Supplementing and Remediating for Maximum Biology Achievement

Expanding Excellence 2014

Shenango Area Jr/Sr High School
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Part A: Course Offerings ~ "Honors" Biology for All Students

Curricular Overview

In the past, lower achieving students took Environmental Science instead of Biology. Obviously once the Biology Keystone Exam was implemented, that class had to be eliminated, as it was not designed to prepare students for the content on that test. We replaced Environmental Science with a course called Conceptual Biology, which was designed to cover the Biology Keystone Assessment Anchors, but in a more simplistic manner than our regular Biology course, which was at that time reserved for students on the academic and honors path.

Though it was supposed to teach the same content in theory, we found that the passing rate for the Biology Keystone Exam for students in Conceptual Biology was extremely low, and the learning environment was very negative due to the composition of learners. Many students in that class still struggled to earn decent grades partly because they fed off of each other's negativity regarding class work and assignments. Following is a comparison of the two Biology courses as they were initially structured following the implementation of the Biology Keystone Exam.

Figure 1: Comparison of Former Biology Courses

	Conceptual Biology	**Academic Biology**
Students Enrolled	Non college-bound students and IEP students (LS, ES, & HI)	College-bound and honors students
Content	Attempted to reach Biology Keystone Assessment Anchors	Biology Keystone Assessment Anchors
Pros	Simplified version of content; Allowed students to earn a science credit if Academic Biology would be too rigorous	Prepared students well for Biology Keystone Exam; Rigorous course
Cons	Poor Biology Keystone Exam passing rate; Negative learning environment; Underperformance by some students	Potentially challenging for some students (low achieving and learning support students)

Following several years of this unfavorable learning environment and poor Biology Keystone Exam scores, we eliminated Conceptual Biology. All students, whether they are gifted, college-bound, non-college-bound, or special needs, take the regular Academic Biology course together, with some students receiving proactive support measures that are discussed later in the Implementation Plan. This supplemental programming helps those students who would have been in Conceptual Biology keep up with the pace and rigor of Academic Biology. We have seen success with these students both with their classroom attitude and achievement and with a better Biology Keystone Exam passing rate. Following is a flow chart of the science course sequence initially after adding Conceptual Biology and after the elimination of that course in favor of all students taking the same Academic Biology, though some as freshmen and most as sophomores.

Figure 2: Original Science Course Sequence after Implementation of Biology Keystone Exam

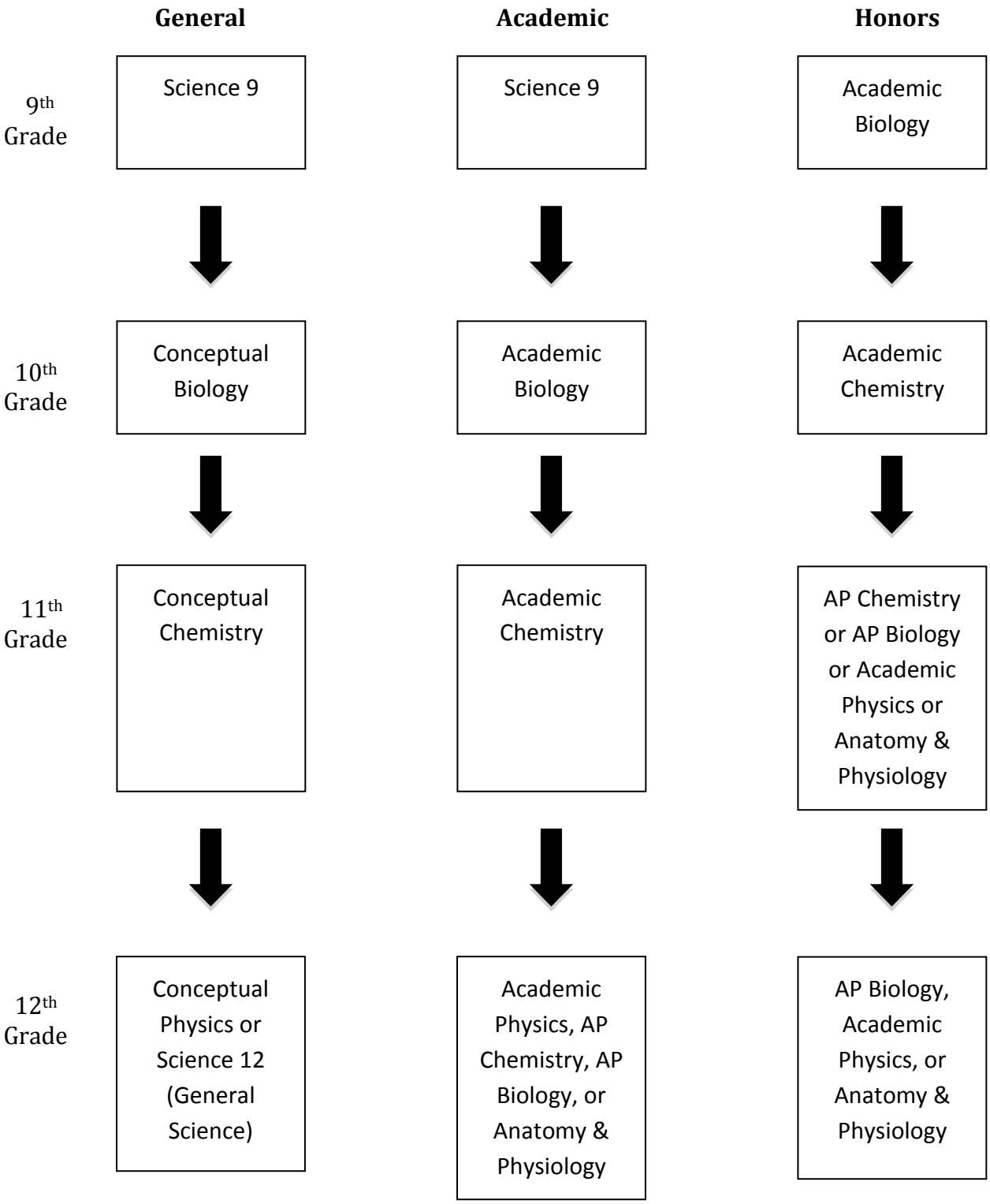
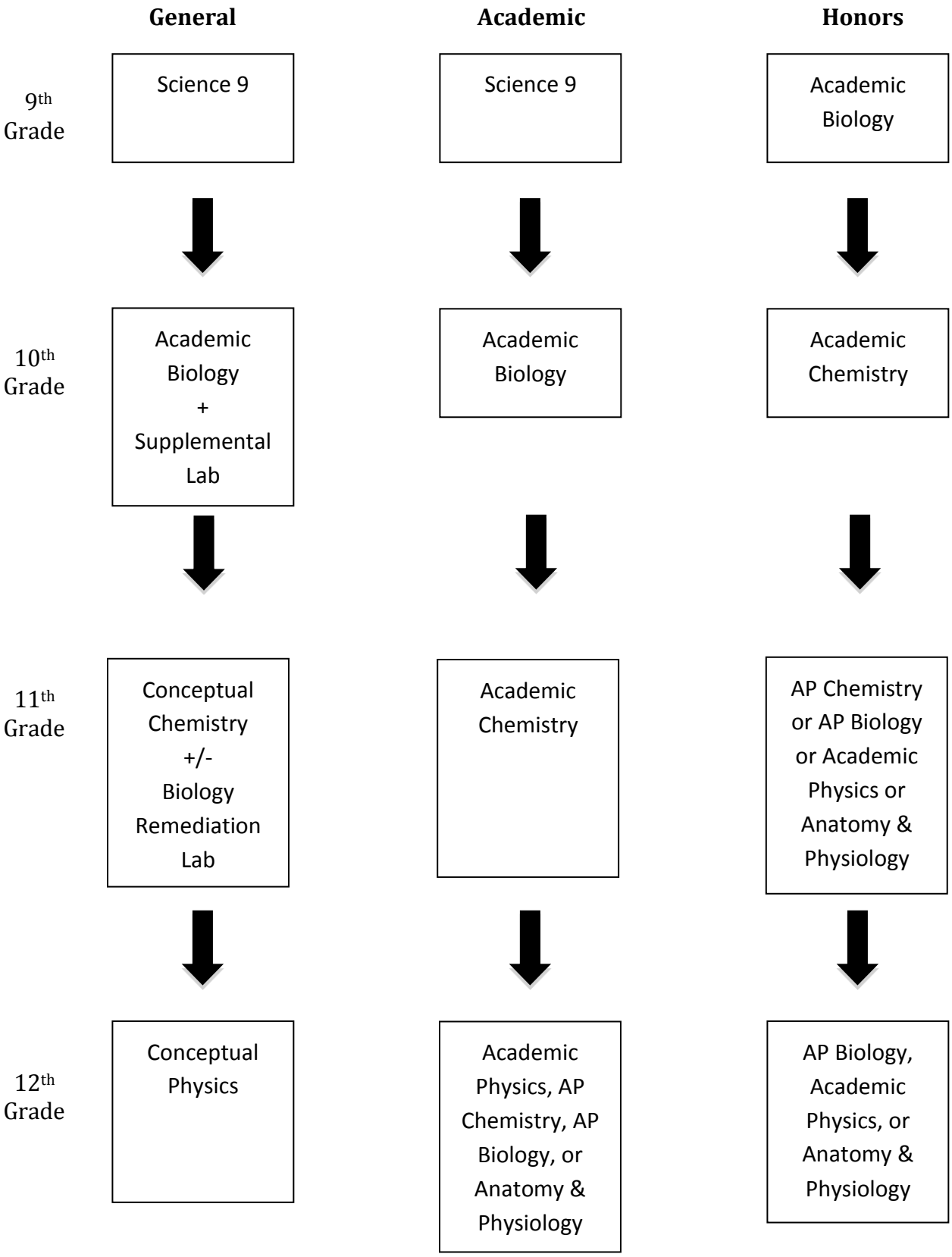


Figure 3: Revised Science Course Sequence after Implementation of Biology Keystone Exam



Change in Culture

The Biology classes are not grouped on ability level in our school district, partially due to scheduling issues surrounding being a small district. This means that a typical Biology class at Shenango High School will consist of a few honors-level freshmen, many college-bound sophomores, and a few low-level or IEP sophomores. Having the former Conceptual Biology students mixed with the higher-achieving students seems to have diluted their sometimes negative attitudes. Additionally, the more involved academic and honors students serve as a reminder for these struggling students on what being an on-task student looks like.

We have found that a large number of students will perform to where the standard is set. If the Biology class is less demanding, they will put in less effort. For the majority of our students, upping the rigor of the course, with the proper supplemental scaffolding in place when needed, has resulted in them raising the level of their effort and achievement. The Academic Biology class that all students take is basically taught as an "Honors" level Biology. All students learn the intricacies of difficult topics such as transcription and translation and the steps of photosynthesis and cellular respiration. Of course, being an effective teacher is critical to making these complex topics manageable.

Data Driven Decisions

For school districts that offer multiple levels of biology (low-level, general, academic, honors, etc…), the district should analyze their Biology Keystone Exam scores by course enrollment. This will allow them to see if certain courses, especially low-level ones, are effective in preparing students to pass the Biology Keystone Exam. If not, then the school district should reconsider the structure of their science course offerings.

Personnel

If your district's science and/or biology course offerings need restructured, a team consisting of the Biology Department, administrators, and school counselors should meet to discuss and implement changes.

Part B: Curricular Alignment

Alignment Overview

Most Biology textbooks are not going to be aligned with the Biology Keystone Assessment Anchors, and the Biology instructors must cross-reference their textbook with the Anchors to ensure that the correct material is being taught. The Biology Keystone Assessment Anchors can be found on the SAS website.

After initially realigning the Biology curriculum and eliminating content not related to the Keystone Exam (e.g. plants, animals, human anatomy and physiology), the instructors should fine-tune the content being taught the following year(s). The best method for this is to really dissect the Biology Assessment Anchors word by word with a critical eye, paying attention to such items as whether examples are listed as "i.e." or "e.g." under the Eligible Content.

Figure 4: Explanation of the Meanings of Terms in the Eligible Content:

	Meaning	Example
i.e.	These exact examples	Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).
e.g.	Examples such as these	Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion).

In the matter cycling Assessment Anchor, the students would only be tested on the water, carbon, oxygen, and nitrogen cycle. If a textbook contains say the water, carbon, nitrogen, and phosphorus cycle, then the phosphorus cycle needs to be omitted while the oxygen cycle is added because the students must know those exact examples. In the properties of water Assessment Anchor, the students could also be tested on other properties of water such as adhesion, high surface tension, or use as a nearly universal solvent.

The Assessment Anchor and Eligible Content Glossary should also be examined and can be found at the end of the Assessment Anchors. It is very useful to use the same terminology as the glossary so that students won't be confused on the Keystone Exam if they see a concept referred to by a different but also acceptable name. For example, in a chapter about evolution, if the textbook refers to breeding racehorses as "artificial selection," but the glossary refers to this concept as "selective breeding," it is better to use the state's terminology so the students are familiar with it before the Keystone Exam. Another example of this problem is the textbook calling the process of forming polymers a "condensation" reaction, while the state uses the term "dehydration synthesis." Teachers with a broader knowledge of Biology are aware that these are the same process, but this sudden change in verbiage could confuse students on the Keystone Exam.

When laying out the Curriculum Map for the Biology course (See Appendix), it is important to not only cut out excess material and expand upon historically underperforming concepts, but also to allow adequate time for review before the Biology Keystone Exam. Because Biology is such a factual subject, it is critical to review concepts from the entire school year, even for high-achieving students. This comprehensive review could take many formats, but we found that talking through the content using a fill-in-the-blank review packet with daily quizzes to be effective.

During this review time, we also discuss the Biology Keystone Exam format. Using available sample questions, we practice the Constructed Response question format and use some of the sample Multiple Choice questions as a class to model some test-taking strategies.

Driven Instruction

After the initial alignment of the curriculum to address the Assessment Anchors, in subsequent years the Biology instructors should analyze the historical Keystone data to assess which Anchors were the greatest areas of weakness, resulting in the poorest scores. These chapters or sections should be expanded to try to correct these deficiencies.

Personnel

The Biology Department and individual Biology instructors should be aligning the curriculum, analyzing the test data for areas of weakness, and fine-tuning the curriculum while implementing best teaching practices. The administrators need to support these efforts by allowing the teachers planning time.

Part C: Proactive Supplemental Instruction

Course Narrative

The supplemental instruction program is a proactive approach taken by the school to assist students who are identified as "at-risk" to be non-proficient on the first administration of the Biology Keystone Exam. The class scaffolds learning in the primary Biology course and provides opportunities for review as well as an in-depth exploration of especially challenging topics within the primary Biology curriculum. Small-group instruction allows for individualized assistance and opportunities to assess deficiencies as the year progresses. Content is delivered in parallel with content covered in the primary Biology course and provides alternate modes of delivery for students. This ranges from pre-teaching upcoming concepts to re-teaching concepts where mastery wasn't obtained. The supplemental instruction program strives to increase achievement, participation, and confidence in the primary Biology course and provide "at-risk" students a better opportunity to pass the Biology Keystone Exam on their first attempt.

Personnel

In order to effectively identify students at risk of non-proficiency, an advisory team of individuals consisting of school counselors and previous science teachers work together to compile a list of students that would benefit from the supplemental instruction program. A certified Biology teacher who is not their primary Biology teacher will provide instruction for the lab sessions. Communication between the counseling staff and Biology department during the early portion of the school year allows for late additions of students that may have been missed previously.

Eligible Students

Any students deemed to be at risk of non-proficiency by the advisory team are placed into the supplemental instruction program. These decisions are made utilizing both qualitative and quantitative data from previous performance within the department as well as previous standardized test scores in all academic areas. In addition, students who are struggling significantly at the beginning of the year in their primary Biology course are placed into the program.

Figure 5: Student Identification for Supplemental Instruction

Indicators	
✓	Non-Proficient on 8th grade Science PSSA
✓	<75% average in previous year's science class
✓	Teacher Recommendation

Course Structure

The supplemental instruction program is offered as a year-long lab course meeting every other day. At our school, labs are half-credit courses that meet Monday/Wednesday/Friday one semester and Tuesday/Thursday the other semester. This allows students to fit Supplemental Instruction in with

minimal impact on their schedules. Students can take a variety of courses on the opposite days including, remediation labs, science labs, PE, SAT courses and part-time band or choir classes. The lab groups switch days at the end of the semester, thus each student in the program receives an additional fifty percent of Biology instruction during the academic year in addition to their primary Biology course. Content is delivered in parallel with the content covered in the primary Biology course with a focus on addressing challenging topics within the course and Biology Keystone Exam where students have traditionally struggled. Continual review in a multitude of formats provides the teacher an opportunity to assess areas of content where additional instructional time is needed and instructional flexibility is key. Projects and in-class assignments separate from the primary Biology course enhance and scaffold content knowledge, as students are provided alternate perspectives and modes of delivery. Small group instruction allows for continual reinforcement and feedback for students within the supplemental instruction program and addresses deficiencies for individual students. A key to this success is keeping average class sizes small so it can border on a tutoring lab as opposed to direct whole group instruction. A few weeks prior to the Keystone Exam, students focus on test-taking strategies and complete formal assessments reviewing material covered throughout the year. These assessments take many formats and include teacher-constructed exams utilizing the PDESAS Assessment Creator tool as well as sites such as Edmentum's *Study Island* program (account required). Additional time is taken during this period for exploration and reflection of topics that students performed poorly upon.

Data Driven Instruction

The advisory team utilizes quantitative data from previous PSSA performance and student transcripts as well as qualitative data from previous teachers and counselors to accurately identify students at-risk of non-proficiency and place them in the supplemental instruction program. Historical Keystone Exam data is analyzed to identify areas of deficiency in previous years and ensure that appropriate instructional time is taken during the supplemental course to address any misconceptions that may exist. Throughout the academic year, ongoing communication between the primary Biology instructor and supplemental course instructor ensures that students having difficulties on particular topics are focused on in small-group instruction. Test scores from individual chapters in the primary Biology curriculum are analyzed by the supplemental Biology instructor to provide a framework for items to be covered in depth during the Keystone Review at the end of the academic year.

Cultural Shift

Perhaps one of the most positive secondary benefits to this program (assuming that increased achievement is #1) was the response of the classically low-performing populations. Students, who for many years had unperformed and view themselves as "bad students", have found success. Instead of having a separate science class with only low performing peers, they are learning side-by-side with academic and honors students. Confidence is gained when they are able to access information during pre-teaching in their supplemental labs then more fully participate in their generally Biology course in a way that previously could not. Much to our delight, a Biology teacher at our school tells of the surprised expression on "smart" student faces and the triumphant expression on a "bad" student's face when they are able to answer a tough question in class prior to others.

Part D: Reactive Remediation Program

Course Narrative

The remediation program is a reactive approach taken by the school to assist non-proficient students in their attempt to achieve a score of proficient on the Keystone Biology Exam. The course content is designed by the instructor to thoroughly address each and every item of eligible content in the anchors of each module and ensure that each student is prepared for the next administration of the exam. Direct data-driven instruction is delivered so that students are able to focus their efforts on particular areas of weakness. Small-group instruction allows for individualized assistance and opportunities to address misconceptions as the year progresses. Students are instructed on how the exam is scored and test-taking strategies are focused upon and stressed throughout the course. During the academic year, students are required to take the Biology Keystone Exam during the winter testing window and, if necessary, the spring testing window. Students that achieve a level of proficiency on the exam are removed from the course immediately. The remediation program strives to instill the expectation that each and every student can, and will, pass the Biology Keystone Exam and ensures that each student is given the best possible opportunity to do so.

Personnel

A certified Biology teacher will provide instruction for the lab sessions. School counselors are involved in the scheduling of alternate classes for students that score proficient on the Biology Keystone Exam.

Eligible Students

Any and all students that are below a score of "Proficient" on the administration of the Biology Keystone Exam are automatically placed into the mandatory remediation program. This includes any students that participated in the summer remediation and/or summer testing as well. Students that achieve proficiency on any re-test of the Biology Keystone Exam are removed from the course immediately once the district receives those Proficient scores.

Figure 6: Spotlight on Summer Keystone Camp

Overview:	We have found great success in offering a week-long summer remediation camp for students who are non-proficient, followed by the July Keystone Retest.
When:	We schedule 5 or 6 day classes for 2 ½ hours per day for the week immediately leading up to the summer testing window. This format allows for some students to participate in multiple classes (Biology, Algebra and/or Literature) if necessary.
How:	There is some financial investment to compensate teachers to plan and

	offer the camp. There are also some added responsibilities for the building administration to quickly turn around spring keystone scores, organize, advertise and recruit students to attend. Students received letter invitations followed by personal phone calls.
Who:	All non-proficient students are invited but particular emphasis is placed on recruiting students scoring within 20 scaled points of proficiency, because this population is the most likely to find success after a short term remediation attempt.
Results:	We have been pleasantly surprised that nearly 50% of students completing the summer Keystone Camps have reached proficiency on the retest. This is always rewarding for our students because it frees up their schedule during the school year by not having to take remediation labs.

Course Structure

The remediation program is offered in two sections to students as a semester-based lab course meeting every other day. The lab groups switch days at the end of the semester, thus each student in the program receives an equal amount of remediation during the academic year in preparation for the Keystone Exam. Due to the time constraint placed upon the course by the winter testing window, the first semester of the course is highly concentrated on key concepts of each eligible content area and addressing areas of severe need determined by students' previous scores on the exam and a Classroom Diagnostic Tool (CDT) test performed during the first few weeks of the course. Challenging topics are divided by anchors and addressed in the classroom in a variety of formats. The instructor ensures that each vocabulary term from the state provided glossary is applied to the proper anchor area(s) and that students are familiar with key terminology. Assessments are given at the end of each anchor to evaluate student comprehension and these assessments take many formats as well; including teacher-constructed exams, exams created utilizing the PDESAS Assessment Creator tool, and assessments given using Edmentum's *Study Island* program. Throughout the course, test-taking strategies and constructed response guidelines are taught, reinforced, and practiced.

After the winter testing session has been completed, the instructor focuses on a more developed and in-depth look at challenging anchors with the remaining students in the course. Individualized instructional time is spent with students taking the spring exam, once again formulating a strategy based upon the exam results and raw score data. The instructor paces the course based upon student needs and ensures that all areas of concern are addressed thoroughly in preparation for the spring testing window.

Data Driven Instruction

The students' previous Biology Keystone Exam scores are analyzed at the beginning of the year in order to assess which anchors within the modules each student has struggled with and to formulate

a strategy with which the students can increase their scores. Increased instructional time is spent on anchors that many students showed difficulty with. Additionally, results from the CDT are analyzed and compared with results from the Keystone Exam to further guide instruction during the course. Qualitative data gained through instructional assistance during the students' use of Edmentum's *Study Island* program also provides valuable feedback for the instructor and helps to assess deficiencies in student content knowledge.

Part D: Appendix

Curriculum Map for Biology Course

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
1	Foundations of Biology	**A: The Science of Life** - biology, characteristics of life, scientific method, controlled experiment, theory, microscopes	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. Describe and interpret relationships between structure and function at various levels of biological organization. Explain how organisms maintain homeostasis. Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.	Open Notes Quizzes; Intro to Microscope Lab; Microscope Quiz; Ch. 1 Test	BIO.A.1.1.1 BIO.A.1.2.2 BIO.A.4.2.1 BIO.B.3.3.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
2	Foundations of Biology	**A: Chemistry of Life** - element, atom, compound, chemical bonds, energy, reactants/products, activation energy, polarity of water, hydrogen bonding, properties of water	Describe and interpret relationships between structure and function at various levels of biological organization. Describe the unique properties of water and how these properties support life on Earth.	Open Notes Quizzes; Properties of Water Lab; Ch. 2 Test	BIO.A.1.2.2 BIO.A.2.1.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
3	Foundations of Biology	**A: Biochemistry** - organic compounds, properties of carbon, monomers, polymers, dehydration synthesis/hydrolysis reactions, ATP, carbohydrates, proteins, enzymes, lipids, nucleic acids	Explain how carbon is uniquely suited to form biological macromolecules. Describe how biological macromolecules form from monomers. Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.	Open Notes Quizzes; The Role of the Enzyme Lab; Identifying Organic Compounds Lab; Ch. 3 Test	BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3 BIO.A.2.3.1 BIO.A.2.3.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
4	Foundations of Biology	**A: Biochemistry** - organic compounds, properties of carbon, monomers, polymers, dehydration synthesis/hydrolysis reactions, ATP, carbohydrates, proteins, enzymes, lipids, nucleic acids	Explain how carbon is uniquely suited to form biological macromolecules. Describe how biological macromolecules form from monomers. Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.	Open Notes Quizzes; The Role of the Enzyme Lab; Identifying Organic Compounds Lab; Ch. 3 Test	BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3 BIO.A.2.3.1 BIO.A.2.3.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
5	Foundations of Biology	**A: Biochemistry** - organic compounds, properties of carbon, monomers, polymers, dehydration synthesis/hydrolysis reactions, ATP, carbohydrates, proteins, enzymes, lipids, nucleic acids	Explain how carbon is uniquely suited to form biological macromolecules. Describe how biological macromolecules form from monomers. Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms. Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction. Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.	Open Notes Quizzes; The Role of the Enzyme Lab; Identifying Organic Compounds Lab; Ch. 3 Test	BIO.A.2.2.1 BIO.A.2.2.2 BIO.A.2.2.3 BIO.A.2.3.1 BIO.A.2.3.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
6	Cell Biology	**A: Cell Structure & Function** - cell, cell theory, cell shape, cell size, basic parts of a cell, types of cells, plasma membrane, nucleus, mitochondria, ribosomes, endoplasmic reticulum, golgi apparatus, vesicles, cytoskeleton, features unique to plant cells	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. Compare cellular structures and their functions in prokaryotic and eukaryotic cells. Describe the fundamental roles of plastids and mitochondria in energy transformations. Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. Describe how membrane-bound organelles facilitate transport of materials within a cell.	Open Notes Quizzes; Cell Analogy Project; Cheek Cell Microscope Lab; Ch. 4 Test	BIO.A.1.1.1 BIO.A.1.2.1 BIO.A.3.1.1 BIO.A.4.1.1 BIO.A.4.1.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions; Reading a story comparing a cell to a city; Construct a project comparing the parts of a cell to a school, house, zoo, etc…
7	Cell Biology	**A: Cell Structure & Function** - cell, cell theory, cell shape, cell size, basic parts of a cell, types of cells, plasma membrane, nucleus, mitochondria, ribosomes, endoplasmic reticulum, golgi apparatus, vesicles, cytoskeleton, features unique to plant cells	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. Compare cellular structures and their functions in prokaryotic and eukaryotic cells. Describe the fundamental roles of plastids and mitochondria in energy transformations. Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. Describe how membrane-bound organelles facilitate transport of materials within a cell.	Open Notes Quizzes; Cell Analogy Project; Cheek Cell Microscope Lab; Ch. 4 Test	BIO.A.1.1.1 BIO.A.1.2.1 BIO.A.3.1.1 BIO.A.4.1.1 BIO.A.4.1.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions; Reading a story comparing a cell to a city; Construct a project comparing the parts of a cell to a school, house, zoo, etc…
8	Cell Biology	**A: Homeostasis & Cell Transport -** passive transport, simple diffusion, osmosis, facilitated diffusion, active transport, sodium-potassium pump, endocytosis (pinocytosis and phagocytosis), exocytosis	Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell. Compare the mechanisms that transport materials across the plasma membrane. Describe how membrane-bound organelles facilitate transport of materials within a cell.	Open Notes Quizzes; Egg Osmosis Lab; Ch. 5 Test	BIO.A.4.1.1 BIO.A.4.1.2 BIO.A.4.1.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
9	Cell Biology	**A: Photosynthesis** - obtaining energy, overview of photosynthesis, chloroplasts, pigments, light reactions, chemiosmosis, carbon fixation, factors affecting photosynthesis	Describe the fundamental roles of plastids and mitochondria in energy transformations. Compare the basic transformation of energy during photosynthesis and cellular respiration. Describe the role of ATP in biochemical reactions.	Open Notes Quizzes; Photosynthesis Lab; Ch. 6 Test	BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
10	Cell Biology	**A: Cellular Respiration** - cellular respiration, overview, glycolysis, fermentation, aerobic respiration, Krebs cycle, electron transport chain	Describe the fundamental roles of plastids and mitochondria in energy transformations. Compare the basic transformation of energy during photosynthesis and cellular respiration. Describe the role of ATP in biochemical reactions.	Open Notes Quizzes; Yeast Fermentation Lab; Ch. 7 Test	BIO.A.3.1.1 BIO.A.3.2.1 BIO.A.3.2.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
11	Cell Biology	**A: Cellular Reproduction** - DNA, homologous pair of chromosomes, prokaryotic vs. eukaryotic chromosomes, autosomes vs. sex chromosomes, karyotype, haploid vs. diploid, binary fission, cell cycle, mitosis, control of cell division, meiosis, mitosis vs. meiosis	Describe the events that occur during the cell cycle: interphase, nuclear division, cytokinesis. Compare the processes and outcomes of mitotic and meiotic nuclear divisions.	Open Notes Quizzes; Mitosis & Meiosis Modeling Activity; Ch. 8 Test	BIO.B.1.1.1 BIO.B.1.1.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
12	Cell Biology	**A: Cellular Reproduction** - DNA, homologous pair of chromosomes, prokaryotic vs. eukaryotic chromosomes, autosomes vs. sex chromosomes, karyotype, haploid vs. diploid, binary fission, cell cycle, mitosis, control of cell division, meiosis, mitosis vs. meiosis	Describe the events that occur during the cell cycle: interphase, nuclear division, cytokinesis. Compare the processes and outcomes of mitotic and meiotic nuclear divisions.	Open Notes Quizzes; Mitosis & Meiosis Modeling Activity; Ch. 8 Test	BIO.B.1.1.1 BIO.B.1.1.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
13	Genetics and Biotechnology	**A: Fundamentals of Genetics** - Gregor Mendel, law of segregation, law of independent assortment, common genetics terms, Punnett squares, monohybrid vs. dihybrid crosses, incomplete dominance, codominance	Explain the functional relationships between DNA, genes, alleles, and chromosomes and their role in inheritance. Describe and/or predict observed patterns of inheritance.	Open Notes Quizzes; Design a Species Project; Ch. 9 Test	BIO.B.1.2.2 BIO.B.2.1.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions; Creating a new species with certain inherited characteristics
14	Genetics and Biotechnology	**A: Fundamentals of Genetics** - Gregor Mendel, law of segregation, law of independent assortment, common genetics terms, Punnett squares, monohybrid vs. dihybrid crosses, incomplete dominance, codominance	Explain the functional relationships between DNA, genes, alleles, and chromosomes and their role in inheritance. Describe and/or predict observed patterns of inheritance.	Open Notes Quizzes; Design a Species Project; Ch. 9 Test	BIO.B.1.2.2 BIO.B.2.1.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions; Creating a new species with certain inherited characteristics
15	Genetics and Biotechnology	**A: DNA, RNA, & Protein Synthesi**s - DNA structure, DNA replication, protein synthesis, transcription vs. translation	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. Describe how the processes of transcription and translation are similar in all organisms. Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.	Open Notes Quizzes; Candy DNA Replication Lab; Modeling Transcription & Translation Activity; Ch. 10 Test; Ch. 10.4 Test	BIO.A.1.1.1 BIO.B.1.2.1 BIO.B.2.2.1 BIO.B.2.2.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
16	Genetics and Biotechnology	**A: DNA, RNA, & Protein Synthesi**s - DNA structure, DNA replication, protein synthesis, transcription vs. translation	Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms. Describe how the process of DNA replication results in the transmission and/or conservation of genetic information. Describe how the processes of transcription and translation are similar in all organisms. Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.	Open Notes Quizzes; Candy DNA Replication Lab; Modeling Transcription & Translation Activity; Ch. 10 Test; Ch. 10.4 Test	BIO.A.1.1.1 BIO.B.1.2.1 BIO.B.2.2.1 BIO.B.2.2.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
17	Genetics and Biotechnology	**A: Inheritance Patterns & Human Genetics** - sex-linked trait, mutations, nondisjunction, pedigree, carrier, polygenic, gene therapy	Explain the functional relationships between DNA, genes, alleles, and chromosomes and their role in inheritance. Describe and/or predict observed patterns of inheritance. Describe processes that can alter composition or number of chromosomes. Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype.	Open Notes Quizzes; Genetic Disorders Lab; Ch. 12 Test	BIO.B.1.2.2 BIO.B.2.1.1 BIO.B.2.1.2 BIO.B.2.3.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
18	Genetics and Biotechnology	**A: Inheritance Patterns & Human Genetics** - sex-linked trait, mutations, nondisjunction, pedigree, carrier, polygenic, gene therapy	Explain the functional relationships between DNA, genes, alleles, and chromosomes and their role in inheritance. Describe and/or predict observed patterns of inheritance. Describe processes that can alter composition or number of chromosomes. Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype.	Open Notes Quizzes; Genetic Disorders Lab; Ch. 12 Test	BIO.B.1.2.2 BIO.B.2.1.1 BIO.B.2.1.2 BIO.B.2.3.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
19	Genetics and Biotechnology	**A: Gene Technology** - PCR, restriction enzyme, gel electrophoresis, DNA fingerprinting, genetic engineering, recombinant DNA, cloning	Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture.	Open Notes Quizzes; "Who Ate the Cheese?!" Lab; Ch. 13 Test	BIO.B.2.4.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
20	Genetics and Biotechnology	**A: Gene Technology** - PCR, restriction enzyme, gel electrophoresis, DNA fingerprinting, genetic engineering, recombinant DNA, cloning	Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture.	Open Notes Quizzes; "Who Ate the Cheese?!" Lab; Ch. 13 Test	BIO.B.2.4.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
21	Evolution	**A: Theory of Evolution** - evolution, natural selection, adaptation, fitness, evidence of evolution, artificial selection, coevolution	Explain how natural selection can impact allele frequencies of a population. Explain how genetic mutations may result in genotypic and phenotypic variations within a population. Interpret evidence supporting the theory of evolution.	Open Notes Quizzes; Modeling Natural Selection Lab; Ch. 15 Test	BIO.B.3.1.1 BIO.B.3.1.3 BIO.B.3.2.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
22	Evolution	**A: Theory of Evolution** - evolution, natural selection, adaptation, fitness, evidence of evolution, artificial selection, coevolution	Explain how natural selection can impact allele frequencies of a population. Explain how genetic mutations may result in genotypic and phenotypic variations within a population. Interpret evidence supporting the theory of evolution.	Open Notes Quizzes; Modeling Natural Selection Lab; Ch. 15 Test	BIO.B.3.1.1 BIO.B.3.1.3 BIO.B.3.2.1	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
23	Evolution	**A: Population Genetics & Speciation -** microevolution, gene pool, Hardy-Weinberg equilibrium, immigration vs. emigration, gene flow, genetic drift, sexual selection, stabilizing vs. disruptive vs. directional selection, speciation, morphological vs. biological species concept, geographic vs. reproductive isolation, gradualism vs. punctuated equilibrium	Explain how natural selection can impact allele frequencies of a population. Describe the factors that can contribute to the development of new species. Explain how genetic mutations may result in genotypic and phenotypic variations within a population.	Open Notes Quizzes; Teddy Graham Evolution Lab; Ch. 16 Test	BIO.B.3.1.1 BIO.B.3.1.2 BIO.B.3.1.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
24	Evolution	**A: Population Genetics & Speciation -** microevolution, gene pool, Hardy-Weinberg equilibrium, immigration vs. emigration, gene flow, genetic drift, sexual selection, stabilizing vs. disruptive vs. directional selection, speciation, morphological vs. biological species concept, geographic vs. reproductive isolation, gradualism vs. punctuated equilibrium	Explain how natural selection can impact allele frequencies of a population. Describe the factors that can contribute to the development of new species. Explain how genetic mutations may result in genotypic and phenotypic variations within a population.	Open Notes Quizzes; Teddy Graham Evolution Lab; Ch. 16 Test	BIO.B.3.1.1 BIO.B.3.1.2 BIO.B.3.1.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
25	Ecology	**A: Introduction to Ecology -** ecology, interdependence, biosphere, ecosystem, community, population, habitat, biotic vs. abiotic factors, niche, generalist vs. specialist, producer, consumer, decomposer, trophic level, food chain vs. food web, water cycle, carbon cycle, nitrogen cycle, oxygen cycle	Describe the levels of ecological organization. Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. Describe how energy flows through an ecosystem. Describe how matter recycles through an ecosystem.	Open Notes Quizzes; Food Web Worksheet; Ch. 18 Test	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
26	Ecology	**A: Introduction to Ecology -** ecology, interdependence, biosphere, ecosystem, community, population, habitat, biotic vs. abiotic factors, niche, generalist vs. specialist, producer, consumer, decomposer, trophic level, food chain vs. food web, water cycle, carbon cycle, nitrogen cycle, oxygen cycle	Describe the levels of ecological organization. Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems. Describe how energy flows through an ecosystem. Describe how matter recycles through an ecosystem.	Open Notes Quizzes; Food Web Worksheet; Ch. 18 Test	BIO.B.4.1.1 BIO.B.4.1.2 BIO.B.4.2.1 BIO.B.4.2.3	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
27	Ecology	**A: Populations -** population, population density, dispersion, birth vs. death rate, life expectancy, age structure, survivorship curve, exponential vs. logistic model of growth, limiting factor, carrying capacity	Describe the effects of limiting factors on population dynamics and potential species extinction.	Open Notes Quizzes; Population Data Worksheet; Ch. 19 Test	BIO.B.4.2.5	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
28	Ecology	**A: Community Ecology -** predation, interspecific competition, symbiosis, species-area effect, disturbance, ecological succession	Describe biotic interactions in an ecosystem. Describe how ecosystems change in response to natural and human disturbances.	Open Notes Quizzes; Ecological Succession Worksheet; Species Interaction Worksheet; Ch. 20 Test	BIO.B.4.2.2 BIO.B.4.2.4	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
29	Ecology	**A: Ecosystems -** biome, tundra, tropical forest, temperate deciduous forest, taiga, temperate grassland, savanna, chaparral, desert, zones of the ocean, estuary, eutrophic vs. oligotrophic lakes, freshwater wetlands	Describe the levels of ecological organization. Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.	Open Notes Quizzes; Ch. 21 Test	BIO.B.4.1.1 BIO.B.4.1.2	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
30	Ecology	**A: Humans & the Environment -** environmental science, ozone layer, greenhouse effect, smog, CFCs, acid rain, biological magnification, extinction, keystone species	Describe how ecosystems change in response to natural and human disturbances.	Open Notes Quizzes; Eco-Footprint Quiz; Ch. 22 Test	BIO.B.4.2.4	Reading and following a laboratory procedure; Composing answers to laboratory questions and test questions
31	Keystone Review	**A: Reviewing Keystone Standards -** review foundations of biology	Review information for the Biology Keystone.	Review Packet; Review Quizzes; Practice Tests	Various	Composing answers to quiz questions; Practice "Constructed Response" questions

Week	Unit	Topic/Content	Learning Objectives/Skills	Assessment(s)	Standards	Authentic Literacy
32	Keystone Review	**A: Reviewing Keystone Standards -** review cell biology	Review information for the Biology Keystone.	Review Packet; Review Quizzes; Practice Tests	Various	Composing answers to quiz questions; Practice "Constructed Response" questions
33	Keystone Review	**A: Reviewing Keystone Standards -** review genetics and biotechnology	Review information for the Biology Keystone.	Review Packet; Review Quizzes; Practice Tests	Various	Composing answers to quiz questions; Practice "Constructed Response" questions
34	Keystone Review	**A: Reviewing Keystone Standards** - review evolution	Review information for the Biology Keystone.	Review Packet; Review Quizzes; Practice Tests	Various	Composing answers to quiz questions; Practice "Constructed Response" questions
35	Keystone Review	**A: Reviewing Keystone Standards** - review ecology	Review information for the Biology Keystone.	Review Packet; Review Quizzes; Practice Tests	Various	Composing answers to quiz questions; Practice "Constructed Response" questions
36	Vertebrates	**A: Comparative Vertebrate Anatomy** - rat dissection	Describe and interpret relationships between structure and function at various levels of biological organization.	Rat Dissection Test	BIO.A.1.2.2	Composing answers to quiz questions

Steps to Implement Biology Achievement Plan

Action Steps to Implementation		
Steps	**Action**	**Duration**
1	Course sequence planning. Elimination of below level courses and initial planning for offering supplemental and remedial instruction during school hours.	Month
2	Macro-level detailed review of course content in alignment with eligible content for alignment.	Weeks
3	Data and archival review to identify at-risk students for supplemental instruction	Week
4	Instructional planning with staff and schedules to support supplemental and remedial instruction	Weeks
5	Planning for Summer Keystone Camp (remediation and retesting)	Week
6	Recruit students and offer Summer Keystone Camp and retesting	Week
7	Detailed review of assessment data and performance, leading to micro-level course alignment and instructional planning. Cutting and adding necessary content/instruction. Expanding and contracting necessary content/instruction.	Weeks
8	Students enrolled in supplemental and remedial courses. Teacher collaboration on supplemental and core Biology instruction.	Months
9	Retest and continue Remediation until proficiency or senior level Project Based Assessments are reached	Months