if it is successful. The students in the hybrid section met in the same lab section and facility, but they did not meet for lecture, as it was online. Therefore, there was no way to control for the environment they chose for the lecture portion of the class.

*Testing:* The students were all tested together with objective multiple-choice tests in the lecture class, so there should have been no variation in results there. During labs, the students were given practical exams, most of which were reasonably objective, but there

was some subjectivity possible. Lab assignments tended to be fill-in and essay, so there was some potential for instructor grading bias there as well. Since the instructor knew that all students in a given section were receiving mentoring it is possible this impacted how they were evaluated in lab, even if subconsciously. Instrument effects should have been minimal.

**Other Limitations.** This study is a program evaluation. Therefore, there were limitations that were inherent due to this complexity. Discussion of these other limitations follows.

***Mentors and Their Training.*** Certain skills were identified for the mentors—primarily prior success in science combined with training in JC resources—so that the mentors could guide the students in those limited areas; these were described in Chapter 2 and briefly summarized in Appendix B. It is possible that there were more effective skills that would have better helped the students. It is also possible that there were better methods to train the mentors than were used. Perhaps certain populations would be better suited to provide mentoring—there was a mix of students and faculty, and perhaps one of these was more effective than others. Also, because this program relied on volunteers, then it is possible that those who volunteered were not as effective as paid mentors would have been. There were mentors who dropped out, and in one case whose mentees had to be re-assigned, although it was very early in the term and likely had little impact. But mentors dropping out even before the term started placed an excessive burden on the remaining mentors—and may have resulted in decreased effectiveness given the mentor-mentee ratios that resulted. Finally, it is possible that some mentoring relationships were

ineffective matches, but given the low number of available mentors, re-assignments would have been difficult if any had been requested.

***Other Factors Impacting Success and Persistence.*** Many factors can impact student science success. Such factors may include first-generation status (Barry, Hudley, Kelly, & Cho, 2009; Goldrick-Rab & Sorensen, 2010; Hawley & Harris, 2005; Inman & Mayes, 1999; Jehangir, 2010; Mechur-Karp, 2011), high school science and math grades (Barnett, 2010; Crisp, 2010; Mendoza, Mendez, & Malcolm, 2009; Pope, 2002), science and math ACT scores (Khazanov, 2011), whether a supplemental instructor was made available for the class (McClenney, 2011), and so on. Control variables in this study were whether the students were enrolled in developmental education, whether the students were new to college, number of concurrently enrolled courses, whether the students were concurrently enrolled in Math 131, whether they had declared a program of study, and whether they previously took a Human Biology class. All of these were selected as they were predicted to possibly impact success and persistence in the class, and to therefore rule them out as factors in order to ensure that mentoring is the only effect studied. Since other factors that might have had an impact were not taken into account in this study, this limits the validity.

***Non-Random Sample Selection.*** This research was limited to two to four sections per term of the particular class. Perhaps there were other factors which impacted success in the other groups, such as evening classes, classes at smaller campus branches, and so on, which would benefit from being examined. And because there were two other anatomy and physiology options at JC, it is possible that what helped in one of them will

not help in the others. In short, conducting the study this way limited generalizability of the findings, both internally and externally.

***Success Variable Selection.*** For students to be eligible for transfer into occupational and baccalaureate programs, a 3.0 minimum is generally required, rather than the 2.0 minimum used for this study. Many students therefore repeat the class to get the higher grade. For these students—and the programs looking to accept them—a 2.0 grade is not the threshold for success.

### **Summary**

This study should help to establish whether mentoring improves success and persistence in science classes. This should expand the literature, as studies of mentoring have usually been limited to developmental education programs. It should also expand the literature on improving STEM success, which is a priority for higher education.

## CHAPTER 4: RESULTS AND ANALYSIS

### **Results and Analysis of the Research Question Data**

**Research Questions.** This project was intended to explore the following research questions:

- Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?
- Does individual mentoring in BIO 132 at JC improve persistence?

All quantitative data were pulled from the Jackson College course management system, Datatel, by the Institutional Research department. The data was imported into SPSS. All identifying information was removed from the data, and then it was passed on to the researcher.

**Demographic Findings and Analysis.** Demographic data were collected to assess how closely the students receiving mentors reflected the population of students that take BIO 132 overall. The data compared were gender and race/ethnicity. This comparison was necessary because of the process used to select students for the study, which was quasi-random—selection was not entirely random. Whole sections of BIO 132 were selected to be experimental groups, and other whole sections were chosen to be compared as control sections, and the sections chosen were not selected based on student characteristics, so for these reasons the students in these sections essentially randomized themselves. However, the selection was not an entirely random selection of students from all sections in a given term, so it is possible that students who chose particular sections

have certain characteristics in common that are different from students who selected other sections. It was therefore necessary to establish they are reflective of the total population to increase internal validity of the study.

Selection methods were discussed in Chapter 3, but are reviewed here briefly for clarity. In some BIO 132 classes, in a class of approximately 50 students, the group is divided in half for labs, so that there are 25 students in each lab. These groups would be ideal for dividing so that one half was the control group and one half was experimental, because they were alike in almost every respect except when the different labs met. They were in the same lecture class with each other, with the same instructor, same time, location, delivery methods, and so on. This gave them increased subject and location validity, as mentoring was the only significant difference between the groups. All the fall study groups were selected this way, with half of one 50-student lecture class mentored (experimental) and half not mentored (control), and half of the groups ran this way in winter, where the research's mentoring program ran as a brief pilot.

In spring term, there were only two sections offered by the college. One section was taught by the lead instructor for BIO 132 and the other by an instructor with years of experience in this class. Therefore the sections were all taught by instructors with approximately equivalent experience in teaching the class. Both instructors were used for the pilot in winter. The plan was to use both for the length of the program to yield the maximal consistency. In spring, one section was entirely online and one was at a second campus an hour away from the main campus. Therefore the sample populations were potentially quite different from the ones from the other term, as this was the only term where an entirely online section needed to be used. And for fall term, the lead faculty

instructor took an unexpected leave, so another instructor had to be used. He had also taught BIO 132 for many years, and he taught in the same off-campus location used in spring term.

Therefore, even though it was attempted to make the groups both representative of students in other terms and to limit differences between the selected control and experimental groups as much as possible, because they were not entirely randomized, some error may have been introduced into the results. In order to try to be certain the degree of error was not significant, the experimental groups were compared to other sections of BIO 132 that were not part of the study. In Winter and Fall 2013, there were several more sections running which were not selected for mentoring or control groups. All of the sections that were neither control nor experimental from 2013 were selected for comparison, as well as every section from 2012. The data compared were gender and race/ethnicity. As shown in Table 2, the sample of students in the study that were mentored was similar in most respects to the overall population of BIO 132 students. The control group students were combined with all other non-mentored students for this analysis.

*Table 2: Comparison of Characteristics of Sampled Students with Those of the Overall BIO 132 Group*

CHARACTERISTIC	PERCENT OF MENTORED STUDENTS <sup>A</sup>	PERCENT OF TOTAL BIO 132 <sup>B</sup>
Gender	100% (n=58)	100% (n=676)
Male	13.8% (n=8)	23.8% (n=161)
Female	86.2% (n=50)	76.2% (n=515)
Race/Ethnicity	100% (n=58)	99.7% (n=674) <sup>C</sup>
American Indian	1.7% (n=1)	0.6% (n=4)
Black	3.4% (n=2)	4.7% (n=32)
Hispanic	1.7% (n=1)	5.0% (n=34)
Multiple Races	3.4% (n=2)	2.2% (n=15)
Unknown	5.2% (n=3)	5.3% (n=36)

CHARACTERISTIC	PERCENT OF MENTORED STUDENTS <sup>A</sup>	PERCENT OF TOTAL BIO 132 <sup>B</sup>
White	84.5% (n=49)	81.8% (n=553)

<sup>a.</sup> Percentage of all students included in the experimental groups in 2013.

<sup>b.</sup> Percentage of all students taking BIO 132 in 2012 and 2013.

<sup>c.</sup> Students self-identify ethnicity, and two students in this group made no selection. Data are from Datatel course management system (as in all subsequent tables).

In regards to gender, the populations were similar, though not identical. The mentored group had 10% more female students, so to determine whether this was statistically significant, a Chi-square analysis was needed. For the total percent of white and non-white students the results show much less variation. The major differences were in the specific proportions of non-white students, as the mentored group contained a slightly lower percentage of black and Hispanic students. Again, as with gender, in order to determine whether these differences were significant, a Chi-square was run on the data.

*Table 3: Chi-Square Comparing Sampled Students with the Overall BIO 132 Group*

CHARACTERISTIC	PEARSON CHI-SQUARE	P
Gender	3.513 <sup>a</sup>	0.061
Race/Ethnicity <sup>b</sup>	0.006 <sup>c</sup>	0.937

<sup>a</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 20.24.

<sup>b</sup> To be able to run Chi square, data need to be bivariate, so the students were compared as white vs. other.

<sup>c</sup> 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.26.

There was not a significant relationship between the gender of students in the experimental group as compared to the total group. Likewise, there was not a significant relationship between race/ethnicity of students in the experimental group as compared to the total group. This means the experimental group could be considered to be statistically

equivalent to the total group of students taking BIO 132 in terms of gender and race/ethnicity.

**Research Question 1.** The first research question was: Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?

**Findings and Analysis.** In order to answer this question, success rates for mentored students were compared to those who were not mentored.

*Table 4: Success Rates of Mentored / Non-Mentored Students in BIO 132 in Spring and Fall 2013*

CHARACTERISTIC	MENTORED	NON-MENTORED
Successful (2.0 or greater)	55.2% (n=32)	57.4% (n=35)
Not successful (< 2.0) or withdrew	44.8% (n=26)	42.6% (n=26)
Total	100% (n=58)	100% (n=61)

The relationship between success in BIO 132 and mentoring was not substantively significant based on the difference between the categories of mentoring shown in Table 4. Next, a Pearson Chi-square was run on the data. As Table 5 shows, the results were as follows: Pearson Chi-square test = 0.059, Phi = -0.022, p = 0.809. The threshold for statistical significance is  $p \leq 0.05$ ; therefore, the result of 0.809 is not statistically significant.

*Table 5: Chi-Square Analysis of Success of Mentored/Non-Mentored Students in Spring and Fall 2013*

	VALUE	PHI	P
Pearson Chi-Square	0.059	-0.022	0.809
N of Valid Cases	119		

However, the mentoring program was not as well monitored in the fall term, and had many new, less experienced mentors. It is expected that these changes in the mentoring program by term played a significant role in success rates. So another analysis was run for only the Fall 2013 students, as shown in Table 6.

*Table 6: Success Rates of Mentored / Non-Mentored Students in BIO 132 in Fall 2013 Only*

CHARACTERISTIC	MENTORED	NON-MENTORED
Successful (2.0 or greater)	50.0% (n=19)	68.2% (n=30)
Not successful (< 2.0) or withdrew	50.0% (n=19)	31.8% (n=14)
Total	100% (n=38)	100% (n=44)

The relationship between success in BIO 132 and mentoring in Fall 2013 was not significant based on the difference between the categories of mentoring shown in Table 6. Next, a Pearson Chi-square was run on the data. As Table 7 shows, the results were as follows: Pearson Chi-square test = 2.803, Phi = -0.185, p = 0.094. The threshold for statistical significance is  $p \leq 0.05$ ; therefore, the result of 0.094 is not statistically significant.

*Table 7: Chi-Square Analysis of Success of Mentored/Non-Mentored Students in Fall 2013 Only*

	VALUE	PHI	P
Pearson Chi-Square	2.803	-0.185	0.094
N of Valid Cases	82		

Another Chi-square test was run for only the Spring 2013 students, as shown in Table 8.

Table 8: Success Rates of Mentored/Non-Mentored Students in BIO 132 in Spring 2013 Only

CHARACTERISTIC	MENTORED	NON-MENTORED
Successful (2.0 or greater)	65.0% (n=13)	29.4% (n=5)
Not successful (< 2.0) or withdrew	35.0% (n=7)	70.6% (n=12)
Total	100% (n=20)	100% (n=17)

With the fall students excluded, the cross-tabulation analysis showed a stronger relationship between success in BIO 132 and mentoring. Table 8 indicates that mentored students were 35.6% more likely to succeed compared to those who were not mentored. Next, a Pearson Chi-square was run on the data.

Table 9: Chi-Square Analysis of Success of Mentored/Non-Mentored Students in Spring 2013 Only

	VALUE	PHI	P
Pearson Chi-Square	4.659	0.355	0.031
N of Valid Cases	37		

Table 9 shows that there was a stronger—although still fairly weak—relationship between course success and mentoring. In other words, as mentoring was available the success went up. Although the 0.355 Phi was fairly weak, the p level indicated this correlation was significant. However, it is important to note that disaggregating the data in this manner—breaking it down term-by-term—resulted in smaller sample size.

**Control Variable Findings and Analysis.** In an attempt to rule out other confounding variables, a number of factors were studied. These “control variables” were

analyzed to determine if they positively or negatively affected the dependent variable of success studied in Research Question 1. If they had any significant impact on increasing or decreasing the dependent variables, they would be analyzed further using logistic regression (in order to be able to analyze the impact of multiple simultaneous variables). But first each was subjected to cross-tabulation and Chi-square analysis, tested against success individually, and none were found to have any significant relationship. The results follow.

*Developmental education:* For this variable, all students who took Human Biology in Spring and Fall 2013 were assessed to find if they had ever enrolled in any developmental education class. A cross-tabulation was then run to compare their success in Human Biology against whether they had or had not ever taken any developmental education.

*Table 10:* Success Rates of Spring/Fall 2013 BIO 132 Students Who Took Developmental Education (DE)

CHARACTERISTIC	TOOK DEV. ED.	NEVER TOOK DEV. ED.
Successful (2.0 or greater)	55.8% (n =43)	57.1% (n =24)
Not successful (< 2.0) or withdrew	44.2% (n =34)	42.9% (n = 18)
Total	100% (n = 20)	100% (n = 17)

The relationship between developmental education and BIO 132 success was not significant based on the difference between the categories of developmental education shown in Table 10. Next, a Pearson Chi-square was run on the data. As Table 11 shows, the results were as follows: Pearson Chi-square test = 0.019, Phi = -0.013, p = 0.891. The

threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.891 was not statistically significant.

*Table 11: Chi-Square Analysis of Success of DE/Non-DE Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	0.019	-0.013	0.891
N of Valid Cases	119		

*First Term in College:* All students from Spring and Fall 2013 Human Biology were assessed to see if they were in their first term of college. A cross-tabulation was then run to compare their success in Human Biology against whether they were first term or not (see Table 12).

*Table 12: Success Rates of Spring/Fall 2013 BIO 132 Students Who Are First Term*

CHARACTERISTIC	FIRST TERM	NOT FIRST TERM
Successful (2.0 or greater)	37.5% (n = 6)	59.2% (n = 61)
Not successful (< 2.0) or withdrew	62.5% (n = 10)	40.8% (n = 42)
Total	100% (n = 16)	100% (n = 103)

The relationship between first term of college and BIO 132 success was not significant based on the difference between the categories of first term of college shown in Table 12. Next, a Pearson Chi-square was run on the data. As Table 13 shows, the results were as follows: Pearson Chi-square test = 2.656, Phi = -0.149,  $p = 0.103$ .

Table 13: Chi-Square Analysis of Success of First Term (FT)/Non-FT Spring/Fall 2013 BIO 132 Students

	VALUE	PHI	P
Pearson Chi-Square	2.656	-0.149	0.103
N of Valid Cases	119		

The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.103 was not statistically significant.

*Full-time Status:* Students were considered full time if they took 12 credits or more in the term in which they were enrolled in Human Biology. A cross-tabulation was then run to compare their success in Human Biology against whether they had been full time or part time during the term they took the class.

Table 14: Success Rates of Spring/Fall 2013 BIO 132 Students Who Are Full Time (12 or More Credits)

CHARACTERISTIC	FULL TIME	PART TIME
Successful (2.0 or greater)	58.3% (n = 42)	53.2% (n = 25)
Not successful (< 2.0) or withdrew	41.7% (n = 30)	46.8% (n = 22)
Total	100% (n = 72)	100% (n = 47)

The relationship between full-time attendance of college and BIO 132 success was not significant based on the difference between the categories of full-time attendance shown in Table 14. Next, a Pearson Chi-square was run on the data. As Table 15 shows, the results were as follows: Pearson Chi-square test = 0.306, Phi = 0.051,  $p = 0.580$ . The

threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.580 was not statistically significant.

*Table 15: Chi-Square Analysis of Success of Full Time/Part Time Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	0.306	0.051	0.580
N of Valid Cases	119		

*Taking Human Biology Concurrent with Math 131:* Students enrolled in Human Biology in Spring and Fall 2013 were assessed to see if they enrolled in Math 131 during the same term they took the Human Biology. A cross-tabulation was then run to see if their success in Human Biology was impacted by concurrent Math 131 enrollment.

*Table 16: Success Rates of Spring/Fall 2013 BIO 132 Students Who Took Math 131 Concurrently*

CHARACTERISTIC	CONCURRENT WITH MATH 131	NOT CONCURRENT WITH MATH 131
Successful (2.0 or greater)	68.4% (n = 13)	54.0% (n = 54)
Not successful (< 2.0) or withdrew	31.6% (n = 6)	46.0% (n = 46)
Total	100% (n = 19)	100% (n = 100)

The relationship between concurrent enrollment in Math 131 and BIO 132 success was not significant based on the difference between the categories of concurrent Math 131 enrollment shown in Table 16. Next, a Pearson Chi-square was run on the data. As Table 17 shows, the results were as follows: Pearson Chi-square test = 1.350, Phi =

0.106,  $p = 0.245$ . The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.245 was not statistically significant.

*Table 17: Chi-Square Analysis of Success of Concurrent Math Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	1.350	0.106	0.245
N of Valid Cases	119		

*Health Care/Science Major:* The students enrolled in Human Biology in Spring and Fall 2013 were assessed for a declared major. If they declared a major in health care (respiratory care, nursing, sonography, radiology, medical assisting, or emergency medical technician) or science they were considered health or science majors, and were contrasted with students who had declared no major or any other major. A cross-tabulation was then run to compare their success in Human Biology against whether they had declared a health care or science major.

*Table 18: Success Rates of Spring/Fall 2013 BIO 132 Students Who Declared Health/Science Majors*

CHARACTERISTIC	HEALTH CARE/SCIENCE MAJOR	NOT HEALTH CARE/SCIENCE MAJOR
Successful (2.0 or greater)	58.4% (n= 59)	33.3% (n= 5)
Not successful (< 2.0) or withdrew	41.6% (n= 42)	66.7% (n= 10)
Total	100% (n = 101)	100% (n = 15)

The relationship between declaring a healthcare/science major and BIO 132 success was not significant based on the difference between the categories of major declaration shown in Table 18. Next, a Pearson Chi-square was run on the data. As Table 19 shows, the results were as follows: Pearson Chi-square test = 0.306, Phi = 0.051, p = 0.580. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.580 was not statistically significant.

*Table 19: Chi-Square Analysis of Success of Health/Science Major Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	0.306	0.051	0.580
N of Valid Cases	116		

*Prior Human Biology Attempts:* Students who had ever taken any Human Biology in any previous term were compared from the pool of students who took Human Biology in Spring and Fall 2013. A cross-tabulation was then run to compare their success in Human Biology against whether they had previously attempted Human Biology.

*Table 20: Success Rates of Spring/Fall 2013 BIO 132 Students Who Have Taken Human Biology Before*

CHARACTERISTIC	TOOK BIO BEFORE	NEVER TOOK BIO BEFORE
Successful (2.0 or greater)	67.7% (n = 21)	52.3% (n = 46)
Not successful (< 2.0) or withdrew	32.3% (n = 10)	47.7% (n = 42)
Total	100% (n = 31)	100% (n = 88)

The relationship between prior Human Biology attempts and BIO 132 success was not significant based on the difference between the categories of prior Human Biology attempts shown in Table 20. Next, a Pearson Chi-square was run on the data. As Table 21 shows, the results were as follows: Pearson Chi-square test = 2.230, Phi = 0.137, p = 0.135. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.135 was not statistically significant.

*Table 21: Chi-Square Analysis of Success of Repeat Human Biology Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	2.230	0.137	0.135
N of Valid Cases	119		

**Research Question 2.** The second research question was: Does individual mentoring improve persistence in BIO 132 (Human Biology) at Jackson College (JC)?

**Findings and Analysis.** In order to answer this question, persistence rates for mentored students were compared to those who were not mentored. As was done with research question 1, a separate crosstab analysis was run for the spring term, because persistence to the next term was the measure used, and enrollment in spring term at JC is far less in all classes than in fall and winter terms. In each case, the persistence to the next term was measured. So for Spring 2013 Human Biology students studied, the measure was whether the students enrolled in Fall 2013, and for Fall 2013 Human Biology students, the measure was whether they enrolled in Winter 2014. The measure was the same whether each term was assessed separately, or whether the measures were combined. In Tables 22 and 23, where persistence for Spring and Fall 2013 students was

assessed, the students from each term were still assessed as to whether they persisted to the next term only.

*Table 22: Persistence to Next Term of Mentored/Non-Mentored BIO 132 Students in Spring/Fall 2013*

CHARACTERISTIC	MENTORED	NON-MENTORED
Persist (took classes the following term)	69.0% (n = 40)	67.2% (n = 41)
Not Persist (took no classes the following term)	31.0% (n = 18)	32.8% (n = 20)
Total	100% (n = 58)	100% (n = 61)

The relationship between persistence and mentoring for both spring and fall terms in BIO 132 was not substantively significant based on the difference between the categories of mentoring—less than a 30% difference across the categories shown in Table 22. Next, a Pearson Chi-square was run on the data. As Table 23 shows, the results were as follows: Pearson Chi-square test = 0.042, Phi = 0.019, p = 0.838. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.838 was not statistically significant.

*Table 23: Chi-Square Analysis of Persistence of Mentored/Non-Mentored Students in Spring/Fall 2013*

	VALUE	PHI	P
Pearson Chi-Square	0.042	0.019	0.838
N of Valid Cases	119		

As noted in the section on research question 1, the mentoring program was not as well monitored in the fall term, and had many new, less experienced mentors. It is

expected that term played a significant role in persistence rates. Therefore, another analysis was run for only the Fall 2013 students, as shown in Table 24.

*Table 24: Persistence to Winter Term of Mentored/Non-Mentored BIO 132 Students in Fall 2013 Only*

CHARACTERISTIC	MENTORED	NON-MENTORED
Persist (took classes the following term)	65.8% (n = 25)	77.3% (n = 34)
Not Persist (took no classes the following term)	34.2% (n = 13)	22.7% (n = 10)
Total	100% (n = 38)	100% (n = 44)

The relationship between persistence in BIO 132 and mentoring in Fall 2013 was not significant based on the difference between the categories of mentoring shown in Table 24. Next, a Pearson Chi-square was run on the data. As Table 25 shows, the results were as follows: Pearson Chi-square test = 1.332, Phi = -0.127, p = 0.248. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.248 was not statistically significant.

*Table 25: Chi-Square Analysis of Persistence of Mentored/Non-Mentored Students in Fall 2013 Only*

	VALUE	PHI	P
Pearson Chi-Square	1.332	-0.127	0.248
N of Valid Cases	82		

Another analysis was run for the Spring 2013 students only, as shown in Table 26. The data for persistence from spring to fall tells a different story than the data for Fall

2013 to Winter 2014 persistence. Results indicated mentored students were 34% more likely to persist to the next term.

*Table 26: Persistence to Fall Term of Mentored/Non-Mentored BIO 132 Students in Spring 2013 Only*

CHARACTERISTIC	MENTORED	NON-MENTORED
Persist (took classes the following term)	75.0% (n=15)	41.2% (n=7)
Not Persist (took no classes the following term)	25.0% (n=5)	58.8% (n=10)
Total	100% (n=20)	100% (n=17)

Further analysis was therefore needed to determine whether this difference was statistically significant, so a Pearson Chi-square was run on the data next. As Table 27 shows, the results were as follows: Pearson Chi-square test = 4.361, Phi = 0.343,  $p = 0.037$ . The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.037 was statistically significant.

*Table 27: Chi-Square Analysis of Persistence of Mentored/Non-Mentored Students in Spring 2013*

	VALUE	PHI	P
Pearson Chi-Square	4.361	0.343	0.037
N of Valid Cases	37		

Table 27 shows that there was now a stronger—although still fairly weak—relationship between spring-to-fall persistence and mentoring. In other words, as mentoring was available the persistence increased. Although the 0.343 Phi is fairly weak, the  $p$  level now indicated this relationship was significant.

**Control Variable Findings and Analysis.** As with research question 1, an attempt was made to rule out possible confounding variables. The same ones were studied as with question 1, and each variable was tested against persistence individually with none found to have any significant relationship.

*Developmental education:* For this variable, all students who took Human Biology in Spring and Fall 2013 were assessed to find if they had ever enrolled in any developmental education class. A cross-tabulation was then run to compare their persistence to the next term against whether they had or had not taken any developmental education.

Table 28: Persistence of Spring/Fall 2013 BIO 132 Students Who Took Developmental Education (DE)

CHARACTERISTIC	TOOK DEV. ED.	NEVER TOOK DEV. ED.
Persist (took classes the following term)	68.8% (n = 53)	66.7% (n = 28)
Not Persist (took no classes the following term)	31.2% (n = 24)	33.3% (n = 14)
Total	100% (n = 77)	100% (n = 42)

The relationship between developmental education and BIO 132 persistence was not significant based on the difference between the categories of developmental education shown in Table 28. Next, a Pearson Chi-square was run on the data. As Table 29 shows, the results were as follows: Pearson Chi-square test = 0.059, Phi = 0.022, p = 0.809. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.809 was not statistically significant.

Table 29: Chi-Square Analysis of Persistence of DE/Non-DE Spring/Fall 2013 BIO 132 Students

	VALUE	PHI	P
Pearson Chi-Square	0.059	0.022	0.809
N of Valid Cases	119		

*First Term in College:* All students from Spring and Fall 2013 Human Biology were assessed to see if they were in their first term of college. A cross-tabulation was then run to compare their persistence to the next term against whether they were first term or not.

Table 30: Persistence of Spring/Fall 2013 BIO 132 Students Who Are First Term

CHARACTERISTIC	FIRST TERM	NOT FIRST TERM
Successful (2.0 or greater)	75.0% (n = 12)	67.0% (n = 69)
Not successful (< 2.0) or withdrew	25.0% (n = 4)	33.0% (n = 34)
Total	100% (n = 16)	100% (n = 103)

The relationship between first term of college and BIO 132 persistence was not significant based on the difference between the categories of first term of college shown in Table 30. Next, a Pearson Chi-square was run on the data. As Table 31 shows, the results were as follows: Pearson Chi-square test = 0.409, Phi = 0.059, p = 0.523. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.523 was not statistically significant.

Table 31: Chi-Square Data for Persistence, First Term (FT)/Non-FT Spring/Fall 2013 BIO 132 Students

	VALUE	PHI	P
Pearson Chi-Square	0.409	0.059	0.523
N of Valid Cases	119		

*Full-time Status:* Students were considered full time if they took 12 credits or more in the term in which they were enrolled in Human Biology. A cross-tabulation was then run to compare their persistence to the next term against whether they had been full time or part time during the term they took the class.

Table 32: Persistence of Spring/Fall 2013 BIO 132 Students Who Are Full Time (12 or More Credits)

CHARACTERISTIC	FULL TIME (FT)	PART TIME (PT)
Persist (took classes the following term)	75.0% (n = 54)	57.4% (n = 27)
Not Persist (took no classes the following term)	25.0% (n = 18)	42.6% (n = 20)
Total	100% (n = 72)	100% (n = 47)

The relationship between full-time attendance of college and BIO 132 persistence was not significant based on the difference between the categories of full-time attendance shown in Table 32. Next, a Pearson Chi-square was run on the data. As Table 33 shows, the results were as follows: Pearson Chi-square test = 4.031, Phi = 0.184, p = 0.045. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.045 was statistically significant—but for a relationship that was extremely weak.

*Table 33: Chi-Square Analysis of Persistence of FT/PT Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	4.031	0.184	0.045
N of Valid Cases	119		

To determine in what way this result indicated full-time status impacted the results, a cross-tabulation was run on full-time status for mentored and non-mentored groups. The results are shown in Table 34.

*Table 34: Impact of Full-time Status of Spring/Fall 2013 BIO 132 Students Who Are Mentored*

CHARACTERISTIC	MENTORED	NOT MENTORED
Full Time (FT)	63.8% (n = 37)	57.4% (n = 35)
Part Time (PT)	36.2% (n = 21)	42.6% (n = 26)
Total	100% (n = 58)	100% (n = 61)

The relationship between full-time status in and mentoring was not significant based on the difference between the categories of mentoring shown in Table 34. Next, a Pearson Chi-square was run on the data. As Table 35 shows, the results were as follows: Pearson Chi-square test = 0.501, Phi = 0.066, p = 0.474. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.971 was not statistically significant.

*Table 35: Chi-Square Analysis of Full-time Status of Mentored Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	0.501	0.066	0.474
N of Valid Cases	119		

Given that the mentored and non-mentored groups demonstrated no statistical difference from each other, this supports the finding that the relationship between full-time attendance of college and BIO 132 persistence is weak but statistically significant.

*Taking Human Biology Concurrently with Math 131:* Students enrolled in Human Biology in Spring and Fall 2013 were assessed to see if they enrolled in Math 131 during the same term they took the Human Biology. A cross-tabulation was then run to see if their persistence to the next term was impacted by concurrent Math 131 enrollment.

Table 36: Persistence of Spring/Fall 2013 BIO 132 Students Who Took Math 131 Concurrently

CHARACTERISTIC	CONCURRENT WITH MATH 131	NOT CONCURRENT WITH MATH 131
Persist (took classes the following term)	68.4% (n = 13)	68.0% (n = 68)
Not Persist (took no classes the following term)	31.6% (n = 6)	32.0% (n = 32)
Total	100% (n = 19)	100% (n = 100)

The relationship between concurrent enrollment in Math 131 and BIO 132 persistence was not significant based on the difference between the categories of concurrent Math 131 enrollment shown in Table 36. Next, a Pearson Chi-square was run on the data. As Table 37 shows, the results were as follows: Pearson Chi-square test = 0.001, Phi = 0.003, p = 0.971. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.971 was not statistically significant.

Table 37: Chi-Square Analysis of Persistence of Concurrent Math Spring/Fall 2013 BIO 132 Students

	VALUE	PHI	P
Pearson Chi-Square	0.001	0.003	0.971
N of Valid Cases	119		

*Healthcare/Science Major:* The students enrolled in Human Biology in Spring and Fall 2013 were assessed for a declared major. If they declared a major in healthcare (nursing, respiratory care, sonography, radiology, medical assisting or emergency medical technician) or science they were considered health or science majors, and were contrasted with students who had declared no major or another major. A cross-tabulation was then run to compare their persistence to the next term against whether they had declared a healthcare or science major.

Table 38: Persistence of Spring/Fall 2013 BIO 132 Students Who Declared Health/Science Majors

CHARACTERISTIC	HEALTH/SCIENCE MAJOR	NOT HEALTH/SCIENCE MAJOR
Persist (took classes the following term)	69.3% (n = 70)	53.3% (n = 8)
Not Persist (took no classes the following term)	30.7% (n = 31)	46.7% (n = 7)
Total	100% (n = 101)	100% (n = 15)

The relationship between declaring a healthcare/science major and BIO 132 persistence was not significant based on the difference between the categories of major declaration shown in Table 38. Next, a Pearson Chi-square was run on the data. As Table

39 shows, the results were as follows: Pearson Chi-square test = 1.513, Phi = 0.114, p = 0.219. The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.219 was not statistically significant.

*Table 39: Chi-Square Data for Persistence of Health/Science Major Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	1.513	0.114	0.219
N of Valid Cases	116		

*Prior Human Biology Attempts:* Students who had taken Human Biology in any previous term were compared from the pool of students who took Human Biology in Spring and Fall 2013. A cross tabulation was then run to compare their persistence to the next term against whether they had ever previously attempted Human Biology.

*Table 40: Persistence of Spring/Fall 2013 BIO 132 Students Who Have Taken Human Biology Before*

CHARACTERISTIC	TOOK BIO BEFORE	NEVER TOOK BIO BEFORE
Persist (took classes the following term)	65.8% (n = 25)	77.3% (n = 34)
Not Persist (took no classes the following term)	34.2% (n = 13)	22.7% (n = 10)
Total	100% (n = 38)	100% (n = 44)

The relationship between prior Human Biology attempts and BIO 132 persistence was not significant based on the difference between the categories of prior Human Biology attempts shown in Table 40. Next, a Pearson Chi-square was run on the data. As Table 41 shows, the results were as follows: Pearson Chi-square test = 3.375, Phi = -

0.168,  $p = 0.066$ . The threshold for statistical significance was  $p \leq 0.05$ ; therefore, the result of 0.066 was not statistically significant.

*Table 41: Chi-Square Data for Persistence of Repeat Human Biology Spring/Fall 2013 BIO 132 Students*

	VALUE	PHI	P
Pearson Chi-Square	3.375	-0.168	0.066
N of Valid Cases	119		

**Summary of Results for Research Questions 1 and 2.** This project was intended to explore the following research questions:

- Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?
- Does individual mentoring in BIO 132 at JC improve persistence?

For both question 1 and 2, fall data indicate no improvement, and for spring, data indicate statistically significant (though small) improvement. Of all of the control variables, only the relationship between full-time attendance of college and BIO 132 persistence had any statistically significant impact.

### **Results and Analysis of the Mentor Survey Data**

The group of mentors changed over the course of the three terms of the study. There were 16 total mentors. One was a faculty member, and all the rest were community college students who had taken BIO 132 and received a course grade of at least a 3.0. The mentors that served in the program are shown in Table 42. All communication in the program was done through College email.

Table 42: Mentor Participation by Term

MENTOR	WINTER	SPRING	FALL
Mentor01 (only faculty mentor)	X	X	X
Mentor05, Mentor08	X	X	X
Mentor03, Mentor04, Mentor07	X	X	
Mentor10		X	X
Mentor02, Mentor06, Mentor09	X		
Mentor11		X	
Mentor12, Mentor13, Mentor14, Mentor15, Mentor16			X

Mentors were recruited with email letters sent to science students who had earned a grade of 3.0 or higher for the previous two years, as well as healthcare students (sonography, respiratory care, nursing, and radiology) and faculty in health care and science (see Appendix E for sample student recruiting letter, and Appendix F for sample faculty recruiting letter). Three mentors served in all three terms of the program, four mentors served for two terms, and nine served for one term. Each term the mentors were asked if they wished to continue. There were enough that continued from winter to spring that no new recruiting was done, but a new series of recruiting letters was sent to ensure there were enough mentors for fall to accommodate a larger number of students.

**Mentor Training and Assignment.** Each term the mentors were offered training/re-training in the principles, goals and guidelines for the mentoring program. The materials were sent to the mentors (see Appendix G and Appendix H). In summary, the mentors were told:

- **The rationale for the mentoring program:** Because many community college students belong to families where nobody has gone to college, and many students whose families have never been to college do not succeed,

then they start at a disadvantage. And because students who want to enter a healthcare program can just begin college with Human Biology, if they have had no prior college experience or families members to advise them, they may get overwhelmed by the demands of such a difficult class, fall behind, and never have a chance to catch up, which may explain in part the class's high failure rate. The mentoring program is here to try to help such students acquire quickly the information they may have missed. This information might include how to find college resources quickly—and even what those resources are, that they need to prepare for such a class before it even starts and ensure they never get behind, how best to prepare for exams in such a class, and much more.

- **Early intervention is key:** In order to be sure the mentored student does not fall into the trap of getting behind in the first place, the intervention must occur very early—within the first three weeks, but preferably within the first week.
- **Making contact with mentored students:** Email an introduction that includes information about how the mentor succeeded in Human Biology, giving any opening advice, and letting the student know the mentor will be there for the student for the entire term. Provide the student with contact information. Ask if any help is needed right away. Then set up a contact schedule—weekly for the first month, and every couple of weeks after that.
- **Role of mentor:** To provide information on how to provide resources—using the provided resources guide and the mentor's own experience—and to be a role model and cheerleader for the student's success.

Live training sessions were made available for mentors who wished to attend. Only one mentor ever came to the live training. The mentors received their mentoring assignments with their informational letters. They were given the names of their students

along with contact student email addresses. The only exception was in winter term, where the students were asked which method of contact they preferred, and they could select any email address or phone contact.

This mentoring program was operated with no budget and minimal human resources—one person running it in addition to other full-time duties. All of the mentors were volunteers. The lack of resources and volunteer nature of the program made it difficult to demand much of any of the participants, so communications were often less than optimal as all involved often placed other commitments at a higher priority. The mentors were monitored loosely, and that monitoring was done differently each term.

**Results and Analysis of Responses from Mentors.** Each term the mentors were asked a series of open-ended questions about how the mentoring program was going from their perspective. In winter and fall the mentors were polled once, at the end of the term. In spring they were asked at the midterm and at the end of the term. A sample email letter is in Appendix I. The questions asked were

- Did the student ever respond to your initial request?
- Did the student ask for any help after that?
- Did you have regular contact? If so, was it scheduled or un-scheduled?
- How did it go with you and the student otherwise? Did you feel you helped?
- Any other comments?

The responses are categorized in Table 43.

Table 43: Mentor Responses by Term

RESPONSES	WINTER	SPRING	FALL
Mentor did not respond	1	2	1
No students responded	3	1	4
Student responded but said no help was needed	1	2	1
Student asked for help locating resources or tips in BIO 132	3	2	2
Student wanted a sounding board for stress	1	1	1
Student wanted to discuss application process for health programs		1	

Three mentors (Mentor09, Mentor11, and Mentor15) never responded to queries about their experience. One mentor (Mentor04) responded in the winter term, but did not respond in spring, and email contact in the second week of the term was returned as undeliverable. One mentor (Mentor10) responded at the end of Spring to say she had finally realized she had given the students a non-working email address, so had never heard from them for that reason. Most of the mentors responded with a brief answer rather than to each question individually. Three mentors in winter, one in spring, and four in fall reported that no students ever responded to being contacted. Four students responded but said they needed no help (one each in winter and fall and two in spring). Six students asked for help of various kinds. One student in each term seemed primarily to want to discuss stresses (in and out of class) with the mentors. One student wanted to discuss the application process and workload in a healthcare program.

Mentor05 participated in all three terms of the program, and had some perspective to offer that encompassed all three terms. This was her response at the end of the fall term:

Only one of my five [fall] students responded to my initial request. They didn't really ask for help, more so to just talk about their struggles with the class. I only had one exchange with that student, but they never responded back after that. I tried to reach out to the students on a weekly basis at first, followed by an e-mail sent every 3-4 weeks or so. Since the start of this program, I have found that for the students that did respond to my e-mails, they all seemed to have the same struggles. They said they felt there was too much information and not enough direction on how to study all of it. Many of them seemed very discouraged, which could potentially be a reason why students drop the class or fail. They might feel so discouraged that they give up. Even having a mentor to turn to for support might not be enough for some students.

Mentor12 only participated for the fall term, and had contact with students that she wished to describe:

Stu35 and Stu38 were the only two who ever got back with me. I only had contact with them once and nothing after October. One of them got back to me about two weeks after the initial email I sent and the other about a month later. The other two students, I never heard back from them. I am not sure that I was helpful to the student except that they knew I was there if they needed. But, I would still be interested in mentoring again if I were asked to. I believe it is important to at least let the students know there is one of their peers there to help.

Mentor13 also only participated for the fall term, but expressed more concerns with the validity of the program:

[I]t seemed to be a huge waste of my time, after finding all that information for them, sharing it, giving suggestions and resources and hints, to

have only one response and then none after her initial exam. This was an ineffective process, and I felt it was unwanted by the students I "mentored"....I think I would have felt more effective if I were a real live tutor to the students, or at least to those students who wanted help and tutoring. It's hard to judge, since I had no feedback other than the one girl, who said she appreciated the tips, suggestions and hints on how to succeed in the class. I never heard from her after that first exam, and I sent her several emails to see how she did and what else we could do to help her do well in the class. Perhaps group mentoring sessions would be more in line than email.

**Summary of Themes Found in the Responses from Mentors.** The comments made by mentors Mentor05 and Mentor12 encapsulate two themes that emerged in feedback from most of the mentors and every term:

- **Belief the program helped:** All of the mentors who responded—except Mentor13—said they believed the mentoring was helping the students in some fashion, with many wishing to continue mentoring—even though in some cases they could not continue for other reasons.
- **Uncertainty about student needs:** All of the mentors expressed a degree of uncertainty at some point—and some throughout—about whether what they did was helping. Because the students would generally at some point just stop responding to the mentors, the mentors were not sure if this lack of response meant the students were successful and just needed no more help, whether the students had failed, or exactly what it meant.

These apparently contradictory results indicate that the program operates with a great deal of uncertainty for those involved, even though they are optimistic about how it should or might be working.

## **Results and Analysis of the Survey of Mentored Students**

**Mentored Students.** There were 70 total students who were assigned mentors. In the first (pilot) term, Winter 2013, nine students were assigned mentors, and as there were also nine mentors, there was a 1:1 relationship. In Spring 2013, there were 20 students assigned to the eight mentors. Four mentors had three students assigned, and four mentors had two students assigned. In Fall 2013, there were 41 students assigned to the nine mentors. Five mentors were assigned five students (of these, three had mentored the previous two terms), and four mentors had four students assigned. The original plan had been to have ratios of 1:3 or 1:4, but because fewer mentors continued and insufficient mentors responded to recruiting attempts, the ratios had to be increased to 1:4 and 1:5. It is possible this overtaxed some of the mentors, although it is difficult to say, given the poor student response to the program in fall term.

The students were sent a letter in spring and fall terms telling them that they were going to be assigned a mentor and explaining the potential benefits. A sample email letter is seen in Appendix J. In winter the program was optional, and few students accepted the mentors, so it was decided to use this group as a pilot group. The primary reason for this decision was because it took so many weeks to get a group established (due to multiple failed attempts to get enough students to participate), the program could not run as planned from the beginning of the term, and between that and the fact that it was voluntary, it was decided there was too much variation from the other two terms the program ran. The winter term pilot was useful for getting mentors comfortable in their roles and working through some of the logistics of program operation.

**Results and Analyses of Responses from Mentored Students.** At the end of the Fall 2013 term all the mentored students were sent an email link to a survey asking about how the mentoring program had gone from their perspective. They were sent an email inviting them to participate, followed up with a repeat request two weeks later. The email and survey are included in Appendix C. There were nine respondents, and two student email addresses were no longer valid, so there were 68 total surveyed for a return rate of 13%. This sample size is so small as to make the results potentially unreliable. Other aspects seen with the data—especially the results from question 7, which indicate the population that responded is not representative of the total student population—further render the results questionable. The questions and responses are discussed next.

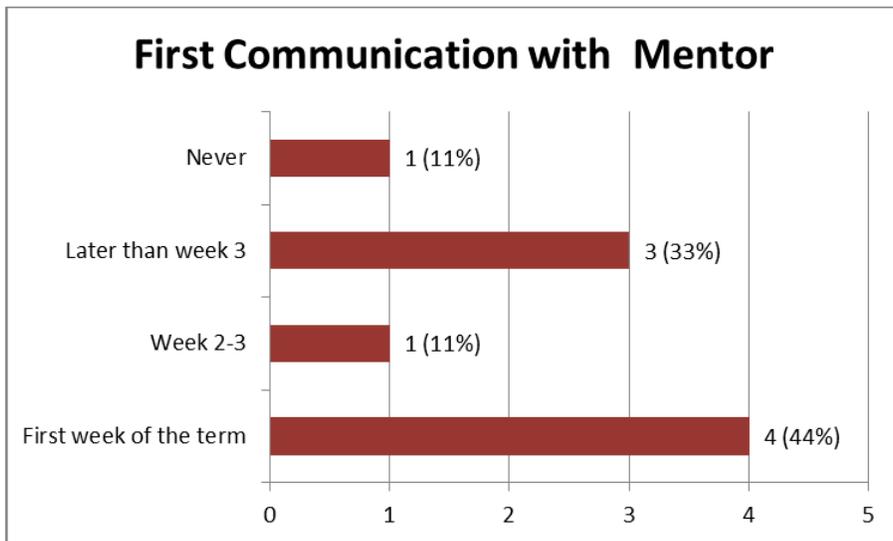


Figure 1. First Communication with Mentor

**Question 1: When was your first communication with your mentor?** With this question, an attempt was being made to determine if the program had succeeded in establishing first contact early—within three weeks at the outside, and preferably within the first week. As shown in Figure 1, four or 44% of respondents did report first contact

within the first week, and 5 (55%) reported being contacted in the three week timeframe. Three people (33%) reported being contacted later than the third week, with one (11%) saying no contact had ever been made.

Since this survey covered the entire year of the program, it covered the pilot period of Winter 2013, when the first contact by mentors was not made until the fifth week. Since the results were anonymous, some of those students may have responded. There were also mentors who reported difficulty reaching their assigned students initially, so it's possible the students were reporting the first time they actually had communication with the mentor as opposed to the first time the mentor attempted contact. And one mentor reported never being able to communicate with the mentored students due to an email error not discovered until much later, so it is possible that that is the reason the one student reported no contact (along with the possibilities that the student is reporting never having interaction or failure of some other sort). In any case, a choice of "never" for this question resulted to the respondent being diverted directly to question 7, as questions 2-6 ask about how the student experienced the mentoring program. Therefore the total number of respondents for those questions is eight rather than the nine that responded to the survey and for whom there are answers recorded in question 1 and questions 7-10.

In addition, for every survey question, the respondents were given the option of making comments. For question 1, there was one comment made: "I received an email letting me know who they were and how they was [sic] here to help me succeed in bio [sic] 132." This comment is reflective of what the mentors were supposed to do, so supports their success in reaching out to this student (although there is no indication from the comment about whether the student used the mentor or found mentoring helpful).

There were comments made in response to the first four questions, and none after that. All the comments that were made by the participants are shown next to the questions that elicited the comments. All the comments are negative or neutral—none are positive.

**Question 2: After the first contact, how often did you communicate with your mentor?** It was left up to the mentors and students to decide the frequency with which they communicated, and whether they wished it to be scheduled or as needed. Responses are shown in Figure 2. This question attempts to determine what sort of frequency was actually selected. One student (12%) reports a frequency that is at least monthly, although it is not clear whether this was scheduled or just happenstance. Three students (38%) reported contact that was sporadic and unscheduled, and four (50%) reported never having spoken to their mentor again after the first contact. Many of the mentors also reported having spoken to the mentored students only once, so this response aligns with that reporting. It also aligns with what they were told in training—to reach out to the students but let the students guide frequency of communication.

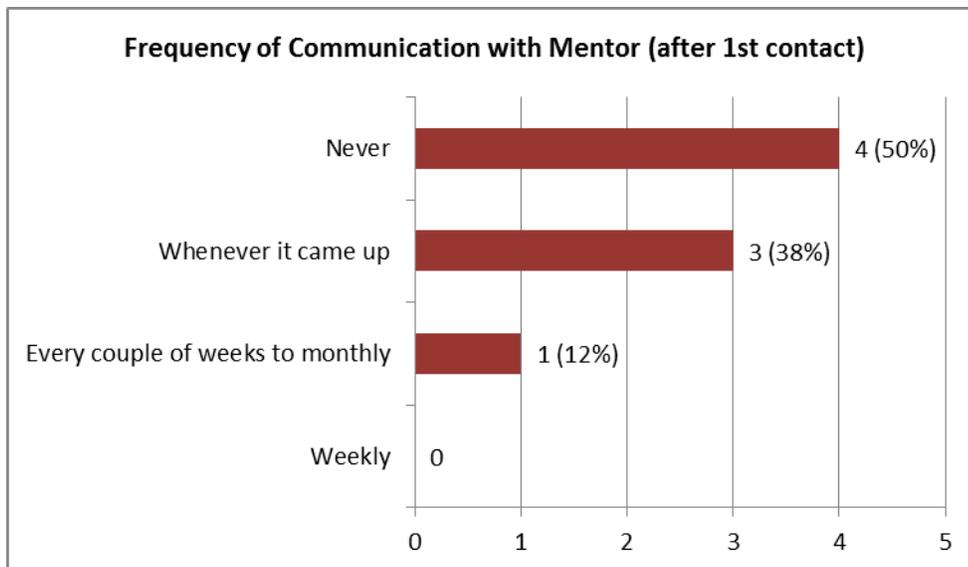


Figure 2. Frequency of Communication with Mentor

Two students wrote comments in response to this question. The first comment was “Wrote my mentor once and she responded. After that she never contacted me!” The mentors were supposed to offer to set up a schedule of contact and, if the student appeared to want to communicate rarely, to let the student know that they would continue to be available. It is possible that the mentor failed to adequately continue reaching out to this student, but it is also possible the mentor left further communication attempts up to the student, and the student did not understand this. Just as the first student seemed to want more contact from the mentor, the second seemed to feel the attempts by the mentor were more than needed, saying, “I never communicated with her other then [sic] her sending me emails... I didn't understand the point of a mental support.” It is possible this student needed no such support, but it is also possible the student just did not understand the purpose of having it available.

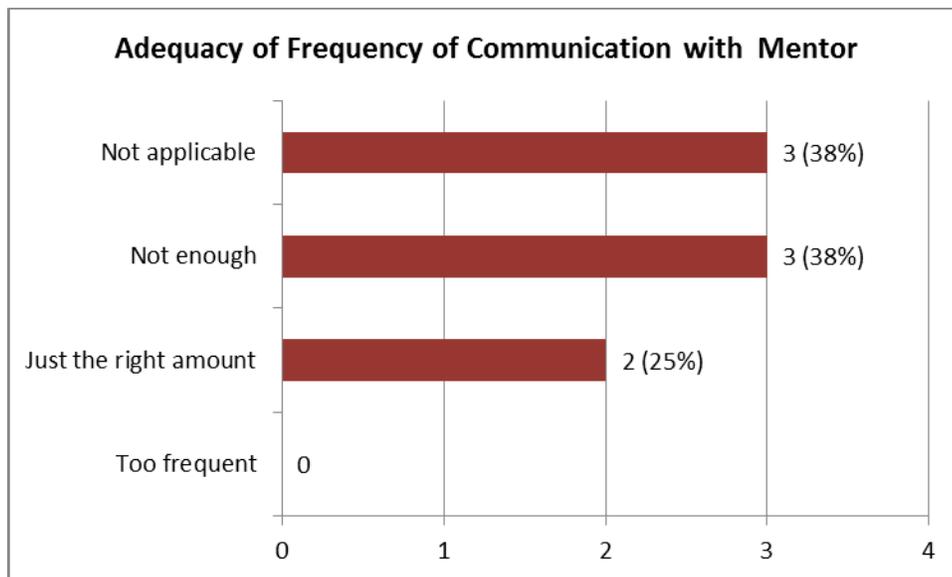


Figure 3. Adequacy of Frequency of Communication with Mentor

**Question 3: What did you think about the frequency of communication with your mentor?** The previous question asks about frequency but does not assess whether this

frequency was appropriate, which is what this question attempts to answer. The answers are shown in Figure 3. Two students (25%) reported that the frequency was appropriate, while three (38%) reported it was inadequate. Three (38%) reported that this question was not applicable to them.

One of the students who commented seems likely to have been one who responded “not applicable, as the student said, “I really think this was a pointless thing.” The other student who commented said, “I didn’t communicate with her to [sic] much but when I did it took a while to get a response. Also, we talked more about the radiography program then [sic] BIO.” This seems likely, as the mentors were directed to be supportive of any topics the students wished to discuss, and they were also given to understand that the mentoring program was designed to support students who aspire to work in an applied science field. Also, the mentors frequently reported discussing future careers with the students.

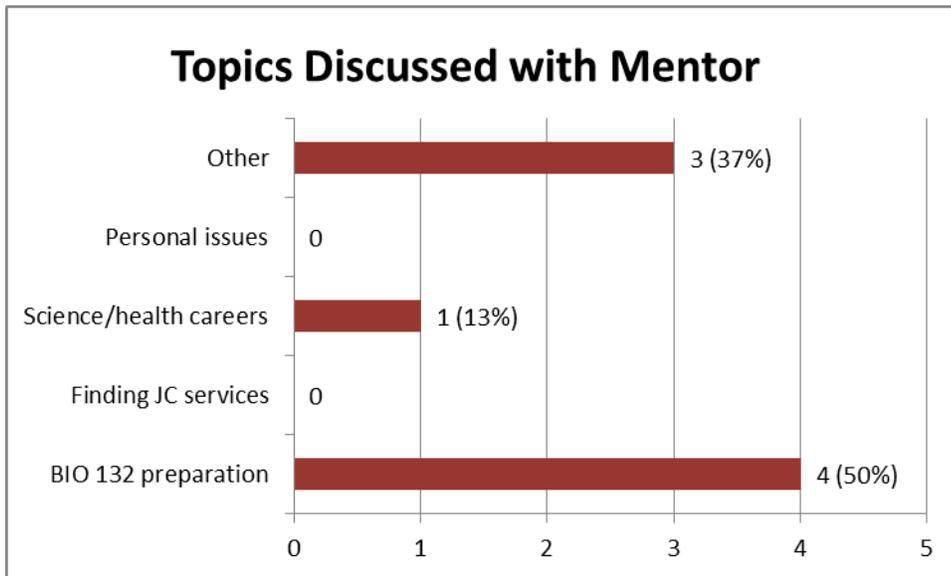


Figure 4. Topics Discussed with Mentor

***Question 4: What general topics did you typically discuss with your mentor?*** With this question an attempt was made to determine about what the students wanted to ask mentors for support. The results are shown in Figure 4. Four (50%) reported discussing the material or preparation for the class, BIO 132. Three (37%) discussed other topics (which were not further explicated in comments), and one (13%) wanted to discuss career options related to science. None of the students reported wanting help finding JC services or discussing personal issues, although the mentors reported spending a fair amount of time discussing these topics.

Two students made comments about this question. One said, “We didn't speak about any tips, and I do not think someone verbally telling me would of [sic] been any help.” It sounds from this comment that this student would have preferred to meet with the mentor in person, which should have been an option, but was not a common feature of the program. It would probably be helpful to have live face-to-face mentoring meeting scheduled on occasion for this purpose. The other comment was “Nothing [;] did not respond to any of the emails.” It is not clear from this whether the student means the mentor did not respond to student email or the student did not communicate with the mentor.

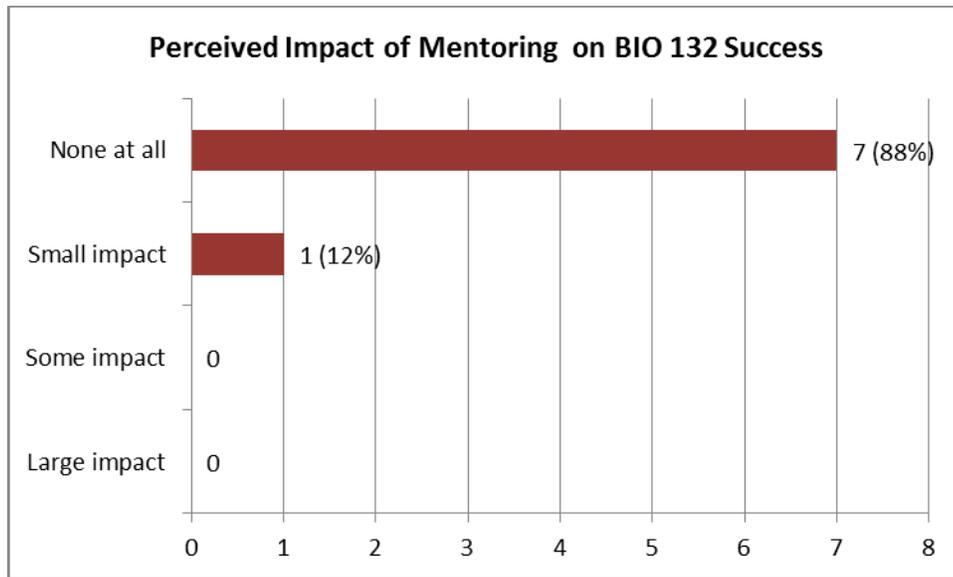


Figure 5. Perceived Impact of Mentoring on BIO 132 Success

***Question 5: What impact did mentoring have on your academic success in BIO***

***132?*** This question was designed to determine if the students felt the mentoring helped. There had been anecdotal reports from students and mentors over the past year that indicated some felt the mentoring had been useful to varying degrees, but as shown in Figure 5, this was not the case with survey respondents. In response to the question, only 1 (12%) reported it had any impact at all, while 7 (88%) reported it had no impact on their success.

Comparison of the results from Question 3 and Question 5 results in an apparent paradox. Three students (38%) said in response to Question 3 that the frequency of mentoring was inadequate. But 100% of the students said the mentoring had little or no impact. Perhaps the three who felt it was inadequate meant it would have had an impact if it had been adequate in frequency, although it appears initially that they are saying it was inadequate in frequency and had no impact.

***Question 6: At the end of the term, was the way you were preparing for an exam in BIO 132 different than when you started the class?*** As noted in the literature review, it has been reported extensively that many first-generation students do not know what to do to succeed in college classes. One area where it was believed there was an issue was regarding exam preparation, because if the students did not understand how to study effectively, and because the exams are weighted heavily in the classes, this would potentially be a major reason for failure. The BIO 132 lead instructor believed this was a major issue, because he gave the first exam in the fifth week, and that was the first time many of the students realized they were not grasping the material (or preparing for the exam effectively). Because in this class only 3-4 exams were given, by the time the students figured out how to prepare effectively (if they ever did), they often were unable to recover. So the mentors were encouraged to tell the students they mentored how the mentors had prepared for exams, whether they used tutors or study groups, whether they made exam outlines, and so on. This question was asked in an attempt to find out if the students had started the class not knowing how to prepare for exams but had learned this from the mentors.

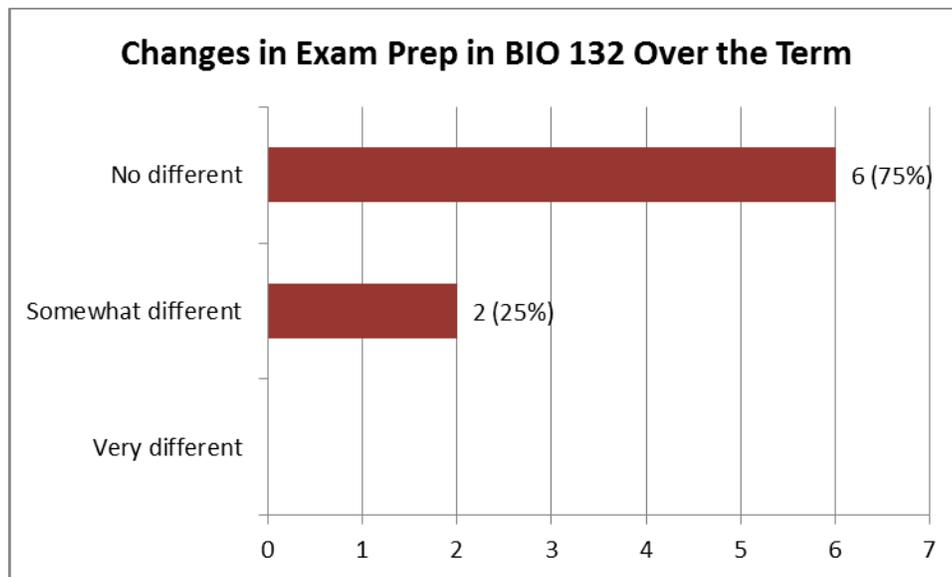


Figure 6. Changes in Exam Prep in BIO 132 Over the Term

As shown in Figure 6, the students did not report much impact from mentoring on their exam preparation behavior. Only two (25%) reported any impact, while six (75%) said it had no impact. Most of the mentors reported starting their communication with the students by describing how they had prepared for success in the class and believed the students had found this helpful, so perhaps none of those students responded to the survey, or perhaps the mentors overestimated the usefulness to the students of this advice.

**Question 7: What was your grade in BIO 132?** Because the data on student success and the survey were anonymous, there was no way to determine how successful the students that responded to the survey were without asking them. In response to this question, as shown in Figure 7, eight (89%) reported a grade of 3.0 or higher, while only one (11%) reported a failing grade. This indicates that the population responding to the survey is skewed toward those who were successful, because success was defined as being 2.0 and higher and only averaged 55.2% in the mentored group. If the data is re-tabulated to determine who scored 3.0 or higher, the percentage of successful mentored

students dropped to 43.1%. This could indicate only the more successful students responded to the survey, and that this sub-sample is not representative of the total group of mentored students—but rather only a select group at the top of the sample. This may mean the respondents to the survey were primarily among those who did not want the mentors and rejected their help.

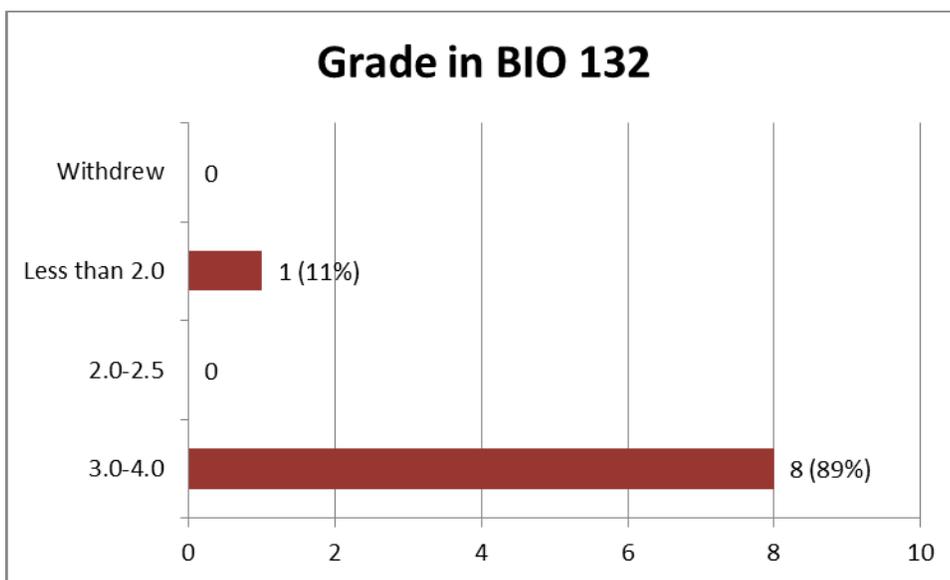


Figure 7. Grade in BIO 132

**Question 8: *When enrolled in BIO 132, did you feel comfortable in the academic environment of JC?*** Because a great deal of the literature says that lack of familiarity with the college setting is linked to reduced persistence and success, improving comfort with the setting was a goal of the mentoring program. As shown in Figure 8, eight (89%) indicated they were comfortable, with six (67%) saying they were very comfortable and two (22%) saying they were somewhat comfortable. Only one student (11%) reported being very uncomfortable with the college’s academic environment. The responses do not clarify whether the mentors helped with students becoming comfortable with the

academic environment or whether the students had already been comfortable before they had mentors.

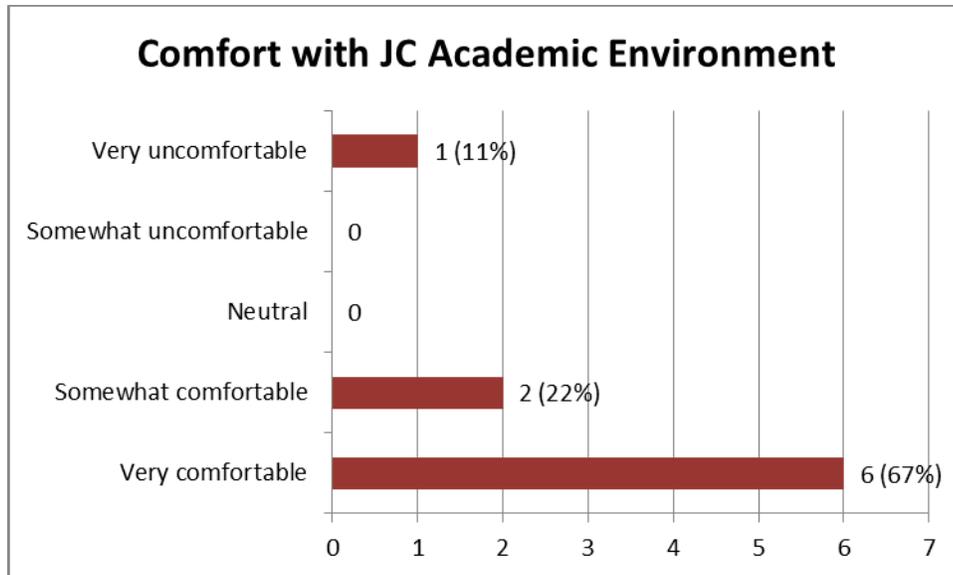


Figure 8. Comfort with JC Academic Environment

**Question 9: For the term after you took BIO 132, did you enroll at JC or another school?** As with the question on success, because the data are all anonymous, the only way to find out if the survey respondents persisted to the next term was to ask them in the survey.

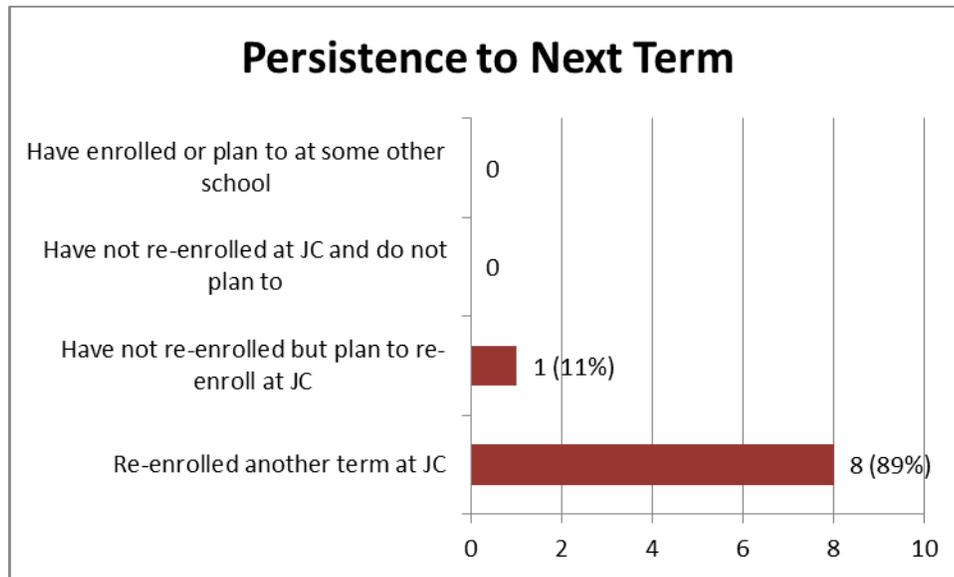


Figure 9. Persistence to Next Term

In response to the question, as shown in Figure 9, persistence to the next term is reported at 89%, with 11% saying they planned to return (since the survey ran between terms, it was possible for respondents to be returning in Winter 2014 without having yet enrolled). As with the results for success, this data shows skewing to higher persistence than the total mentored population, where the value averaged 69%. Again, this could indicate only the students who persisted responded to the survey, among other possibilities.

**Question 10: As for your program of study, what is your status?** An ultimate goal of improving student success would be measuring completion, but the time interval for this study did allow for assessing that outcome. However, as many students who take anatomy and physiology are taking it as part of a larger plan (entering a program or transferring to a university for a baccalaureate degree), it was possible to ask about progress toward those likely goals.

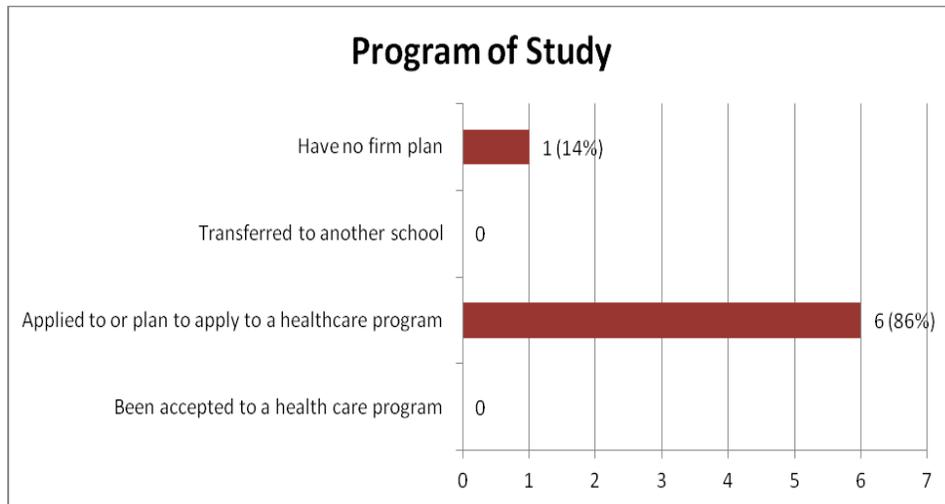


Figure 10. Program of Study

Figure 10 shows that six (86% of those responding) said they had or planned to apply to a healthcare program, while one had not made any decisions. Two students did not respond to this question, which could indicate none of the answers were applicable to them, or it could indicate that they did not choose to answer for some other reason.

**Summary of Themes Found in the Responses from Mentored Students.** The responses from the students indicate a few significant items:

- The early communication goal was met, but subsequent communication may have been lacking:** The students did not know that early communication was a goal, but they still indicated it had been done (in Question 1), even though most of their responses about the program were negative or neutral otherwise. In Question 2, they report very infrequent follow-up communication, which the program allows for, as it allows the students to decide how frequently they wish to communicate. In Question 3, nearly 40% of respondents say this contact frequency is insufficient. So communication protocols for the mentors may need to be adjusted based on these results.

- **None of the students reported asking for help finding JC services:** This was believed to be an important aspect the mentoring program should address. Perhaps this result—from Question 4—reflects the fact that this sample is not representative of those that needed such help, or the respondents didn't think it was as significant as the other topics discussed, or the students felt it had been addressed by the mentors before they had ever had to ask. The mentors themselves reported that they'd answered questions about JC services, so there seems to be a disparity there.
- **None of the students thought the program had significant impact on success in the class:** This contradicts the reports of the mentors that many students indicated the program was helping them (but supports the mentor reports of uncertainty about this as well). Since the sample of students that responded is not representative, it's difficult to be sure whether this result would be true of a more representative sample.
- **Success and persistence results reported by the students indicate this group is not representative of the total population:** Question 7 is about success and Question 9 is about persistence, and the results indicate a nearly 90% rate of each. Yet success in the total group was 43% of the group at the level of 3.0 or higher reported by the respondents, and persistence was 69%. Both of these results indicate that the sample size is not only so small as to make the results unreliable, but also that the fact that they are not representative of the total group makes it difficult to gather any meaningful information from them.

## Summary

Quantitative data were collected from the Jackson College Institutional Research Department to address the research questions. Surveys were then conducted with mentors and mentored students to provide further data. Pearson Chi-square analyses were conducted on the data to determine if mentoring impacted student success and

persistence. The results of the analyses showed that there was a slightly significant impact on success and persistence in the Spring 2013 term only.

Responses from both the mentors and the students were also mostly negative regarding the impact of the program. Based on their responses, the mentors seemed more uncertain, with many saying they thought the program was a good idea, but they were not sure if it helped the students or not. The students who responded to the survey were a very small sample, and most were students who succeeded in the class, so it's possible the results were not valid for the total range of students. But the results indicated they thought the program had no impact on their success. Chapter 5 will provide a discussion of the results, implications, and recommendations for further research.

## CHAPTER 5: DISCUSSION

### **Restatement of the Problem**

The success rate in Human Biology (BIO) 132 at Jackson College is 55.9%. Students who do not succeed in BIO 132, which is a gateway course for many health care careers, often fail to persist at the college and thus fail to enter healthcare programs. Fewer qualified students available to enter health care careers means that the college cannot meet increased demand for health care workers and STEM graduates (Melguizo and Wolniak, 2012; Starobin and Laanan, 2008). In addition, fewer successful graduates means the college will fail to meet the needs of the community in accessing entry to better jobs.

This research study is an attempt to address a gap in the knowledge about mentoring programs. Mentoring programs have been studied extensively at four-year colleges, but less so at community colleges. In addition, the majority has been designed to work with different populations than those of science students. An extensive review of the literature by this researcher has found no evidence of studies that examine the impact of mentoring programs on introductory science students in community colleges.

At the beginning of this research, an administrator at Jackson College said studying such a program seemed meaningless, making the observation, “Everyone knows mentoring programs work. What’s the point in studying this?” This question highlights a problem often found in program implementation: it is too often based on anecdotal rather

than research evidence. When a program fails to perform to expectation, it is then ended or altered without examination of what factors were actually involved. It is important to perform meaningful analysis of programs in order to effectively alter them, keep the parts that are successful, and make logical decisions about them. This study has examined all the quantitative and qualitative evidence in order to establish what aspects of the mentoring intervention had the greatest impact on success and persistence on Human Biology students. This chapter will further discuss those results and provide recommendations for the future of science mentoring at Jackson College and other community colleges.

## **Findings**

The first research question was, “Does individual mentoring improve success in BIO 132 (Human Biology) at Jackson College (JC)?” The second research question was, “Does individual mentoring in BIO 132 at JC improve persistence?” Although the precise numbers were somewhat different, similar results were found for both these questions. For the combined Spring and Fall 2013 terms the results showed no significant difference in success—defined as students completing the class with a 2.0 or greater—or in persistence. There were a great many changes in how the program was run between the two terms, however. The program lost one instructor who had participated in the pilot winter term and study spring term. The mentoring program was not as closely monitored in fall term, with less frequent check-ins of the mentors than in spring term. There were six mentors who had also participated in the winter pilot who worked with the program in spring, but only four with experience in a prior term worked with the program in fall.

Because there were a great many changes in how the program was run between the two terms, the data was examined for each term individually. When the data was disaggregated, the fall term data still showed no significant difference, but now the spring data showed a statistically significant difference. However, breaking the data down term-by-term reduces the sample sizes to such an extent that this is a limitation. There were 58 mentored students under study in the combined spring and fall terms, but only 20 in the spring term alone.

Another problem with studying the spring term alone is that there was far less homogeneity between the mentored and non-mentored groups that term. In fall the mentored students all had the same lecture class and the same instructor for labs, and the only difference was that their lab met different days than the lab for the control group. In spring, the two groups not only had different instructors, but entirely different settings. The mentored group met live, while the control group was entirely online. It is possible that the difference in setting accounts for the difference in success and persistence. Future research may be warranted that includes more diverse Human Biology groups, as well as groups with less variation, in order to try to determine if differences in the results persist as these factors are changed. Future research may also be warranted into whether the program is more effective if it is more formalized.

Several control variables were examined. They were whether the students had ever enrolled in developmental education, whether the students were new to college, whether they were full or part-time, whether the students were concurrently enrolled in Human Biology with Math 131, whether they had declared a program of study where BIO 132 was significant, and whether they previously took a Human Biology class. None of the

control variables demonstrated any statistical significance related to success or persistence.

The goal of the qualitative research was to add richness to the quantitative data. The surveying of the mentors and mentored students gave some information that could be added to the statistical data. Based on the qualitative data alone, the value of the mentoring program shows mixed results.

**Mentor Poll Results.** Many of the mentors wished to continue in the program from term to term, saying they believed it made a difference in student success. A few wanted to continue in the hope it had been helpful, even though they had not gotten any meaningful indication from the mentored students about whether it had helped. Only one mentor said she thought the program was probably ineffective—but her response seemed to be more about the fact that she felt she was not helping anyone, so the program must not be working, in contrast with the other mentors who felt that the program might be helping anyway. Certainly a program run this way requires a lot of tolerance for the unknown on the part of the mentors, and the frustration with that unknown aspect was expressed by this mentor. The way the program was set up—the mentors could reach out to the students, but could not know what if anything was meant by a lack of response from students—left many of the mentors uncertain about whether the students found the program helpful. In some cases the mentors would have contact with the students for a while and then the contact would stop, and the mentors could not know if that meant the students were successful or not successful. It might be useful in the future for the mentoring program to look at ways to strengthen ties to the mentored students, helping them stay engaged and communicating more freely and frequently.

The more extensive comments made by the mentor who participated in the pilot and both terms of this study (Mentor05) might provide useful in future intervention. This mentor said that she found one constant in all the mentoring contacts she had—that the students seemed discouraged and overwhelmed by the class, especially by not being sure how to best direct their study for the class. This observation seems to warrant further study. If it turns out that many of the students who have difficulty are unsure about how to direct their study, perhaps an intervention could be designed to address that.

This mentor also observed that mentoring alone would not be enough for some students. This is a valid observation, as the mentoring program was not designed to help students overcome every obstacle on its own. The mentoring program was designed to point the student toward resources that could help, as well as providing a voice of encouragement and support from someone who had been through the class successfully. However, if the larger questions of how to improve success and persistence are to be answered, it might be best to consider adding other resources that the students identified during mentoring.

**Mentored Student Survey Results.** While the responses from the mentors indicated a largely optimistic if ambiguous view of the mentoring program, the responses from the mentored students were unambiguous and negative. Nearly 90% said they thought the mentoring program had no impact on their success. But nearly 90% also said they had earned a 3.0 or greater in the class. Given that only 43% of mentored students earned a 3.0 or greater, the respondents were not particularly representative of the entire group. It is therefore difficult to be certain if the results tell much about what a more representative sample would show.

The response rate for the survey was poor at 13%. More frequent surveying of the students might have resulted in a greater response rate, as the students were only surveyed at the end of the fall term. This means that for some students one and two terms passed between the term they took the class and when they were surveyed. This is something that warrants further study.

The survey also returned the apparently paradoxical result that nearly 40% of the students said the mentoring frequency was inadequate while 100% said mentoring had little or no impact. It is not possible to examine this data and conclude anything meaningful—it could mean the students who said the frequency was inadequate meant more frequent contact would have led to a more positive impact, or any number of other things that cannot be determined. This lack of clarity can be found with the responses to many of the questions. Perhaps in the future interviewing of the students might provide more clear results, as the interviewer could ask the students to clarify responses, which cannot be done with a survey.

### **Implications for Practice**

**Value of the Mentoring Program If It Can Be Modified for Greater Effectiveness.** If the mentoring program can improve student success and persistence, there are many positive results that flow from that. Improving science success the first time out will save money spent taking the same class multiple times. Succeeding in the class will increase student confidence and likeliness to persist, leading to improved degree completion, successful transfer into—and completion of—occupational programs and four-year degree programs. Learning how to study and master subject matter in Human Biology is a transferrable skill, so the student will be more likely to succeed in

other concurrent and subsequent classes. Success in basic science is a prerequisite for many financially rewarding and in-demand careers (STEM skills, n.d.; Burning Glass, 2014), so that more graduates will be produced who can command significant wages over an entire professional lifetime (Malcom, Dowd, & Yu, 2010, p. 3). For this particular mentoring program, a number of items that might prove useful to improving it are suggested by the results.

**Provide Mentors with More Consistent Monitoring and Support.** There was not good consistency in managing the program from term to term, with varying frequency of contacting the mentors to offer them support and get feedback. In the term with the greatest success, Spring 2013, the mentors were contacted every 2-3 weeks, and suggestions for improvement and course correction were made in response to mentor feedback. It is possible that contributed to the greater success of the program that term. But monitoring with greater consistency would help to narrow down reasons for success and failure in the program.

**Alter Mentor Training.** Mentor training was done online with only one exception, and perhaps changes in the training of the mentors would have impacted the results. Live training was offered and rejected by the majority of mentors, but there are other options. For example, training videos could be made and made available for the mentors to consult at any time.

**Increase Communication Between Mentors.** The mentors never interacted with each other. Perhaps communication amongst them might have helped them mentor more effectively. It was originally planned to have a science mentoring center, where the mentors could gather, and the students could drop in, but the resources for this were

never made available. Still, even if a physical mentoring center cannot be designated, there are other ways to facilitate communication amongst the mentors, including social media, the college intranet, and many other possibilities.

**Alter Mix of Mentors.** The mentors were all students except for one faculty mentor. While some of the mentors said they thought that peer aspect was helpful—and said the students they mentored also appreciated it—perhaps a greater mix of professionals might have helped. The original plan was to have a greater mix of faculty, graduate professionals, and students. It is possible that might help strengthen the program. It also might reduce turnover, as the greatest turnover was seen with student mentors that graduated and elected to stop mentoring after that.

**Increase the Number of Mentors.** There were never as many mentors as the program was designed to have, so perhaps mentor recruiting efforts should be improved in the future. The fact that mentors with too many mentees could be less effective was supported by Khazanov (2011), who in discussing a mentoring program that ran with student mentors suggested that the number of students each had to mentor should be limited because the mentors were “juggling this commitment with [their] own schoolwork” (p. 118). All of the recruiting was done by email, and perhaps different types of appeals might bring in more and varied types of mentors. For example, personal appeals to the various allied health Advisory Committees and alumni could be attempted.

The number of mentors assigned may also have fewer than the mentors that actually followed through and contacted the students. Mentor10 definitely contacted no students in spring. Two mentors never responded to the director in spring and one in fall, so it is not possible to say with certainty whether they even participated. Therefore, out of the

eight mentors for spring term, one definitely did not contact the students, and it's possible as many as three (38%) did not contact any students. These numbers are far lower than would be useful to run this program adequately.

**Increase Resources in Support of the Program.** The program was designed to be inexpensive, relying entirely on volunteers. If the college could devote some grant dollars to the program for offering stipends to the mentors, that might help offer more incentive for participation. But if that is not possible, perhaps the college might offer other types of incentives to help with recruiting more mentors, such as tuition vouchers and vouchers for the bookstore.

**Encourage Phone and Live Contact between Mentors and Students.** All of the mentoring was done online—this was not required, as only initial contacts had to be done by email. But perhaps the mentors, students, or both felt it would be imposing to ask for more contact, so it might prove useful to remind the mentors that they can suggest other types of contact. It might also prove useful to be able to offer a physical location for contact between the groups, much like the college offers for the Men of Merit mentoring program it operates, as already noted above.

This research study provided insight into the usefulness of the mentoring program in improving success and persistence. This will help Jackson College and other colleges looking to improve science success make decisions about which aspects of mentoring programs they might wish to implement, improve, change or discontinue. It might also suggest other interventions that might be useful, based on the qualitative results. This study has also provided information that might prove useful to future researchers looking to determine how to study such programs in the future. Hopefully this study will give

colleges information that will help them improve introductory science success and persistence.

### **Implications for Leadership of the Mentoring Program**

This program was run by the researcher for the study. Although there is some usefulness to having a program run by its designer, and also for a researcher concerned with monitoring its outcomes, there are also drawbacks. There is a dichotomy inherent in the roles of researcher and leader, and this can lead to a conflict of interest. In this particular case, the researcher made some decisions in running the program that may not have been the best choices for the leader of the program (mostly relating to how the mentors were assigned and trained, so this process would remain in line with study and IRB guidelines). In other cases, the leader made choices that were not so useful for the researcher (becoming bogged down in multiple roles so that the program leadership suffered). It would be necessary for the success of the program in the future to pay more attention to these issues and better separate these roles.

### **Limitations**

This research study was limited in the number of mentored students who participated. It would therefore be useful to conduct future research with a greater number of respondents in order to get more effective feedback. Surveying the mentored students might also have limited the usefulness of the results, as there was a lot of ambiguity about what the students meant to convey. In the future better results might be obtained by interviewing the students. The research study was also limited by the total number of mentored students that could be included, given the size of the program, number and types of sections available for study, and other factors. It would be useful in

future research to be able to study a larger group that had more experienced mentors and had fewer confounding variables—as in the case where the Spring group was split by online versus live sections.

The results of this research also point out a limitation of the program that has not been discussed in program limitations before. But the program has been operated with minimal resources—no budget and very little in human resources as well—and it may have been too little for the program to be able to succeed. It might be necessary for the administration of the college and the director of the program to make a decision to either commit more or drop it altogether if it can only be run with the present level of support.

### **Recommendations for Future Research**

The overall results of this research study are inconclusive, because one term indicated improvement while one did not, but other factors may have led to those results. In order to get more conclusive results in the future, it would be useful to recruit and train a larger group of mentors, and continue recruiting over time, so that a huge loss of several mentors in one term—as happened in the fall term—would be less likely. It would also be helpful to run the program with more consistency and over the course of a full year with the study running the entire time to see if confounding factors could be reduced. If the program were more consistent in its operation and larger in scope it would be possible to gather more valid and reliable results.

Surveying the students also yielded data that lacked reliability, as the respondents did not seem reflective of the total population. The responses were also often ambiguous. It would be helpful in the future to interview the mentored students, and probably term-by-term, to increase both the quantity and usefulness of the responses.

The mentors were more responsive than the mentored students were, but they also were not consistent in responding to questions. They were polled term-by-term, and more than once per term. But they did not all respond to email requests for information, and their responses varied greatly in length and detail. It might be more useful to interview them in the future to try to get more detail and utility from the results.

It is the researcher's opinion that one of the more enlightening items to emerge from this research was the observation made by Mentor05 that students need more direction in what to study, and that this was consistent over all terms of study. It suggests that success and persistence might be improved more by addressing this concern than any other. Perhaps examining class objectives and using them to better guide students might provide that direction that so many students said they needed, and improve results as a result.

## **Summary**

Community colleges are increasingly faced with attempting to improve student success and persistence. Also, there is increasingly greater pressure to improve success in STEM areas specifically. This research study evaluated a program designed to address both of these issues—a mentoring program targeted at introductory science students that aimed to improve success and persistence.

Although this study did not conclusively prove that the mentoring program improved success and persistence in Human Biology, it did show some promising results that merit further study. Quantitative results indicated statistical improvement in one term, and qualitative results indicated the mentors felt the program was useful to a number of students. If the program runs with more consistency and the data is gathered

again during that period, more conclusive results might be obtained. Also, interviewing of the subjects—both mentors and mentored students—might yield more useful information. At this point the results are too inconclusive to declare with any certainty that this program has improved success and persistence, although there are indications that it has. Continuing the program and gathering more data would provide the college with enough information to make a valid decision about the program and its efforts to improve success and persistence. If it turns out to be useful, it could help Jackson College and other community colleges improve in even more areas over time.

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APPENDIX  
A: Consent Form

**Background:**

You have been invited to participate in a mentoring program that it is hoped will help you to be successful in this class, and in a study to determine whether this program does in fact help you. I ask that you read the following information and ask any questions you may have before agreeing to be in this study.

**Purpose:**

The purpose of this program is to determine whether mentoring can improve success in this class, and the purpose of the study is to determine whether the program helps you. Findings from the study will be used to provide others with information about the impact of mentoring on science success and whether it would hinder or enhance the success of others in the future.

This study is being conducted by: Ann Flint, a doctoral student in the Community College Leadership program at Ferris State University.

**Mentoring Program Procedures:**

If you agree to participate:

1. You will be matched with a mentor who has had success in science. Your mentor will contact you this week to check in with you and find out how you are doing, and will make a plan with you for regular check-in as well as letting you know how to reach out for help between meetings.
2. Your mentor will make initial contact through your JC email address. You will need to state a preferred method of contact if you wish another method.
3. Your participation in the mentoring program will last for this entire term.

**Study Procedures:**

If you agree to participate, I would ask you to:

1. Participate in an individual interview during the Fall or Winter of the 2012-2013 school year at a date and time that are convenient for you.
  - a. The interview would take between 1-2 hours. I would like to audiotape the interview for assistance with transcribing the information after the interview is complete.
  - b. Audiotaping is not a requirement for participation. You will be asked prior to the interview if you would agree to allow me to audiotape the interview, and you may decline to have it taped should you so choose.
  - c. The transcript and notes taken by the interviewer will only be available to Ann Flint and Noreen Thomas, the advisor to the study. No one else will have access to the data and your responses will be kept anonymous.
2. Check transcripts of your interview for accuracy and clarity.
3. If needed, participate in follow-up phone calls or e-mails to clarify any information collected during the study.

**Risks:**

It is possible you may feel uncomfortable at times as the mentor tries to help you push yourself beyond what you normally do. The mentor will be trying to help and encourage you, but may sometimes challenge you to try different study methods, or approach your instructor or a tutor for help, and so on.

As mentioned, the information you provide will only be available to the researcher and her advisor. Information from each interview will be analyzed to determine overall findings. Findings will be written up as a part of a doctoral dissertation.

### **Benefits**

Many students wish to enter science careers, such as environmental inspection or nursing, but have little science background when they start. Science classes can be quite challenging, and are especially so if you have not taken much high school science or math, if you are returning to college after years away from your last schooling, or have had no family members who have attended college to give advice. As a result, many students enroll in science classes with high expectations, but fail to succeed because they don't know how to correctly approach the class (or perhaps the whole college experience). Falling behind becomes an insurmountable obstacle and more rapidly than the average person expects.

A mentor can help by giving you advice to help you get back on track quickly. Your mentor may be an allied health student, a professional working in a scientific field, or a science faculty member. Your mentor will be a role model for success and a source of information on getting help in your science class (or at JC overall, if you need it). Your mentor will not be a science tutor, but can help you find science tutoring help.

A major benefit to participation in the follow-up study is an opportunity to reflect on your experiences and provide information that will assist program coordinators in making decisions about the effectiveness of and need for the program. When individuals choose not to participate, that perspective is absent from the overall analysis.

### **Confidentiality**

Your study information will be kept confidential by not using any identifying information (name, student ID) throughout the process. After transcripts are made of the taped interviews, the tapes will be erased, and the interview transcripts will be saved on an external hard drive, which will be attached to a computer not connected to a network. This hard drive will be kept locked in a file cabinet when not in use. No other individuals other than the principal investigator will have access to the transcripts. The original recordings will be destroyed within five years from the time of the interview.

### **Voluntary Nature of the Mentoring Program and Study**

Your decision to participate will not affect your current or future relations with Jackson College or Ferris State University. If you decide to participate, you are free to withdraw at any time without affecting those relationships.

### **Contacts and Questions:**

The primary researcher conducting the study is Ann Flint. The advisor for this dissertation study is Dr. Noreen Thomas. You may ask any questions you have now.

If you have any additional questions at another time, you may contact Ann Flint at [flintanm@jccmi.edu](mailto:flintanm@jccmi.edu) or 517-796-8684.

If you have any questions or concerns regarding the study and would like to talk to someone other than the researchers, please contact the Ferris State University Institutional Review Board at 231-591-2759 or IRB@ferris.edu.

You will be given a copy of this form to keep for your records.

**Statement of Consent:**

I have read the above information. I have asked questions and have received sufficient answers. I consent to participate in the program and study.

Signature \_\_\_\_\_ Date \_\_\_\_\_

Printed Name \_\_\_\_\_

**How to contact you:** Please enter an email address or phone number for your mentor to contact you if you do not wish them to use your JC email address:

\_\_\_\_\_

APPENDIX  
B: Mentoring Program Design

Here are the basic proposals for how the mentoring program was established and the groups selected for study:

- **Mentors were solicited through email request.** Mentors were recruited with email letters sent to science students who had gotten a grade of 3.0 or higher for the previous two years, as well as health care students (sonography, respiratory care, nursing and radiology) and faculty in health care and science (see Appendix E for sample student recruiting letter, and Appendix F for sample faculty recruiting letter). Each term the mentors were asked if they wished to continue. There were enough that continued from winter to spring that no new recruiting was done, but a new series of recruiting letters was sent to ensure there were enough mentors for fall (which had the largest number of students being mentored).
- **Mentors were offered training initially, and offered refresher training for every subsequent term.** Each term the mentors were all offered training/re-training in the principles, goals and guidelines for the mentoring program. The materials were sent to the mentors (see Appendix G and Appendix H), and live training sessions were made available for mentors who wished to meet. Only one mentor ever came to the live training.
- **Mentors were trained in adequate numbers for each student to have an individual mentor (the mentors may each have 3-4 students assigned to them).** The mentors were trained in study skills, “college knowledge” (the skills needed to navigate the college’s bureaucracy), and the importance of communicating how high the bar is set and that the student must begin preparing correctly from the beginning so as not to get irretrievably behind. They were also encouraged to function as “cheerleaders” that inspired the student to believe he/she could succeed, and as a role model for the student to see where success in this class could lead (all mentors would either be working in science fields or successful completers of the class currently enrolled in a science and/or healthcare major). Training was in the term before mentors were assigned in each case.
- **Mentors were assigned first by gender, and then randomly.** In the early planning phases when the mentoring program was being discussed with mentors and potential

mentees, both frequently expressed preference for a mentor of the same gender (and this was the only expressed request). Therefore, when assigning students to mentors, they were split by gender and randomly assigned until each mentor reached the maximum, and then they were simply assigned randomly after that. The maximum number was three in spring and five in fall.

- **Mentors were assigned to each student before the first week of class.** Establishing good habits in the beginning is crucial, so the students had the mentors coaching them to get off to a good start. The mentors received their mentoring assignments with their informational letters. They were given the names of their students along with student email addresses to establish contact, and instructed to establish contact within the first week. The only exception was in winter term, where the students were asked which method of contact they preferred, and they could select any email address or phone contact.
- **The program was run during each term in 2013.** In each 2013 term, two to four sections of BIO 132 were selected. Where possible, classes with one lecture and two labs were chosen, so all the students attended the same lecture class, and the only variation was the time their labs met. In each class, the group was divided in half for labs (total class  $n = 50$ , each lab  $n = 25$ ). One lab from each section was selected for the control group, and the other lab was the experimental group. This was done for every section in fall and for half the group in winter. The other half for winter and the spring groups were chosen by other means described in Chapter 3.
- **Data was gathered to further refine the program.** Goals include improving success in the BIO 132 sections themselves (as measured by grade of 2.0), and increasing persistence to the following term. Longer-term goals include improving higher end success (minimum grade of 3.0 for admission to occupational programs and university transfer), improving success of other classes taken by this cohort (assuming the improved skills and support will translate to success in other classes), increasing rate of admission to and successful completion of occupational program and university baccalaureate programs.

Mentors were assigned to the students before the terms started, in a manner such that each student had an individual mentor, and the mentors each had three to four students assigned to

them. Because it is vital that students get off to a good start, and the literature review suggests that missteps begin even in the first week of class, it was considered vital to get the mentors in touch with the students during that first week. It was initially planned that all students would consent to receive a mentor, and that the students would be presented with the consent form (Appendix A) at the beginning of their first lab. This was done in the winter term, but most students refused to accept the mentors, not understanding the value of the intervention. More of them accepted mentors after they had taken their first exam, but this was in the fifth week of the term, which is far too late to prove useful in most cases, and the data reflected this. It was then decided that all students in the designated pilot/experimental groups would then be assigned mentors in subsequent terms. Since this program was run by the college, consent was not needed for participation—just for interviewing them. In the spring and fall terms, then, the mentors were able to receive their assigned mentees during the first week. The mentors were instructed to contact each student (using the student’s college email address) within the first week.

APPENDIX  
C: Survey of Mentored Students

Greetings!

I am writing to ask you to participate in a poll to get your opinions of the mentoring program in which you participated. You took BIO 132 in 2013 and were assigned a mentor in order to help you succeed in BIO 132 and here at JC. I'd like to find out what you think about the program. Your opinion about the program will be an important factor in deciding whether to continue with it in the future.

The poll is very short—it consists of 10 multiple choice questions, with space provided for comments if you have any. This poll should take 5-10 minutes to complete. But even though it should take very little of your time, the results are very important. Also, the poll is completely anonymous—there will be no way to identify you out of the nearly 80 people who received mentors over the past year. So please take a few minutes and complete this poll at <https://www.quicksurveys.com/s/Lb98B>.

Thank you in advance for your help!  
Ann Flint, MS, RRT  
BIO 132 Mentoring Coordinator

When was your first communication with your mentor? (Q1 of 10)

- First week of the term
- Week 2-3
- Later than week 3
- Never (if you choose this, you will skip to Question 7 of 10)

Comments?

Character Count 1000

After the first contact, how often did you communicate with your mentor? (Q2 of 10)

- Weekly
- Every couple of weeks to monthly
- Whenever it came up
- Never

Comments?

Character Count 1000

What did you think about the frequency of communication with your mentor? (Q3 of 10)

- Too frequent
- Just the right amount
- Not enough
- Not applicable

Comments?

Character Count

What general topics did you typically discuss with your mentor ? (Q4 of 10)

- BIO 132 preparation
- Finding JC services
- Science/health careers
- Personal issues
- Other

Comments?

Character Count

What impact did mentoring have on your academic success in BIO 132? (Q5 of 10)

- Large impact
- Some impact
- Small impact
- None at all

Comments?

Character Count

At the end of the term, was the way you were preparing for an exam in BIO 132 different than when you started the class? (Q6 of 10)

**Very different**

**Somewhat different**

**No different**

---

Comments?

Character Count

What was your grade in BIO 132? (Q7 of 10)

**3.0-4.0**

**2.0-2.5**

**Less than 2.0**

**Withdrew**

---

Comments?

Character Count

When enrolled in BIO 132, did you feel comfortable in the academic environment of JC? (Q8 of 10)

**Very comfortable**

**Somewhat comfortable**

**Neutral**

**Somewhat uncomfortable**

**Very uncomfortable**

---

Comments?

Character Count

For the term after you took BIO 132, did you enroll at JC or another school? (Q9 of 10)

- Re-enrolled another term at JC
- Have not re-enrolled but plan to re-enroll at JC
- Have not re-enrolled at JC and do not plan to
- Have enrolled or plan to at some other school

Comments?

Character Count:

As for your program of study, what is your status? (Q10 of 10)

- Been accepted to a health care program
- Applied to or plan to apply to a health care program
- Transferred to another school
- Have no firm plan

Comments?

Character Count:

<https://www.quicksurveys.com/s/Lb98B> to take  
<https://www.quicksurveys.com/report.aspx?surveyId=1153541> to see responses

APPENDIX  
D: IRB Approval Letter

To: Dr. Noreen Thomas & Ann Flint  
From: C. Meinholdt, IRB Chair  
Re: IRB Applications #120904 (Title: An Analysis of Improving Science Success at a Multi-Campus Community College through Mentoring)  
Date: October 12<sup>th</sup>, 2012

The Ferris State University Institutional Review Board (IRB) has reviewed your application for using human subjects in the study, “An Analysis of Improving Science Success at a Multi-Campus Community College through Mentoring” (#120904) and determined that it is *exempt – IC* from full committee review. This exemption has an expiration date three years from the date of this letter. As such, you may collect data according to procedures in your application until October 12<sup>th</sup>, 2015. It is your obligation to inform the IRB of any changes in your research protocol that would substantially alter the methods and procedures reviewed and approved by the IRB in this application. Your application has been assigned a project number (#120904) which you may wish to refer to in future applications involving the same research procedure.

Finally, we wish to inform researchers that the IRB will require final reports for all research protocols approved as mandated by FR 45, Title 46 (Code of Federal Regulations) for using human subjects in research. The follow-up report form is available at: <http://www.ferris.edu/htmls/administration/academicaffairs/vpoffice/hsrc>. Thank you for your compliance with these guidelines and best wishes for a successful research endeavor. Please let me know if we can be of future assistance.

APPENDIX  
E: Mentor Recruiting Letter (Students)

This letter was modified slightly for different populations. Students who had gotten a 3.0 in intermediate algebra and human biology got this specific one, and students who had gotten a 3.0 and higher in chemistry and microbiology were also sent similar letters. Students who had gotten into an allied health program were sent a similar letter, with modifications appropriate to the program in which they'd enrolled.

Dear JC Science Student:

**Congratulations!** Our records indicate that you have successfully completed intermediate algebra and biology at JC, and have an interest in an allied health program. Being successful in science is very important to moving on to many vital, sustainable careers. Having been successful in not only basic science but also in getting started in your new profession puts you in the position of role model to those who are seeking the same success you have had.

We are expanding a new program to team successful students like you with those who are looking to succeed in the future. It is a mentoring program which is organized around the concept that if you have been successful you can give encouragement to those who are trying to succeed because you've been where they are now and know what it's like. You would not be a tutor—you'd mainly be a sort of cheerleader, encouraging the student to keep going, and letting that person know someone is thinking about them and wishing them well. If the student has questions about resources at the college (i.e., the library, tutoring, etc.), you'd have a guide you could use to tell the student how to find the resources. And you could be, quite simply, a role model of success, letting the student know that YOU succeeded, so they can, too.

We are looking to get mentors to commit to the following:

- Attend a brief training session to learn how to refer students to resources and provide proper encouragement. Because we will be starting this program to help students in Fall, 2013, we'd like to do training the week class starts in August. It will be available live or online.
- Be willing to take on 3-4 BIO 132 students as a mentor.
- Contact the students the first week of class to be sure they know how to get started off on the right foot, form an effective study plan, and know how to find the resources they need.
- Be willing to take phone calls or email from them to continue to provide encouragement.
- Reach out once a month during the term to ask if the students need anything.

If you would be interested in helping other science students to succeed as you have, please call or email for further information or to express interest. I appreciate your attention in any case.

Again, congratulations on your academic record. I look forward to exploring the possibility that you could be a role model for future science students!

Sincerely,  
Ann Flint, MS, RRT  
Program Director, Respiratory Care

## APPENDIX

### F: Mentor Recruiting Letter (Faculty)

This version of the letter was sent to all full-time health care faculty to seek faculty mentors as well as recommendations for student mentors. A similar letter was sent to all full-time science faculty.

Dear JC Allied Health and Nursing Faculty:

I am looking to recruit successful science students to mentor beginning science (i.e., BIO 132) students, and you have some of the best examples of science success in the college attending your program. Some of our best mentors this past year were allied health and nursing students. I therefore **plan** to again email your current program students to request their help. The mentoring program does not require a lot of time commitment, and yet I really hope it will give these BIO students a role model for success to emulate.

I am seeking anyone who has achieved success in science, by the way, which includes you, your graduates and your communities of interest working in your field. So if **you or anyone you know is interested** in participating, I would appreciate your contacting me about that as well.

What I am running is a mentoring program which is organized around the concept that if you have been successful you can give encouragement to those who are trying to succeed because you've been where they are now and know what it's like. You would not be a tutor—you'd mainly be a sort of cheerleader, encouraging the student to keep going, and letting that person know someone is thinking about them and wishing them well. If the student has questions about resources at the college (i.e., the library, tutoring, etc.), you'd have a guide you could use to tell the student how to find the resources. And you could be, quite simply, a role model of success, letting the student know that YOU succeeded, so they can, too.

We are looking to get mentors to commit to the following:

- Attend a brief training session to learn how to refer students to resources and provide proper encouragement. Because we will be starting this program to help students in Fall, 2013, we'd like to do training the week class starts in August. It will be available live or online.
- Be willing to take on 3-4 BIO 132 students as a mentor.
- Contact the students the first week of class to be sure they know how to get started off on the right foot, form an effective study plan, and know how to find the resources they need.
- Be willing to take phone calls or email from them to continue to provide encouragement.
- Reach out once a month during the term to ask if the students need anything.

If you would be interested in helping other science students to succeed as you have, please call or email for further information or to express interest. I appreciate your attention in any case.

Sincerely,  
Ann Flint, MS, RRT  
Program Director, Respiratory Care

## APPENDIX

### G: Mentor Assignment and Informational Letter

Dear BIO 132 Mentor:

**Thank you for agreeing to help future science students succeed!** I have your students available. You should be able to help with anything needed for the students you mentor. Your assigned students and email information is:

Student	Contact
Stu10	Stu10@jccmi.edu
Stu11	Stu11@my.jccmi.edu

What you should do:

1. You should contact each student (by email for now—you can ask the student to select a preference), and introduce yourself as the mentor. Let the student know that you are there to be supportive and give advice about how to succeed. Tell the student about yourself, with attention to how you succeeded in introductory science (especially BIO 132 if you took that), and where it has taken you afterward. Talk about how you set up to succeed from the beginning of the term (i.e., set up a calendar for the class, sought tutoring, joined a study group, etc.). Ask the student if any advice is needed now. Provide the student with your contact information. And then make a schedule to check up on the student—at least weekly for the first month, and every couple of weeks after that.
2. Review the mentoring rationale following my signature. If you feel pretty good about it, you may not wish to attend mentor orientation. If you do, I'm going to have **two sessions on Thursday, May 16 (11AM and 6PM) in HLC 204** to discuss the mentoring process and your role. Both will cover the same ground (briefly) and then I'll take questions. If you need time but neither of those work, please let me know and I will schedule with you.
3. And that's about it! Your job is to provide information on how to find resources at the college (see the attached guide), and to be a cheerleader/role model for the student's success. For example—you are not supposed to be a tutor—you are supposed to help the student FIND tutoring, if needed.

Again, thank you for agreeing to help others. I look forward to exploring the possibility that this program could help science students succeed!

Sincerely,

Ann Flint, MS, RRT  
BIO 132 Mentoring Coordinator

Program Director, Respiratory Care  
Jackson College, JW 245  
2111 Emmons Rd.  
Jackson, MI 49201  
ph: 517.796.8684; f: 517.768.7004; e: [flintannm@jccmi.edu](mailto:flintannm@jccmi.edu)

**Rationale:**

1. Many students who have never been to college and whose families have never been to college do not succeed.
2. There are many reasons for this—not familiar with college culture, how to study, etc.
3. Students here at JC who wish to go into a career in health care need to take BIO 132 or BIO 155, and they can enter BIO 132 with NO prior college background. Therefore, many of them, trying to get started on the path to health care ASAP, take it before they have truly learned how to study and maneuver the college environment effectively. As a result, many students get behind early, and cannot adjust in time to bring their grades up—if they ever figure it out

before the class ends—so the pass rate is very poor. Many students end up being discouraged by this and leaving.

4. Research on what helps students succeed shows that there are many factors that contribute. Major ones we will focus on in this project are EARLY intervention and providing supportive guidance to help the student quickly get used to the college setting and how to be successful. So, for example, many new students don't know they need to come to class prepared to take notes. They don't know that they need to get their books before class starts, or that they need to make a calendar for the class and plan a study schedule, or make flash cards, or form a study group—or whatever method is best for them to master the material. Sometimes the issue is simply that because they've never known anyone that's gone to college, they just get paralyzed by doubts about whether they can succeed, and just need someone who has come from a similar background to provide encouragement that it IS possible.
5. So...that is YOUR role. You have succeeded with science and so you can discuss how you did it and provide a role model of success. If the student has questions about how to find resources, like tutoring, or financial aid, then you can point him/her in the right direction.
6. The other part of the equation—that the intervention is EARLY in order to help the student get organized and fully prepared to succeed from the beginning—involves making contact as early in the term as possible. It is usually recommended this be within the first three weeks.

APPENDIX  
H: Mentoring Resource List

*Note: contact names, phone numbers, and email addresses were removed from this list prior to publishing*

RESOURCE	DESCRIBE	WEBSITE
211	Links people with human services. Any time of the day or night, trained professionals are ready to help	<a href="http://www.centralmichigan211.org/home.html">www.centralmichigan211.org/home.html</a>
ABC Academy	Day Care	<a href="http://www.jccmi.edu/studentlife/Child_Care.htm">www.jccmi.edu/studentlife/Child_Care.htm</a>
Admission Services		<a href="http://www.jccmi.edu/studentservices/admissions">www.jccmi.edu/studentservices/admissions</a>
Allied Health Office		<a href="http://www.jccmi.edu/Academics/AlliedHealth/contact.htm">www.jccmi.edu/Academics/AlliedHealth/contact.htm</a>
Advising		<a href="http://www.jccmi.edu/studentservices/admissions/advising.htm">www.jccmi.edu/studentservices/admissions/advising.htm</a>
Advising: Health Care		
Advising: Univ. Transfer		<a href="http://personal.jccmi.edu/VisserPatriciL">personal.jccmi.edu/VisserPatriciL</a>
Bookstore		<a href="http://www.jccmi.edu/info/bookstore.htm">www.jccmi.edu/info/bookstore.htm</a>
Bus Service		<a href="http://www.jccmi.edu/info/bus_schedule.htm">www.jccmi.edu/info/bus_schedule.htm</a>
Campus View Housing Service Desk		<a href="http://www.jccmi.edu/studentlife/campusview">www.jccmi.edu/studentlife/campusview</a>
Cashier		<a href="http://www.jccmi.edu/businessoffice/Cashier.htm">www.jccmi.edu/businessoffice/Cashier.htm</a>
Center for Family Health	Physicals • Health education Counseling • Pregnancy testing Medicaid enrollment • Dental hygiene	<a href="http://www.centerforfamilyhealth.org">www.centerforfamilyhealth.org</a>
Center for Student Success		<a href="http://www.jccmi.edu/success/HelpCenter.htm">www.jccmi.edu/success/HelpCenter.htm</a>
Community Connections (LifeWays)	Mental health screening and Developmental disability service referral	<a href="http://www.lifewayscmh.org">www.lifewayscmh.org</a>
Fieldhouse		<a href="http://www.jccmi.edu/Academics/healthphysicalfitness">www.jccmi.edu/Academics/healthphysicalfitness</a>
Financial aid appeals		<a href="http://www.jccmi.edu/ombudsman">www.jccmi.edu/ombudsman</a>
Financial Aid Office		<a href="http://www.jccmi.edu/businessoffice/financialaid/">www.jccmi.edu/businessoffice/financialaid/</a>
Food Assistance		<a href="http://www.centralmichigan211.org">www.centralmichigan211.org</a>
Food Service		<a href="http://www.jccmi.edu/info/foodservice/">www.jccmi.edu/info/foodservice/</a>
Health Clinic		<a href="http://www.jccmi.edu/info/healthclinic">www.jccmi.edu/info/healthclinic</a>
International Student Advisor		<a href="http://www.jccmi.edu/futurestudents/International">www.jccmi.edu/futurestudents/International</a>
JC @ LISD TECH (Adrian)		<a href="http://www.jccmi.edu/lenawee">www.jccmi.edu/lenawee</a>
LeTarte Center, Hillsdale		<a href="http://www.jccmi.edu/hillsdale">www.jccmi.edu/hillsdale</a>
Library		<a href="http://www.jccmi.edu/library">www.jccmi.edu/library</a>
North Campus		
Nursing Admissions		<a href="http://www.jccmi.edu/Academics/nursing/contact.htm">www.jccmi.edu/Academics/nursing/contact.htm</a>
Office of Multicultural Relations		<a href="http://www.jccmi.edu/Diversity">www.jccmi.edu/Diversity</a>
Ombudsman		<a href="http://www.jccmi.edu/ombudsman">www.jccmi.edu/ombudsman</a>
Operator (Switchboard)	(8-5, M-F)	
Record Services/Transcripts		<a href="http://www.jccmi.edu/StudentServices/Registration/Transcripts.htm">www.jccmi.edu/StudentServices/Registration/Transcripts.htm</a>
Registrar		
Security		<a href="http://www.jccmi.edu/security">www.jccmi.edu/security</a>
Registration		<a href="http://www.jccmi.edu/studentservices/registration">www.jccmi.edu/studentservices/registration</a>
Solution Center (IT)	Log in and Technology Assistance	
Special Needs Office		
Student Services		<a href="http://www.jccmi.edu/studentservices">www.jccmi.edu/studentservices</a>
Testing Lab		<a href="http://www.jccmi.edu/library/testinglab.htm">www.jccmi.edu/library/testinglab.htm</a>
Tutoring (Central Campus)	Science and other tutoring	<a href="http://www.khanacademy.org/science/biology/human-biology">www.khanacademy.org/science/biology/human-biology</a>
Veterans Services		<a href="http://www.jccmi.edu/studentservices/veterans">www.jccmi.edu/studentservices/veterans</a>
Web Tools		<a href="http://www.jccmi.edu/info/webtools.htm">www.jccmi.edu/info/webtools.htm</a>

APPENDIX  
I: Mentor Follow-Up Questions

I am writing to ask you a couple of questions about the mentoring project:

- Did the student ever respond to your initial request?
- Did the student ask for any help after that?
- Did you have regular contact? If so, was it scheduled or un-scheduled?
- How did it go with you and the student otherwise? Did you feel you helped?
- Any other comments?

And then I have another question for you, about this term: would you like to mentor again? This time the students will ALL be assigned mentors, and from the beginning—so we'll have a better chance to see if it works. There are about 24 students involved, so depending on how many mentors want to proceed, we will have 2-3 students per mentor.

If you'd like to proceed, please let me know, and I will send you the student contact info, as well re-sending the mentoring guide.

Thank you!

## APPENDIX

J: Letter Introducing BIO 132 Students to Mentoring Program

Greetings, BIO 132 Student!

I am writing to inform you that JCC is trying a program to improve science success in BIO 132. We have established a team of mentors to help you this term, if you need it. To begin:

- You will be matched with a mentor who has had success in science. Your mentor will contact you this week to check in with you and find out how you are doing, and will make a plan with you for regular check-in as well as letting you know how to reach out for help between meetings.
- Your mentor will make initial contact through your JCC email address. You will need to state a preferred method of contact if you wish another method.
- Your participation in the mentoring program will last for this entire term.

Many students wish to enter science careers, such as environmental inspection or nursing, but have little science background when they start. Science classes can be quite challenging, and are especially so if you have not taken much high school science or math, if you are returning to college after years away from your last schooling, or have had no family members who have attended college to give advice. As a result, many students enroll in science classes with high expectations, but fail to succeed because they don't know how to correctly approach the class (or perhaps the whole college experience). Falling behind becomes an insurmountable obstacle and more rapidly than the average person expects.

A mentor can help by giving you advice to help you get back on track quickly. Your mentor may be an allied health student, a professional working in a scientific field, or a science faculty member. Your mentor will be a role model for success and a source of information on getting help in your science class (or at JCC overall, if you need it). Your mentor will not be a science tutor, but can help you find science tutoring help. Feel free to ask your mentor anything—the mentor's role is to help you get what you need to succeed.

Best of luck to you this term!

Ann Flint, MS, RRT

BIO 132 Mentoring Coordinator