Cultivating a Stem investigation: Reading and Task Expectations for introductory Biology Courses

Tina M. Ballard
tballard@elgin.edu

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ABSTRACT

CULTIVATING A STEM INVESTIGATION: READING AND TASK EXPECTATIONS FOR INTRODUCTORY BIOLOGY COURSES

Tina M. Ballard, Ed.D.
Department of Curriculum and Instruction
Northern Illinois University, 2021
Jodi P. Lampi and Sonya L. Armstrong, Co-Directors

College completion is an important discussion in today’s world with only about 30% of community college students completing their degrees within three years of starting their programs. Especially in the Science, Technology, Engineering, and Math (STEM) fields, students are changing their majors or not completing their degrees for a variety of reasons. Previous research has established that there are high attrition and failure rates for introductory biology courses which may be causing some students to change their majors or not complete their degrees.

This multicase study investigated the reading and task demands for introductory biology courses designed for STEM majors at community colleges in a Midwestern state. By better understanding the reading and task demands for this specific discipline, the teaching and learning instruction can be improved for biology professors, developmental educators, and first-year college students. Data sources included interviews with biology professors and documents collected from the professors such as syllabi and sample tests, quizzes, and laboratory materials. Data analysis included both content analysis and transcript analysis.

Analysis of the data indicated that the professors viewed biology as a broad discipline with a wide range of options for students to study. In addition, there are disciplinary specific
reading aspects that students should be made aware of to focus on in their biology assignments, as well as a variety of purposes for reading the various texts assigned in the introductory biology course. Finally, the wide range of tasks expected for the course are all designed to improve learning but may need to be scaffolded and explained to help students understand the expectations and purposes of each task.
CULTIVATING A STEM INVESTIGATION: READING AND TASK EXPECTATIONS FOR INTRODUCTORY BIOLOGY COURSES

BY

Tina M. Ballard
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A DISSERTATION SUBMITTED TO THE GRADUATE SCHOOL IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF EDUCATION

DEPARTMENT OF CURRICULUM AND INSTRUCTION

Doctoral Co-Directors:
Jodi P. Lampi and Sonya L. Armstrong
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DEDICATION

To my biggest and most supportive cheerleaders, Clayton, Cody, Emily, Spencer, and Becca: you inspire me to be a better educator and change the world
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>LIST OF TABLES</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>x</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>xi</td>
</tr>
<tr>
<td>LIST OF APPENDICES</td>
<td>xii</td>
</tr>
</tbody>
</table>

## Chapter

1. **INTRODUCTION** ................................................................. 1
   - Community College Completion ............................................... 2
   - Addressing Reading Expectations .......................................... 3
   - From Content Area Reading to Disciplinary Literacy .................... 5
     - Content Area Reading ......................................................... 6
     - Disciplinary Literacy ......................................................... 8
   - Developmental Reading ........................................................ 12
   - Problem Statement .................................................................... 14
   - Impetus for the Study ............................................................. 15
   - Statement of Purpose and Research Questions ............................. 16
   - Research Approach ................................................................... 17
   - Rationale and Significance of the Study .................................... 18
   - Delimitations ............................................................................ 20
   - Glossary of Terms .................................................................... 20
   - Summary of Chapter One .......................................................... 22
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization of the Dissertation</td>
<td>22</td>
</tr>
<tr>
<td>2. REVIEW OF THE LITERATURE</td>
<td>23</td>
</tr>
<tr>
<td>Theoretical Framework</td>
<td>23</td>
</tr>
<tr>
<td>Model of Domain Learning</td>
<td>24</td>
</tr>
<tr>
<td>Sociolinguistic Theory</td>
<td>25</td>
</tr>
<tr>
<td>Disciplinary Literacy</td>
<td>27</td>
</tr>
<tr>
<td>Intersection of Theories</td>
<td>27</td>
</tr>
<tr>
<td>College Success</td>
<td>29</td>
</tr>
<tr>
<td>Study Strategies</td>
<td>30</td>
</tr>
<tr>
<td>Comprehension Strategies</td>
<td>32</td>
</tr>
<tr>
<td>Study Time</td>
<td>34</td>
</tr>
<tr>
<td>Reading Compliance</td>
<td>36</td>
</tr>
<tr>
<td>Research on Disciplinary Literacy</td>
<td>36</td>
</tr>
<tr>
<td>Research on Text and Task Demands</td>
<td>40</td>
</tr>
<tr>
<td>Reality Checks</td>
<td>41</td>
</tr>
<tr>
<td>Curriculum Audit Model</td>
<td>43</td>
</tr>
<tr>
<td>Research About Professors’ Expectations with Reading and Learning</td>
<td>47</td>
</tr>
<tr>
<td>Task Demands</td>
<td>50</td>
</tr>
<tr>
<td>Gaps in the Literature</td>
<td>52</td>
</tr>
<tr>
<td>Summary of Chapter Two</td>
<td>53</td>
</tr>
<tr>
<td>3. METHODS</td>
<td>54</td>
</tr>
<tr>
<td>Purpose</td>
<td>54</td>
</tr>
</tbody>
</table>
# Chapter

<table>
<thead>
<tr>
<th>Research Design</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rationale for Qualitative Research</td>
<td>54</td>
</tr>
<tr>
<td>Rationale for Case Study</td>
<td>55</td>
</tr>
<tr>
<td>Participants</td>
<td>56</td>
</tr>
<tr>
<td>Sampling and Participant Selection</td>
<td>59</td>
</tr>
<tr>
<td>Case Information</td>
<td>59</td>
</tr>
<tr>
<td>Institutional and Participant Contexts</td>
<td>61</td>
</tr>
<tr>
<td>Course Considerations</td>
<td>62</td>
</tr>
<tr>
<td>Data Collection Methods</td>
<td>64</td>
</tr>
<tr>
<td>Documents</td>
<td>65</td>
</tr>
<tr>
<td>Interviews</td>
<td>66</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>68</td>
</tr>
<tr>
<td>Content Analysis</td>
<td>70</td>
</tr>
<tr>
<td>Transcript Analysis</td>
<td>70</td>
</tr>
<tr>
<td>Cross-Case Analysis</td>
<td>72</td>
</tr>
<tr>
<td>Finishing the Analysis</td>
<td>76</td>
</tr>
<tr>
<td>Ethical Considerations</td>
<td>77</td>
</tr>
<tr>
<td>Issues of Trustworthiness</td>
<td>78</td>
</tr>
<tr>
<td>Delimitations</td>
<td>80</td>
</tr>
<tr>
<td>Summary of Chapter Three</td>
<td>80</td>
</tr>
<tr>
<td>4. FINDINGS</td>
<td>81</td>
</tr>
<tr>
<td>Case A</td>
<td>82</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Case B</td>
<td>85</td>
</tr>
<tr>
<td>Case C</td>
<td>88</td>
</tr>
<tr>
<td>Case D</td>
<td>92</td>
</tr>
<tr>
<td>Case E</td>
<td>96</td>
</tr>
<tr>
<td>Cross-Case Analysis</td>
<td>99</td>
</tr>
<tr>
<td>Theme 1: Reading Matters and has Several Different Purposes</td>
<td>99</td>
</tr>
<tr>
<td>Theme 2: Tasks Were Designed to Improve Learning</td>
<td>104</td>
</tr>
<tr>
<td>Chapter Four Summary</td>
<td>107</td>
</tr>
<tr>
<td>5. DISCUSSION</td>
<td>109</td>
</tr>
<tr>
<td>Summary of the Study</td>
<td>109</td>
</tr>
<tr>
<td>Summary of the Findings</td>
<td>110</td>
</tr>
<tr>
<td>Theme 1: Reading Matters and has Several Different Purposes</td>
<td>110</td>
</tr>
<tr>
<td>Theme 2: Tasks Were Designed to Improve Learning</td>
<td>112</td>
</tr>
<tr>
<td>Connections Across Themes</td>
<td>113</td>
</tr>
<tr>
<td>Findings Viewed Through Theoretical Frameworks</td>
<td>115</td>
</tr>
<tr>
<td>Implications</td>
<td>116</td>
</tr>
<tr>
<td>Implications for Community Colleges</td>
<td>116</td>
</tr>
<tr>
<td>Implications for Biology Professors</td>
<td>117</td>
</tr>
<tr>
<td>Implications for Developmental Educators</td>
<td>118</td>
</tr>
<tr>
<td>Recommendations</td>
<td>118</td>
</tr>
<tr>
<td>Recommendations for Community Colleges</td>
<td>118</td>
</tr>
<tr>
<td>Recommendations for Biology Professors</td>
<td>119</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>---------</td>
<td>------</td>
</tr>
<tr>
<td>Recommendations for Developmental Reading Educators</td>
<td>120</td>
</tr>
<tr>
<td>Recommendations for Future Research</td>
<td>121</td>
</tr>
<tr>
<td>Conclusion</td>
<td>122</td>
</tr>
<tr>
<td>Summary of Chapter Five</td>
<td>123</td>
</tr>
<tr>
<td>REFERENCES</td>
<td>125</td>
</tr>
<tr>
<td>APPENDICES</td>
<td>137</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Documents Collected and Analyzed Per Case</td>
<td>67</td>
</tr>
<tr>
<td>2. Example Passages Coded as</td>
<td>75</td>
</tr>
</tbody>
</table>
# LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Connections Between Theories in Theoretical Framework</td>
<td>28</td>
</tr>
</tbody>
</table>
# LIST OF APPENDICES

<table>
<thead>
<tr>
<th>Appendix</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. PROFESSOR RECRUITMENT EMAIL</td>
<td>137</td>
</tr>
<tr>
<td>B. PROFESSOR INTERVIEW GUIDE</td>
<td>139</td>
</tr>
<tr>
<td>C. SYLLABUS ANALYSIS INSTRUMENT</td>
<td>142</td>
</tr>
</tbody>
</table>
CHAPTER 1
INTRODUCTION

Teaching and learning are important cornerstones of higher education. However, neither of them occurs in a vacuum because they are so intertwined with each other. Students depend on professors to teach, explain, and guide them through the learning process, and professors expect students to read, ask questions, and use study strategies to learn the material that is needed for each course. I often think about teaching and learning as two sides of the same coin; no matter how hard a person tries, they really cannot be separated. However, by examining each side of the coin, different ideas can be noted. Similarly, with education, it is valuable to examine learning from both the professors’ and students’ perspectives. Although the main focus of my study is to determine the professors’ reading and task expectations for introductory biology courses, the students’ needs must also be considered. Therefore, there are three main areas that frame the background of my study. First of all, potential reasons for low graduation rates at community colleges are explored because of the possible impact that STEM courses play on the graduation rates. Then, reading issues, including content area literacy, disciplinary literacy, and college reading demands and readiness are discussed in order to connect these topics to teaching and learning concerns within the introductory biology courses. Finally, a brief overview of developmental reading is given to help explain another potential need for this study.
Community College Completion

Nationally, only about 30% of community college students finish their Associate degree within three years (National Center for Education Statistics [NCES], 2019) which is keeping many students from reaching their college and career goals. Introductory college courses are sometimes referred to as gatekeeper classes because of “high levels of competition, large class sizes, and high failure rates” (Eagan & Jaeger, 2008, p. 40). Gatekeeper courses may function to allow students to continue on to the courses in their majors, or they keep students from progressing on to higher level courses and from completing their degrees (Scott et al., 2017; Sebesta & Speth, 2017). Failure rates range from around 20% to over 50% at various colleges for first-year courses (Fuller, 2017; Ueckert, et al., 2011; Wishusen & Wishusen, 2007).

One example of a gatekeeper course is the introductory biology course required for some students going into a Science, Technology, Engineering, or Math (STEM) field because the failure and attrition rates are often high for this course. Some institutions have noted high attrition rates specifically for their first-year biology course (Brown, 1995; Tawde et al., 2017). Freeman et al. (2011) reviewed previous studies and concluded that “it appears common for one-third of students to fail in STEM gateway courses” (p. 175). High failure and attrition rates in first-year biology courses at many institutions is a concerning issue for several reasons. Both high failure and attrition rates cause increased costs for students because the courses must be retaken which also causes students to spend more semesters finishing their degrees. Especially for students who plan to enter a health-related or some STEM fields, introductory biology courses are required in order to move into their area of study (Scott et al., 2017). These elements
indicated a need to explore factors that lead to students being unsuccessful in the first-year biology courses.

Although there may be various reasons why students change majors or drop out of college, Theobald et al. (2020) stated that one major reason is poor performance in introductory courses. Freeman et al. (2011) stated that failure in “introductory courses cause students to take longer to graduate, leave the STEM disciplines, or drop out of school entirely” (p. 175). Students who struggle in their first-year courses may have a more difficult time completing their degrees. Other students are not completing their college degrees in STEM fields because they are switching majors (Alzen et al., 2018; Bettinger, 2010; Chen & Soldner, 2013; Crisp et al., 2009; Goulden et al., 2009; Ost, 2010). Differences in completion or graduation rates for students who begin college as a STEM major compared to those who start in another degree have also been recognized. According to Higher Education Research Brief (2010), students who started as STEM majors are less likely to graduate with a bachelor’s degree within five years than students who started as a non-STEM major. Although there may be many reasons why students are not completing their degrees, not being successful in their introductory courses is one barrier that needs to be explored to determine the potential causes.

Addressing Reading Expectations

Successful performance in college courses is often dependent on students’ reading skills. Research has shown that students need to have good reading skills in order to be successful in college courses (Deloza, 2013; Holschuh & Paulson, 2018; Pugh et al., 2000) because over 80% of learning in college comes from reading texts independently (Holschuh, 2019; Simpson & Nist, 2000). In addition, most college professors expect students to be able to comprehend college
textbooks (Association of American Colleges and Universities [AACU], 2017; Hermida, 2006; Holschuh & Paulson, 2013; Liu & Read; 2020), and they rely on the textbook to provide foundational knowledge for the topics in the course (Alfassi, 2004; Coil et al., 2010; Pugh et al., 2000). Without the knowledge from reading the textbooks, students will have a more difficult time being successful in the course. However, many first-year students may not have the necessary reading skills to comprehend the textbooks. According to The Nation’s Report Card (2018), 37% of high school seniors tested proficient or above in reading on the National Assessment of Educational Progress [NAEP]. Additionally, 47% of high school graduates who took the ACT in 2017 tested “college-ready” in reading (ACT, 2017). Although reading scores do not present the entire picture for knowing if a student will be successful in a college course, it is one measure that should be considered. Reading expectations are different for various courses or disciplines, so understanding these differences is also important.

Reading science textbooks can be especially challenging for students. Hodges (2015) argued that professors must teach students how to read science texts because “science writing is so different in style and packed with information and new vocabulary that it is hard for students to know what they should learn from it” (p. 42). Introductory science textbooks traditionally have been written in very dense and technical writing formats which is different than the narrative style that many students are more familiar and comfortable with. The conventions of science writing make it more concise and compressed than other types that students are used to reading (Snow, 2010). Hodges (2015) also pointed out that the cognitive load involved with reading science texts is demanding, so students may not recognize when they are confused by the text. Finally, Hodges (2015) noted that students often do not understand the purpose of reading
science texts and that they should evaluate and question what they read, instead of just reading to identify facts.

Understanding expectations is an important part of education in all grade levels because misunderstandings can lead to poor performance. However, those expectations may not be the same for students entering postsecondary education as they are used to from the K-12 institutions (Holschuh & Aultman, 2018; Yancey, 2009). In high school, students may have been given specific assignments, worksheets, and study guides for exams, but they may not have the same guidance in their college courses. Additionally, students often begin college with unrealistic expectations of how they will be taught and what they will need to do to learn information for courses (Hassel & Ridout, 2018). Finally, as students move through their educational levels, the disciplinary expectations begin to change. As Shanahan and Shanahan (2008) have pointed out, the literacy expectations become more specific and have changed from basic and intermediate literacy skills to disciplinary literacy skills that are specialized to specific subjects. Therefore, for the introductory biology courses, students may be expected to read, write, and think in different ways than they were in their high school biology courses. These changes in expectations can be challenging for first-year college students.

From Content Area Reading to Disciplinary Literacy

As the focus of education changed from rote memorization in the early 1900’s to a focus on understanding texts to learn, the idea of content area reading instruction started to develop (Moore et al., 1983). Researchers in reading education realized that students needed a variety of strategies to use when they approached the different texts across their courses. These strategies were called content-area reading strategies.
Content Area Reading

Content area reading strategies focused on “the teaching of a generalizable set of study skills across content areas for use in subject matter classes” (Shanahan & Shanahan, 2012). This might have been vocabulary instruction that focused on teaching common prefixes, roots, and suffixes, so students could recognize parts of new words in a variety of content courses, or general reading strategies such as making connections or inferences that students could apply in science, English, or history courses. In addition, students were taught to summarize, question, or visualize information from the text, and the same strategies were used for every course with the belief that the strategies would improve both literacy skills and knowledge in the content area (Brozo et al., 2013). However, even after several generations of teachers had been introduced to content area reading strategies, some researchers found that teachers were unlikely to use these strategies in their classrooms (Hall, 2005; Hasselquist et al., 2019; Lesley, 2014; Ratekin et al., 1985; Stewart & O’Brien, 1989). Some teachers reported feeling inadequate to teach reading in their courses (Draper, 2002; Stewart & O’Brien 1989), and others felt they should not have to teach reading in their courses or that there was not enough time to focus on literacy strategies in the content course (Muth, 1993; O’Brien et al., 1995; Stewart & O’Brien 1989.) Although the generalized reading strategies taught in content area reading were helpful for some students, they were not as helpful at improving students’ reading, writing, or learning skills as researchers thought they would be. Researchers have started to address a more nuanced approach to literacy (McConachie et al., 2006; Moje, 2008; O’Brien & Stewart, 1992; Shanahan & Shanahan, 2008) because they asserted that each discipline has its own expectations for reading.
Shanahan and Shanahan (2008) reported that in the 1990’s, many states started to focus on helping young children’s reading skills. The perception was that if students were given a sound foundation in basic reading skills, such as phonemic awareness, decoding, and fluency, they would be successful with any reading assignment they encountered for the rest of their lives. Although adding resources to focus on basic reading skills did improve reading scores for elementary students, by the time the students were in 8th grade, their scores fell compared to other nations (Shanahan & Shanahan, 2008). According to the Program for International Student Assessment (PISA) results for 2018, 15-year-olds in the United States ranked 13th out of the 38 countries for their reading skills.

The basic literacy instruction presented in elementary schools and the generalized reading strategies that were used in middle and high schools are not enough to help high school and college students become established in the various disciplines (Greenleaf, et al., 2011; Shanahan & Shanahan, 2008, 2012). Shanahan (2009) referred to the fact that successful readers do not all read in the same way because of differences in purposes of reading and the types of texts being read. However, she also noted that each discipline has its own way of representing and evaluating information because of the traditions in each field. Shanahan contended that experts not only know how to approach the texts in the field, they can also evaluate the information and interpret the writing because they are intimately involved with creating the information. However, novices do not have as many of these tools to be able to comprehend the texts they are faced with reading. Cisco (2020) also noted that there are various reasons why students may struggle with texts in various disciplines. The reasons range from not having the “required literacy skill sets to make sense” of the texts to not having “sufficient background knowledge” or struggling with the “academic jargon” (Cisco, 2020, p. 73). No matter the reason, there are
“specific reading, writing, and thinking practices that students must learn” (Cisco, 2020, p. 73) to be successful in the various disciplines. By understanding the strategies and processes used by experts, novices can be more effectively brought into the discipline. One way to do this is by understanding what professors ¹ expect their students to do with their readings and tasks.

**Disciplinary Literacy**

Disciplinary literacy is different from content area reading for a variety of reasons. First of all, disciplinary literacy is based on the concept that each subject area has a unique set of skills that are used to engage in it (Lee & Spratley, 2010; McConachie, 2010; Moje, 2008; Moje & Speyer, 2008; Shanahan & Shanahan, 2008). Unlike the idea of using general reading strategies to improve learning and comprehension across disciplines, Shanahan and Shanahan (2008) called for “advanced literacy instruction embedded within content-area classes” (p. 40). In other words, students need to be taught disciplinary ways to read, learn, and think. However, these skills are more advanced than the general reading strategies, may not be introduced until students are older, and may be a way to improve learning in each discipline (Manderino, 2011; Moje, 2008). Another aspect that makes disciplinary literacy different from content area reading is because it focuses on the epistemological beliefs connected to each subject area (Goldman et al., 2016). Moje (2008) explained that each discipline has its own criteria for what counts as valid evidence because of the norms and practices in each area. The ways of knowing and understanding in each discipline ultimately affect the reading and writing strategies used, so this is an important facet to consider in disciplinary literacy research. Finally, disciplinary literacy researchers used

¹ For my study, I have chosen to use the term professor after talking to the biology faculty members at my institution and the participants in my study, and they indicated that was the term they preferred (instead of teacher or instructor).
functional language analysis to determine the differences in language use between the disciplines (Fang & Schleppegrell, 2010). This technique allows people to “identify language patterns and associated meanings specific to particular disciplines” (Fang & Schleppegrell, 2010, p. 588).

Fang (2005) also noted that scientific writing tends to be “dense, technical, and abstract” (p. 337) which can be challenging for students to understand.

There are other aspects of disciplinary literacy that are important to consider as well. DiDomenico et al. (2018) defined disciplinary literacy as being

comprised of the (a) habits of thinking exhibited by disciplinary experts, (b) reading, writing, and talking using the full range of texts valued in the discipline, (c) unique habits of practice enacted in the disciplines, and (d) beliefs about knowledge and knowledge production that constitute the disciplines. (p. 84)

One of the habits of thinking explains how experts approach a text or task in their field. For example, when historians read a text, they consider who the author was and their background. This process is called sourcing (Shanahan & Shanahan, 2012; Wineburg, 1991, 1998) and influences the way the historian interprets the text. On the other hand, scientists may consider who the author is before they read a text in order to determine credibility, but they are not concerned with who the author is while trying to make sense of the report (Shanahan & Shanahan, 2012). Communication (reading, writing, or talking) is also different for each discipline. For example, mathematicians appear to have specific functions for their use of language. Croce and McCormick (2019) found that professionals who use mathematics in their jobs use language to identify “mathematics for a purpose and the language of telling a story” (p. 3). The language used was often connected to who their intended audience was. For example, if the mathematics professionals were speaking to a novice, they were more likely to explain terms clearly and not go into as many details about the mathematical processes. Manderino and
Wickens (2014) also argued that it is important to identify the various texts and habits of practice used in each discipline. For example, they stated that in history, “interpretation is facilitated through the comparison of competing accounts,” (p. 31) but, in science, “the nature of scientific inquiry is grounded in the construction of hypothesis through the testing and analysis of multiple datasets” (p. 31). Therefore, knowledge is created and interpreted differently in each field. Students need to recognize that they will use a wide variety of thought processes and types of texts in different disciplines. These differences in reading and language expectations for disciplines are vital for students to understand so that they can discern the differences in each context, but it is just as important for professors to identify these expectations so they can be explained and taught to their students.

Because each discipline has its own unique ways of thinking, reading, writing, and speaking, understanding the demands of each discipline is vital to helping students improve their literacy skills in each field. Both professors and students need to be aware of what processes are best used in various disciplines, so they can match instructional and learning practices to each. Although disciplinary literacy practices have been explored for several content areas, specifically history (Lee & Spratley, 2010; Shreiner & Zwart, 2020; Wineburg, 1998), literature (Flower & Hayes, 1981; Lee & Spratley, 2010), English/language arts (Rainey, 2016; Reynolds & Rush, 2017; Reynolds et al., 2020) mathematics (Enderson & Colwell, 2021; Johnson et al., 2011; Lee & Spratley, 2010), and chemistry (Shanahan et al., 2011; Shanahan & Shanahan, 2008), relatively little research has been done in biology to determine what disciplinary specific skills and strategies are used by experts and are needed by students to be successful. Some research in biology has been done by Holschuh (1998; 2003) that explored students’ epistemological beliefs in biology with their use of various learning strategies and Hynd et al. (2000) that focused on the
connection between motivation and conceptual changes involved in learning in science courses.

In order to move forward in helping both professors and students, the reading practices used in biology courses must be analyzed in more depth.

**Disciplinary Literacy Concerns**

One issue with the concept of disciplinary literacy is that professors are not always aware of the literacy skills needed in their subjects (Colwell & Reinking, 2016; Enderson & Colwell, 2021; Paul, 2018). Typically, at the community college level, professors must hold a master’s degree or higher in the content area they teach. For example, in order to teach biology, the professor must have at least a master’s degree in biology, but there is typically no requirement for the professor to have training in education or literacy. Zaidi (2016) said that educators’ “training is restricted to content delivery, not literacy instruction, which is crucial to comprehending text” (p. 33). Similarly, Goldman (2012) pointed out that content knowledge affects a person’s reading behavior because people who are reading outside of their area of expertise do not use the same complex strategies as when they are reading in their area of expertise. Therefore, even “good readers” will need help learning and using the discipline specific reading strategies that are necessary for disciplinary literacy instruction. Additionally, the discipline professors may not be aware of the specific reading strategies and skills they are using to make sense of the texts in their disciplines. Monte-Sano et al. (2014) argued that teachers must understand how information is created, communicated, and evaluated in their disciplines in order to teach disciplinary literacy. In other words, it is not enough for professors to just know the content and factual information in their area, they must recognize and be able to explain the habits of thinking and practice that are valued in their discipline.
Developmental Reading

The field of developmental reading has a long history in American education. Stahl and King (2018) pointed out that the field of developmental education is entwined with the field of college reading which has been provided at the college level since the 1630’s. Although some people believe developmental reading courses at the college level are new, the reality is that preparatory departments at universities were common even in the 1800’s (Wyatt, 1992).

The main focus of developmental education was to make sure students were prepared to be successful in their postsecondary coursework (Bohlig et al., 2018; Boylan & Bonham, 2007). Paulson and Holschuh (2018) argued that “reading instruction is entirely appropriate at every educational level, including…postsecondary” (p. 27). Because the reading demands have increased and changed from high schools, students need to be taught how to approach the new reading demands appropriately, so they can be successful in their courses. In addition, the disciplinary expectations different at the college level, so students need instruction in the new literacy demands of college (Williamson, 2008).

Reading and writing placement tests, such as the SAT, ACT, or the Accuplacer, are used by 98% of public two-year colleges (Rutschow et al., 2019), to determine if students are “college-ready” for reading and/or writing. According to ACT (2019), 45% of the students who took the ACT in 2019 scored “college-ready” for reading. This leaves over half of the students who are un(der)prepared for the reading demands in college courses and may have to take a developmental reading course before being able to take a college-level course with a reading pre-requisite. Chen (2016) found that about 28% of students who started at a 2-year public institution began in a developmental English/reading course.
Historically, many developmental reading courses have focused on instruction of discrete reading skills (i.e. identifying the main idea, using context clues to define terms, or selecting an inference from a passage) from short, out-of-context reading passages which are also known as “skill-drill type teaching approaches” (p. 8) (Armstrong & Newman, 2011). Although there has been a push for more disciplinary literacy instruction for students (Armstrong & Stahl, 2017; Shanahan & Shanahan, 2008), it is not clear if or how this has been implemented into classrooms in community colleges. In order to determine what should be taught in developmental education courses, more specific research is needed to determine the disciplinary literacy expectations that should be taught to students.

Finally, the education and professional development of the reading professors needs to be considered. Stahl and Armstrong (2018) pointed out that in the 1970s-1990s, many faculty members who taught developmental courses had doctoral degrees and completed research regularly. When four-year institutions began to remove “‘remedial’ education” (p. 49) courses from their campuses, it reduced the number of people with doctorates and changed the research foci for those who were left with tenure. In addition, many institutions were restructuring their developmental education programs, so that college reading and study strategy programs…are being dismantled and faculty are being reduced or laid off. The limited remaining instruction in reading and study strategies is not being taught by individuals with advanced theoretical training in the discipline [reading] or expertise with postsecondary populations. (Stahl & Armstrong, 2018, p. 49)

This is not to say that professors of developmental reading are not professionals who are doing their best to prepare students for college courses. However, there are many complicating factors that impact the curriculum and pedagogy of developmental reading courses. In order to best prepare students for college-level reading demands, the disciplinary reading demands and
expectations must be determined in order improve the knowledge base for developmental educators.

Problem Statement

The high failure and attrition rates for introductory biology courses are not only preventing students from completing the individual courses but are also contributing to lower graduation rates for STEM majors. Reading is an important aspect of learning in college courses, but there needs to be clarification on the disciplinary expectations, especially for reading in biology courses. There have been expert-novice studies completed for various disciplines, (Hynd-Shanahan et al., 2004; Leinhardt & Young, 1996; Shanahan et al., 2011; Wineburg, 1991) but there is no research that explores what professors expect their students to focus on while reading for introductory biology courses. Learning what the disciplinary expectations are for introductory biology courses will allow literacy experts, developmental educators, and biology professors to better inform instructional approaches and learning strategies that should be used by students.

Developmental literacy courses are designed to help students prepare for the reading and writing tasks they will face in college-level courses, but most literacy professors are not trained in disciplines outside of English. However, developmental literacy educators are typically trained in English/literature (Givens, 2008) and do not have specialized education in postsecondary literacy. For example, although they have may have a master’s degree in English or literature, they do not always have training in reading or literacy. They also may not have the discipline-specific training needed to assist students with the literacy demands in all the other disciplines students will be required to take courses in. Lampi et al. (2019) noted that traditionally
developmental reading courses have focused on “teaching isolated reading skills, such as selecting the main idea” (p. 245), but this approach does not help prepare students for the disciplinary expectations of their college courses. Because the reading demands and expectations are different in each discipline, it is important to determine and explain the disciplinary expectations for developmental literacy instructors. I designed this study to determine the reading and task expectations of introductory biology courses in order to help both developmental educators and biology professors identify ways to help their students be more successful with the demands of the introductory biology course.

Impetus for the Study

Prior to working with college students, I taught English and biology at the high school level. My academic background in English taught me to help students analyze literary texts, while my background in biology taught me to help students master science content. Although I knew there were differences in the way I read biology textbooks and literature, it never occurred to me to consider what those differences were, or to articulate those differences, so I did not explain them to my students. Instead, we would often end biology class with the instructions to read a chapter or section of the textbook for homework, and the next day I found that many students struggled with comprehending it or did not attempt to read it. At one point, I reached out to the reading specialist to obtain guidance for how to help my students. It was a less-than-helpful conversation in which I left knowing that some of my students read at a third-grade or fourth-grade level, but not knowing what that meant or how to assist them. Ultimately, this led to my starting a master’s degree program focusing on improving reading skills for K-12 students.
As time progressed, I started teaching developmental reading courses at a community college. The courses were mostly “skills-based” which used workbook-type textbooks with short passages that asked students to identify the main idea, define terms using context clues, and make inferences from the passages. I recognized that not only were these skills different from what I did when reading for learning in my courses, the passages were not representative of what I read in my college courses. I began to wonder if I was really preparing students for what they needed to do in their future courses. I started talking to content-area teachers to see what they wanted their students to be able to do with their texts. I was surprised by the number of teachers (from different educational levels and contexts) who mentioned not expecting students to read because “they wouldn’t (or couldn’t) do it.” I was worried about students not being expected to complete a task that is so central to learning and that may be expected of them in their future careers. I also began to wonder whether teachers were prepared to help their students make sense of their textbooks. Specifically, because of my background in science, I am interested in what professors expect from their students with reading in biology courses. In order to help with both of these goals, I want to understand what the reading expectations are for introductory biology courses and what tasks professors expect their students to be able to do with the information they read.

Statement of Purpose and Research Questions

The purpose of this research was to explore the reading and task expectations of professors in introductory biology courses designed for STEM majors at several community colleges in the Midwest. Both the amount and types of reading, as well as the professors’ expectations of students while they are reading, were examined. The reading and task
expectations of the professors were determined by collecting data from interviews and artifacts such as assignments, syllabi, and formative and summative evaluation tasks. Identifying the reading expectations also allowed for identification of specific tasks from the readings that are required for introductory-level biology courses. To help determine the best ways to help students and professors, the following research questions were addressed:

1. What are professors’ reading expectations in introductory biology courses designed for STEM majors at community colleges in a midwestern state, and in what ways are each professors’ expectations similar or different?

2. What tasks do biology professors expect students to be able to complete in order to demonstrate mastery of the course content?

Research Approach

This study used qualitative case study methodology to determine the reading and task expectations of first-year biology courses designed for STEM majors at community colleges in the midwest. Merriam’s (1998) research design helped to shape and determine the steps for this study which is further explained in Chapter Three. Specifically, in this multicase study, I examined the reading and task expectations from five different cases which allowed me to determine the similarities and differences between the cases.

Data collection was completed by collecting course documents from each participant to analyze and by interviewing each participant with a semi-structured interview (Seidman, 2013). The coding process used open coding techniques (Bogdan & Biklen, 2007). Data analysis was completed for individual cases and then by completing a cross-case analysis using the constant comparison method (Corbin & Strauss, 2015).
Rationale and Significance of the Study

There is a need for updated research on course expectations, especially focusing on reading. Simpson (1996) suggested that colleges complete “reality checks” to determine the types of reading materials that are being assigned to students and how the activities in class were connected to the assignments, but these have not been published frequently. In 1982, Richardson et al. described the literacy practices at a single community college and reflected on how those literacy practices were understood at the time. They found that people were concerned with perceived declining literacy standards at the community college and a reduced demand for reading and writing in some of the courses. Other studies were completed in the 1990’s, but they focused on specific institutions or individual courses (Burrell et al., 1997; Carson et al., 1992). However, this research is outdated and did not focus specifically on a biology course. More recently, research has been done that focused on identifying literacy demands in career/technical coursework and developmental education (Armstrong et al., 2019). There have also been studies that focused on programs designed to improve student success in biology at the university level (Ueckert et al., 2011; Wischusen & Wischusen, 2007), but not at the community college level. Holschuh (2013) attended four different first-year courses at one institution in order to discover the reading and literacy demands of those courses, but she investigated a physical geography course, not a biology course. Understanding biology professors’ reading and task expectations at the community college level will add to the knowledge base about the demands of college courses.

In addition, by identifying and explaining not only what biology professors expect students to read but focusing on how they want students to make sense of the texts, this study
will add to the disciplinary literacy research that has been completed in other fields (Brozo & Crain, 2018; Chapman, 2015; Croce & McCormick, 2019; Paul, 2018; Reynolds & Rush, 2017; Shanahan et al., 2011; Wineburg, 1991). This is important because each discipline is unique and has different ways of thinking, reading, and writing that are often tacit to the experts, but not made clear or explicit to the novices or students entering the field. Therefore, identifying the expectations will allow for more explicit reading instruction which should improve students’ success in the course.

Although biology professors are well-trained in the content of their field, they are not often versed in the reading processes and strategies that are useful for students to use while reading the introductory textbooks for their courses. Similarly, developmental literacy professors are well-trained in reading and writing expectations because most community colleges require a minimum of a master’s degree in English or reading to teach these courses (Givens, 2008), but they do not typically have the disciplinary expertise in biology to help students know the best strategies to use in the introductory biology courses. By identifying and explaining the reading and task expectations for the introductory biology courses, both the biology professors and developmental reading professors can learn what is important for students to do to be successful in the courses.

Finally, by identifying the disciplinary literacy expectations required to be successful for the introductory biology courses, it will be possible to determine which learning or study strategies will be the most effective for students to use. As noted by Simpson et al. (2004), “strategy instruction must be embedded within a disciplinary context” (p. 15). However, many first-year college students rely on passive learning strategies when they need to use more complex, strategic learning strategies (Simpson & Nist, 2000). By identifying the disciplinary
expectations, specific strategic learning strategies can be created or adapted and then taught to first-year students in order to help them improve their learning for the introductory biology courses.

Delimitations

This study was delimited by the purposeful sampling used to gather participants. Because this study focused on the expectations of biology professors who taught the introductory courses designed for STEM majors, only professors who had taught the required course at their institution were eligible to participate. In addition, this study focused on the expectations at community colleges and not at other types of institutions such as four-year universities.

Glossary of Terms

*Learning* - Jonassen’s (2002) definition that describes “meaningful learning as a willful, intentional, active, conscious, constructive, and socially mediated practice that includes reciprocal intention-action-reflection activities” (p. 45) most closely matches my definition of learning. Learning is an active process that involves “meaning making, not knowledge-reception” (Jonassen, 2002, p. 45). Reading is an important aspect or step in learning, but it is not the only way that students are expected to learn information from the courses. Instead, students need to be intentional and use repetition in order to remember and learn the vast amounts of information that is expected for the introductory biology course.

*Reading* – Reading is a complex process that involves much more than decoding and linguistic comprehension as described by the simple view of reading (Hoover & Gough, 1990). Instead, I view reading as a process that involves making meaning by using one’s background
knowledge or schema. Readers must understand the words (vocabulary), but also the context of the information, in order to comprehend the text. Reading is an active process in which the reader must be engaged, including setting a purpose for the reading event, asking and answering questions, and recognizing when comprehension is breaking down. Like Bartholamae and Pertrosky (1986), I believe that when reading is defined as something other than the activity of working one’s way through a long, complex text and imposing order and meaning on the information acquired from the text, it is easy to see literacy as the sum of constituent skills. (p. 12)

It is important to recognize that reading is more than just identifying the main idea of a passage or defining the terms on the page. Instead, individuals must be actively engaged with making meaning with the words on the page to be considered reading the text.

Tasks- Doyle and Carter (1984) define tasks as having “three elements: (a) a goal or product; (b) a set of resources or ‘givens’ available in the situation; and (c) a set of operations that can be applied to the resources to reach the goal or generate the product” (p. 130). They also discuss the fact that tasks are typically “embedded in an evaluation system” (p. 131). I use this definition of tasks and use the term to refer to activities or assignments that professors expect students to complete for points in the course – such as tests, quizzes, and laboratory activities. However, I also expand it further to include other activities that may not be graded, but that professors would like to see students complete especially connected to reading or studying. For example, many college professors do not give students points for taking notes while reading their textbooks, but they do expect students to complete this activity, so I refer to it as a task.
Summary of Chapter One

Because of the high failure and attrition rates for introductory biology courses designed for STEM majors, it is important to understand the reading and task demands from a disciplinary literacy viewpoint in order to better help prepare both biology and developmental literacy educators with pedagogical techniques for teaching their students. In addition, understanding the reading and task demands can lead to the development of appropriate learning or study strategies for the biology courses which may improve student success. Chapter One introduced the background and context for this study, explained the problem statement and continued to explain the purpose of the study. It then continued with impetus of the study, the research questions, the rationale and significance, research approach, and the delimitations of the study.

Organization of the Dissertation

Chapter Two discusses the literature that on both the methodological and theoretical foundations that guided this study in order to situate my study within the literature on disciplinary literacy and biology expectations. Chapter Three details the methodology for my study as well as the data collection and analysis procedures. In addition, it explains the ethical concerns and issues of trustworthiness that were important to the study. Chapter Four presents the analysis results, and Chapter Five explains the results of the study as well as the implications and recommendations for future research.
In this chapter, I review the literature that informed this multicase study that was designed to determine the reading and task expectations for introductory biology courses designed for STEM majors at community colleges. Because the purpose of my study is to help improve teaching for both biology and developmental reading professors and learning for first-year biology students, I begin by presenting my theoretical framework that guided my study. Then, I continue by reviewing the literature that focuses on several factors, including study strategies, comprehension strategies, study time, and reading compliance that may influence students’ success in college courses. Then, I introduce literature that focused on disciplinary literacy research in various contexts in order to situate my study within the current research. I continue to present existing research about the reading and task demands at both the secondary and postsecondary contexts with an emphasis on expectations at the postsecondary level before explaining the gaps in the literature that guided my study. The chapter concludes with a summary of Chapter Two.

Theoretical Framework

The theoretical framework that guided this study relied on three main concepts which all fall under a social-cultural perspective. Alexander’s (2003; 2006) Model of Domain Learning that described the importance of continual learning of reading strategies, Gee’s (1989, 2001) sociolinguistic theory related to power involved with language and learning, and Moje’s (2008)
and Shanahan and Shanahan’s (2008, 2012, 2017) theory on disciplinary literacy that recognized there are differences in reading and learning in various contexts work together to highlight important aspects of this study. Each of these theories is described below.

**Model of Domain Learning**

Alexander’s (2003; 2006) Model of Domain Reading (MDL) described reading as an ongoing process that does not stop once a person has mastered early reading skills such as decoding. I believe that adults continue to develop as readers throughout their lifetime or from “womb to tomb” (Alexander, 2006, p. 415). Alexander (2006) pointed out that adults are different from children and teens “cognitively, physically, and socially” (p. 415) and that their literacy demands have changed. I agree with Alexander (2003) that individuals are not either a novice or expert, but instead they move along a path from acclimation to competence to expertise. During this journey, professors must guide students through how to be “strategic within a domain, since their strategic processing will often be ineffective and inefficient when left to their own devices” (Alexander, 2003, p. 12). In addition, Alexander recognized that both the types of interest and strategy use change as people mature.

Two forms of interest influence students’ attention to a topic. Situational interest (Hidi & Renninger, 2006; Alexander & Jetton, 1996) occurred when something outside of a person grabs their attention. This may be from something occurring in a classroom, hearing a person talk about a topic, or reading something about it. On the other hand, individual interest is when a person is naturally curious about a topic, and it comes from within the individual. Situational interest does not typically last as long as individual interest, but sometimes situational interest is the first step that leads to individual interest. Professors can help to create situational interest in
topics or disciplines which can help increase students’ motivation to learn. However, as people mature and learn more about topics, individual interest is needed to improve reading and learning.

Similarly, strategy use changes over the lifespan. For new or unexperienced readers, surface strategies such as rereading are often used (Alexander, 2006). However, as people develop in their reading skills, they move towards deep-processing strategies which “involve the personalization or transformation of text” (p. 422). Individuals in this stage may make comparisons with other texts or begin to question what they read. Alexander (2006) also indicated that people should not be separated into “good” and “poor” readers, and instead said that it is more useful to consider individuals as moving along a continuum from acclimation to expertise. The differences in levels along the continuum are important to understand, so educators can help address the issues that may come up in the new situations adult learners face. In addition, professors can help guide students to appropriate reading and learning strategies for the individual disciplines.

**Sociolinguistic Theory**

Gee (2001) argued that language is used to “think about and act on the world” (p. 714). In addition, he stated that there are many different social languages which may help identify people in a specific group such as lawyers, doctors, or scientists. These social languages may assign people to, or keep people out of, a specific identity and are often learned by “scaffolding, modeling, and instructional guidance by mentors” (p. 719). Everyone belongs to a primary Discourse with their family that they learn as children. However, secondary discourses are used as people enter new situations such as schools, religious institutions, or businesses (Gee, 1989).
Individuals typically do not become fluent in these secondary discourses or social languages on their own; they need the help of others who are already part of the group. More specifically, Gee (2001) defined Discourses (with a capital D) as “ways of talking, listening, writing, reading, acting, interacting, believing, valuing, and feeling...in the service of enacting meaningful socially situated identities” (p. 719). In other words, for anyone to become part of a specific group, they must be able to participate in the Discourse activities. Therefore, for students to become part of the Discourse community, the “saying (writing)-doing-being-valuing-believing” (Gee, 1996, p. 127) combinations must match the expected activities and language of those within the Discourse. In addition, Gee (1996) stated that all Discourses are best mastered through acquisition and not learning. He said that acquisition happens subconsciously by exposure to models, trial and error, or watching, doing, and learning refers to knowledge gained by teaching or explanation and analysis (Gee, 2001, p. 539). Students need to have exposure to and practice with natural and meaningful literacy practices within the Discourse in order to become fluent in it. However, in order to critique a Discourse, one must have meta-level knowledge about it which is best done through learning (Gee, 1996, p. 145). This is important because students may need direct instruction in the ways of learning and thinking about a discipline, but they also need plenty of practice with applying and using the language and thinking skills in order to become a member of the Discourse community. Professors in the introductory biology courses need to allow students time and practice with the realistic literacy skills needed to become part of the Discourse community. Specifically, Gee (1989) argued that “Discourses are intimately related to the distribution of social power and hierarchical structure in society” (p. 2). Therefore, understanding the Discourses involved in disciplines must be explored and understood in order to help students become members of a discipline because anyone who does not correctly use the
Discourses will not be accepted into the discourse community. For example, students who do not correctly use the scientific language will not be accepted into the scientific community.

**Disciplinary Literacy**

Disciplinary literacy is based on the concept that each discipline has specific ways of reading, writing, thinking, and speaking which students can be taught in order for students to be brought into the field of study (Shanahan & Shanahan, 2008). Hinton and Suh (2019) completed a literature review of disciplinary literacy for the *Journal of Adolescent & Adult Literacy* and said that all of the articles described “disciplinary literacy as devoted to teaching discipline-specific knowledge and the means to enact practices unique to the discipline” (p. 281). Similarly, Holschuh (2014) described disciplinary literacy as “unpacking the ‘secrets’ of the discipline” (p. 89). These “secrets” must be unpacked in order to make them clear, especially for students coming into the discipline. Science, math, history, and English/language arts all have their own ways of making meaning and conveying information. Because biology has very different reading demands than other disciplines, it is necessary to understand what the reading expectations are for this discipline.

**Intersection of Theories**

These three concepts not only helped to frame the focus of this study, but they also shaped how I think about literacy and how I interpreted the data to determine the results of the study. For example, both reading expectations and language use change as people develop throughout their lifetime and move into a new Discourse. These changes need to be understood in order to help prepare students more effectively for the learning tasks and expectations of the
Discourse community of biology. In addition, because power belongs to the experts in a discipline, it is crucial to recognize what the experts do and expect from new members, in order for the power to be dispersed to the newer members or students. By examining the professors’ expectations, more information will be available to help improve students’ learning and understanding of the Discourses. Figure 1 is a visual explanation of connections between the theories.

Figure 1. Connection among theories in theoretical framework.
As students begin introductory-level biology courses, they encounter new ways of reading, speaking, writing, and learning. For students who are majoring in biology or a health-care field, these Discourses must be explored in order to help students become members of the biology community. Similarly, the differences between biology and other disciplines need to be considered to best identify ways to benefit students as they move into this new culture of college. Without understanding the expectations of professors, students will remain powerless and outsiders in this new world they are trying to join. Additionally, because reading expectations are different in college than in previous educational levels, the expectations must be made tacit for students, so that they can be successful.

College Success

Although my study focuses on the professors’ reading and task expectations, success in college courses is dependent on both the professors’ expectations and the students’ fulfilment of these expectations. For first-year college students, the expectations have often changed from high school, so they are often unaware of what they need to do to be successful. Professors can help students by explaining or modeling these expectations to students. Literacy research (Holschuh & Lampi, 2018; Mulcahy-Ernt & Caverly, 2018; Nist & Hogrebe, 1987; Paff, 2017; Weinstein & Acee, 2018) has identified several factors that may influence students’ success in college. Although these seem to be dependent on the student, professors can also help guide students into the appropriate Discourses and use of each of these factors. Exploring the professors’ expectations can help to determine what the Discourses are which can further help guide students into the appropriate reading, writing, speaking, and learning strategies to be used for the
discipline. These include study strategies, comprehension strategies, study time, and reading compliance. Each of these will be discussed below.

**Study Strategies**

Study strategies or learning strategies help students succeed in college courses. Weinstein and Acee (2018) explained that learning strategies “include any cognitive, metacognitive, motivational, affective, or behavioral process or action that facilitates the generation of meaningful and retrievable memories and increases the probability learning and the transfer of learning to new situations” (p. 227). Similarly, Al-Hilawani (2016) argued that study skills “help students during the learning process to acquire, retain, and produce the new information” (p. 75).

In their foundational research, Weinstein and Meyer (1986) proposed five general categories of learning strategies: rehearsal, elaboration, organizational, comprehension monitoring, and affective and motivational strategies. The first three are applicable to this study and will be discussed below. Rehearsal strategies are those techniques (such as highlighting or underlining) that are designed to help students identify the information from the text to be learned and to repeat the information to remember” (Mulcahy-Ernt & Caverly, 2018). Previous research has indicated that students who struggle with “literal comprehension strategies … are often unable to recognize important concepts and thus underline randomly (Caverly et al., 2000, p. 110). Other studies have showed that increased background knowledge in a topic increases a reader’s ability to underline appropriately (Nist & Hogrebe, 1987; Snyder, 1984). Therefore, students who place into developmental reading courses or beginning college students may need rehearsal strategy instruction to know how to identify important concepts or main ideas from texts, so they are able to highlight and underline effectively.
Elaboration strategies are designed to integrate new information with previous knowledge and can generate mental images to help students remember information (Mulcahy-Ernt & Caverly, 2018, p. 198). Annotating, summarizing, generating test questions, or self-questioning are common elaboration strategies. In one study, Simpson and Nist (1990) randomly assigned two classes to a textbook annotation treatment group and two classes to a preview-question group treatment. Both groups were instructed to keep track of the time they spent studying for each of three tests. The annotation treatment group was taught to annotate texts as a study strategy, and the preview-question group was taught to preview the text to determine the purpose and organization of the text. In addition, the students in the preview-question group were taught to create and answer questions about the text to check their understanding of the information of the text and to rehearse the concepts before the test. The results showed that the annotation group not only scored better on all three exams, but they also reported spending less time studying which showed that they were more efficient in their study methods. Summarizing has also been shown to be an effective elaboration tool for studying or learning (Graham & Herbert, 2010; Herbert et al., 2013). Kolic-Vrhonec et al. (2011) found that undergraduate psychology students who summarized scientific texts effectively also did better on measures of text comprehension.

The third type of strategies, organizational strategies, were used to recognize or recreate the structure of the text or to group similar information (Mulcahy-Ernt & Caverly, 2018, p. 198). Mapping, outlining, or creating mnemonics were considered organizational strategies. Research has shown that mapping and outlining were effective for improving learning for both low- and average-reading ability students (Amer, 1994; Boyle & Perego, 1991; Lipson, 1995; Spiegel & Barufaldi, 1994). Nesbit and Adesope (2006) completed a meta-analysis of studies that showed that completing concept maps helped students attain knowledge retention and transfer. More
recently, researchers have shown that effective learning happens when “cognitive, metacognitive, motivational, affective, behavioral, and environmental factors” (Weinstein & Acee, 2018, p. 229) interact in strategic ways. In other words, the learner must determine which strategies are appropriate and best to use in each context and apply them accordingly. However, because first-year college students may be unfamiliar with the most appropriate learning strategies, professors can help guide them to determine the best strategies to use for different content. Identifying the appropriate study strategies to use for each context leads to higher levels of success in college courses for students.

**Comprehension Strategies**

Another factor that can impact student success in college is reading comprehension because researchers estimate that over 80% of learning comes from independent reading in college courses (Nist & Simpson, 2000). Comprehension requires understanding “concepts, knowledge, phenomena, and language/terminology unique to a sociocultural context under examination” (Holschuh & Lampi, 2018, p. 119). Many first-year students struggle with comprehending challenging texts. The 2006 National Survey of American College Students (NSACS) found that although college students had higher prose and document literacy skills than the average American, 76% of students at the 2-year colleges had basic or intermediate literacy skills in both categories (Baer et al., 2006). These levels do not allow students to understand complex and lengthy texts or synthesize information which are skills needed to be successful in college courses. According to a 2016 U.S. Department of Education report, 28% of students enrolled in two-year colleges took a developmental reading or English course because they were considered unprepared for college level reading or writing demands (Snyder et al.,
Moreover, according to 2019 NAEP results, only 37% of high school seniors scored at or above the proficient level of reading. Finally, about 50% of college students are not able to comprehend complex texts (Kuh et al., 2005). With the number of students who struggle with understanding texts, identifying the professors’ expectations may help to develop instructional methods or reading strategies to increase student success.

Successful students often use comprehension strategies as they read. Students who place into developmental reading courses may spend time learning to apply these comprehension strategies to a variety of texts. Comprehension strategies include “metacognitive, cognitive, and affective” components (Holschuh & Aultman, 2000, p. 121), and although they may begin as teacher-directed strategies, ultimately, they should become generative strategies used by students (Simpson & Rush, 2003; Wittrock, 1992). It is important to remember that comprehension “strategies require purposeful effort and students generate meaning by building relations between the text and what they already know. Thus, the mind is not passive while reading; rather it is intentionally organizing, isolating, and elaborating on key information” (Holschuh & Lampi, 2018, p. 128). In other words, students need to be taught that the comprehension strategies require them to be active learners who take responsibility for understanding and learning the information. Research has shown that students who receive direct instruction in strategy use perform better than students who did not receive the instruction (Alfassi, 2004; Falk-Ross, 2002; Friend, 2000). Holschuh and Lampi (2018) also suggested that the comprehension strategies taught to students should be flexible, so students can use them in a variety of contexts. Because comprehension strategies are also affected by disciplinary conventions (Holschuh, 2014; Shanahan & Shanahan, 2008; Wineburg & Reisman, 2015) and the level of topic and domain knowledge of a learner (Alexander, 2003, 2012), there is not one specific comprehension
strategy that can be taught to students enrolled in an introductory biology course. Instead, it is necessary to determine the disciplinary expectations in order to help create the most effective comprehension strategies for students to use.

**Study Time**

American institutions of higher education use a standard measure of credit hours to determine the amount of learning that is supposed to take place in a course, but traditionally it has been based on the amount of time a student spends inside of a classroom each week (Shedd, 2003). The Carnegie unit was defined and accepted in 1909 and stated that a “satisfactory year’s work in any major subject cannot be accomplished in less than 120 sixty-minute hours or their equivalent” (Shedd, 2003, p. 7). However, the foundation that created the definition focused more on the amount of time spent on the subject instead of the amount of learning that was attained by the student (Kreplin, 1971). In 2009, the U.S. Department of Education updated the definition of a credit hour as:

An amount of work represented in intended learning outcomes and verified by evidence of student achievement that is an institutionally established equivalency that is not less than one hour of classroom or direct faculty instruction and a **minimum of two hours of out of class work for each week** for approximately fifteen weeks for one semester…or the equivalent amount of work over a different amount of time. (National Archives, 2010, emphasis mine)

This reinforces the commonly held belief and often repeated rule of thumb that students are supposed to study for at least two hours a week for each credit hour. However, the problem is that many students do not know what they are supposed to do during those hours each week (Paff, 2017). Professors tell them to read the textbook, but they do not typically explain what they want students to focus on during the reading. They tell students to study for the exams, but
do not give clear guidance on the best ways to do so. By understanding the professors’ reading and task expectations, clearer guidance can be given to students for the best ways to use this study time.

Understanding factors that can help students succeed in their first year of college is one way to improve teaching and learning. Study strategies, comprehension strategies, study time, and reading compliance can all impact first-year students’ success in their introductory courses. However, the literacy expectations are varied and complex in each of the different courses that students take, so it is also necessary to consider the disciplinary literacy expectations for college courses.

Reading Compliance

There have been mixed results on determining reading compliance of students. Some have found students often do not read what is assigned (Berry et al., 2010; Sikorski et al., 2002). Sikorski et al. (2002) found that about 80% of students surveyed at two different institutions reported either never or infrequently reading the textbooks for introductory courses and that they typically spent less than three hours on reading assignments per week. Other studies focused on reading compliance for specific disciplines. Starcher and Proffitt (2011) completed a descriptive research study and found that about 40% of business undergraduates at a U.S. school read less than half of the assigned reading and only 5% of students complete more than 75% of the readings. Yonker and Cummins-Sebree (2009) collected surveys from 298 Introductory to Psychology students. They found that 60% of students reported completing less than half of the reading assignments. Similarly, Clump et al. (2007) found that about 27% of students in psychology courses reported completing the required reading before the day of the lecture, but
the number jumped to almost 70% that completed the reading before the test over the material. Gurung and Martin (2011) ascertained similar findings with about 69% of students reporting that they completed the assigned readings. In an upper-level philosophy course, Brost and Bradley (2006) designed a course with a variety of readings assigned by guest lecturers. There were assignments and exams that covered the readings and lectures, yet most students reported reading just some or most of the readings. In science courses, Smith and Jacobs (2003) found that introductory chemistry students spent about 2.5 hours a week with their text and organic chemistry students disclosed reading their textbook for less than 3.5 hours a week. On the other hand, Armstrong et al. (2019) found that almost all students self-reported reading a majority of the texts assigned. However, this research depended on self-report findings and did not ask students to describe how well they were engaging with the text or understanding what they were reading. These findings suggest that while reading is expected for learning in college courses, it is not clear if students are completing the reading assignments effectively. Although these studies have focused on student reports of reading compliance, there has not been research that determined if students were meeting the professors’ expectations with the reading assignments because research does not clearly indicate what professors want students to do besides to finish the reading assignments.

Research on Disciplinary Literacy

Disciplinary literacy practices have been explored in several content areas. In literature, students must be able to make intertextual connections and understand rhetorical tools used by authors in order to make sense of texts (Flower & Hayes, 1981; Lee & Spratley, 2010). Reynolds and Rush (2017) found that the experts in English/language arts used their comprehension skills
to build an interpretation of the text that could be supported (or refuted) by further evidence in the text. In addition, Reynolds et al. (2020) described a heuristic of generating, weaving, and curating to help students understand the disciplinary process of reading texts for English/language arts. Science and mathematics also have specific expectations for reading texts. Johnson et al. (2011) identified that the focus for both mathematics and geography is on patterns. Both fields use patterns to understand the world more. Shanahan et al. (2011) analyzed expert readers in history, mathematics, and chemistry. They found that the experts in history focused on who or what caused something to happen, but the chemists were careful to not project agency onto the scientific term. For example, a person in history may have an intention to cause an interaction, but an atom in science does not. They also found that the experts in each of these fields used the text structure differently. Although the chemists and mathematicians used the “text structure to support understanding and to locate particular information” (p. 406), the historians used the text structure to understand how the information was organized. Holschuh (1998) also examined the differences in strategy usage for students in introductory-level biology courses with various epistemological beliefs. However, there continues to be a need for more specific information about what biology professors expect their students to do with the reading assignments for the introductory biology courses.

Other studies have investigated the features in textbooks and how they relate to student comprehension and interest (Mikk & Kukemelk, 2010; Wiley et al., 2017). Mikk and Kukemelk (2010) found that longer sentences decreased interest in the textbooks. They also established that more symbols and abbreviations in the text decreased students’ interest. Wiley et al. (2017) determined that the graphics in biology textbooks change from more realistic in middle school to more explanatory in college and that college students were more interested in the realistic
graphics, but they did not always understand what the functions of the graphics were. Although it was helpful to understand what students perceive about the books, it is also important to know what professors want students to focus on in the texts, so that students will know what to focus on while learning.

There have been numerous research studies that focused on aspects of reading in science or biology courses, but many focused on elementary, middle, and high schools (Berland & Reiser, 2009; Fang & Wei, 2010; Hogan et al., 1999; Lee et al., 1995; McNeill et al., 2006). For example, Fang and Wei (2010) used a quasi-experimental approach with sixth graders to examine if direct reading instruction with an inquiry-based science course would impact students’ overall reading compared to students in an inquiry-based science course. They found that the students who received the reading instruction scored better on all of the science literacy measures. McNeill et al. (2006) also worked with middle schoolers to determine if students who received faded scaffolding support would do better than students who had continuous support on the post-test. On the post-test, students in the faded support group gave stronger reasoning explanations than the students in the continuous support group. Hogan et al. (1999) examined discourse patterns of middle school students when a teacher was present and later absent from their small group discussions and found that teacher-guided discussions lead to higher levels of reasoning, but peer group discussions were more exploratory and generative. Other studies have focused on students at the university level (Brown, 1995; Holschuh, 2000; Scott et al., 2017), but they did not focus specifically on reading or task expectations for the courses. Scott et al. (2017) focused on determining the effect of class size on students’ engagement and performance, and Holschuh (2000) examined the strategy use of students in an introductory biology course. Brown’s (1995) study created an inventory to help place students in a supplemental instruction
course based on reading skills and interest level which was found to be helpful for students. Although some studies focused on improving argumentation or claims and evidence (Berland & Reiser, 2009; McNeill et al., 2006), none investigated what the specific reading and task expectations are for introductory biology courses.

There have also been studies that have focused on the types of texts that can help students overcome their scientific misconceptions. Refutational texts are those that show the differences between correct and incorrect ideas (Posner, et al., 1982). Hynd and Alverman (1986) discovered that refutational texts helped less-skilled readers to move past their misconceptions. Ariasi and Mason (2011) found that readers of refutational texts had eye movements that spent more time fixating on the information than those reading non-refutational texts.

Other research has focused on literacy more broadly to include reading, writing, listening, and speaking practices used in science courses. Tang (2016) investigated how science teachers used literacy in their physics and chemistry secondary classrooms in Singapore. The findings showed that listening involved students mostly listening to teacher talk and writing took up about 7 percent of the class time, but it typically was just copying down information. Less than 1 percent of time was spent on writing that involved summarizing, arguing, or explaining concepts. In addition, reading was not done in the classroom very often.

Understanding the reading demands that are required for the discipline of biology is one area that is needed to improve teaching and learning for introductory biology courses. By identifying the disciplinary expectations, instruction can be improved upon and students can make more informed choices about effective reading and study strategies to use in the course. In addition, it is necessary to understand the task demands required for the biology courses which will be explored next.
Research on Text and Task Demands

It wasn’t until the late 1980’s that research began to examine the reading and task demands at the college level. Orlando et al.’s (1989) foundational study was designed to determine what the reading demands were for first-year students in college and the students’ perceptions of the demands. Specifically, the researchers wanted to determine the amount of reading required for various courses, how the reading was connected to class activities, and the relationship between the reading assignments and the examinations. They surveyed two psychology professors and two American history professors as well as their students and found that many of the students believed the reading assignments had different purposes than the professors. For example, although one of the history professors believed the readings should introduce concepts not covered in class and provide a different point of view, most of the students believed the readings were only used to introduce or review concepts covered in class.

This line of research also began to uncover the reading expectations for various college courses. Orlando et al.’s (1989) study found that students were expected to read between 600 and 750 pages from their textbook during the semester for each course. In 1994, Chase et al. surveyed and interviewed faculty and students and found that in a university history class, students were expected to read about 80 pages per week and in a biology course, students had to read 45 pages per week between the textbook, lab material, and study guide. At their institution, Burrell et al. (1997) also used a survey for faculty members of the core courses (science, math, history, and English) and found that each core course expected students to read an average of 31 pages per week with a range between 15 and 61 pages per week. Colarusso (1999) collected surveys from faculty members as well. Most of the surveys were for first-year courses and about
60% of the respondents indicated that students needed to read between 200-600 pages of text for their course during the semester. More recently, Schnee (2018) found students reported having to read 30 pages or less each week for all of their classes combined. Although these studies helped to determine the number of pages that professors expect students to read, they did not help uncover what the professors expected students to do with the reading assignments.

Additionally, research suggested that there are differences in expectations for reading assignments in various college courses. Wambach (1999) found that science professors reported that the purpose of reading was to learn specific knowledge and facts to recall later, but mathematics and social science professors said that the purpose of reading was to be prepared for the class lecture and discussion. As noted above, Orlando et al. (1989) interviewed two history and two psychology professors and found that the psychology professors agreed that a purpose of reading the textbook was to review concepts discussed in class. One psychology professor stated that it should be to learn concepts not covered in class, while the other thought that the text should be used to help students discover alternative points of view. The history teachers both believed that the texts should be used to introduce topics not covered in class. This line of research started to shed light on understanding what students needed to do to be successful in college courses, but typically focused on the types and amount of reading materials that were expected for students to read and did not explore the tasks that were assigned with the reading assignments.

Reality Checks

In the 1990’s, some literacy research began to focus on both the tasks and texts that students encountered in their college courses (Simpson, 1996). This research focused on the
types of reading material being assigned to students and the relationship between readings and class activities, but also attempted to determine when the readings were expected to be completed, what types of tests were required, the levels of thinking required for tests, and the criteria used to evaluate written work for students (Simpson, 1996). This research was recommended for literacy professors who taught learning strategy courses so they could better prepare students for the tasks at their institutions (Burrell et al., 1997).

Several empirical studies focused on determining the reading and task expectations of various university courses. Burrell et al. (1997) investigated the academic literacy demands for the core courses at their campus by designing a survey that used both open and closed-ended questions and then used a qualitative content analysis for the open-ended questions. They found that there were differences in expectations among the disciplines. One difference was the amount of reading expected. For example, the social science/humanities professors expected students to read about 61 pages per week while the math/science lecture professors reported expecting students to read about 26 pages per week. Another difference was on the ways students were assessed on the reading material. 35% of the foreign language faculty reported that most of the test questions came from the textbook, but over 60% of the social science/humanities and math/science lecture professors reported that the majority of the test questions came from a combination of the text and lecture information which indicates that reading the textbook may be expected more in these courses. Other studies have focused on a single course. For example, Carson et al. (1992) focused on a first-year American History course to determine the reading requirements for students. They collected course documents, interviewed professors, collected surveys from students, and observed class sessions every week to determine the reading and writing expectations for the course, as well as the students’ responses to the expectations. They
found that the professors expected students to read “an average of 825 pages over the course of
the 10-week term” (Carson et al., 1992, p. 29), but also that the “reading assignments also
included reading maps and locating relevant features” (p. 29). In addition, students had to be able
to read their course notes and a book for a book review project. The focus of the reading was on
discourse skills such as:

those skills that allow students to recognize, synthesize, and retrieve information from
their reading, both across texts and across textbook chapters. In addition, students needed
to be able to see relationships between parts and wholes and between the specific and the
general in order to place events and/or persons in the appropriate historical context. They
were also required to retain facts and their significance (e.g., names, places, events,
documents) for rapid recall, and to relate new and old information as a way of directing
reading comprehension and of synthesizing notetaking and reading. Finally, students
needed to recognize noncrucial information in order to vary their reading strategies and
rates appropriately. (pp. 28-29)

Reading involved complex skills and comprehension strategies to be successful in this course. In
addition, vocabulary acquisition strategies were found to be important for success in the course.
Students were expected to use a dictionary and context clues to make sense out of difficult
words, and these words were needed to understand the historical events and how they were
related. These studies showed that reading is important for success in college courses, but
because the studies are dated and do not focus on biology courses, my study fills in a needed gap
in the literature on the reading expectations needed for the introductory biology courses designed
for STEM majors at community colleges.

Curriculum Audit Model

Later, research started to focus on determining the alignment between developmental
education courses and introductory general education courses (Armstrong & Stahl, 2017;
Armstrong et al., 2015, 2016, 2019; Greci, 2019; McClennen, 2016) and the career technical
education (Armstrong et al., 2021) at the community college level. Armstrong et al. (2015) undertook an evaluative study that focused on identifying the task expectations for developmental reading courses, general education (GE) courses, and career/technical education (CTE) courses, and how the expectations aligned in these courses at one community college.

They collected data from surveys and focus groups from both instructors and students. In addition, they analyzed the textbooks with several different readability indices. From these sources, they found that there was not a “consistent definition of college reading readiness” (Armstrong et al., 2015, p. 8). They also found that the developmental reading courses used different types and difficulty of texts from those being used in both the general education courses and the career/technical education (GE/CTE) courses. In the GE/CTE courses, the text was used to supplement the instruction and sometimes, “text alternatives, such as instructor lecture notes, PowerPoints, and outlines, were made available to students. In such situations, although the text was assigned, it may not have been read” (p. 9). The researchers found that students found these text supplements so helpful that they did not need to read the texts.

McClennen (2016) also investigated the alignment of task expectations by interviewing professors and observing both the developmental course and the first-year communication or English course at a community college and at a university. She found that in three of the four courses, the reading and writing tasks were aligned between the developmental course and the college level course and students were expected to evaluate sources and use critical thinking skills to make connections between texts. However, she also noted that it would be important to define what assignments or activities make up a literacy task before starting a study because many assignments include both reading and writing components and, in the English/communication studies courses that she researched, the tasks often built on each other.
and were part of larger assignments which made analyzing individual tasks more challenging. She also said that the alignment between these courses may have been because of the intentionality of connecting the developmental course with the introductory English course at both institutions. It is also important to determine what the reading and task expectations are in the introductory biology courses are in order to make sure that the developmental reading or literacy courses are able to prepare students for the demands of the biology courses because it is unknown at this time if this goal is being accomplished at many institutions.

Armstrong and Stahl (2017) emailed a survey to all full-time faculty members at a community college and 130 of the instructors responded (a 62% response rate). The survey asked the introductory level instructors how the developmental reading instructors could better prepare students for the introductory level courses. The instructors’ responses were grouped into five themes: reading comprehension, vocabulary instruction, emphasis on writing, study skills instruction, and disciplinary literacy instruction. Although many instructors indicated that the developmental courses needed to focus on comprehension, there was no clear definition or explanation of what college-level comprehension meant. The researchers noted that “These content faculty offered no evidence that they had any particular definition of reading comprehension in mind” (Armstrong & Stahl, 2017, p. 104). Therefore, more exploration and questioning of faculty members is needed to better understand what they expect students to do when they comprehend a text in each discipline.

Greci (2019) replicated parts of Armstrong et al.’s (2015) study at the University of Alaska Fairbanks. Greci also used classroom observations, surveys, and focus groups for both students and instructors to determine their “expectations, perceptions, habits, and practices” (p. 19) related to reading demands in both the developmental and 100-level courses at the various
campuses for the university of Alaska Fairbanks. Unlike the Armstrong et al. (2015) study, Greci (2019) found that the developmental courses used college-level texts and not workbook practice texts. However, she found that students reported not feeling prepared for the reading demands faced in college courses. Students struggled with both the amount of reading and the difficulty with comprehending the texts and remembering the details in the texts. Similarly, faculty members reported that students were not monitoring their comprehension or prepared for the reading demands of college courses. Faculty members also reported that students were not taking the steps to be active readers because they were not completing activities such as: previewing, rereading, annotating, summarizing, or notetaking during the reading process. Faculty at this campus also discussed the importance of student motivation to improve reading. This study focused on the professors’ interpretations of their students’ issues with reading, but it did not focus on what the professors expected students to do with the readings beyond the general recommendation that students need to monitor their comprehension as they read. My study builds on this study’s finding to determine the professor’s expectations for reading and tasks for the introductory biology course designed for STEM majors across five community colleges.

By building on both the reality check and curriculum audit models of literacy research, this study was intended to determine not only the specific, tacit reading and task expectations for the introductory biology courses, but it was also designed to investigate the implicit professors’ expectations that may not be clearly expressed to students. In order to fully understand these implicit expectations, research about professors’ expectations with reading and learning are explored below.
Research About Professors’ Expectations with Reading and Learning

Professors expect students to learn from their course readings (Simpson, 1984; Steuer, 1996); however, they have different purposes for students to read. Aagaard et al. (2014) argued that students need to be deeply engaged with the text before class, so they are familiar with the terms and concepts before the professor gives the lecture over the material. Reading is designed to prepare students for the lecture by having students increase their background knowledge about the topic. Still other professors pointed out that class time should be used for higher level learning which is only possible if the text is used to understand basic concepts before students attend class (Jones, 2011). Students are expected to complete the reading assignments in order to be prepared for active learning which requires having background knowledge about the topic. In addition, because college students are expected to be autonomous learners, many professors see reading as an important aspect of studying and learning the material (Railton & Watson, 2005). In other words, reading is an avenue to improve learning and one step in the study process, but the goal is to memorize the information. In addition, Armstrong et al. (2015) found that general education (GE) and career/technical (CTE) professors used texts to “support, or in a few cases supplement, the instructor” (p. 9) for learning concepts from the course. This also means that the text is designed to help students learn the information, but it is designed to be in addition to the classroom lecture or activities. Finally, it has been noted that to professors, textbooks “represent authoritative, received knowledge that students are expected learn rather than challenge” (Richardson, 2004, p. 518). All of these purposes for reading indicate that professors implicitly expect students to read the material in order to learn in some way. What is not well understood is
what professors expect students to be able to do with the information in the text which is what this study is designed to help uncover.

The extant research has also shown that professors have a variety of purposes for assigning college texts which may not connect with the students’ purposes for reading the texts. Jolliffe (2007) stated composition professors typically have four main functions for assigning texts for their students: “to get the gist,” or understand the big ideas, “read to complicate” or think about ideas in new ways, “bounce off” function or to connect the literature to their own lives, or “reading to imitate” or to give students a text to use as a mentor text. A 2013 study by National Council of Teachers of English (NCTE) indicated that there were three different types of reading tasks: to access and retrieve information, to integrate and interpret information, and to reflect and evaluate information. Del Principe and Ihara (2016) used a qualitative study to collect course materials from and interviewed ten students each semester for two years to determine the ways students described interacting with texts. They found that students described five main themes for interacting with texts. The first was to supplement lectures when they were confused about a topic covered in class. The second theme was when there was no class reading assigned or the texts listed on assigned on the syllabi were not used in the course, so students listened and took notes as texts. Third, students would use the text and “read to complete a task” (p. 233). In this case, students would use the text as a resource to complete a task or a project. The fourth theme was when students would analyze the text to identify style, form, or the author’s argument. The last theme was “reflecting on text” (p. 233) which occurred when students would respond to the text with a person reaction or opinion. Research has also indicated that students read in order to find information that they think will be on exams instead of trying to understand or explore concepts in more depth (Fox & Alexander, 2011; Linderholm, 2006; Manarin, 2012).
By understanding why the professors want students to read the textbook and what they want students to glean from the reading material, better suggestions on when to read and what to focus on during the reading sessions can be determined.

Because of the number of students who do not complete the reading assignments or struggle with reading, many professors have found ways to present the information so students do not have to read. Greenleaf and Valencia (2017) reported that ninth grade teachers in many subject areas found “inventive ways” (p. 236) to not have students work with texts. Instead, teachers would provide notes, have students listen to texts on audiotape, watch movies, or even read aloud to students. Richardson et al. (1983) mentioned that one community college professor went over the text during class time because they felt the students could not handle the reading assignments. These practices have been referred to as “workarounds” (Armstrong, et al., 2019; NCEE, 2013). Without knowing what professors want students to be able to get from reading the text, those skills cannot be directly taught to students and professors may continue to use workarounds instead of assigning the texts to students. Another issue is that there is no agreed upon definition of comprehension. Armstrong and Stahl (2017) noted that college faculty from their study did not have a specific definition for reading comprehension, yet they expected students to be able to do it. Further investigation is needed to determine what faculty members mean when they expect students to read their texts.

Although research indicates that professors want students to read their textbooks (Berry et al., 2010; Heiner et al., 2014), there is conflicting expectations about when and why the reading should be done. Some research indicated that professors expect students to read their texts before the class period (Aagaard et al., 2014; Gammerdinger & Kocher, 2018). These teachers depend on students reading their text in order to build background knowledge and have
familiarity with the topic and vocabulary during the course lectures. However, Lord (2007) argued that the textbook should be used to reinforce and expand on topics that were previously covered in the lecture and that students should not read the text until after the class is completed. In addition, Armstrong et al. (2015) found that at one community college, about 57% of professors expected students to read the text before class and 36% wanted students to read both before and after class. However, almost 21% of the surveyed students responded that they were unsure of when they were supposed to read texts.

**Task Demands**

Many of the tasks students are required to complete depend on reading or comprehending the course material. Simpson and Nist (2000) defined tasks as “the products students are asked to formulate” (p. 529). Richardson et al. (1983) reported that multiple choice and in-class essay exams were the most common forms of assessments at a community college. However, some students may not understand what their professors expect them to be able to do with the reading material (Holschuh, 2013; Schallert & Tierney, 1982). In a history unit, teachers indicated that the tasks included “identifying, evaluating, and discussing the significance of key events” (Hynd & Hubbard, 2004, p. 150) while students believed that their job was to memorize the information. Braine (1988) identified differences in expected writing tasks for students in different majors. For example, engineering students needed to write lab reports and research papers more frequently than students in natural sciences.

Required tasks at universities often compel students to take responsibility for their learning and rely less on teacher-created learning tasks (Tomanek & Montplaisir, 2004). Tomanek and Montplaisir (2004) analyzed student survey data and found that most students did
not create learning tasks for themselves and the ones that did, typically only focused on them to prepare for exams. In a Learning-to-Learn course, Hynd et al. (2004) created a task that required students to read three texts with conflicting ideas about the Tonkin Gulf Incident and use them to create their own account of what they believed happened. The task was designed to help students learn to think like historians and participate in a discipline-specific task. Additionally, Newman (2008) found that students enrolled in a developmental reading course at a community college who were taught to read like historians and use intertextuality had significantly higher scores on methods of evaluation than students in the control group who learned general reading strategies such as identifying the main idea or making inferences from texts. All of these tasks required students to take responsibility for their own learning of the material.

There are also different types of reading that can be considered different types of tasks. Caverly et al. (2000) distinguished reading from *textbook study reading* and defined it as “a strategic approach to reading in which students adjust their comprehending behavior before, during, and after reading with the purpose of satisfying a specific task” (p. 105). They described the importance of understanding the student’s reading ability and background knowledge, the instruction provided, the text or material used, and the task demand when determining learning strategies that are the most effective and efficient for students. Therefore, reading a text is a specific type of task that students need to understand the purpose for and adjust their reading strategies accordingly. In order to do this, it is critical to understand what professors expect students to do with the information they have read as well as determine what professors believe is important in the reading assignments.
Gaps in the Literature

Previous studies have focused on reading and learning expectations in university courses (Railton & Watson, 2005; Simpson, 1984; Steuer, 1996) and reading expectations in sciences in the elementary and secondary contexts (Berland & Reiser, 2009; Fang & Wei, 2010; Hogan et al., 1999; Lee et al., 1995; McNeill et al., 2006; O’Neill, 2001), but there is a lack of studies done at the community college level. Many studies have relied on surveys of students (Schnee, 2018; Sikorski et al., 2002; Yonker & Cummins-Sebree, 2009), students and faculty (Burrell et al., 1997; Orlando et al., 1989), or faculty (Colarusso, 1990), to determine reading expectations or demands. In addition, the studies have focused on students’ comprehension of texts (Kuh et al., 2005) but not the professors’ expectations in regard to reading the texts. Scholarship has also investigated disciplinary literacy expectations for physics (Tang, 2006), chemistry (Shanahan & Shanahan, 2008), literature (Lee & Spratley, 2010), English/language arts (Reynolds & Rush, 2017; Reynolds et al., 2020), mathematics (Johnson et al., 2011), and history (Shanahan et al., 2011; Wineburg, 1991; 1998). Research focusing on task expectations in community college (Richardson et al., 1983), writing, (Braine, 1988), and history (Hynd & Hubbard, 2004) has been completed, but there is a need for more up-to-date research specifically focusing on biology courses which this study helps to fill in. Finally, there has been research that focused on college success based on what students do (Clump et al., 2007; Tomanek & Montplaisir, 2004; Yonker & Cummins-Sebree, 2009), but there needs to be further research that also determines the professors’ expectations of students.
Summary of Chapter Two

Chapter Two began by introducing the theoretical framework that guided my study and continued by reviewing the literature related to aspects related to college success and factors that may influence students being successful in their courses such as their study strategies, comprehension strategies, study time, and reading compliance. I then discussed the research related to disciplinary literacy related to various disciplines such as history, mathematics, chemistry, literature, and English/language arts. Additionally, I continued with research that focused on reading and task demands at both the secondary and postsecondary levels in order to indicate gaps in the literature that helped to guide my study.
CHAPTER THREE

METHODS

This chapter describes the rationale and justification for the research methodologies used in this multicase study. I begin with the purpose and research questions of the study and then continue by explaining the research design. I then discuss the rationale for the study design before describing each of the cases. Next, I discuss the data collection and data analysis processes used. I end with the ethical considerations, including issues of credibility and trustworthiness that were considered during this study.

Purpose

The purpose of this qualitative, multicase study was to explore the professors’ reading and task expectations in introductory biology courses at five community colleges in a midwestern state. This study sought to answer the following research questions:

1. What are professors’ reading expectations in introductory biology courses designed for STEM majors at community colleges in a midwestern state, and in what ways are each professors’ expectations similar or different?

2. What tasks do biology professors expect students to be able to complete in order to demonstrate mastery of the course content?

Research Design

Using a multicase study methodology (Merrian, 1998), I examined five professors’ reading and task expectations for students enrolled in first-year biology courses at different
community colleges. The rationale for the research design and the context of the study are described below.

**Rationale for Qualitative Research**

Qualitative research data were gathered from the participants (Bloomberg & Volpe, 2016). Patton (2002) described three types of qualitative data: interviews (with open-ended questions), observations, and documents. My study focused on determining what professors expected their students to do while completing reading assignments and the tasks that must be completed for the class with the readings. Identifying and explaining the reading and text-based task expectations in first-year biology courses were best done with interviews and document analysis which lend themselves to qualitative research (Creswell & Creswell, 2018; Mertens, 2015). Mertens (2015) explained that in qualitative research, the researcher does not start with expectations of specific findings. Additionally, Denzin and Lincoln (2011) explained that “qualitative researchers study things in their natural settings, attempting to make sense of or to interpret phenomena in terms of the meanings people bring them” (p. 4). For this study, I used interviews and documents to gather participants’ perspectives and explanations of the reading and task expectations.

Another important factor for using qualitative research for this study is that often qualitative research is grounded in the constructivist paradigm. Specifically, social constructivism describes that reality is “socially, culturally, and historically constructed” (Bloomberg & Volpe, 2016, p. 42). The participants in my study are all impacted by the culture of academia and their field of study – biology. In other words, the context of the research study is important because the participants’ values and background impact their reality. In addition,
reality is not considered one absolute truth, but instead, it is based on the fact that “individuals develop subjective meanings of their own personal experience, and that this gives way to multiple meanings” (Bloomberg & Volpe, 2016, p. 43). This research study was grounded in constructivism because the goal was to determine each participant’s truth and explanation of their reading and task expectations for their students. My goal was to understand the participants’ expectations for their students.

Case studies are a type of qualitative research (Merriam, 1988) because the goal is to describe an in-depth study of individuals or groups. In this study, I wanted to understand what professors expect from their students in introductory biology courses designed for STEM majors, so I could better understand what students need to do to be successful in the introductory biology courses. Understanding the reading and task expectations is important for several reasons. First, recognizing the expectations can help professors improve their teaching methods. Second, this can also help students improve their learning. Finally, the findings can help to improve curriculum for developmental education reading courses.

**Rationale for Case Study**

Case studies are used in qualitative research because they allow the researcher to describe and analyze a specific process or activity in-depth (Creswell & Creswell, 2018). A case can be defined as an individual person, a group, or classrooms and institutions, and it must be a bounded system (Creswell & Creswell, 2018; Mertens, 2015). A bounded system, according to Merriam (1998), has to be “a thing, a single entity, a unit around which there are boundaries” (p. 27). In other words, there must be a way to define what is included and what is excluded from the case.
Merriam also noted that there must be limits to the number of people who could be included in each case.

The three main methodologists of case studies (Yin, Stake, and Merriam) have different beliefs about knowledge creation, design protocols, and data analysis methods that need to be considered. Stake and Merriam both defined a case as requiring examining “a thing” with a specific boundary (Yazan, 2015, p. 138). Yin elaborated that it must be in a real-life context and that the “researcher has little control over the phenomenon and context” (Yin, 2003, p. 13). In addition, both Stake and Merriam used constructivism as the foundation for their epistemological commitments (Yazan, 2015, p. 137), but Yin used positivism for more objectivity. Another difference is the degree of flexibility in the design. Stake allowed for the most flexibility in design and stated there may be major changes throughout the research project. Yin was not flexible in the design and expected all steps to be carefully planned out before data collection begun. Merriam is in between the two and has suggestions for how to complete each of the steps, but recognized there may be slight changes along the way (Merriam, 1998). Yin focused on both qualitative and quantitative data to analyze and suggested using pattern matching, explanation building, and cross-case synthesis while analyzing the data (Yin, 2003, p. 109). Both Stake and Merriam suggested collecting and analyzing data at the same time (Yazan, 2015), but Merriam gave six specific strategies for analyzing data, including ethnographic, narrative, phenomenological, constant comparative, content analysis, and analytic induction (Merriam, 1998). Merriam also proposed that data collection be driven by data analysis throughout the project (Merriam, 1998). Based on these characteristics, I find myself most closely aligned with Merriam because of the constructivist viewpoint, flexibility allowed within the data collection, and content analysis data analysis strategies.
In addition, Merriam (1988) discussed that case studies are often used to examine a current or contemporary phenomenon. Disciplinary literacy expectations have become a point of interest for literacy researchers over the last few decades. For example, Brozo and Crain (2018) investigated a disciplinary literacy strategy for a middle school mathematics class that asked students to use writing as a way to document their problem-solving methods. Cramer (2016) explored how a variety of content area high school teachers defined and used disciplinary literacy strategies with their students.

Merriam (1998) explained that case studies have three defining features which all apply to this study. First, a case study is particularistic which means that it must “focus on a particular situation, event, program, or phenomenon” (p. 30). For this study, I focused on specific professors’ courses, and all courses were designed as introductory biology courses for STEM majors. By focusing on this particular course, I was able to compare findings across the different professors’ courses which created a multicase or comparative case study (Merriam, 1998, p. 40). A case study was also intended to be descriptive (Merriam, 1998) and gather rich and complete details of a specific situation. Because this study gathered information from a variety of sources, including professor interviews and content analysis of syllabi, assessments, assignments, and laboratory activities, there was a rich description of data available for analysis. Finally, Merriam (1998) also stated that case studies are heuristic. This means that the case study “can bring about the discovery of new meaning” (p. 30). One goal of my study was to add to the knowledge about disciplinary literacy expectations for biology courses in order to help improve biology course instruction and learning strategies for students. In addition, the disciplinary literacy expectations could be used to improve instruction for developmental reading courses by helping students understand the reading expectations that are specifically needed for biology courses.
In this study, I used a qualitative research design in order to better understand the professors’ reading and task expectations for their students. Bloomberg and Volpe (2016) emphasized that qualitative research is focused on determining how events or ideas “are experienced, interpreted, and understood, in a particular context, and at a particular point in time” (p. 41). My study specifically focused on introductory biology courses designed for STEM majors at five community colleges in a midwestern state. Bogdan and Biklen (2007) also stated that qualitative research is descriptive because the collected data focused on words or pictures instead of numbers. For my study, I focused on collecting data that used professors’ words to describe their expectations for reading and tasks in their introductory biology courses. Additionally, Merriam (1988) defined qualitative research as “an umbrella concept covering several forms of inquiry that helps us understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible” (p. 5). By using documents that professors had already created for their students, I was able to collect data in an unobtrusive manner.

Participants

The participants in my study were five professors who taught the introductory biology course designed for STEM majors at their institution within the previous two years. Below, I describe the sampling procedures used to gather the participants and information about each of the community colleges.

Sampling and Participant Selection

The sample for this study was a convenience sample because the respondents were “chosen based on their convenience and availability” (Creswell & Creswell, 2018, p. 150).
Although convenience samples may be considered less desirable than random or systematic sampling, for my study it was appropriate because participants needed to live within a reasonable driving distance and teach at a community college in the midwestern state. However, the sample was also purposeful (Bloomberg & Volpe, 2016) because I needed participants who taught the introductory biology course designed for STEM majors within the past two years. That narrowed down the pool of participants from each institution that could be involved in the study which also contributed to the need for a convenience sample.

To gather participants for this study, I identified ten community colleges that were located within a three-hour drive of my home. From there, I went to each institution’s website and identified email addresses for either the dean in charge of the biology department or the individual faculty members in the biology department, depending on the information available on the institution’s website. For the institutions that did not identify the faculty members who taught specific courses, I contacted the dean in charge of the biology department in order to determine the correct faculty members to contact. I sent an email that explained the purpose of my study and asked the dean if they could either forward my email or suggest anyone who might be interested in participating (See Appendix A). For the institutions that I could find individual email addresses for the professors, I sent an email that explained the purpose of the study and the time commitment needed to each of the professors who were assigned to teach the introductory biology course designed for STEM majors either in the current or previous semester (according to the institution’s registration website).

After two weeks, I had received a response from one institution, so I followed up with a second email to the faculty members, and I called the deans of the three institutions that were the closest to me. At that point, the deans reached out to their faculty members and asked them to
contact me to participate if they were interested. All three institutions had one professor who emailed me to say they were interested in participating, so I started filling out the IRB forms for the four institutions.

After three more weeks, I sent one last email to the six institutions that I had not heard back from. One more professor responded and agreed to participate, so I completed the IRB process for that institution. Overall, this led to a 50% response rate from the original ten institutions contacted. The five participants were three females and two males and had all been teaching for over five years. In addition, the institutions were from a wide range of different areas and served a variety of student populations.

Case Information

In my study, I considered each professor as a separate case. In this way, both the professor’s expectations and the institution’s requirements of reading and task expectations for the introductory biology course created the boundaries of each case. Because I treated each professor as a bounded system (Merriam, 1998), I was able to determine patterns about the reading expectations such as the ways reading are used both inside and outside of the classroom to improve learning and what types of skills are expected by each professor to complete tasks for the course. I wanted to determine the expectations for introductory biology in order to add to the knowledge of disciplinary expectations. Finally, a case study allowed for a holistic perspective between similarities and differences between the reading and task expectations of the professors for the first-year biology courses because I examined each professor’s expectations on their own and then compared them to each other.
Specifically, this study is a multicase study. According to Bogdan and Biklen (2007), “When researchers study two or more subjects, settings, or depositories of data they are usually doing what we call multicase studies” (p. 69). By focusing on each participant as a different case, I collected and analyzed the data from five different participants and settings. Additionally, this study is considered a comparative case study because the data are being compared and contrasted across the cases (Bogdan & Biklen, 2007).

Merriam (1998) also pointed out that qualitative researchers are interested in the way people make sense of their experiences, which is an important aspect of this case study. By interviewing the participants, I was able to ask them to share their expectations and their explanations for why they have their expectations. These interviews allowed me to better understand their expectations and explain them from the participants’ perspective. Finally, Merriam argued that a case study should be focused on a specific group and allow the researcher to discover something new about the case (Yazan, 2015) which fits with my goals for this study. For example, I focused specifically on particular professors, so I could better understand their distinct reading expectations in order to best explain my interpretation of their expectations.

Institutional and Participant Contexts

Each of the five community colleges in this study serves a unique district of students. Some districts are mostly urban areas or rural areas, and others have a mix of urban, suburban, and rural areas that feed into them. The institutions also vary in size from about 3,000 students per year to over 25,000 per year. These community colleges allowed me to gather input from faculty from a variety of different settings. By gathering data from a variety of settings, I was able to see if there were differences in reading and task expectations between the institutions and
instructors. To keep track of the cases, each was labeled with a specific letter, so the five cases are known as Case A, Case B, Case C, Case D, and Case E. All participants names are pseudonyms. I also have listed the demographic information based on the largest categories or how it was presented on each institution’s website.

Case A’s institution had just over 15,000 students enrolled in 2018, and 28.4% of the students were enrolled full-time (12 or more credit hours). From the institution’s reported data, 54% of enrolled students were female, 42% identified as Hispanic or Latino, 40% as White, 7% as Asian, and 5% as Black or African American. In addition, 54% of students were traditional college age (22 and under). This institution has feeder high schools from urban, suburban, and rural areas. The professor in this case, Ben Hanscom, started teaching at Institution A in 2009. Before that, he taught at Institution E for three years.

Case B’s institution had 24,900 students enrolled in 2018, and 32% of the students were enrolled full-time. The institution reported 54% of students identified as female and 1% didn’t report their sex or it was listed as unknown. Additionally, 50% of students at this institution identified as White, 26% as Hispanic/Latino, 11% as Asian, and 7% as Black or African American. For the ages of students, 23% were recorded as 18 and under and 45% of students as ages 19-24. This college serves students from urban and suburban areas. The professor in this case, Ann Patrick, started teaching at Institution B in 2000 and taught at a different college for four years before moving to Institution B.

Case C’s institution reported 10,668 students enrolled in 2018, and 42% were full-time. About 77% of this institution’s area is considered rural with the rest of the area being suburban areas. About 65% of the students identified as White, 22% as Latino, 2.5% as Asian, and 1.7% as African American, and 53.5% of students identified as female. The institution’s data reported
45% of students were between the ages of 17-20 and 22% were between the ages of 21-24. The professor in this case, Cody Jacobson, started teaching at Institution C in 2017. He was an instructor at a local university for five years before that. In addition, he had been an adjunct instructor at three different community colleges between 2008 and 2020. One of the differences that he noted was the smaller class sizes at the community college made it easier to have a “small, intimate setting” and to be able to keep track of students.

Case D’s institution reported just over 3,500 students in 2018. Almost 80% identified as White, 7% identified as African American, and 3.5% as Latino. In addition, 61% of students identified as female. Almost half (47%) of students were between the ages of 17-20 and 12% were between the ages of 21-24. This college serves students from mostly rural areas. The professor in this case, Karis Guffey, started teaching at Institution D in 2009. She had also taught middle school for four years before that.

Case E’s institution had 12,763 students for the 2018 school year. The institution has a majority of female students (57.4%), and 47% of students were enrolled full-time. Furthermore, 61% of the students identified as White, 20.7% as Hispanic/Latino, 8.5% as Black or African American, and 2.7% as Two or more races. This institution serves students from rural, suburban, and urban areas. The professor in this case, Joan Kafer, started teaching at Institution E in 2000. Before that, she taught at community college in a different state for four years and was a temporary full-time instructor at a university for one year.

Course Considerations

Introductory biology courses were chosen because a majority of students in community colleges are required to take at least one semester of a natural science course that includes a
laboratory component and many students choose biology for that requirement (American Association of the Advancement of Science [AAAS], 2009). In addition, for many STEM degrees, biology is a required course. There are typically different introductory courses for students who are majoring in a STEM area than students who are non-STEM majors. This study focused on the course at each institution that was designed for STEM or health-career majors because this course has been found to have high failure and attrition rates in previous studies and institutions (Brown, 1995; Freeman et al., 2011; Tawde et al., 2017). In addition, introductory biology courses are often “gatekeeper” courses that may prevent students from moving on to their intended field of study (Scott et al., 2017, p. 93).

In addition, because there are students who place in developmental reading courses who plan on continuing on to a science or health-career field, the introductory biology course designed for STEM majors will be a requirement for those students. Since many of the professors for the reading courses are trained in literacy, having more specific knowledge about what biology professors expect from their students during their reading assignments and tasks will allow the reading professors to better prepare their students for their future courses.

Data Collection Methods

Because a case study design requires a wide range of data to analyze (Merriam, 1998; Stake, 1995), this study collected data from two main sources. These sources include documents and professor interviews and are detailed below.
**Documents**

For this study, a variety of documents were collected for analysis. Professors were asked to share their course syllabus, assignments, tests, quizzes, and laboratory materials to help determine how the expectations are explained to students. Bloomberg and Volpe (2016) contended that content analysis could cover a wide range of written records that are typically created for reasons other than the research study. These documents allowed the researcher to gather information that can be used to supplement data collected by other means. For this study, the documents helped me determine what written explanations or expectations were given to the students. They were also used to supplement the information from the interviews. Guba and Lincoln (1989) distinguished records and documents as having different purposes. Charmaz (2006) referred to these as extant texts and recommended paying attention to the reasons and time in which the texts were created. I asked the participants to send me documents from the most recent semesters in order to make sure that the extant texts were current.

When scheduling the interview with each participant, I asked them to send me their course syllabus through email before the interview. In addition, I mentioned that it would be helpful if they could send me a sample assessment, laboratory assignment, or other assignment that they would be willing to share. All of the participants sent their syllabus within a few days of scheduling the interview; however, none of them shared the other materials before the interview. During the interview, when a participant mentioned an assignment or laboratory activity that they assign to students, I asked them if they would be willing to share it with me, and then I followed up with an email request after the interview. In the email, I also asked them
to send me a sample assessment that they would be comfortable sharing with me. Table 1 shows the documents collected for each case.

Table 1
Documents Collected and Analyzed for Each Case

<table>
<thead>
<tr>
<th>Case</th>
<th>Course syllabus</th>
<th>Sample Assessments</th>
<th>Laboratory Materials</th>
<th>Sample Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>E</td>
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</tbody>
</table>

Before each interview, I reviewed the syllabus from the participant in order to determine additional questions that I needed to ask during the interview. First of all, I reviewed the number and types of assessments that were listed. I also recorded the grading scale and how the points were distributed across lecture and laboratory activities. In addition, I reviewed the course schedule to determine the number of chapters that were assigned for students to read each week for both the lecture and laboratory sections of the course. Finally, I wrote down the course objectives in order to discuss each of them with the participant during the interview. Reviewing each syllabus allowed me to create individual questions for the interview, in addition to the standard questions for every participant.
Interviews

Creswell and Creswell (2018) said that interviews allow the researcher to gather information that cannot be gained from observations. In addition, interviews allowed for historical information to be collected. Open-ended questions (See Appendix B) guided the interview process to gather data about how the professors’ view reading and task expectations they have for students related to the reading demands in biology courses. Each participant was interviewed once and each interview lasted between 30 and 60 minutes. Follow up questions were sent through email if needed. Interviews were audio recorded and transcribed using Otter.ai software. After the initial transcription, I listened to each of the recordings and double-checked the transcripts for accuracy. Any vocalized pauses (um’s and ah’s) were deleted to help clarify ideas.

I also used interviews to gather information from the professors about the course reading and task expectations. Patton (2002) described three main types of interviews. The first was an informal or conversational interview which has also been called “unstructured interviewing” (Fontana & Frey, 2000). In this type, the interview questions not determined ahead of time because the researcher’s goal is to have informal conversations to gather information. This type of interview allowed for flexibility in order to be spontaneous and learn as much as possible about the topic. On the other end of the spectrum, Patton (2002) described a structured approach that uses an “interview guide” (p. 343) which lists the questions to be discussed. Interview guides helped to ensure that each interview covered the same topics and allowed for consistency between interviews. Finally, Patton (2002) described a combinational approach which uses “a standardized interview format…and leav[es] the interviewer free to pursue any subjects of
interest during later parts of the interview” (p. 347). For my interviews, I used a combination approach (or a semi-structured interview) and created an interview guide which specific questions and topics to ask in a particular order, but I also followed up on participants’ responses with different questions to gain more information about their responses. For example, during Ben’s interview, he mentioned that he didn’t think many students were completing the assigned readings, so I asked him if he could clarify how many he would guess actually complete the assignments.

Questions on the interview guide were designed to be asked in a specific order. For example, questions at the start of the interview were designed to get background information about the participants but also to help them feel more comfortable with me. Participants were then asked about the course set-up, course expectations, and students’ perceptions of the expectations (See Appendix B). To create the interview questions, I referred to my research questions and created questions that would help get the information needed to answer them. In addition, I reviewed several sample biology syllabi of non-participants to determine what questions I had about the documents and what I needed to understand in more depth. For example, after reviewing the sample syllabi, I realized that most professors gave students a schedule of what to read, but there was not any information on what they expected students to do while they were reading. Therefore, I decided to ask each participant to explain what they want their students to focus on while they are reading the various assignments.

The interviews were designed to be face-to-face. However, one participant requested a phone interview, so after getting a revised IRB approval, we completed the interview in that manner. All interviews were scheduled based on the participant’s availability, and the face-to-face interviews were held at a mutually agreeable place. Several professors chose to have me
meet them in their office or classroom, but one asked to meet at a coffee shop that was closer to his home. Each participant was interviewed one time, and the interviews lasted between 30 and 60 minutes. The average interview was about 50 minutes in length.

Data Analysis

There are several terms used to describe the analysis of documents. For example, document analysis, document review, content analysis, and thematic analysis (Braun & Clark, 2006) are all terms that are used to refer to analyzing written documents. For consistency, I used the term content analysis. Wolcott (1994) described analysis as “the identification of essential features and the systematic description of interrelationships among them – in short, how things work” (p. 12). For my study, this definition guided my analysis of both the content analysis and interview transcripts because I was sorting and analyzing data to determine what the reading and task expectations were for each of the cases.

For both types of data, I used Merriam’s (1988; 1998) advice for researchers who are undertaking a case study and examined the data with three levels of analysis. The first level included organizing the data topically. The second level of analysis involved categorizing the data. The third level of analysis included making inferences and creating themes from the codes. I describe each of these levels with the different types of data below.

Content Analysis

Content analysis was used to provide data and to verify findings from other sources (Bowen et al., 2009). Before the first level of analysis, I spent time reading and reviewing all of the documents by reading through one syllabi per participant, class assignments, tests, and
quizzes that were collected. As I read, I paid attention to the types of information that were included in each document. Then, when I reread the documents, I focused on a specific type of document for each case. For example, I reread the syllabi for each of the cases, and then went back and read the sample assessments for each of the cases. Then, to start the analysis process for level one, I needed to organize the documents. I followed Merriam’s (1998) suggestion and organized the documents topically. I uploaded all of the documents into NVivo 12 and saved each document as the case name and type of document. I chose NVivo 12 because it allowed me to have a digital space that was secure to search for data across nodes or data types. For example, the syllabus for Case A was saved as Case_A_syllabus. In addition, during the first level, I began open coding (Corbin & Strauss, 2008) the documents with my codes which were created based on descriptions from the types of reading I had noticed the professors mentioned in the interviews such as in-class reading, lab reading, or reading expectations. In addition, other codes came from information that I had recognized that were common in all of the professors’ syllabi and connected to my research questions such as grading and tasks. In addition, codes were developed as documents were analyzed such as advice, book requirements, course outcomes, and course schedule. Hoffman et al. (2011) noted that it is useful for analyzing and describing written texts. They also stated that inferences can be made from the documents about the characteristics and effects of a text.

At this point, I moved on to level two of the analysis process which involved categorizing the data. I began by reviewing the documents and making sure that all of the appropriate information was coded. Once documents had been coded, the codes were listed and compared to identify themes and patterns within and across cases. Glaser and Strauss (1968) called this constant comparative analysis because the cases were compared for similarities and differences.
The constant comparative method also involved breaking the data into smaller units (Lincoln & Guba, 1985) which could be compared. For example, test questions started by being coded as *assessments*, but then in the second phase of coding, I split the code (Miles & Huberman, 1984) into different levels of questions according to Bloom’s taxonomy levels in the Cognitive Domain (Bloom, 1956). The split codes were *knowledge, comprehension, application, analysis, synthesis,* and *evaluation.*

In addition, I created a chart to keep track of information from the documents (Appendix C). Appendix C was a document that was filled out for each participant’s syllabus. There was a chart to record the chapters and pages that were assigned for reading each week of the semester. There was another chart to record the tasks that were assigned during the semester along with the grading percentages for each task. In addition, there was space allotted to write the directions for each task explained on the syllabus. Finally, there were two questions that were designed to record the types of exam and quiz questions that were explained on the syllabus. These completed documents allowed me to compare information between syllabi in a methodical and organized manner. The documents were filled out for each participant and then uploaded into NVivo 12 before coding each of them. Because the assignments were very different from each other, it was difficult to make comparisons between them. However, Appendix C did allow for comparison of tasks required to complete each assignment.

**Transcript Analysis**

Analysis of the interview transcripts followed the same levels as the content analysis. The first level included organizing data topically. To do this, I transcribed the interviews using Otter.ai software and reviewed the recordings to check each transcript for accuracy. Where
corrections were needed, I stopped the recording and fixed the errors. Vocalized pauses (ahs and ums) were deleted. The transcriptions were then uploaded into NVivo 12 with each file saved as the case name and type of document. Both a priori and open-coding techniques (Bogdan & Biklen, 2007) were used. I created a priori codes from major topics in my research questions. For example, when a professor mentioned their expectation for reading in the interview transcript, I used the a priori code reading expectations to label that information. For research question number two, I had identified the a priori codes assessments and grading to distinguish between the various expectations. Assessments focused on descriptions of tests or quizzes and included the number of assessments, as well as the types of questions that were asked with the tests or quizzes. On the other hand, grading was used to code information that described how students would earn the grade for the course.

The second level of analysis involved categorizing the data. To do this, I reread the transcripts and began to label information with open coding techniques (Corbin & Strauss, 2008). For example, I noticed that the participants described their perceived differences between biology and other science courses, so I coded their responses as differences. In addition, I noticed that each of the participants mentioned advice that they had for students, so I coded these sections as advice. Some of these were pointing out resources on campus, but others were more personal suggestions for how students could be more successful in the courses. Similarly, the professors frequently mentioned ways that students could study effectively for biology, so those ideas became coded as how to learn in biology. In addition, one of the interview questions asked the participants to define biology, so definitions became another code. Also, during this second level of analysis, I used Miles and Huberman’s (1984) suggestion to split the codes to make the categories more specific. I split reading expectations into in class reading and lab reading to
distinguish between types of reading expectations that were specifically mentioned for either in-class time or during laboratory time.

Bloomberg and Volpe (2016) described an editing approach to coding as one that uses emergent codes to best classify the information in a logical fashion. In this case, codes were created around reading and task expectations identified in the data. The data analysis process was recursive throughout the data collection process which allowed for new codes to be created and to determine the connections between and across cases. Therefore, new data were analyzed and compared to previous data throughout the collection process to see if new codes should be added and previous data recoded. However, after I had gone through the data three times, I did not find any new codes to add. At this point, my codes were advice, concerns, definition, differences, grading, reading expectations, and tasks.

Table 2 shares sample codes for participants. The in-class reading codes typically focused on what the professor did with reading during class (lecture) time. The lab reading codes described what the professors expected their students to use reading for during the laboratory time. The reading expectations code was used to identify places where the professors explicitly explained the tasks professors expected students to complete.

The third level of analysis included making inferences and creating themes from the codes. For example, at this point, I determined that there were codes around “reading expectations” for both lectures and laboratory activities, so these were grouped together under the theme reading matters. Similarly, I had coded information as institution ideas for an idea that a professor had shared about what her institution had done in the past to help students be successful in the biology courses. However, after I finished coding, I realized that there was only
## Table 2

### Coded Example Passages

<table>
<thead>
<tr>
<th>Case A</th>
<th>Case B</th>
<th>Case C</th>
<th>Case D</th>
<th>Case E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-Class Reading</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>There was no discussion of in-class reading expectations from this interview.</td>
<td>“I still use transparencies and PowerPoints (in class)”</td>
<td>“In the lecture, I tried not to have them reading walls of text. But, reading graphics is huge. Sometimes, I’ll even put a figure up on the screen.”</td>
<td>“I have my PowerPoint (on the screen)...and they take notes and things like that and then other samples that are put up there.”</td>
<td>There was no discussion of in-class reading expectations from this interview.</td>
</tr>
</tbody>
</table>

| **Lab Reading** | | | | |
| “They will be reading the manual.” | “There are questions in the lab manual.” “A lot of what is being taught in lab reinforces what you’re learning in lecture.” | “The manual has explicit instructions. It’s just that they didn’t take the time to read that I can tell” | There was no discussion of reading expectations during laboratory during this interview. | “have labs that have protocols that they’re supposed to read.” “A lot of this is instructions, but there’s this sort of introduction, you know, explanations and terms and things that they need to pay attention to.” |

| **Reading Expectations** | | | | |
| “The first thing I would say (is) I just want you to read it first time. Don’t worry about trying to do anything, just read it. Then, read it again. This time, write down words you don’t understand, make a Quizlet or note cards with the vocab terms.” | “There is a summary at the end of the chapter...and it has a nice encapsulation of what the chapter covers. And so what I tell them is read through that … and go back to the parts that you don’t understand and look those up in the chapter.” | “...read the chapter before we talk about it in class.” “I also tell them you felt like you didn’t absorb anything, but you primed it right, you laid the foundation for the second time around. So, keep that up, even if you feel like you didn’t absorb anything. It didn’t hurt you.” | “I try to tell them that I would hope that as they’re reading, they’re trying to understand the material, and they’re not trying to memorize it as they go.” | “I would definitely want them to take notes on that chapter...to essentially outline it and boil it down to what are the major points...and how are these points organized in a way that makes sense.” |
one item under that code, so I combined it with the *advice* code. Information from the code *advice* was transformed into the theme *supports matter*.

Data analysis concluded after I had reviewed the documents and codes multiple times and reached data saturation of themes.

**Cross-Case Analysis**

After completing the within-case coding process, I went back through the data again and coded for cross-case analysis. This time, I specifically focused on making sure that I used the same codes throughout each of the cases. For example, I looked for examples of *grading* or *success* that I may have missed the first time going through each of the cases.

During the cross-case analysis, I viewed each of the nodes/codes in NVivo 12 to see how the data from each case was similar and different from each other. For example, under the code *definition*, I could easily see that each professor may have started with a basic definition of biology as “the study of life,” but then they each went on to describe it in different ways, yet most of them also focused on the wide variety of areas to specialize in the field of biology. Their unique perspectives and definitions brought to light their own perspectives on why they believe studying biology is important. This led to the development of the first theme: Biology is a unique and diverse discipline.

Additionally, after I coded the interviews for each case with the first level of coding, I analyzed the interviews again and coded for patterns (Saldana, 2009). I created three new “pattern codes” that were used to “identify an emergent theme, configuration, or explanation” (Miles & Huberman, 1994, p. 69), and I continued to use open coding (Glaser & Strauss, 1967) to determine these codes. For example, I coded any descriptions of resources that could be used
by students to improve success as *college resources*. In addition, I coded *reading and success* to identify places where the professors mentioned how and why reading affected success in their courses. For example, Anne mentioned that she talked to her students about the importance of reading “the first day and then I bring it up a couple more times.” Finally, I identified and coded places where different purposes of reading were identified and explained as *reading purposes* and this led to the development of the second theme: Reading matters and has several different purposes.

The third theme was identified by returning to my second research question and reviewing the coded sections labeled as *tasks*. As suggested by Bloomberg and Volpe (2016), I reread the coded data while asking the questions “why?” and “why not?” (p. 241) in order to determine the purpose of the various tasks.

**Finishing the Analysis**

After verifying all of my codes by reviewing the transcripts and documents in NVivo12, I then used the program to sort and review the data. I also used the query function to help identify the documents that included specific search terms. For example, I searched for the code *assessments* and reviewed all of the information from the various documents to make sure the ideas were coded accurately. In addition, I compared the coded information across cases to see the similarities and differences between the cases. In this example, I noticed that all of the professors give quizzes over the laboratory material, but some gave the quizzes more frequently than others. Some professors scheduled weekly laboratory quizzes, but others mentioned that the quizzes would be “given most weeks” and encouraged students to review the course schedule for specific dates.
Ethical Considerations

Maintaining confidentiality was an important ethical consideration for this study because interviews can lead to participants feeling like their privacy has been invaded (Bloomberg & Volpe, 2016; Merriam, 1998; Mertens, 2015). In this study, one of the participants works at the same institution as I do which could cause concerns about privacy and feelings of being evaluated, even though professor evaluation was not a goal of this study. In order to maintain confidentiality of all participants, each participant was asked to choose a pseudonym. One professor responded that they could not think of one, so I assigned a pseudonym to that participant. In addition, when the interviews were transcribed, any personally identifiable information was removed from the transcript. Finally, all transcripts and documents were kept on a computer protected by a password.

Issues of Trustworthiness

The issue of trustworthiness is related to credibility, dependability, and confirmability (Bloomberg & Volpe, 2016). One way to determine credibility is to make sure the type of study used matches the research questions. For this study, I determined that using a case study method was the best way to focus on the research questions because it allowed for rich data collection using a variety of sources.

Merriam (1998) said that in order to have credible and reliable results in a qualitative study, it is important to check that every aspect of the study was “reliably and validly constructed” (p. 199). For example, it is important to consider if the interview questions were reliable as well as if the information gathered was properly analyzed. For my study, my
interview guide was approved by my committee members and the questions were clearly connected to my research questions. As I analyzed the data, I frequently returned to the original documents to consider the context of the response and to verify the accuracy of my explanations of the data.

Another way I improved reliability of this study was by collecting data from different sources and triangulating the data. The interviews and documents were used to confirm accuracy of the information. Foreman (1948) discussed that validity and reliability are developed by using materials that “exhibit true occurrences” (p. 413). Guba and Lincoln (1989) stated that “the constructivist paradigm’s insurances of integrity of the findings are rooted in the data themselves. This means that data …can be tracked to their sources” (p. 243). The documents the professors shared with me were created and used with their students, so they were used to verify directions and explanations given to students. This information was also elaborated on during the interviews to confirm the professors’ expectations and my interpretations.

Peer debriefing was also done by discussing my data and findings with other doctoral students in the literacy program and with my advisors. I shared my findings and discussed the possible implications with them to gather their thoughts and perspectives. In addition, I was able to determine if my interpretations of the data were clear and logical. They offered suggestions for new ways of thinking about and interpreting the data as well.

In addition, member checks (Mertens, 2015) were used by sending each participant a copy of the findings from their case through email. In the email, I asked each participant to read the document and share with me their thoughts about the findings and themes from their interview and documents. Each participant responded within three days, and all participants agreed with the findings presented.
This study was approved by Northern Illinois University’s Institutional Review Board. In addition, a proposal was submitted and approved by the Institutional Review Boards at each of the participating community colleges.

Delimitations

One delimitation of this study was that there were only five participants, and there was no diversity with race because all of the participants were White. Although a majority of professors at each of the institutions were White, the results may be influenced by this aspect. Another delimitation would be in the design study. Due to time and resource constraints, I chose to not observe the professors’ interactions with students or to analyze the textbook chapters. By including these data sources, I might have been able to triangulate my results with more certainty.

Summary of Chapter Three

Chapter Three reviewed the purpose and research questions of my study and focused on the rationale for the methodology and research design. It also introduced the cases and participants, and explained the data collection and data analysis methods before closing with a description of the ethical considerations and delimitations of the study.
CHAPTER FOUR
FINDINGS

This study was a qualitative multicase study that focused on determining the reading and task expectations for introductory biology courses designed for STEM majors at community colleges. The participants were full-time faculty members in biology and who had taught the course designed for STEM majors within the previous two years. Cases A and E taught sections in a hybrid format, meaning that the lecture part of the courses were completed asynchronously, online through the course management system and laboratory part of the courses were completed face-to-face, once a week. Cases B, C, and D were taught in a traditional face-to-face format that met on campus for both lecture and laboratory portions of the courses. Data sources were interviews and documents. I collected data across a 10-week period and analyzed them using open coding; first as individual cases and then as a cross-case analysis.

Specifically, the following research questions guided the study:

1. What are professors’ reading expectations in introductory biology courses designed for STEM majors at community colleges in a midwestern state, and in what ways are each professors’ expectations similar or different?

2. What tasks do biology professors expect students to be able to complete in order to demonstrate mastery of the course content?

For each of the cases below, I reintroduce the participant and describe findings from the interviews, syllabi, and other course documents that connect to the research questions.
Case A

Ben Hanscom was the participant for Case A. A significant amount of textbook reading was expected for learning the course material, and in the interview, Ben said that he expected students to read the assigned textbooks chapters and laboratory manual before each class period. The textbook for the course was Campbell’s Biology: Concepts & Connections (9th edition). The syllabus indicated that most weeks there would be one chapter covered each week. However, there were two weeks that the same chapter was covered for both weeks and there were nine chapters covered for three weeks of the course, along with another chapter for each of those weeks. There were no directions or suggestions for students about what to focus on or how to complete the reading assignments in any of the written handouts or syllabus for Ben’s course.

There were specific suggestions that Ben had for students while they were reading the textbook that he shared during the interview. First of all, he emphasized the importance of learning the vocabulary because if students could not use the vocabulary correctly, they would have a difficult time with the rest of the course. He wanted students to consider learning the language as an investment into their future learning. Understanding and being able to use the terms correctly was an important step in the learning process. In addition, Ben wanted students to pay attention to the charts and graphs in the textbook. He explained that students needed to be able interpret and create graphs on both of their laboratory exams, so they needed to get practice interpreting graphs from the textbook.

Readings that Ben assigned outside of the course textbook demonstrated different types of reading expectations and skills. In addition to the course textbook, there were other types of reading assigned to students. The laboratory manual was a custom book designed for the
institution. For six weeks, there was one chapter in the laboratory manual assigned each week. One laboratory chapter was spread out over two weeks and the “Gross Anatomy” laboratory was scheduled for three weeks. The reading in the laboratory manual mostly focused on the background information needed for the laboratory activity and the steps that students would be required to follow for the activity. In addition, Ben assigned supplemental articles on various topics that he thought would be helpful and interesting to the students. For example, one article was about the “first person who had three genetic parents” and another was about a theory on aging. Students were also required to purchase an access code to Pearson’s Mastering Biology. He stated the program uses “their own NPR articles” that are “interesting…well written… and high quality.” This program also had access to an e-book for students to read. These various types of texts required students to read differently because there was a wide variety of information in each type of text. For example, in the laboratory manual, students were expected to understand the steps that they will need to follow, so they needed to recognize the order of events and the processes they needed to complete in the activity. In the articles, students were expected to understand the main ideas and events described in the texts. In addition, students needed to be able to connect the ideas from the articles to the topics learned in class and discuss the connections.

Ben’s advice in the interview focused on strategies to help students learn and remember the material from the textbook. For example, he suggested that students read the text several times with a different focus each time. The first time he said that he suggests students “just read it [and] not worry about trying to do anything.” Then, when they read it the second time, they should “write down words if [they] don’t understand them” and make flash cards with the word on one side and the definition on the other. The third time through the text, he said that he tries to
“teach them to build a little note outline” by writing down the main point of each section and then adding sub-points to the outline. He also said that he encourages students to write “down any questions that pop in [their] mind.” Overall, Ben appeared to want to help students really understand and learn the material for the course. He emphasized the importance of writing and repetition for students to learn the information because both repeating information and writing ideas will help students remember the details long term.

There were a few different types of tasks that were required and expected in Ben’s course. Each type of task required students to use different reading and learning strategies. In the hybrid course, students were expected to complete 14 homework assignments in the Mastering Biology program which were worth about 18% of their overall grade. These assignments typically ask students multiple-choice, true/false, short-answer, or matching type questions over the textbook or short videos that students watched. Students could use their notes and the textbook on these untimed activities. There were also 14 quizzes in Mastering Biology that were worth almost 12% of their grade. The quizzes were taken on the computer program and typically had multiple choice questions that were grouped into scenarios. These timed questions typically required students to analyze the scenario in order to correctly answer the two or three questions for each scenario. There were 13 lecture exams that were worth almost 57% of the grade. These exams consisted of mostly multiple-choice questions. Out of the 50 questions analyzed on one test, 19 of them were classified as knowledge-level questions according to Bloom’s taxonomy and 21 were considered comprehension-level questions. Ten questions were classified as application-level questions. A majority of the questions fell under Bloom’s two lowest levels of questions which indicated that most of the assessment requires rote memorization in order to be successful. In addition, there were two laboratory exams that were worth almost 9% of the total
grade. The laboratory exams had multiple-choice, true-false, fill-in-the-blank, and interpretation questions. According to Ben, both laboratory exams required “graph interpretation and creation” because those skills are a major focus of the course. In order for students to be successful on the laboratory exams, they must use memorization of information, but they must also be able to apply the information from the course to answer the questions. According to the syllabus, the cumulative final exam was worth about 4% of the total grade and was either “50 or 100 multiple-choice questions pulled from each of the 12 chapters equally.” It was also noted in the syllabus that the final exam must be taken in order to pass the course. Because a large majority of a student’s grade was based on exams, students must use appropriate learning strategies to retain the vast amount of information provided in the lectures, textbook, and laboratory activities.

Case B

Anne Patrick was the participant for Case B. Reading was designed as an activity to help students become familiar with topics and to introduce new terminology to students. There were two main sources of reading for Anne’s course. Anne stated that students “need to read the book, and they need to read the lab manual.” In the syllabus, students were given the chapters to be covered in both the lecture and laboratory for each week. Each week, students were expected to read between one and four chapters from Campbell’s Biology (11th ed.) and one or two chapters in their laboratory manual, Adams et. al, Investigations in the Biology 1151 Laboratory. The only exception was that the same textbook chapter was assigned for the last three weeks of the term. This was a significant amount of reading expected of students. There were no specific directions or expectations for students to direct them on the reading assignments in the syllabus. However, in the interview, Anne mentioned that students need to read the textbook in order to
“be aware of the words that I am going to be using because … I go through explanations of the
words, but if they’ve never even looked at them, [the students will think] what [are] you saying?”
Therefore, the main focus of reading the textbook appeared to be to become familiar with the
terminology in order to make taking notes from the lecture easier and more familiar for students.
Learning vocabulary seemed to be an important aspect that students were expected to complete
from reading the textbook. The laboratory manual chapters were directed to be read before the
lab meeting each week, so students would be familiar with the material and expectations before
the laboratory started. Overall, reading was expected in order to help prepare students for the
lecture or laboratory activities for Anne’s courses.

There were a variety of tasks expected of students in Anne’s classes that used reading and
writing to complete. Students were expected to complete one homework assignment and one
written report. The homework assignment was worth 20 points (3% of the total grade). The
handout for the homework assignment explained the various steps in the scientific method and
the reasons and examples for each of the steps. Then, students were asked to write a 2-4-page
paper that showed their understanding of applying the scientific method to a real-life situation.
The paper required students to create a question, hypothesis, predictions from the hypothesis, a
potential experimental procedure, and a conclusion. In order to be successful with this task,
students must have read and understood each of the steps in the scientific method, but then they
also needed to be able to apply the steps in a real-life situation to show that they understood the
steps. On the other hand, the 100-point written report was worth 15% of the final grade and
asked students to research one of the two options. The first option was to research a particular
field of biology, what that field studies and why, and two scientists who have made contributions
to that field in the past seven years. The second option was to “research a current controversial
issue in biology” and explain both sides of the issue and some background information about it. In addition, students were expected to explain their “feelings about the issue,” what should be done about the issue, and why. This assignment required students to read journal articles, books, and internet sources to gather information. This type of reading is different from the introductory textbook and the laboratory manual. Scientific texts tend to be written with lots of details which make them challenging to understand (Hodges, 2015). The final paper was to be between five and ten pages in length and use APA format, including citations. Understanding and applying APA format may be a task that students are unfamiliar with which may have required them to research or learn on their own.

There were also three lecture exams scheduled throughout the semester that were each worth 100-points, for a total of 45% of the grade. The lecture exams were a combination of short-answer and multiple-choice questions. The exam was not shared with me, so I could not analyze the questions. However, Anne said that she required students to memorize information which may indicate that the questions were typically knowledge and comprehension level. There were also six laboratory quizzes that were each worth 20 points for a total of about 18% of the final grade. Anne said that these quizzes ask students questions about what they did in the laboratory activities and were typically short-answer type questions. She asked students to respond to the questions in a sentence or two. The quizzes were designed to hold students accountable for the processes completed in the laboratory activities. The final exam was not cumulative and was worth 120 points or about 18% of the overall grade. The final exam consisted of more fill-in-the-blank and short answer questions than the other exams because Anne said that the material does not lend itself to multiple-choice type questions. This exam seemed to be more application and analysis types of questions than the other exams. Overall, this
was a wide range of tasks that students were expected to complete successfully throughout the semester. Students would need to adopt a variety of learning strategies to be successful with all of them.

Case C

Cody Jacobson was the participant for Case C. He used reading assignments to help students become familiar with the material before the lecture and laboratory, but the types of texts affected the purpose of the reading. Cody discussed the importance of students reading the textbook and the laboratory materials before the class. The schedule was laid out in the syllabus and directed students to read either one or two chapters from *Biology: The Unity and Diversity of Life*, 14th ed, each week. There was a custom laboratory manual produced for this institution and each week focused on a different chapter. The laboratory manual described the steps that students need to follow to complete the laboratory activity. In the interview, Cody said that he expected students to read the assignment before the laboratory so that they would be prepared to complete the activity and to ask questions about anything that was confusing. This text focused on following directions and understanding the steps in a process. The differences in types of reading were important to recognize, so students could know what type of information to pay attention to during the reading.

Asking students to read means more than just saying the word in the textbook. Cody stated that students did not read during class time, but instead, he put up a blank figure or chart on the screen. He said,

Every major point I want to make is in a picture, or diagram, or chart, or graph of data, so I kind of start with that. And I have a tablet and stylus that I can write on my slides, and
students follow along. I’m not reading a paragraph, but reading a graph, a figure. What is the story? What are the data saying? We do a lot of that in class.

Although he did not describe this as reading, it is important to recognize that it is a specific type of reading. Making sense of visuals seemed to be an important skill that Cody wanted his students to be able to complete. Helping students to recognize different types of reading is a valuable skill that is important in the discipline of biology (Hodges, 2015).

Reading for learning is an important aspect of reading in biology. Cody’s advice focused on reading and how to approach reading and learning. He said that he tells students to “read the chapter before we talk about it in class.” He reported that many students tell him that they try to read the book, but that they do not understand it until they go over it during the lecture. He said he reminds students that

you felt like you didn’t absorb anything but you primed it. You laid the foundation for the second time around. So, keep that up, even if you feel like you didn’t absorb anything [because] it didn’t hurt you and it probably helped.

Reading through the textbook before the lecture serves to activate background knowledge which is an important aspect of reading. In addition, he said that he wanted students to recognize the difference between reading the biology textbook and novels. He said that “you’re going to have to go back over [the text]. You’re going to bounce around. You’ll see a word or vocab term that you need….It’s not a linear story. It’s very circular.” Reading in biology was different than reading a novel or fictional writing and uses a different process. Students need to recognize that reading is different in various situations. A disciplinary focus in biology is that reading is not a linear process and instead requires people to recognize where the information is located on the page and the ability to switch back and forth between the various pieces and forms of
information. For example, students may find the information described in words in one part of
the page and then see it again in a graph or table on another part of the page.

Reading the textbook was also designed to help students learn other important skills
connected to biology. For example, Cody emphasized how important learning vocabulary is in
biology because students cannot have discussions about the material or know how to apply it, if
they do not understand the meanings of the words. In addition, Cody wanted students to be able
to read and understand the visuals – charts, graphs, and pictures – in the textbook as they were
reading. He said that, “reading graphics is huge” and really important for student success in the
course. Reading in biology was a more complex activity than saying the words in the textbook
and required students to use a variety of skills and strategies to be successful with the reading.

There were a variety of tasks for Cody’s course that required students to read, write, and
apply the skills learned in the laboratory activities. Cody’s course tasks were divided into two
categories: lecture and laboratory assignments. For the lecture component, he required five
homework assignments that were each worth 20 points (2% each or 10% total). These were
“study guides” that he created for each unit and require students to answer questions as they are
reading the textbook. He said that he designed these as “small, bite size chunks” to encourage
students to look for the answers as they were reading the textbook. He mentioned that the
questions were “in sequence [so] if you missed [a question], go back and it’s there.” The first
semester that Cody made the study guides, he noticed that quite a few of the students did not do
them, and the students that did complete them were more successful. So, he decided, “Let’s try
something new this semester. As much as I don’t like this, I’m taking a very small number of
points, and essentially saying that I’m turning that study guide … [into] a homework.” By
incentivizing the study guides with a total of a hundred points, Cody was encouraging students to
complete the reading assignments. He also was able to direct students to the most important information in the textbook. This served to help students know what to focus on, but also to help check their comprehension of the textbook reading. Although these study guides were briefly described in the syllabus, their purpose was not as clearly explained in the syllabus as it was during the interview.

There were also five lecture exams that were each worth 100 points (10% each). These exams contained multiple-choice, true/false, and matching type questions. The final lecture exam was also worth 100 points or 10% of the overall grade and was all multiple-choice questions. For the 50 questions analyzed on the final exam, 29 were knowledge-level questions, 18 were comprehension-level questions, and three were application-level questions. This reinforced the idea that much of the learning for this introductory biology course was focused on memorization which impacts the learning strategies that should be used by students.

In the laboratory section of the course, there were also a variety of tasks that needed to be completed to be successful. There were approximately nine laboratory assignments that were worth a total of 52 points (about 5% of the total grade). These required students to answer questions about the previous week’s lab. In order to be successful, students needed to follow the directions to complete the activities and understand the concepts in order to answer the questions correctly. There was a laboratory midterm exam that was worth 64 points (about 6%) and a final exam that was worth 84 points (about 8%). For both the midterm and final laboratory exams, he required students to demonstrate the ability to use a microscope correctly. For example, he said that he may put a slide with cells and ask students to identify one that is in anaphase. This required students to apply the skills they had learned in the lab. There were also multiple-choice, matching, and true/false questions about the laboratory content, so students needed to remember
and understand the content from the laboratory assignments to be successful on the midterm and final exam. Additionally, there was a laboratory paper that was worth 100 points (10% of the total grade). The laboratory paper required students to work in a group to create their own laboratory project and carry it out. Then, they “as an individual, write it up as a report.” Cody said that he gave students a “long, detailed rubric …[that tells them] point by point what [they] should do.” He also gave them samples of “what a good, thorough, complete [one] would look like, here’s what a decent [one looks like], and here’s a not so good, and here’s what a crappy [one] looks like. This is a giant six-page matrix” for students to review. He also said that he gave students a checklist to go through before they turn in the final report to help them make sure they have the minimum requirements. By giving students the rubric and checklist, he hoped to help students be successful on the laboratory paper. However, these required students to use another form of reading and metacognition in order to use them successfully.

Case D

Karis Guffey was the participant for Case D. Reading assignments were given in order to improve understanding of the material and to help students prepare for the lecture and laboratory parts of class. Karis talked about the importance of students understanding the material as they read it. She said that they don’t “need to memorize it as they go,” but they should be “trying to understand the sentences that they’re reading.” She reflected on the fact that when she was a student, she would often get to the end of the chapter, close the book, and be grateful that she was done. It wasn’t until later in her education that she recognized the importance of really understanding the reading and not just completing it. She wanted students to recognize the importance of understanding the text sooner in their educational careers. The idea of
comprehension being more important than completion was an important skill for students to learn.

The reading schedule for both the lecture and the laboratory were listed in the syllabus. Each week, students were expected to read one or two chapters from *Campbell Essential Biology* (5th ed) to prepare for the lecture. There was one week when three chapters were assigned. The reading assignments were designed to introduce topics and vocabulary and to activate background knowledge to prepare students for the lecture over the material. Learning the vocabulary was an important skill because Karis said that if students do not understand the terms, they will not be able to understand the information in the text or in her lectures. In addition, students were directed to read one or two exercises or chapters from *Thinking About Biology: An Introductory Laboratory Manual* (5th edition) for the laboratory section. The laboratory manual was designed to help students prepare for the week’s activity, so they would know what steps or processes would need to be completed during the laboratory time.

Learning the material or topics from the biology course was not always easy and would take a variety of learning strategies. Karis had advice for both reading and test-taking for students. While reading, she stated that students need to try “to read paragraph by paragraph and to make sure the understand the sentences that they’re reading.” She also said that taking notes on the material is important if they need to do that to understand the text. Recording the information in their own words would help students check their understanding of the material and also forces them to organize it in a logical manner. These are both important skills needed to memorize the information. In addition, while students are taking the tests, she said that she tells them to really read the question and dissect the questions [because] you need to know your stuff in order to answer this question. … The answer is not just gonna pop out at you. You have to make sure you understand each of the questions.
Reading test questions is similar to reading the textbook for Karis because both required students to read carefully and focus on understanding the material.

There were several tasks that were required for the lecture part of the course. Karis’ course had four unit exams that were worth 40% of the overall grade. According to the syllabus, the exams may have “multiple choice, matching, fill in the blank and essay questions.” On one of the tests, 44 of the 50 questions were knowledge-level questions. In addition, five of the questions were classified as comprehension-level and only one was an application-level question. This indicated that the focus of the course was on memorization and understanding of the topics. The final exam was worth 150 points or 15% of the total grade. It was cumulative and had the same types of questions as the other exams. There were also 200 points designated for “Quizzes, Discussion, and Assignments.” These points were described as “one homework assignment and several daily quizzes per unit.” The homework assignments were a combination of critical thinking and matching review questions. The homework assignments were designed to help students reflect on the material and to help them check their understanding of the reading assignments. The quizzes were typically multiple choice or short answer questions on the previous day’s lesson. These were designed to help students check their understanding of the lecture material and to help reinforce the importance of attending class while making sure they were engaged with the topics.

There were also different tasks that were required for the laboratory part of class that required different reading and learning skills. First of all, there was a quiz scheduled typically for the beginning of each laboratory session that covered the material from the previous week’s activity. According to the syllabus, the quizzes “may be written or may include active demonstration of your work.” The syllabus stated that laboratory quizzes could not be made up
for points, but the lowest score was dropped at the end of the semester. These quizzes were designed to reinforce the steps of the laboratory activity and check students’ understanding of the material. There were also 100 points designated for the lab report, presentation, and assignments. From these, 25 points were designated for the group report and presentation and an additional 15 points were designated for individual tasks to be completed with the laboratory activities. There were also 10 points designated for a reflection assignment that asked students to rate their own participation as well as their group members’ participation. The presentation was scheduled for the last laboratory session of the semester and required students to share information from their laboratory report. The laboratory report was presented as a poster, but had specific information that was required to be included such as an introduction, materials and methods, results, analysis of data, and a conclusion. Each section was clearly explained in the handout for students to review, along with a grading rubric. This laboratory report required students to follow directions, but also apply the information from genetics and Punnett Squares to a real-life situation when they were breeding *Drosophila* fruit flies. They had to record information in tables or charts and use mathematics to calculate the Chi-Square analysis of probability for the traits of the fruit flies. There were also 50 points designated for the laboratory assignments, and these were turned in at the start of the next laboratory session. Students were required to answer questions or complete drawings of what they observed during the laboratory activity. Each of these tasks required different reading skills. For example, during the laboratory activity, students had to be able to follow the steps but also record information from the visuals or activities in order to review and remember what they did at a later time.
Case E

Joan Kafer was the participant for Case E. There was a considerable amount of reading expected for Joan’s course. Joan discussed that biology is “definitely reading heavy” because of the amount of reading that is expected for both the lecture and the laboratory parts of the course. For example, she mentioned that students were expected to read 14 chapters in Mader and Winderlspecht’s *Biology* (McGraw Hill, 13th ed.) during the semester and lab protocols for each week. However, there were differences in the expectations for the textbook and laboratory reading assignments. The textbook was assigned to help students become familiar with the topics that would be covered in the lecture. She described the lab protocols as “a sort of introduction, you know, explanations and terms and things that they need to pay attention to” in order to be successful in the laboratory activity. In other words, students needed to read the laboratory manual in order to define the vocabulary terms and to know the steps for the weekly activity, but the textbook reading was designed to improve background knowledge for the topics in the lecture.

Reading the textbook required students to focus on a few concepts. First of all, Joan pointed out that learning the vocabulary was really important for student success. She wanted students to recognize the terms, but also to memorize the definitions so they “would not have to go back to the book” frequently. In addition, Joan wanted students to pay attention to the visuals like the graphs and charts in the textbook because they were important for understanding the textbook material. There was more to reading in the biology textbook than just the words and paragraphs, and it was important for students to understand how the vocabulary and visuals can increase their learning or understanding of the topics.
Just reading the textbook would not be enough for students to learn the information. Joan emphasized that students needed to do more with the information in the text, so they were processing it in order to learn it. Joan wanted to make sure that students “take notes on that chapter…just to essentially outline it and boil it down to what are the major points…and how are these points organized.” She said that taking notes is important because it helps students “reorganize that stuff in their own mind and writing it down in a way that makes sense to them. They’re processing it.” This processing of the information is what leads to understanding and learning of the material.

The tasks that Joan required for points included several different types of skills. First of all, Joan’s course had four unit exams and one cumulative final exam that were worth 55% of the total grade. The exams were “a combination of multiple-choice, T/F, matching, short-answer and lab practical questions.” These required students to identify the important information and memorize definitions, facts, and processes. In addition, Joan created a “note packet that has these pieces that are labeled from lecture, and these are things that we talked about in class” and students were encouraged to take notes directly on the note packets. They were designed to allow students to record their information from both the lecture and the textbook readings in one place and were supposed to encourage students to take notes in an organized way. However, she said that many of the students do not use them, and she started requiring students in the hybrid course to turn in the note packets after she discovered that many students were not watching the video lectures. She said that, “I collected every week their note packets and gave them a little bit of credit…but it felt bad. Like, I felt bad having to do that as a college teacher.” Although she recognized that taking notes and watching the video lectures were needed to be successful in course, there was something that made her feel guilty about giving points or requiring the note
packets to be turned in. There were also the Connect Learn Smart (McGraw Hill) online activities that students were assigned to complete before the associated lecture time. Joan said that when she first started assigning Connect Learn Smart (McGraw Hill), she assumed that students would read the book and then answer the questions as a review. However, the sales representative informed her that is not the reality for most students. Instead, the program asks the students questions and if students answer incorrectly, the program takes them back to the section in the e-book to review the text and then goes back to the questions. It is an adaptive program which means that it will ask students questions about a topic until they get a specific number correct and then it moves on to other topics that students are still struggling with. The Connect Learn Smart (McGraw Hill) activities and note packets were worth 12% of their overall grade. Together, these two activities were designed to help students prepare for the course tests by encouraging them to read parts of the textbook and record important information to review.

In addition to the lecture activities, there were 13 laboratory assignments that were worth 19% of the final grade. These assignments were described in the syllabus as “hands-on and collaborative and allow students to examine and experiment with course concepts.” Students could turn in their laboratory assignments at the end of class or before the next class session started. The laboratory assignments were designed to make sure that students were completing the activities and focusing on the most important concepts from the laboratory. There were also 10 laboratory quizzes scheduled during the semester that were worth a total of 14% of students’ grades. Each laboratory quiz was listed on the course schedule and covered previous weeks’ labs. They could “include fill-in-the-blank and short-answer questions, diagram labeling, and multiple choice, matching and T/F questions.” These were designed to review the material and to give students the opportunity to reflect on their learning of the material.
The concept of repetition and review with learning the topics was important. Joan emphasized that she tells students about the importance of labeling diagrams, drawing pictures, taking notes, creating vocabulary cards, and asking questions to make sure that they really know the concepts. For example, she encouraged students to draw and label what they saw under the microscope, even though they have pictures in their laboratory manual. She said that she tells them, “you’re learning how to use the microscope [and] your hand is moving over the paper and your drawing what you see. Your brain is processing. You are learning.” There were important steps in the learning process that come from both reading and doing the laboratory activities, but learning also takes more time and effort outside of the classroom.

Cross-Case Analysis

After completing the analyses for the individual cases, I reviewed the cases in a cross-case analysis and used the constant comparative method to determine two themes from the findings. These themes had both similarities and differences between the cases that highlighted their importance.

The two themes were as follows:

1. Reading matters and has several different purposes;
2. Tasks are designed to improve learning.

**Theme 1: Reading Matters and Has Several Different Purposes**

The first research question for my study focused on identifying the reading expectations in the introductory biology courses. The participants discussed the importance of reading for
student success and the reading assignments were clearly laid out in each participants’ syllabus for students.

All of the participants discussed the importance for reading the textbook before attending the lecture in which the material will be covered or discussed. Ben, Karis, Cody, and Joan all directly said that the textbook readings should be completed before class. However, Anne said that she tells students “if you don’t have time to read the whole chapter (before class), read through that [the summary or review at the end of the chapter] and then go back to the parts that you don’t understand and look those up in the chapter.”

One purpose for reading was to introduce students to the vocabulary terms that would be needed. All of the participants discussed the importance of students focusing on learning vocabulary terms while they are reading. Ben said, “if you don’t know the vocabulary, you can’t really do anything” which emphasized the importance of understanding and being able to use the terms correctly. Similarly, Anne said that she told students to focus on “the words that are bold that are kind of emphasized in that section of the chapter” and to “make use of [their] book.” The important aspect for Anne was that students “need to be aware of the words that I’m going to be using” in order to understand the information in the lecture. Joan also said that learning the vocabulary is important as “terms and things that they need to pay attention to.” She also wanted students to understand the words because they need to “have that stuff in their brain…without having to go back to a book.” Cody recognized that “there’s a lot of vocabulary” in biology and that students need to learn the words so they can have the “cool, interesting discussions and problem solving” involved in biology. Karis also discussed the importance of learning vocabulary while students are reading because without understanding the words, students won’t understand the information. She said that she told students, “don’t skip over something…if
there’s a word that you don’t understand, stop and try to figure out what it means.” Overall, learning vocabulary was focused on as an important first step to learning the material and for being successful in the course.

With the exception of Cody’s syllabus, none of the course documents explained the importance of focusing on vocabulary during reading or learning the vocabulary words. In Cody’s syllabus, there were tips on learning the vocabulary and studying. For example, he said that “before you can apply any of the biological concepts presented in this class, you must first master the vocabulary. As with any new language, frequent repetition is key.”

Another important aspect of reading the textbook for most of the participants was to pay attention to the charts, figures, and graphs (or visuals) in the textbook. Karis said that, “there are lots of charts … and graphs and things like that” and she will point out the ones that she thinks are really important for students to learn and understand. She said that she tells students “if it’s a chart, see what it is summarizing, and then if it’s a graph, figure out what [it] is trying to tell you.” Cody stated that “reading graphics is huge.” He also said that reading and interpreting graphs and data tables is really important for students to be able to do. He said that he asked students to identify which graph is representing a specific data set and reminded students to “bounce back and forth and see what are the variables and what are the axes labeled as” in order to determine the correct answer. Anne said that she encouraged students “to look at the figures to help explain some of the concepts, and they really do help.” Joan also mentioned that the visuals are “very important” for students to read and review. The emphasis for each of the participants was on using the visuals to increase comprehension of the material in the textbook. Karis and Anne both discussed the idea that the textbooks are set up in a specific way that will help students understand the material better, so it is important for students to recognize why they have
put the information in specific places. Students need to recognize that reading the textbook involved focusing on the visuals and that those visuals reinforce the concepts in each of the chapters which may make them easier to understand. Although these concepts were brought up during the interviews, none of the information was described in any of the course documents that were given to students.

The idea of memorization came up with three of the participants. However, they had different thoughts about approaching memorization. Joan said that “there’s a lot of memorizing, especially at the lower levels.” She emphasized the fact that students need to memorize basic information, so they do not need to look up information all the time. Similarly, Cody said that students need to memorize information and the best way to do that is through repetition or rote memorization. On the other hand, Karis said that she tells students not to focus on memorization as they are reading. Instead, she said that she tells them to read to “try to understand it as they go.” However, these differences may be due to the differences between reading and studying. For example, both Joan and Cody discussed the importance of memorizing vocabulary and information, but they did not say that memorizing needed to be done while reading.

Reading the textbook for biology is expected before the lecture on the assigned topic, but specific directions to students about focusing on the vocabulary and visuals may be helpful. These disciplinary expectations are important for students to understand so they can be successful in the course. Finally, the different types of reading (laboratory manual, textbook words, and textbook visuals) are all important, but they each have a different purpose and require different reading skills that may need to be explained to students.

Although reading is an important part of the required expectations for the introductory biology courses, three of the participants mentioned that they have noticed a decreased number
of students who complete the reading assignments than in the past or an increased number of students who appear to be struggling to understand the reading assignments. Joan said that, “I’ll be honest with you. We struggle terribly to get our students to read.” Later in the interview, she stated that, “There’s just that thing that students don’t read. They don’t want to. They don’t value it. They don’t see the value in it. Maybe they don’t have the skills for it.” Ben also said that, “I find that just nobody really wants to read anymore.” Later in the interview, he stated that, “10 years ago, [students] did [read the articles]…they would come up to me and say, ‘Hey. Do you have something else like that? That was really interesting’ or ‘That helped me understand mitochondria.’ Yeah, but not anymore.” Another way that he recognized that students struggled with reading was because students seemed to need more help with completing the laboratory activities. He said that, “That’s another way I know they’re not reading very well because I have to go around and mitigate almost every single lab table because they misunderstood something in the directions.” He said that he estimates less than 5 students read the textbook for each section that he teaches. Cody also said that he sees students struggling with understanding what to do during the laboratory sessions. He stated that at the start of each laboratory meeting, he reviews what they were doing and where the materials were before telling students to talk with their partners to “come up with a strategy; have a plan with your group. Who’s going to get what; who’s gonna do what?” However, he said that there are many times that students asked, “Well, what am I supposed to do?” and he directs them back to read the laboratory manual while he checks in with other students before coming back and realizing that the students were still confused. Cody said that, “I see that they are [reading] and they still don’t get it. That’s when I noticed if I read the manual out loud, they go, ‘okay.’” Reading the steps out loud to the students helped them to understand what they needed to do. Joan, Ben, and Cody were concerned about
the fact that many students do not seem to read the assignments or understand the material they attempted to read, but they did not know how to help the students.

Theme 2: Tasks Were Designed to Improve Learning

The tasks that the participants expected students to complete were always focused on learning and understanding the material in new ways. As previously mentioned, tasks for this study were defined as activities that professors expected students to complete, typically for points. To determine the tasks that the participants expected students to complete, the information came from the syllabi and the interview transcripts.

Three participants mentioned taking notes from the textbook as an important task. Ben and Joan both stated that taking notes was a necessity and that students should record the main ideas or create an outline as they read. On the other hand, Karis mentioned that students should create notes “if they need to” in order to understand the material. Anne did not directly mention taking notes, but did say that students need to “understand what’s going on” as they are reading. Although students were not typically given points for taking notes, it was encouraged to help improve learning.

The most common task across the cases was taking tests or quizzes which were designed to check for learning of the required material. For all of the participants’ courses, the lecture exams were worth the majority of points for the course. Anne had three lecture exams and a non-cumulative final exam that were worth a total of 63% of the overall grade. Karis and Joan each had four lecture exams and a cumulative final exam. When the scores for all of the exams were combined, they were worth 55% of the overall grade for both professors’ courses. Cody had five exams scheduled and a cumulative final exam that together were worth 60% of the overall grade.
Ben had the most scheduled exams with 13, but this was for a hybrid course, and he said that he used to give fewer exams but students preferred to have more exams that covered less information. The exams and cumulative final exam in Ben’s class were worth a total of 61% of the overall grade. In order to be successful on these tests, students needed to memorize important information, including terms and processes from the textbook and lectures.

The laboratory part of the courses varied in percentage of overall grade and expectations more than the lecture part of the courses. In Ben’s course, the laboratory part consisted of two tests and was worth 10% of the total grade. In Karis’ course, the laboratory part was worth 25% of the overall grade and required a report and presentation in addition to a quiz each week. Cody’s course had the laboratory part worth 30% of the overall grade and had 9 laboratory assignments, two exams, and a paper. Anne and Joan’s courses each had the laboratory part worth 33% of the total grade. Anne required students to complete one homework assignment, one written report, and six laboratory quizzes while Joan required 13 laboratory assignments and 10 quizzes during the semester. Although there were differences in the amounts and types of quizzes and other tasks in the laboratory component of the courses, all of the laboratory activities were designed as hands-on activities and to supplement the material in the lecture portion of the course.

Although tests were the most significant part of students’ grades, the participants also tried a variety of tasks to help students prepare for the tests. Two participants mentioned that they created worksheets for students to complete as they were reading the textbooks to help students make sure they were understanding what they read and to help students know what to focus on as they were reading. They both made comments about giving a “small number of points” for these assignments. In addition, both made apologetic comments about having to
require the assignments, but recognized that students who completed the assignments were more successful. For example, Joan said that she told students, “I’m sorry. That feels like high school or middle school where you have to turn this in, but I learned the hard way that if I don’t make you turn it in, then people won’t do it, and that hurts you because you are coming to class completely unprepared.” Similarly, Cody said that, “As much as I don’t like this, I’m taking a very small number of points, and essentially saying I’m turning that study guide … [into] your homework.” He said that “I think that should, if they do that [the study guide] with their book, that should prep them for our in class.” Both Cody and Joan discussed the fact that completing the assignment would help students be more prepared for the lecture and assist students in recognizing where they are confused, yet they were concerned about having to “give points” for them. There may be a few reasons for this reaction. First of all, professors often teach in the same way they were taught and traditionally, introductory biology courses focused on tests and quizzes to show mastery of learning. In addition, some people believe that college students should be self-motivated to learn the content and also believe that students know how to learn. In this case, “giving points” for completing activities may seem to be lowering standards.

Some professors were trying to use technology to increase student completion of tasks and improve learning. Two participants used an online platform for homework assignments. Ben required students to complete assignments and quizzes in Mastering Biology (Pearson), and Joan required students to complete assignments in Connect Learn Smart (McGraw Hill). Joan said that the program “asks them some questions and when they don’t answer them properly because they haven’t read, it stops them and bounces them over to the e-book and says read this section (just a paragraph or two), then come back and work some more.” The program takes students between the questions and the e-book repeatedly until students are familiar with the material. She
also described the program as “it’s basically a set of electronic flashcards.” Sometimes the questions make students “type in [the answer] or choose the right answer.” In the syllabus, Ben explained *Mastering Biology* to students as

a mix of assessment methods that include, but are not necessarily limited to: multiple choice, true/false, fill in the blank, matching, drag and drop, watching videos and/or animations and answering questions about them, reading articles critically, and short answer questions.

Ben also assigned quizzes through *Mastering Biology*. The quizzes have the same types of questions as the homework assignments, but they are timed. The amount of time allowed varies for each quiz, but it is dependent upon the number and difficulty of the questions. These electronic assignments were designed to help students complete their reading and check for understanding.

The ultimate goal for all of the participants was to help students learn the content for the biology course, and they assigned tasks to assist students with this goal. It is important to recognize that the tasks were closely connected to the learning that the professors wanted their students to complete which typically was connected to reading in both the textbook and the laboratory books.

**Chapter Four Summary**

After analyzing the data from the interview transcripts, course syllabi, and other handouts, I was able to answer my two research questions and identify other patterns of professors’ expectations between and across the cases. Each of the professors expects their students to read both the textbook and the laboratory materials before attending the class session. In addition, some professors expect students to read primary research for use in writing
assignments such as research papers or laboratory reports. In addition, the participants reported that students need to pay attention to and understand the visuals such as graphs, charts, and tables in the reading materials. There were differences in expectations with tasks connected to reading; however, most of the participants stated that understanding the text was the primary focus and students should consider taking notes to improve their comprehension. In addition, participants stated that learning vocabulary is an important aspect to be successful in first-year biology courses.
CHAPTER FIVE

DISCUSSION

This chapter presents a summary of the study, a summary of the findings, and a discussion of the research questions. It continues with a discussion of the implications and recommendations for community colleges, biology faculty members, and developmental reading educators and concludes with a summary of the chapter.

1. What are professors’ reading expectations in introductory biology courses designed for STEM majors at community colleges in a midwestern state, and in what ways are each professors’ expectations similar or different?

2. What tasks do biology professors expect students to be able to complete in order to demonstrate mastery of the course content?

Summary of the Study

The purpose of this qualitative, multicase study was to determine the professors’ reading and task expectations for introductory biology courses designed for STEM majors at community colleges. This research was needed because of the lack of research focusing on the professors’ expectations for students while reading the textbook and disciplinary literacy expectations in biology courses in community colleges. Using a multicase study that was designed to be particularistic, descriptive, and heuristic (Merriam, 1998) helped guide this study from the creation of the interview questions through the content analysis and analysis of the findings.
Reading is an important part of learning for college courses (Nist & Simpson, 2000), and research has shown that students need to have good reading skills to be successful in college (Deloza, 2013; Holschuh & Paulson, 2013; Pugh et al., 2000). However, reading is not the same in every content area and not all discipline professors are aware of the specific reading strategies or skills that they use when making sense of the discipline specific texts (Colwell & Reinking, 2016; Enderson & Colwell, 2021). Therefore, this study was designed to help determine the reading and task expectations by interviewing the biology professors and analyzing their documents designed for students. The findings will help biology professors determine ways to help their students but can also be used by developmental reading professors to help prepare their students for the demands of their future courses.

Summary of Findings

Exploring the participants’ interview transcripts, the syllabi, and other course materials for reading and task expectations through the theoretical frameworks of disciplinary literacy, sociolinguistic theory, and Model of Domain Learning, I focused on determining the unique reading expectations that are needed for success in introductory biology courses designed for STEM majors.

Theme One: Reading Matters and has Several Different Purposes

The participants in this study all stated that they expected students to read both the assigned textbook and laboratory pages before the class period for which they were assigned which affirms previous findings (Aagaard et al., 2014; Gammerdinger & Kocher, 2018). In addition, all of the participants reported that learning vocabulary terms and definitions and
understanding visuals such as graphs, charts, and pictures were important for students. Wiley et al. (2017) reported that many students did not understand the function of graphics in the textbook, so professors may consider explaining the importance of reading the graphics to their students. Although reading has several purposes, the most common purposes for reading the biology textbook seemed to be to improve background knowledge to prepare for the class lectures, to learn vocabulary terms, and to reinforce learning of the course topics which aligns with Fitzpatrick and McConnell’s (2009) assertion that faculty expect students to use textbooks to prepare for class discussions and as a resource to review. On the other hand, the main purpose for reading the laboratory manual was to understand the steps involved in the laboratory activity for the week, so professors may want to help students recognize the importance of understanding and following directions from text. All of the participants asked their students to read at least one chapter per week from the course textbook, but frequently more than one chapter was assigned. In addition, students were expected to read at least one chapter in their laboratory manual each week. This indicated that there is a significant amount of reading to be completed for the introductory biology course, but that the range of purposes may impact how students should approach the various reading assignments.

Participants also said that they do not expect students to read much (or at all) during class sessions because there is so much content to get through, they do not have the time to focus on teaching reading skills or specific reading assignments during class. This is similar to Tang’s (2016) finding that very little reading is done during class time in science classes. In addition, it affirms the findings that showed that teachers often feel like there is not enough time available to teach reading strategies because of the amount of content to be covered (Muth, 1993; O’Brien, et al., 1995; Stewart & O’Brien, 1989). However, by taking the time to teach reading and learning
strategies that are appropriate for biology, professors may help students by improving overall success in the course. Specifically, it is important that students are taught strategies for learning vocabulary terms and how to make sense of the visuals in the textbook. In addition, students need to be taught to distinguish important ideas from the textbook in order to take notes effectively.

For developmental reading professors, these strategies can be focused on specifically during the class. For example, students should be taught how to read the biology textbook and to focus on strategies for learning biology vocabulary terms and comprehending the visuals in the textbook. In addition, students should be encouraged to practice reading and taking notes from a real chapter in a biology textbook in order to understand what the process will be like. They will need support and scaffolding in order to recognize the importance of making sense of the visuals and not just skimming them or skipping them all together. Students will need to learn strategies to learn vocabulary terms beyond just memorizing the textbook definition so they can use the words correctly in their speaking and writing, as well as understand the words in the reading assignments.

Theme Two: Tasks Were Designed to Improve Learning

Two of the participants described one of the tasks as completing a study guide or guided reading questions. For this task, students were asked to answer questions as they were reading the textbook. The professors said that they felt like the study guides helped students know what to focus on when they were reading and made sure students were understanding the text. In addition, they recognized that students who completed the study guides were more successful on the tests, yet they expressed feeling bad about giving points for these assignments or requiring
students to do them. This may be due to the perception that students in college are supposed to take responsibility for their own learning and not rely on teacher-created tasks (Tomanek & Montplaisir, 2004). Ultimately, though, they decided to give the small number of points for the assignments to encourage learning.

Similarly, four of the participants discussed the importance of students taking notes on the textbook material, but they did not give points or require this activity. Three of the participants said that they encourage students to take notes to have material to review and because it helps students learn the information. For example, Joan said that the repetition of reading and writing the material will ultimately help students understand and learn it. The fourth participant said that she wants students to be “fairly deliberate” when they are reading to make sure they understand the information but said that taking notes is just one of the strategies that students could use for this process. Even though taking notes is not a required task, it was encouraged in order to improve learning. Caverly and Orlando (1991) argued that it may be necessary to teach students how to take notes and that notetaking is most effective if students are aware of the type of assessment they will complete and can adjust their note taking process to fit the task (p. 128).

**Connections Across Themes**

There was a strong connection between the reading and task expectations for introductory biology courses. All of the themes related back to student success and learning. In order for students to learn the material and meet the course expectations, the professors wanted students to recognize the importance and wide range of options available to study in biology to increase student motivation through interest. Previous research has shown that interest can be developed
by people in an individual’s life (like a professor) and the environment (such as a course) (Renninger, 2000; Renninger & Hidi, 2002) and that interest can improve learning (Alexander & Murphy, 1998; Hoffman, 2002) so biology is a unique and diverse discipline is connected to student learning. In addition, all of the reading assignments and tasks were designed to help students improve their learning of the topics. The tasks that needed to be completed relied on successful reading and comprehension of the texts. Chase et al. (1994) found that in their study comparing reading demands in four disciplines in high school and university courses “reading was a vehicle for gathering information and ideas which would then be transferred through analysis and synthesis into written exams, essays, or other application activities such as labs” (p. 12). For the participants in this study, reading was one step that was needed to help students complete the tasks and be successful in the course. However, there are a variety of strategies and tasks that need to be used to learn the material, so students should be instructed on how to use the strategies effectively to improve their learning. As Holschuh (2013) noted, memorization is often an important skill that is needed to be successful in first-year courses. It is also essential to remember that “research has estimated that over 80% of college-learning tasks involve reading” (Holschuh, 2019, p. 600), so reading is an important part of learning.

When discussing what the professors wanted students to do while they were reading their textbooks, the participants often mentioned study strategies such as rehearsal and elaboration strategies (Mulcahy-Ernt & Caverly, 2018). There may be some confusion between the terms of reading and studying. Although both are important aspects of learning, they are not the same and should not be used interchangeably with each other. For example, highlighting or underlining the main ideas as students read is an important rehearsal reading strategy, and annotation is a useful
elaboration strategy while reading. However, alone, these are not enough to help students study and learn the information for quizzes and exams.

**Findings Viewed Through Theoretical Framework**

Through the lens of Alexander’s Model of Domain Learning (2003; 2006), the reading expectations for the introductory biology courses are different from what students have been exposed to in their previous educational experiences, so they will need explicit instruction (Holschuh & Lampi, 2018) on the best strategies to use while reading the texts for the course. Specifically, students will need instruction on how to learn the many vocabulary terms and how to read the visuals in the textbook. In addition, because students are still developing in their path from acclimation to competence, they will need the guidance of their professors in order to move towards expertise while completing the reading assignments and preparing for the course tasks. Similarly, the tasks that students are expected to complete for this course, as well as the grading methods, may be different, so students will need both direct instruction and modeling for how to prepare for and complete the tasks effectively. This will include written instructions on how to study for exams and both when to complete the reading assignments, but also the purpose of completing the various reading assignments for the course.

Similarly, disciplinary literacy (Holschuh, 2014; Moje, 2008; Shanahan & Shanahan, 2008) indicated that the reading and learning strategies should be different for biology than for other disciplines because of the specific epistemological beliefs and language used in the discipline. The findings from this study showed that students need to be able to learn a wide range of vocabulary terms, and Beth specifically mentioned that learning word parts such as prefixes, roots, and suffixes would be beneficial for the biology courses because so many of the
words are derived from Latin words. Additionally, although visuals are not unique to biology, the specific types of diagrams and pictures that students will need to be able to comprehend are specific to this course. For example, several of the participants mentioned that students needed to be able to draw and label parts of diagrams like cell structures and parts of plants. For students in a biology course, these specific, disciplinary skills are important to learning the content.

Implications

The findings from this multicase study have implications for community colleges, biology faculty members, and developmental educators. Each group is discussed below.

Implications for Community Colleges

Many community colleges use placement testing to determine if students will start in developmental reading, writing, or mathematics courses. However, this study showed that the reading and task expectations for introductory biology courses may be demanding for many first-year college students who place into “college-level” courses. Alexander’s (2006) Model of Domain Learning reinforces the fact that reading demands are different at the college level than students have been introduced to, so they may need more support and instruction for reading and study strategies in the new environment of community college. In addition, community colleges are often siloed with each department or division working in their own space without time or efforts for them to work together. In order for faculty to learn from each other, professional development opportunities or professional learning communities need to be provided consistently and intentionally.
Implications for Biology Faculty

Because of the high failure and attrition rates for introductory biology courses (Freeman et al., 2011) at many community colleges, biology faculty members should identify the purposes they want for their students to achieve from the reading assignments for their courses. Additionally, since reading is an important aspect of learning in college courses (Holschuh, 2019; Simpson & Nist, 2000), it is important to assist students in understanding what they need to do while reading the text to get the most out of the assignment. Helping students to understand what the professors expect students to attain from the readings will give them something to focus on while reading and encourage them to complete the reading assignments. This, in turn, may help to improve learning and increase the success rates in the courses.

Faculty members need to recognize that vocabulary and graphics and visuals are important for students to understand while reading their textbooks. Similarly, because there are so many purposes of reading involved in the course, it is vital that professors distinguish the purpose of each reading assignment to help students recognize what they should be paying attention to during the reading event. Finally, as Moje (2007) discussed, discipline members (such as biology faculty) may not be aware of their approaches to reading texts, so the findings from this study may help faculty members understand expectations or begin to identify their own expectations for their students.

It is also important to note that there are differences between the terms reading and studying. Professors are telling students to read the textbook to prepare for the class lecture, but there also appears to be the expectation that students should be reading to study and learn the material. These differences in terms may not be well understood by the students. The instructors
may not have a clear understanding of the difference between reading and studying, so the students may also be confused about the differences.

**Implications for Developmental Educators**

As the field of developmental education continues to change, it is vital that developmental educators continue to determine the most effective ways to prepare students for “college-level” courses. As more and more disciplinary expectations are explored, developmental educators will need to find ways to help students recognize and understand the differences among the disciplines (Johnson et al., 2011). In addition, they will need to help prepare students for the reading and learning demands they will face in each of the various disciplines. This study helped to show that developmental reading educators can help students prepare for introductory biology courses by instructing students in vocabulary strategies, note taking strategies, and ways to read or interpret visuals such as charts, graphs, and pictures often found in biology textbooks.

**Recommendations**

Based on the findings of this research, there are specific recommendations for community colleges, biology faculty members, and developmental educators. In addition, recommendations for further research are discussed below.

**Recommendations for Community Colleges**

There are many ways that community college administrators can help improve student success for introductory biology courses. First, because the participants noted that they were
unsure of how to help students with their reading difficulties, colleges should facilitate professional learning communities between the literacy experts and discipline experts on campus. For example, by scheduling time for the biology professors and the reading professors to discuss expectations for their courses, reading professors can help biology professors design reading strategies that will be effective for their courses and vice versa. In addition, curriculum and assessments could be better aligned. In addition, because the participants noted that students struggle with the reading demands for the course, student supports need to be encouraged on campuses. Although many community colleges offer general tutoring for biology, there needs to be more emphasis placed on how to help students with the reading demands they face. Again, since reading demands are different across the disciplines, it is vital that students are given the support and instruction to recognize how to read and learn from the texts in their different contexts. This support could mean a supplemental instruction course that is connected to the introductory biology course or having a reading specialist available in the tutoring center to assist students with reading and learning demands.

**Recommendations for Biology Faculty**

Because the findings indicated that there are a variety of purposes for reading in the introductory biology courses, professors should give students specific directions for reading the various assignments. I am not suggesting that faculty shorten assignments or tell students to only read specific pages, but they should tell students why they are reading the text. For example, the professor could instruct students to read the chapter to get a basic understanding of the vocabulary terms in order to prepare for the lecture during the next class. In addition, a professor could direct students to make sure they can discuss the steps described in the process in a
chapter. By helping students to recognize why they are reading, they may be more successful because they will know what they should be able to do when they are done with the reading assignment.

Similarly, because there are different purposes for reading the various texts, I also want to encourage faculty members to think about or discuss what they want students to get from the reading assignments. Often, faculty members teach in the same way they were taught without reflecting on the reasons for it. It is easy to tell students to read chapters for homework, but if faculty members are going to later tell students what they need to know and not hold students accountable for the information in the text, then it is not a worthwhile assignment. Students need to have a reason or purpose for an assignment in order to make it meaningful.

Based on the finding that most of the exam questions were focused on the lowest levels of Bloom’s taxonomy, the biology professors should help students to recognize that learning strategies will need to focus on memorizing information. Understanding basic facts and processes is an important aspect of an introductory course and this needs to be explained to students. In addition, although most of the participants stated that they emphasized the importance of application of the material, this was not shown in the assessment. If application of the material is important, then the professors will need to find alternative ways to assess their students in order to make sure they can apply the information appropriately.

**Recommendations for Developmental Reading Educators**

Because reading biology textbooks requires specific skills that are different from reading in other disciplines, my first recommendation for developmental reading professors is to engage in conversations with professors from a variety of disciplines from their campus to determine
what the reading expectations are in other courses. It is also helpful to review the textbook or other reading materials that the disciplinary professors expect their students to read in order to better understand their expectations. Similar to Holschuh’s (2013) study in which she attending several first-year courses in order to determine the literacy expectations for each course, having conversations about reading expectations with other professors can help developmental educators better recognize what they are preparing their students for.

In addition, it is important that students enrolled in developmental reading courses are able to complete reading and task expectations that they will experience in first-year courses, including biology courses – with the needed scaffolding and support. Because of the results of this study, we can better prepare students for the demands they will face in their introductory biology course by teaching them ways to learn vocabulary, take notes effective, read both textbooks and primary source documents, and understand common visuals found in biology textbooks.

**Recommendations for Future Research**

This study focused on the professors’ reading and task expectations, and although previous research has focused on students, further research is needed to determine how students’ and professors’ expectations align (or not) with each other. This could be done by replicating this study, but also interviewing students from the professors’ courses to see how they explain the professors’ expectations. Another option would be to have a literacy expert sit in on the biology course sessions to determine the literacy expectations of the course (similar to Holschuh, 2013) and compare the findings to the biology professor’s explanations. Similarly, further research could explore how students actually study or prepare for their introductory biology courses. A
think-aloud protocol could be used to have students explain the process they use when completing an assignment or when reading a textbook. In addition, an expert-novice study could be completed to determine how a biology expert (such as a professor) reads a biology text compared to a novice (such as a first-year student). Further research could also investigate what the differences in expectations are between the introductory biology courses designed for STEM majors and the courses for non-STEM majors, as well as other disciplines such as chemistry, history, and psychology.

Conclusion

With the high attrition and failure rates of introductory biology courses for STEM majors keeping students at community colleges from completing their degrees, understanding the reading and task demands required of students is one step towards helping to improve teaching and learning for these courses. By understanding that students need to read their textbooks and laboratory manuals for specific purposes such as preparing for lectures, improving background knowledge, learning vocabulary, understanding visuals, and being able to follow procedures in a laboratory activity, professors can better instruct students on why and how to read their textbooks effectively. In addition, although the tasks that students are asked to complete in biology courses may look similar to tasks that they complete in other courses, it is important to note the disciplinary differences in the expectations. Reading and writing in APA format is one difference, but also reading the charts, graphs, and tables while integrating the information with the words in the text may be new for many students. Biology professors need to explicitly teach their students how to be successful with the reading and task demands in their courses. In order
to do this, professors need to be aware of what the reading expectations are, so they can be explained to their students.

Although some developmental educators have advanced research and education in postsecondary education, not all developmental professors at the community college level have this same training. Therefore, the knowledge from this study can be used to help inform future instruction for developmental reading courses. The curriculum for the developmental reading courses should help prepare students for realistic tasks that they will encounter in their introductory college courses. By recognizing and understanding what first-year students need to do in their introductory biology courses, developmental reading educators can create more realistic and authentic curriculum and assessments for their students.

Many students are considered un(der)prepared for the reading demands of college courses, and therefore are placed into developmental reading courses. Although these courses are beneficial for students because they help prepare students for the reading and learning demands they will face, I believe we need to make sure we know what we are preparing students for. Additionally, it is necessary for professors to take responsibility for making sure students are prepared for the learning demands of the course and not assume that they know how to complete the reading and study skills that are needed to be successful without direct instruction or mentoring in the discipline.

Summary of Chapter Five

Chapter Five started with a brief review of this multicase study and a summary of the findings described in Chapter Four. It then continued to discuss the themes from the research questions before reviewing the implications and recommendations for community colleges,
biology faculty members, and developmental educators, as well as exploring possible future research opportunities.
REFERENCES


APPENDIX A

PROFESSOR RECRUITMENT EMAIL
Hello,

My name is Tina Ballard, and I am a doctoral student at Northern Illinois University. For my dissertation, I am looking to explore the reading expectations and literacy tasks expected in introductory biology courses at community colleges. Therefore, I am recruiting biology professors at community colleges to participate in this study. In order to gather information on what professors expect students to do with their reading assignments, participants will be asked to share copies of important course documents, including course syllabi, sample assignment requirement handouts, sample quiz/test questions, and laboratory expectations and assignments. In addition, a 45–60-minute interview will be scheduled at a mutually agreeable time in order to discuss the course reading and task expectations. All materials related to this study will be kept secure in a locked drawer or on a password-protected computer.

If you are interested in participating in this study, or have any questions, please contact me by responding to this email.

Thank you,

Tina Ballard
APPENDIX B

PROFESSOR INTERVIEW GUIDE
Professor Interview Guide

1. Questions about the discipline
   a. How do you define biology or the study of biology?
   b. What characteristics do you think make biology unique from other sciences?

2. Questions about the course
   a. What types of reading activities do you expect from students in this course? How are these explained to students?
   b. I define tasks as activities students could or should do for a course — such as annotating a text, taking notes, analyzing graphics, or creating review questions. What kinds of tasks do you expect your students to be able to do because of the reading assignments?
   c. To what extent and in what ways do you use reading in your classroom instruction?
      i. Can you give me an example of when you use reading in your classroom instruction?
   d. What role does reading play in students’ success in your class?
   e. In the syllabus, these are the course objectives listed (review from each syllabus). What source(s) (reading, lecture, both, or other) are used for students to achieve each course objective?

3. Questions about students
   a. If a student approaches you for advice on how to read for this course, how would you respond? (for example, what do you want them to focus on in the text? What do you want them to do while they are reading? What do you want them to do after they finish reading?)
b. How, when, or where do you believe students learn how to do the reading activities required for this course?

c. How do you think students would describe your directions for using the course text?

4. The goal of this study is to determine what students are expected to do with reading and assignments in introductory biology courses. Is there anything else you would like to share with me about the course and the reading or task expectations?

5. Thank you so much for your time and insights.
APPENDIX C

SYLLABUS ANALYSIS INSTRUMENT
Syllabus Analysis Instrument

1. Course number and institution information

2. Reading assignment(s)

   Name of text(s):

<table>
<thead>
<tr>
<th>Week</th>
<th>chapter(s) assigned</th>
<th>pages</th>
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3. Directions given for reading assignments: (when to read, what to pay attention to, expectations, etc.)
4. Tasks assigned for grading

<table>
<thead>
<tr>
<th>Task</th>
<th>Grading percentage (weight)</th>
<th>Directions</th>
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5. Types of exam questions (circle all that apply)

- Multiple choice
- TF
- Matching
- Short answer
- Essay
- Other: _________________________

6. Types of quiz questions (circle all that apply)

- Multiple choice
- TF
- Matching
- Short answer
- Essay
- Other: _________________________