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Quality Instruction Creates Higher Student Learning

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QUALITY INSTRUCTION CREATES HIGHER STUDENT LEARNING

by

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Under the Direction of Rebecca Stobaugh

ABSTRACT

Many agree that science education is in need of reform, due to the fact that America is falling behind other industrialized nations in measures of science performance. In order to revolutionize the direction of this discipline is it up to the educators to implement changes in their classroom. It seems that our educational settings know what needs to be done in order to reach higher standards of achievement, however it is concerning that schools aren't taking the steps necessary to reach these levels. In trying to enhance student learning, there are several methods in science education that are targeted at quality instruction. In incorporating these into one's lesson plans, a teacher could revitalize the field of science, and shine light on it as a fascinating branch of knowledge for exploring young minds.

INDEX WORDS: Science, Education, Effective Strategies, Student Learning, Quality Instruction, Higher Level Thinking

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DEDICATION

To all the past, present, and future educators. Thank you for your time, and good luck as you continue to enrich the minds of today's youth. May these words inspire you and bring you fresh ideas for your classroom.

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Introduction

As a prospective secondary science teacher, I will be required to produce numerous lesson plans and units of study in biology. In doing this, I will incorporate technology, and other activities to engage all of my students. I will also utilize numerous strategic tactics in order to draw my students in to the lesson and provide variety in my lessons in order to appeal to the different multiple intelligences, learning styles, and ability levels. All of these things I have incorporated throughout my unit plan. The goal of my study and of this capstone experience was to find out what it takes to provide quality instruction in order to achieve higher student learning. In doing this, I have looked at a number of different things, including how the United States ranks among other countries in science education, the importance of science as an educational discipline, the responsibility of teachers, how to meet the needs of every learner, and numerous instructional strategies designed to target excellence in science education.

A Perspective on Science Education

According to the 2003 Trends in International Mathematics and Science Study (TIMSS), twenty-five percent of fifteen year old, American students performed below proficiency on science competence tests (Organization for Economic Cooperation and Development, 2007). Furthermore, students' interests in these fields peak at an early age. In fact, only one-third of undergraduates in the United States complete degrees in the fields of science and engineering, compared with two-thirds of students from Japan and China (Berger, 2009). According to the American Association for the Advancement of Science, one of the major goals in educating our students in science is reaching

intellectual competencies in problem solving, independent learning, critical thinking, and decision making. In order to obtain this goal, the way we educate must be transformed from traditional instruction to a more constructive type of education (Organization for Economic Cooperation and Development, 2007).

In research by Schraw, Crippen, and Hartley (2006) several key strategies are addressed to meet the needs of science education. These strategies include collaboration among teachers and students, critical thinking and problem solving, inquiry-based learning, and technology. One concerning factor however is that although these beliefs and ideals for science instruction seem to be universal, very few school districts have implemented change. In fact, most science teachers are continuing to use the simplistic, traditional education methods, and as a result, they fail to foster higher-level thinking, and the students are the ones who suffer.

In order to make a difference and truly impact the field of science, educators need to have an extensive knowledge in their subject. In addition to this, they need to understand the pedagogy of learning and how to develop higher-order thinking and teach these critical thinking and inquiry-based learning skills (Barak and Shakhman, 2008). In addition to the pedagogical knowledge required to plan instruction, Leou (2006) also makes an implication regarding the importance of teachers to reflect on their instruction in order to be able to improve their skills as an educator.

Observations

In order to gain insight on what it means to be a teacher, I spent a lot of time doing field experiences, and observing seasoned teachers, learning from their successes,

and taking notes on things I would do differently in my classroom. The majority of my observations were at McLean County High School, a rural Kentucky high school of about five hundred students. I also had observation experiences at Apollo High School and Daviess County High School, both in Owensboro, Kentucky. Each of these schools are larger institutions with student enrollments of fourteen and eighteen hundred, respectively. My final observations were with the sixty students in the junior class at the Kentucky Academy for Mathematics and Science, located on WKU's campus in Bowling Green, Kentucky. The purpose of these observations was to analyze how effective science methods are being implemented in Kentucky schools.

An In Depth Look at Science Education

Many, including U.S. Congressman Rush Holt, see the importance in science. According to Holt, (2009):

> Science is not just another subject in school. It's how students learn to ask questions so that they can be answered empirically, a skill that every person should have…. It's important for us to understand how the universe works, how people interact, and how things evolve. You need that not just for material well being, but for our political system to function….It is from science that we get the innovation that provides productivity and growth for the future economy, so it is critically important for our economic well-being. It also adds to our quality of life in material ways (Holt, 2009, p.32).

In examining science education, one of the main mediums studied was the educational strategies that can be used to promote higher student learning. The strategies

discussed include promoting scientific literacy, technology and learning, higher order thinking, scientific inquiry, teaching for understanding, active learning, adequate questioning, meeting the needs of every student, a purpose for learning, and teaching to the next level. Each of these instructional methods has been proven as effective in the science curriculum and should thus be incorporated into the science classroom.

Promoting Scientific Literacy

While many would agree that education is yearning for reform, our ultimate goal for science education should be to produce scientifically literate students. According to Sadler (2004), reaching a state of scientific literacy requires the capacity to make decisions regarding issues in science. Since many times these socioscientific issues are moral and ethical questions in nature, it is necessary that a tolerant environment be in existence so that the students feel comfortable voicing their dissenting views and opinions and have an opportunity to examine their beliefs. In his article, Sadler also states his disposition that schools striving to promote responsible decision making, should include moral and ethical discussions in their curriculum. In conclusion, science teachers should strive to examine morality and ethics in order to promote a complete sense of scientific literacy.

Technology and Learning

Another one of the most prominent discussions in science education and a means of promoting scientific literacy is by bringing technology into the classroom. Sometimes this approach is called "digital learning," where connectivity, technology, human resources, and content are interdependent. Many argue that educational tactics such as

this are "critical" in order to prepare our students for analytical thinking skills and today's technological society (CEO Forum, 2000). Others agree and believe that allowing students to interact with technology prepares them for real world applications (Petersen, 2003). For this reason, teachers are highly encouraged to learn about the most appropriate and effective ways to incorporate technology into their teaching strategies in order to make the most of their lessons. Research also suggests that the way a teacher models technology can also have implications on how their students assimilate this use of technology in to their own lives (Annetta et al., 2007).

Other studies, such as the one by Kaino (2008), have revealed the usefulness of technology in learning, and particularly in narrowing the gender gap in science instruction. In this study, they evaluated the gender differences at the secondary school level in learning using technology. The results of this study revealed that students found learning using computers to be useful and a positive form of instruction. Girls did however report slightly more anxiety in learning from computers than did boys, which is important to keep in mind when planning for computer instruction.

Research by Carrell and Menzel (2001) concludes that "students obtain higher level learning from well-designed multimedia presentations than from traditional verbal or text only presentations." These findings have also been observed on problem solving activities and test scores (Mayer, 2001). In a similar study conducted by Mayer (2007) he suggests that the level at which students are engaged can help to assess a well-designed presentation. He also indicates that when a student is engaged, and active

learning is taking place, the material learned is transferred to the long term memory, which is important for student understanding.

Research has shown that technology provides great benefit because of its ability to initiate excitement among the students (Annetta et al., 2007). Other studies however conclude that "In order to excite students about science, you must first excite the science teacher" (Peterson, 2003). The literature also points out that simply incorporating technology into the lessons isn't good enough! Technology should not be used just for the sake of using it, but its purpose should serve to increase student learning. Furthermore, if a teacher uses a multimedia presentation (such as PowerPoint™) to engage students in active learning, the environment should be student-centered, and the goal of the instruction should be interaction between the instructor and all students (Annetta et al., 2007).

Many times the graphics incorporated into a PowerPoint™ are appealing, but seemingly irrelevant in regards to the content. These images, in conclusion, should be left out of the presentation. Multiple elements of research suggest that "unless the combination of text and graphics or the narration of each slide justifies the graphic, the desired transmission of knowledge might not be reached" (Annetta et. al, 2007). Also, in order to entice female learning, (which may not be a bad idea considering the low numbers of females in science and technology fields) one suggestion might be to use colorful graphics in the presentations. Conversely, when trying to appeal to males, one might consider the graphics and their relevance to the overall presentations. Each of these studies provides important information for teachers who are trying to incorporate

technology, including programs such as Powerpoint™, into their lessons. Knowing the research behind what works best for certain groups of students will allow for a more effective presentation style needed to optimize student learning.

Higher Order Thinking

Another important strategy that should be adopted by science educators is the ability of an assignment, question, or activity to promote higher order thinking. Resnick (1987) defined higher-order thinking as a concept without a precise definition, but a rather complex process that requires application from several areas, yields multiple solutions, and often involves uncertainty (Barak and Shakhman, 2008). Based on these characteristics of higher-order thinking, one might list examples such as formulating a hypothesis, planning and carrying out experiments, allowing for variables, analyzing data, making inferences and assumptions, providing arguments, and judging reliable information (Zohar and Dori, 2003). Science is a unique field in the aspect that it teaches students all of these critical thinking skills that they can apply in other curriculums.

In the study by Barak and Shakhman (2008) they examined twenty-two educational strategies designed to promote higher order thinking, and how often they were utilized by teachers. They strategies examined are as follows: presenting data in alternate forms (ie: tables, graphs, and text); teaching multiple methods for problem-solving; linking biology to other disciplines in science; guiding students systematically to justify their solutions to a problem or their decisions; providing time for thinking and cognitive analysis; allowing students to create their own problems; drawing conclusions and generalizations from experimental results; prodding students to form their own

explanations prior to teacher explanations; providing strong and weak points of solutions to a problem; allowing students to determine their own rubric; asking students to discuss their thinking strategies aloud; encouraging student participation in science projects and fairs; providing discussion when answers are ambiguous; predicting the results of an experiment or a theoretical solution to a problem and providing justifications; using concept maps to connect ideas; allowing students to form their own questions about science; providing for group learning; having students explain any difficulties they encountered and how they overcame them; allowing for student debates and student coercion on scientific principles and premises; discussing students' thinking strategies including decision making and problem solving; giving students the opportunity to present diverse viewpoints on controversial issues; and presenting conflicts, including new information that disrupts previous knowledge (Barak and Shakhman, 2008).

Scientific Inquiry

Other studies suggest that a valuable way to provide quality instruction and promote higher order thinking is through scientific inquiry. In fact, the National Science Education Standards argued that curriculum should include more inquiry in order to promote good science instruction. In placing a definition on "inquiry" in science education, there continues to be a difference of opinion. Some believe that the teacher should lead student-based inquiry, whereas others rely heavily on instructional materials for this form of education. Some think that guided discovery is sufficient although some feel that students should plan and conduct their own research needed to answer their questions. Many suggest that hands-on activities can be used as inquiry, although some

argue that "hands-on without minds-on is hardly scientific." Still others believe that computer activities, experiments, and thinking exercises could also be equated with inquiry. It is easy to see that a consensus does not exist about the best instructional strategies in science. There is a unified agreement however that the goal of science instruction is understanding, not only in science content, but also in the inquiry nature of science (Pasley et al., 2004).

Many school districts across the U.S. and all schools in Singapore have already incorporated science inquiry into the curriculum due to its importance in facilitating science curiosity and engagement. Researchers Towndrow, Ling, and Venthan (2008) have described the reflective journal writing strategy as a positive way to promote inquiry in science. In the article, Towndrow et al. defined reflection as a cognitive activity used by individuals to capture, review, and evaluate their experiences. Furthermore, it was noted that reflection is key to promoting inquiry in science learning for students at the high school level. This research also defines the capacity of reflective journal writing as an instructional tool and an avenue for formal and self assessments. In an evaluation of the Scientific Reflective Journal (SRJ) it was stated that the students were better able to view the study of science as an ongoing process when they stopped periodically to evaluate their progress.

Research shows that reflective journal writing can be a very beneficial tool, as it "allows students to identify and record their attitudes and beliefs" (Towndrow et al., 2008). Furthermore it provides a way that students can express their frustrations about science and what they have learned. Often times science students may have questions to

ask but fear making mistakes and would prefer to ask the question in the form of writing. The SRJ provides an avenue for this form of direct questioning which is sometimes less intimidating to students. In conjunction with the article by Towndrow et al. (2008), Sadler's (2004) research also suggests the importance of giving students writing assignments that allow them to explore their beliefs regarding controversial scientific issues. Finally, the SRJ can also be used to inform teachers of the thought processes and understanding of their students and can help teachers in preparing further lessons and in reviewing material previously covered (Towndrow et al., 2008).

Teaching for Understanding

Other recent reviews of science educational strategies stress the importance of teaching for understanding. According to the literature, understanding has been defined as "a matter of being able to do a variety of thought-demanding things with a topic- like explaining, finding evidence and examples, generalizing, applying, analogizing, and representing the topic in a new way" (Perkins and Blythe, 1994). Furthermore, Gardner and Boix-Manzilla (1994) describe understanding as "the capacity to use current knowledge, concepts, and skills, to illuminate new problems" (as reviewed in Pasley et al., 2004).

In popular studies in psychology, Piaget asserted that learning is a result of acquiring specific 'learning structures.' Furthermore, it is the ability one acquires to remember, understand, and solve problems. Other psychological studies by Vygotsky, looked at learning as the result of social interactions. As suggested by Ausbel (1967a, 1967b), whether one learns through "reception learning" (by way of lecture, images,

print, etc) or "discovery learning" (whereas the content must be uncovered by the learner), learning only takes place when the individual can make connections between new information and existing knowledge.

Ausubel (1967a) also contested that science education needs to be relevant to students. Having the factual information is important, but it must be utilized in a way where the students can gain a deeper understanding. Even higher level educational strategies such as discussions and investigations must be situated and contextualized into a broader framework in order for them to be considered meaningful. Essentially, teaching for understanding is the hierarchy of science education. This kind of learning demands more from both teachers and students. Cohen et al. (1993) states that teaching for understanding "requires teachers to have comprehensive and in-depth knowledge of subject matter, competence in representation and manipulation of this knowledge in instruction activities, and skill in managing classroom processes in a way that enables active student learning" (as reviewed by Pasley et al., 2004).

Active Learning: Science as an Investigative Process

In regards to active learning as an effective instructional strategy, research by Stake and Easley (1978) has shown that classrooms that promote memorizing facts do not relate well to students. Those settings however that encourage the understanding of scientific ideals are seen as more important and interesting to the students. In the *Inside the Classroom* study by Weiss et al. (2001) lessons were assessed on their ability to promote student understanding and develop a child's ability to "do" science. The research concludes that meaningful experiences, which promote intellectual student

engagement with science content, personify an effective lesson. They also state that "effective lessons provide students with opportunities to grapple with important science content in meaningful ways." Even innovative, technological lesson plans are not productive if they are irrelevant to student knowledge and instructional content. It is also vital that lessons engage all students, which can be achieved by using various strategies and pathways to facilitate learning, so that each individual in the classroom is accommodated for. In addition, classroom discussion should encourage students to apply new knowledge to previous understanding in order to see the bigger picture. The findings of this study showed that "regardless of the pedagogy (e.g., investigations, teacher presentations, reading, discussions with each other or the teacher), high quality lessons provided opportunities for students to interact purposefully with science content and were focused on the overall learning goals of the concept" (Pasley et al., 2004).

By teaching science as an investigative process, students can become engaged with the discipline in order to develop the understanding that "science is a dynamic body of knowledge, generated and enriched by investigation." On the contrary, today's science classrooms are making the subject dull by presenting it as static facts and procedures that require memorization. According the *Inside the Classroom* study, a measly 21% of science lessons nationally, incorporate scientific experiences for students to see the investigative nature (Pasley et al., 2004). In an attempt to revitalize their science classrooms, the Houston Independent School District has recently spent four million dollars in school science labs which allow students hands-on opportunities in science. Since the emergence of these new facilities, the school district has seen a

notable increase in standardized testing scores, showing that hands-on activities really do work (Berger, 2009).

Adequate Questioning

Research also suggests that the way a teacher uses questioning in his/her classroom has implications on student learning. One of the things that teachers can do to test for student understanding and to promote deliberation about science content lies in skillful questioning. It is important that the teachers not spout off lower level questions where correct answers are emphasized, but rather to challenge students to promote understanding and think on a deeper level (Pasley et al., 2004). In a recent study, only sixteen percent of national lessons used higher level questions that attempted to move students forward. It is also important when doing classroom questioning that the teachers encourage everyone to be involved, rather than waiting for the most verbal students to answer the question before moving on. In doing this, one can assure that everyone has the chance to be involved in the classroom, and that learning and understanding is taking place in all parties. It is also important that the teacher not discourage incorrect answers or comments. This behavior is embarrassing to the students and fails to promote further inquiry. In questioning, it is also vital that the teacher distinguishes between the main ideas and the supporting content, both in lessons as well as lab experiences. This technique is effective because it allows teachers to assess what students already know as well as provoke insightful thinking and discussions in order to achieve the 'bigger picture' and make sense of the key concepts being addressed (Pasley et al., 2004).

Meeting the Needs of Every Student

Another major implication for science educators, and a topic of much concern, is meeting the needs of every student. Many suggest that one of the problems in science education is that there are needs of two different groups: the minority who will continue to study science, and the majority who will not use the discipline throughout life (Osborne, 2007). Science is unlike many other subjects in this regard. Math, writing, reading, and English are continued to be used by most all individuals on a daily basis, but science, is different. You see, the needs of our future scientists are different from that of an ordinary citizen.

A Purpose for Learning

Some educators suggest that both teachers and students need to have a "purpose" in mind. Teachers need to know where the lesson is going, in order to be able to guide the educational process and facilitate student learning, and students too need a purpose, in order to stay engaged and motivated. According to the research, an ideal lesson will "hook" students by giving them something to ponder; perhaps this could be a real-world question, or something that the students can relate to. Successful lessons should also invite students to be engaged with the material by allowing hands-on experience with scientific phenomena.

Teaching to the Next Level

A final strategy that teachers should take into consideration when preparing lessons is the importance of teaching to the next level. The article by Pasley et al. (2004) shines light on the importance of teaching at the appropriate level so that students can

incorporate what they already know and be challenged take it a step further. In doing this however it is crucial that the teacher keep in mind the varying experiences of his/her students in order to accommodate for multiple ability levels. Furthermore, it is of upmost importance that teachers create a classroom environment that is conducive to learning. According to the literature, this type of environment must be both rigorous and respectful. Results from *Inside the Classroom* research revealed that over half of science classrooms received good marks for respect, but very few were judged to be adequate in rigor. In fact, only fourteen percent of classrooms observed were judged to be of adequate intellectual rigor, and only twelve percent had sufficient levels of both rigor and respect. Concluding remarks of this research stated that "the teacher's effectiveness in asking questions, providing explanations, and otherwise helping to push student thinking forward as the lesson unfolds often appeared to determine students' opportunity to learn" (Pasley et al., 2004).

Science Testing

Many educators, and even those outside the realm of education, argue that state mandated testing is putting a damper on education, but science education in particular. In a recent article appearing in the *Houston Chronicle*, Texas teachers called for reform in science education. Scientists believe that schools should inspire student through the use of fun and interactive lessons rather than the rogue memorization that now plagues our classrooms. They also understand that the testing aspect of education has hindered teacher's abilities to incorporate the "fun stuff" and inquiry based learning. Michael Baldwin, a Texas biology teacher states that "It puts huge pressure on teachers to

abandon their curriculum." According to Baldwin, his students must pass the state test to graduate, but then don't have enough science background to be successful in college (Berger, 2009).

Bruce Alberts, former president of the National Academies of Science, and editor of the journal *Science,* criticizes the way students are being taught by saying "Student's don't need to know what an endoplasmic reticulum is." Furthermore he highlights how bad tests are trivializing the study of science and how in effect it is turning students away from this field. Alberts states "Real science is exciting. It's completely different from these textbooks." Fortunately for our students, some teachers do see the need for inquiry based learning and the opportunities for this type of instruction to revolutionize science classes. Leon Lederman, a Nobel-prize winning physicists argues that "if we want scientific literacy, then we want teachers to teach the beauty of science, the fun in it, the humor in it, and to bring example of modern science into the classroom" (Berger, 2009).

My Lessons

In composing my own series of fifteen lesson plans, I tried to utilize the information presented in the research in order implement quality instruction. As this research has shown, students often need a purpose for learning, or a reason to stay engaged and motivated in the lesson, thus every day began with an "objective" of what students are expected to accomplish. Studies have also shown that students do well when given something that will catch their attention and reel them in to the instruction. This can be seen at the beginning of each day in the form of a "hook." Also included are daily "HOT questions" which promote higher order thinking and give students something to

ponder about or a way in which they can relate their science knowledge to real-world experiences.

The literature also provides positive evidence for teaching to the next level and shows that successful lessons pick students up where they are and move them forward in their knowledge. You can see this aspect incorporated into the "bridge" component of the lessons. In this part, typically you will see a brief overview of the day before and how that knowledge is going to be used to drive students further in their understanding.

Research by Perkins and Blythe (1994) also supports teaching for understanding which allows students to internalize information. You can see that this has been incorporated during day six of the lesson plans where the students are required to draw pictures representing their vocabulary terms. It is important that students are able to represent topics in a new way because it allows them to personify a concept in a way in which they can better understand it. This same research suggests that students should be able to find evidence and examples of concepts in science. As you can see throughout the unit, students are required to do this in their research as they look at genetic disorders occurring in real-life cases. Finally, Perkins and Blythe state that students should be able to analyze and apply their knowledge, which they are required to do in days one through four as they work through real genetic problems.

One of the strategies used to promote scientific literacy was by utilizing the student reflective journals. You can see on day fourteen that the students used this as an avenue to express their feelings regarding morals and ethics in genetics. This, in conjunction with the discussion on ethical issues, is counted as beneficial because they

allow students to flesh out their thoughts and analyze their beliefs (Towndrow et al., 2008).

In incorporating technology in learning, students' preferences were considered when designing PowerPoint™ presentations. For the boys, images and charts were only used when they portrayed a sense of relevance. In order to cater to the girls, multiple colors were incorporated to make the presentation visually stimulating (according to the research of Annetta et al., 2007). In creating PowerPoint™ presentations, it was important that they be very interactive and student-centered. In implementing these lessons, one should also keep in mind that it is vital to interact with all students rather than just the most talkative ones in order to ensure that every student is grasping the information. Finally, in utilizing technology in my lesson plans, I was very thoughtful as to how the activities related to the material. I didn't want to use technology, just to be using it, as many teachers tend to do. Rather, the effects of the computer-based activities should have relevance to the material discussed and actually provide students with a better understanding, and perhaps even pertain to real life.

As stated in the literature review, there are many ways to go about promoting student inquiry, which is evident throughout the unit. First, students were required to plan and conduct their own research, by way of their inherited diseases projects which they worked on for the duration of this unit. They also participated in guided discovery through classroom activities and interactive videos. Finally, students got to participate in hands-on discovery through the use of science labs and computer activities. In doing this,

stories, games, and real-life examples were also provided in order to illustrate a vivid picture of real science (Pasley et al., 2004).

In order to meet the needs of every student, I tried incorporating different strategic tactics that would appeal to the multiple intelligences and learning styles, so that all students would be accommodated for. In doing this, it was my hope that each individual would reap the maximum benefits of the lesson. In the lesson plans I also tried to refer back to Vygotsky's theories on learning, regarding making connections between existing knowledge and new information in order for meaningful learning to take place (Pasley et al., 2004).

I also evaluated myself on the ability to use strategies that promoted higher order thinking. In doing this, I reviewed the top twenty-two strategies (as suggested by Barak and Shakhman, 2008) and confirmed that nineteen out of the twenty-two were successfully used in the unit. First, students were required to use graphs and concept maps, not only to draw information from, but also as a way to represent their data. Students linked biology to other disciplines, such as math, in the probability section. Additionally, students were allowed to create their own problems, for example, in the genetics section where they interpreted their own family pedigrees. Finally used tactics such as prediction, discussion, and justification during lab activities. The three strategies not incorporated that should perhaps be used in future lessons are stating the strong and weak points of a problem; presenting conflicts, facts, or examples that interfere with students' knowledge and intuitions; and involving students in determining their grading rubric (Barak and Shakhman, 2008). Other ways I provided for higher order thinking

were allowing students to present arguments and justifications for their viewpoints, carrying out experiments, and analyzing information.

Another strategy utilized in the lessons was adequate questioning. In doing this, it was important that higher level questions were made a priority, both on tests and in classroom discussions. Even though the student may provide the wrong answer, asking a question like "Why is it necessary that DNA be in every cell?" rather than "What does DNA stand for?" provides students with an opportunity to think about what they have learned and adapt it to new questions, rather than just spouting of something they've memorized. Adequate questioning is another way that you can teach to the next level, and challenge those higher ability students.

Perhaps one of the most prominent means of instruction in my lesson plans is active learning in a way that reveals science as an investigative process. In doing this, I tried to allow students to uncover information for themselves, rather than presenting everything to them. This is done during their genetics research projects as well as computer games, classroom exercises and labs. Research continues to show that students who become engaged with the material will have a better understanding and appreciation for it. In presenting science as an investigative process, students will learn to appreciate the discipline and see the bigger picture of science in the world around them.

In order to be able to renew the field of science, I am going to have to utilize my resources and possibly even write grants in order to get funding for new technology and other equipment. I know that I must also keep in mind the rigor and relevance of the assessments I give my students. It is important that in every lesson, I adequately

challenge all students and foster higher cognitive skills. It is also necessary that I keep my students engaged, by providing materials that spark their interests, needs and experiences. Finally it is vital that upon completion of my class, my students will have the necessary science skills in order to be successful in their pursuits, both in college, and in life (as suggested by FAST, 2009). It is important that during my coming years as a teacher I keep in mind the research I have done and the experiences I have had when planning and executing lessons such as these, in my own classroom.

The final and most important thing that I should consciously think about when implementing these lessons is the excitement that I have for the material as a teacher. In order to get the students involved and excited, I, as the teacher must also be just as excited. In other words, without teacher engagement, there will be no student engagement (as suggested by Pasley et al., 2004).

Conclusion

While there are numerous effective instructional strategies an educator can choose from, a key component in science education is promoting student engagement. Effective instruction is to be meaningful, accessible, and have a clear focus for developing an understanding of science concepts. Even the best instructional strategies can be implemented poorly, therefore the strategy does not depict lesson quality. Hands-on learning and open discussion can be just as dull as lecture if they don't capture students' attention and promote understanding. "Focusing on important science content; engaging students; and having an appropriate, accessible learning environment set the stage for learning, but they do not guarantee it. It is up to the teacher to help students

develop understanding of the science they are studying… How science is portrayed is key to student understanding of the discipline" (Pasley et al., 2004).

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Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Tuesday October 21, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 1: The Work of Gregor Mendel, Probability, and Punnett Squares

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This unit discusses Mendel's initial studies of the pea plant, and what they revealed to us about Genetics. It also introduces Punnett Squares, a tool used to analyze different genetic outcomes given the genotypes of the parents.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Since this is the first lesson of the unit, students have very little prior knowledge regarding genetics. It is of utmost importance therefore that the student's understand the information that is presented today. This material will lay a foundation for the future lessons that will continue to build on these principles.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Gifted students might initially jump into discussion with the brain teaser and inquiry activity, whereas I might need to wait and prod lower ability students in order to get them to respond. I should also call on these students and ask their opinions in order to encourage learning and group discussion. The note-taking guide is a good tool for lower ability level students.

Students Will Know …

Students will know what happens during segregation.
Students will know how to use Punnett Squares and predict probability.

Students Will Be Able to Do … (objectives)

1. Students will be able to calculate the phenotypic ratios for monohybrid crosses with 90% accuracy. (DOK 3)
2. Students will be able to determine the genotypes of parents from the phenotypic ratios of their offspring with 80% accuracy. (DOK 3)
3. Students will be able to explain dominance and segregation and complete questions regarding punnett squares and ratios, scoring 3 out of 4 on a rubric (DOK 2).

Connections

Essential Questions

Why are Bob's ear's attached and Billy's not?
Why can Cara roll her tongue and Melissa can't?
How is the principle of dominance like the state champion basketball team?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).
Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).
Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).
Students will graphically represent (e.g., pedigrees, punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1,2	Formative	Inheritance in Maize Activity	3	Use high-low pairing to accommodate for all ability levels
3	Formative	11.1 and 11.2 Worksheets	2	Textbook page numbers appear on the worksheets if students need help answering the questions

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, SmartBoard

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express, Powerpoint,
  www.brainpop.com/science/cellularlifeandgenetics/heredity/

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Vocabulary Sections 1 and 2.
2. Hook: Brain Teaser: Ask students to explain how two brown rabbits could have white offspring. Challenge students to predict the coat color of offspring produced in a cross between two white rabbits. Inquiry Activity: Ask students to look at their classmates. Tell them to notice the shape of their hairline, the space between their two upper front teeth, and they way their earlobes attach. Ask HOT Questions: Why are Bob's ear's attached and Billy's not? Why can Cara roll her tongue and Melissa can't? Discuss the differences observed.
3. Bridge: Ask students if they think these traits they observed in their classmates are inherited. Ask: Do you think their parents exhibited these traits? What about their grandparents? Say: today we are going to learn about the principles of genetics and how certain traits and characteristics we observe are inherited.
4. Activities:
    - Go to www.brainpop.com/science/cellularlifeandgenetics/heredity/
        i. Have students watch the short video, then give them the Brain Pop Heredity Quiz.
    - Lesson over Section 11.1 (The Work of Gregor Mendel) and 11.2 (Probability and Punnett Squares) via Powerpoint. Students should fill out the chapter 11 note taking guide during the lesson. (New American Lecture strategy)
        ii. Discuss the principle of dominance
            - Use Metaphorical Expression strategy to compare dominance in regards to genetics to dominance in a really good basketball team.
            - Ask HOT Question: "How is the principle of dominance like the state champion basketball team?" Explain to the students that the team that dominates in basketball is the team who always wins, such as the state tournaments. Ask them, what might you call a little bitty tiny team that hasn't won a game all season? (Answer: The recessive team).
            - Think of dominance in genetics the same way, because it's the trait that always wins. In Mendel's peas, when tall and short were crossed, tall always won (or in other words, the pea plants were always tall). Ask the class then what this would be called? (Answer is dominance).
        iii. Describe what happens during segregation.
            - Use Metaphorical Expression strategy to explain segregation like pulling two magnets apart. They can pull apart, but once they get back close to another magnet (or allele in the genetics case) then they bind right back together to form a trait.
        iv. Make sure students understand the concept of true-breeding plants.
            - Use Metaphorical Expression strategy to explain true-breeding plants like true-breeding dogs.
            - Poll the students by asking them what kind of dogs they have and where they got them. Ask the students if any of them purchased their dogs from a *breeder.*
            - Take a lab for example and tell the students you want a full-blooded lab. Ask them how you get a dog like this.

        - Discuss how you can get a half-blood dog. For example, maybe the dog has a lab dad, and a golden retriever mom. Explain to the students that a full-blooded dog is the same as a true-breeding plant. In the dog's case, both parents are full-blooded lab. For the plant however, both plants are true-breeding tall.
    v. Discuss Punnett Squares and Probability.
        - Allow students to use the ActiveBoard as an interactive white board to work through Mendel's seven crosses as a class and predict the phenotypic probability for the offspring.
- Inheritance in Maize Activity
    vi. Explain the directions to the students (see handout).
    vii. Divide the students in pairs of two and give each pair an ear of corn and allow them to start the activity. (Use high-low pairing).
    viii. Ask the students to complete the activity and the questions that follow.

5. <u>Closure</u>:
    - As the students if zebras stripes are said to be genetic, then would any zebra have the same stripes? Ask students: What is dominance? Recessive? What does it mean to be true breeding? If you exhibit the same phenotypes as your parents, what could you say about their alleles? Why might Mendel have used pea plants? Give an example of probability and genetics. (Effective Questioning Strategy)
    - Assign 11.1 and 11.2 Review Worksheets (over Gregor Mendel, Probability, and Punnett Squares) for homework.
    - Remind students that they will have a quiz tomorrow over today's material (Section 11.1 and 11.2).

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Wed. October 22, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 2: Exploring Mendelian Genetics

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This lesson discusses different patterns of inheritance that sometimes allow for anomalies or characteristics aside from the typical dominant or recessive trait. Through this lesson, students will be able to see how they acquire certain characteristics such as eye color and skin tone.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Yesterday students learned about traits and how they are inherited. Today's lesson goes one step further from the previous lesson by discussing how two characteristics (ie: pod color and shape) can be inherited independently or together.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Gifted students will need to be challenged while some students might need extra help. During the class activity, pair gifted students with below-grade level students (high-low pairing). The note-taking guide should be beneficial for the lower ability students. During the bell work, provide the gifted students with a dihybrid cross to try. During the quiz, allow lower ability students to choose to take the paper version of the quiz rather than the Clicker quiz if they need more time.

Students Will Know …

Students will know the principle of independent assortment and various inheritance patterns.
Students will have a working understanding of probability and punnett squares.
Students will know how alleles combine to form dominant, recessive, or hybrid traits.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete the monohybrid cross worksheet with 100% accuracy. (DOK 2).
2. Students will be able to answer questions on genetics, calculate probability, and complete punnett squares scoring 80% on the quiz. (DOK 2)
3. Students will be able to combine alleles to produce dominant, recessive, or hybrid traits in the Investigating Inherited Traits Lab. They will do this and answer the questions that follow scoring a 3 out of 4 on a rubric. (DOK 3).

Connections

Essential Questions

Why does everybody have a different skin color?

Why are humans such different heights?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2). Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees, punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Monohybrid Cross Worksheet	2	Challenge gifted students by giving them a dihybrid cross to try.
2	Formative	Quiz over 11.1 and 11.2	1	Students who may need additional time can choose to take the paper version rather than using Clickers.
3	Formative	Investigating Inherited Traits Activity	3	High-low pairing to accommodate for multiple abilities.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
  Computer, media projector, SmartBoard, ActiVote, textbooks, and coins or two-sided disks.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.
  Prentice Hall: Presentation Express, PowerPoint

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework (11.1 and 11.2 Review WS). Students are to complete vocabulary sections 11.3 and 11.4 and do Monohybrid Cross Worksheet.
2. Hook: Ask HOT Question: Why do all people have a slightly different skin color? Also ask: Why are humans such different heights?
3. Bridge: Remind students that height in pea plants is controlled by one of two alleles; the allele for a tall plant is a dominant allele, while the allele for a short plant is recessive. Ask students how many alleles control height in humans a) two or less, or b) more than two (they should raise their hands to answer). Those who answered more than two are correct! Ask them to think about the heights of people they know. Height in humans can vary greatly, and unlike the plants, there are medium height people. It now appears that human height is not controlled by just two alleles. Taking this into consideration, question students about how they think individuals acquire a characteristic (such as medium height), that is different from the dominant or recessive trait? (Effective Questioning Strategy).
4. Activities:
   - Ten question quiz over probability and punnett squares using Clickers.
     i. Input grades into computer program.
   - Investigating Inherited Traits Activity (see handout)
     i. Pair students by ability, and have them flip coins to determine the characteristics of their "baby." Once they have determined all of the characteristics, the students should draw a picture of their offspring and answer the questions that follow. Once the students have completed the lab and questions, they should turn these items in. After the students have completed the lab, review the goals of this activity and discuss the questions aloud.
   - Begin lesson over section 11.3 (Exploring Mendelian Genetics) via PowerPoint (using New American Lecture).
     **Students should fill in their note taking guides during the lesson.
     i. Define Independent Assortment
     ii. Discuss and do examples of dihybrid crosses
       - Pass around the interactive whiteboard, and allow students to work individual examples of two factor crosses. Allow one student to create the problem, and then pass the whiteboard on for another student to work the problem.
     iii. Divide the class into groups of four and provide each group with a poster board and markers. Assign each group of students with one of the four inheritance patterns (incomplete dominance, codominance, multiple alleles, and polygenic traits). On their poster board the students should

provide a description of their inheritance pattern and provide at least one example, not listed in the textbook. The students should use the rest of the space on their poster board to draw something that represents their inheritance pattern. The students will have about twenty minutes to work before presenting their poster to the rest of the class. As each group presents, the other students should complete the graphic organizer included in their note taking packet. (Jigsaw stragegy).

5. Closure
    - Assign Review Worksheet over Section 11.3: Exploring Mendelian Genetics. Also give students the Dihybrid Cross Worksheet for homework.
    - Review today's material by providing examples for each of the inheritance patterns and asking the students to identify the inheritance pattern aloud as a class. Ask HOT Question: Based on what you have learned today, what does cause the variety in skin tones? Also ask them if they think that the traits for height and skin color are on the same chromosome? Why?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Thurs. October 23, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 3: Meiosis

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This unit discusses Meiosis and the process for cell reproduction and division. The purpose is to teach students how cells grow and replicate in order to see the innate mechanisms of the human body.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Students have little/no previous knowledge of meiosis, but should understand mitosis. After today, students should be able to compare and contrast between the two.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  For some students meiosis may be a difficult concept to grasp. The activity should help students by providing them with a visual of this phenomenon. Students will also be allowed to work in groups during the bell work. In addition, the note-taking guide should be beneficial for lower ability level students.

Students Will Know …

Students will know what happens during meiosis.

Students Will Be Able to Do … (objectives)

- Students will be able to work problems dealing with monohybrid crosses, incomplete dominance, and dihybrid crosses on the oompa loompa genetics worksheet. They will complete this with 80% accuracy. (DOK 3).
- Students will be able to compare and contrast between meiosis and mitosis with 90% accuracy. (DOK 2).
- Students will be able to review multiple sources on meiosis and mitosis and complete the internet activity with 100% accuracy. (DOK 3).

Connections

Essential Questions

How do cells have babies?

What does dating have to do with meiosis?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will describe the structure of DNA and explain its role in protein synthesis, cell replication, and reproduction. (SC-H-UD-S-6).

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Oompa Loompa Genetics Worksheet	3	Students can work in groups of 2-3.
2	Formative	Meiosis/Mitosis Graphic Organizer	2	After completing, review answers aloud to review the differences
3	Formative	Meiosis/Mitosis Internet Lesson	3	Some students may need help browsing the internet.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
  Computer, media projector, and textbooks

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.
  Prentice Hall: Presentation Express, PowerPoint

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework (11.3 Review WS). Vocabulary Section 11.5. Allow students to work in groups of 2-3 to complete Oompa Loompa Genetics Worksheet.
2. Hook: Ask HOT question: How do you think cells have babies? (Give them time to come up with reasonable answers). Tell the students that just like humans reproduce, so do cells, although they do it a little differently.
3. Bridge: Remind the students that in chapter ten they learned about mitosis. Ask the class, what happens in mitosis? Tell them that the process of meiosis is similar, and today that is what we will be discussing. It is the way that cells divide and reproduce.
4. Activities:
    - Discuss section 11.4 (Meiosis) via Powerpoint (using Metaphorical Expression Strategy). Students should use their note-taking guide during the lesson (New American Lecture strategy).
        i. Divide the class into two groups: Meiosis I and Meiosis II. Divide each of these groups into four more groups: Prophase, Metaphase, Anaphase, and Telophase. Have the students read section 11.4 in their textbooks, focusing on their individual components of meiosis. Give the students about ten minutes, and then choose one member of each of the eight groups to explain what happens during their stage, and draw a picture of it on the interactive whiteboard.
        ii. Quickly use PowerPoint to review the stages of meiosis.
        iii. Review crossing over. Ask HOT Question: What does dating have to do with Meiosis? (Allow time for possible answers). Use Metaphorical Expression Strategy to compare crossing over to dating relationships. Just like couples don't always stay intact, chromosomes don't either when they go through the phase known as crossing over. They take a piece of them, and give it to someone else. (Just like you give away your heart!)
            - Recruit two volunteers. Have them stand about 2 feet apart and create X's with their bodies (arms in V, legs shoulder width apart). Ask the class, what are these individuals? (Answer: chromosomes). Then have the two move together where their hips are touching. Ask the students what stage does represent? (Answer: Meiosis I, Prophase). Ask: what is the name of this combined pair? (Answer: a Tetrad). Then have the individuals cross their inside legs one over top of the other and exchange shoes on the inside foot only. Ask the class: What is this called? (Answer: crossing over).

iv. Watch Meiosis clips (all). http://wps.prenhall.com/esm_freeman_biosci_1/7/1948/498784.cw/index.html
v. Complete Meiosis/Mitosis graphic organizer (using Compare and Contrast Strategy) and review aloud.
vi. Go to the computer lab and have students do Meiosis/Mitosis Internet Lesson. See directions on worksheet.

5. Closure:

- Assign Review Worksheet 11.4 for homework.
- Review today's high points by asking students to summarize the events of meiosis in their own words. Ask HOT question: Based on what you have learned today, how do cells make babies? What are the stages in meiosis? What occurs in each stage? Also, what are the biggest differences between meiosis and mitosis (without looking at your worksheet)? Ask HOT question: How is dating like meiosis?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Fri. October 24, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 4: Linkage, Gene Mapping and Review

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.
  This lesson discusses gene maps and their relevance to independent assortment and genetics as a whole.

- Describe the students' prior knowledge or the focus of the previous lesson.
  Today's lesson takes yesterday's discussion of meiosis and crossing-over one step further to determine what structures actually assort independently.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).
  Note taking guide should be beneficial for lower ability level students. For review game, divide groups randomly in order to incorporate mixed ability levels in each group, and make the game fair for all teams.

Students Will Know …

Students will know how gene maps are produced and understand their relevance to the human genome.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete the meiosis worksheet with 90% accuracy. (DOK 3).
2. Students will be able to complete the vocabulary quiz with 95% accuracy. (DOK 1).

Connections

Essential Questions

How is a gene like a road map?

Are genes on the same chromosome inherited together?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3). Students will graphically represent (e.g., pedigrees, punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	11.4 Review Worksheet	3	Some students may need assistance.
2	Formative	Vocabulary Quiz	1	None

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, mini whiteboards and dry erase markers

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express, PowerPoint

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework (11.4 Review WS). Vocabulary Quiz.
2. Hook: Ask students HOT question, "What do genes and road maps have in common?"

3. Bridge: Tell students that just like roads have maps, so do genes. Discuss how the understanding of genetic mapping has helped doctors to be able to pinpoint genetic diseases in a pregnant woman. Tell the students that yesterday we talked about the intricate process of meiosis, and how each chromosome that is formed is mapped on a gene map.
4. Activities:
    - Review from yesterday by going through the stages of meiosis and asking students to draw each stage on their whiteboards. (After students draw each stage, the teacher should walk around the room to make sure students are producing a correct drawing).
    - Mini-lesson over Section 11.5 via PowerPoint
        i. Students should use their note-taking guide during the lesson (New American Lecture strategy)
        ii. Define/Describe Gene Mapping.
    - Jeopardy Review Game (using Teams, Games and Tournaments Strategy)
        i. Discuss rules aloud and post on PowerPoint.
        ii. Winning team will earn bonus points for their tests.
5. Closure:
    - Remind students about the test tomorrow and provide them with the review worksheet to prepare. Also, discuss the format of test and accept any last minute questions.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Fri. November 14, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 5: Testing Your Knowledge

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  Today the students will be tested over what they have learned about Genetics over the last four days. They will be required to complete punnett squares, predict probability, and make inferences regarding traits and inheritance patterns.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Students should possess all of the knowledge that is required to be successful on today's exam and open response item.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Some students might have difficulty with the exam, and if they ask for my assistance, I will try to provide them with helpful hints or remind them of what we discussed that can help them answer the questions. Students performing poorly on the exam may also be granted permission to correct their tests for partial credit. In addition to this, extra credit from yesterday's review game will be added to exam scores.

Students Will Know …

Students will know what happens during segregation.
Students will know how to use Punnett Squares and predict probability.
Students will know the principle of independent assortment and various inheritance patterns.
Students will know what happens during meiosis and how it is different from mitosis.
Students will know how gene maps are produced.

Students Will Be Able to Do … (objectives)

1. Students will be able to calculate the probability, differentiate between inheritance patterns, complete punnett squares, compare mitosis and meiosis, interpret gene maps, make inferences from punnett squares, and create their own true-breeding plants exhibiting desired characteristics, with 80% accuracy. (DOK 4).

Connections

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).
Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Summative	Chapter 11 Test and Open Response	4	Lower ability students may be allowed extra time to complete the exam.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer Lab

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  None for this lesson

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Take just a few minutes to look over the material for the test.
2. No Hook and Bridge since it is test day.
3. Activities:
    - Allow about 10 minutes for students to ask last-minute questions regarding test material.
    - Give students the test and wish them luck.
    - For the bonus question, students are allowed to write a question of their own on a topic that they studied for, but that wasn't addressed on the test. This question will be worth five extra points and will be graded on the quality of both the question and the answer.
    - When students turn in their test, hand them the open response item.
    - Remind students periodically about how much time they have remaining.
    - Tests and open responses must be completed within the class period.
    - When all of the students have completed the test and open response, begin explaining the heritable diseases projects/presentations. Show students a list of possible topics but allow them to suggest new topics of their own. If time allows, take the students to the computer lab to begin their research.
4. Closure:
    - Remind students that in order to be prepared for tomorrow, they may want to look at section 12.1.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Mon. November 17, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 6: DNA

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  Today's lesson on DNA paves the way for the subsequent studies in replication, chromosomes, RNA, protein synthesis, and gene regulation. Understanding the foundations of today's lesson is the basis for a working understanding of chapter 12 material.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today the students will take what they have learned about genetics and be able to apply it to DNA, understanding the relationships between DNA and genes.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  While DNA is a very interesting subject, it is quite dense and some students may struggle with understanding various aspects of DNA. The models should help students acquire a visual for the overall structure of DNA, however some students may find assembling the models to be difficult. Once again, note taking guides are used, which should be beneficial for lower ability level students.

Students Will Know …

Students will know that the information passed from parents to offspring is coded in DNA molecules.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete the Brain Pop quiz scoring 80%. (DOK 2).
2. Students will be able to construct a model of DNA and name its various components with 100% accuracy. (DOK 4).

Connections

Essential Questions:

What are the blue prints of the body?

What is the secret code of DNA? (ie: How does it match up?)

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will describe the structure of DNA and explain its role in protein synthesis, cell replication and reproduction. (SC-H-UD-S-6).

Core Content:

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Brain Pop Quiz over DNA	2	none
2	Formative	Molecular Model of DNA Worksheets	4	Lower ability level students may work in pairs to complete this activity

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint, Smart Board, textbooks, A/T/G/C name tags, DNA models.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express, SmartBoard

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Vocabulary Sections 12.1 and 12.2. (Have students look up words in the glossary today rather than in chapter 12 of the textbook). After the students finish their vocabulary, have them choose two vocabulary words to represent with a picture. Each student must choose DNA as one of their words, but the other is their choice. Allow students to draw in the margins/on the back of their bell work using colored pencils/crayons/markers. After giving the students time to complete their drawings, ask a few of them to share what they drew. (The Mind's Eye Strategy).
2. Hook: Ask the students if any of them know what blue prints are. Take this question a step further by asking the HOT question: "What are blue prints in the body?"
3. Bridge: Tell the students "The body is made up of literally trillions of cells, which are composed of deoxyribonucleic acid." Ask the class if they know what deoxyribonucleic acid is. Tell the students that DNA is the short version of this long word, and it is ultimately the blue prints for your body. DNA is what makes you, you, and no two people have the same DNA, except for identical twins.
4. Activities:
   - Go to www.brainpop.com/science/cellularlifeandgenetics/dna/
     -Have students watch the short video then give them the DNA quiz.
   - Lesson over 12.1 via PowerPoint
     **Students should fill out note-taking guide over during lesson (New American Lecture Strategy).
     -Discuss Griffith, Avery, and Hershey-Chase experiments.
     -Define transformation and bacteriophage
     -Examine the structure of DNA.
     -Review nucleotides and how they pair (Chargaff's Rule).
     *Place name tags with the letters A, T, G, and C around students' necks. Shuffle the students and tell them to pair up. The first time you do this activity, the students should scramble around and pair randomly because they don't know the base pairing rule. Review Chargaff's Rule and then try this activity again. The students should now join correctly, always pairing A to T and G to C.
     -Discuss the double helix shape of DNA.
   - Have each student make a molecular model of DNA following the directions in their packet.
     -After each student has completed their model they must show it to teacher.
     -Answer the worksheets following the activity.
5. Closure:
   - Assign Review Worksheet 12.1 for homework.
   - Review material learned today, ask students: What is the function of DNA in the body? Tell the students to suppose that mice DNA contains 48% guanine. Ask them to predict what percentages the cell contains of the other bases. Ask the students what they think might happen if Thymine didn't have an Adenine to pair with? What is the name of the pairing rule? What are bacteriophage? What composes nucleotides? Finally, re-ask the HOT question: How is DNA like blue prints?
   - Homework: work on genetics project assigned yesterday.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Tues. November 18, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 7: Chromosomes and DNA Replication

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This lesson allows students to see the function of DNA in regards to replication and how it is regulated. Today's studies also delve more in to chromosomes and their importance in DNA. Learning the structure and function of this molecule contributes to the relativity of the entire unit.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today's lesson is a continuum of yesterday's lesson, applying the foundations of DNA to discover how DNA replicates.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Replication may be hard for students, but the models will reinforce student learning while providing a visual for students to see the process. This modeling project is somewhat more challenging than yesterdays, thus group work is being utilized.

Students Will Know …

Students will know that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete review worksheet 12.1 over DNA and RNA with 85% accuracy. (DOK 2).
2. Students will be able to complete flow chart with 90% accuracy. (DOK 2).
3. Students will be able to provide a model for DNA replication and answer questions about this process scoring a 3 out of 4 on a rubric. (DOK 3).
4. Students will be able to build a virtual model of DNA and examine its replication using Explore Learning with 80% accuracy. (DOK 3).

Connections

Essential Questions:

What do twins have in common?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and

functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will describe the structure of DNA and explain its role in protein synthesis, cell replication and reproduction. (SC-H-UD-S-6).

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Review WS 12.1 over DNA and RNA	2	Students may work in pairs to complete this assessment if needed
2	Formative	DNA Flowchart	2	Textbook page numbers are provided where students can find the answers to the problems.
3	Formative	DNA Replication Modeling WS	3	Assistance should be given with modeling to insure understanding
4	Formative	Explore Learning: Building DNA	3	Students can work in pairs if they feel uncomfortable doing this activity alone

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
  Computer, media projector, PowerPoint, DNA modeling kits.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.
  Prentice Hall: Presentation Express, www.explorelearning.com

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Vocabulary section 12.3 and 12.4 and Review WS 12.1 over DNA and RNA.
2. Hook: Show students two pictures of two twins, both identical and fraternal, and ask HOT question: What do these individuals have in common? (Allow time for students to think about this before they answer).
3. Bridge: Tell the students that this question is tricky because it has two answers. One set of twins is identical, and the other is fraternal. Identical twins share 100% of DNA and fraternal twins share only 50% (which is the same as any other pair of siblings.
4. Activities:
   - Lesson over 12.2 via PowerPoint using SmartBoard
     **students should fill out their note taking guide during the lesson (New American Lecture Strategy).
     i. Discuss chromosomes in DNA
        **show DNA clip embedded in slide 6
     ii. Examine DNA replication
     iii. Address the role of DNA polymerase
   - Have each student make a physical model of DNA replication following the directions in their packet.
     i. After each student has completed their model they must show it to teacher.
     ii. Answer the worksheets following the activity.
   - Once students have finished their models, take students to the computer lab for an Explore Learning Activity on Building DNA. www.explorelearning.com
     i. Students should follow directions on handout for constructing a model of DNA and examining DNA Replication. They should also answer the questions on the handout as they go along.
5. Closure:
   - Assign 12.2 Review Worksheet and DNA Replication Flowchart for homework.
   - Review material learned today, ask students: What happens during replication? What are histones? Chromatin? What enzyme aids in DNA replication? What are the three types of RNA? What do each of them do? Metaphors? What enzyme assists in transcription? What are introns? Exons? Promotors?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Wed. November 19, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 8: The Role of RNA in Transcription and Translation

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This lesson shows students what types of detailed processes occur inside DNA and RNA. It also helps them to understand that things are likely to go wrong (because so many steps in so little time). Students need to understand the functions of DNA and RNA, and after today they will have a better picture of this.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today's lesson on transcription and translation, stems from yesterday's talk of chromosomes and replication. Understanding yesterday's material is very important for being able to apply today's information.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  The genetic coding charts will be a great tool for students to apply their knowledge of codons. The note taking guide is also good for students who are at lower ability levels. In addition, some students may need extra help with the read for meaning activity. For lower ability level students, I have provided an abridged version of the textbook reading that is at a lower reading level.

Students Will Know …

Students will understand the structure of RNA and know its role in transcription and translation.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete the review worksheet on DNA and RNA, scoring 85%. (DOK 3).
2. Students will understand RNA and Protein Synthesis and be able to answer questions about them, scoring 85%. (DOK 2).
3. Students will be able to use the decoding chart to name amino acids with 100% accuracy. (DOK 2).
4. Students will be able to provide the mRNA strand given the DNA strand, and use the mRNA codons to complete the DNA scavenger hunt with 90% accuracy. (DOK 3).

Connections

Essential Questions:

How do you make protein, besides using a protein shake?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will describe the structure of DNA and explain its role in protein synthesis, cell replication and reproduction. (SC-H-UD-S-6).

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

SC-HS-3.5.1

Students will:

- Predict the impact on species of changes to 1) the potential for a species to increase its numbers, 2) the genetic variability of offspring due to mutation and recombination of genes, 3) a finite supply of the resources required for life, or 4) natural selection. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Review WS 12.2 on DNA and RNA	3	Some students may need assistance
2	Formative	12.3 Reading for Meaning Worksheet	2	None
3	Formative	Name That Amino Acid WS	2	Explain to students how to use the decoders.
4	Formative	DNA Scavenger Hunt	3	High-low pairing to accommodate all students

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint, Smart Board, textbooks, paper, markers/crayons/colored pencils.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express, SmartBoard

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework (12.2 Review WS). Vocabulary section 12.5 and Review WS 12.2.
2. Hook: Ask HOT question: "Does anybody know how to make protein, besides using a protein shake?" Maybe start with the basics, asking students to identify what proteins are. We know they help you build muscle, but why?
3. Bridge: Tell the class that "proteins are made through a process known as translation. During translation the cell uses information from mRNA (which we learned about yesterday) to produce proteins
4. Activities:
    - Have students read section 12.3 in their text books and answer the ten true/false questions on the 12.3 Read for Meaning Worksheet (Read for Meaning strategy). Review the answers to the questions and assess the areas where students had trouble. In those areas, briefly review using the 12.3 Powerpoing (slides 1-19). If students answered incorrectly on their worksheet, they should correct the answer, and explain why that answer is correct.

    **Students should fill out their note taking guides during the lesson (New American Lecture Strategy)

    - After slide 19, stop and have students do the Name That Amino Acid Worksheet, using both decoder handouts. (Teacher will need to explain how to use both decoders). Tell the students that on the test, they will need to know how to use both charts. Have students turn in worksheet when they are finished.
    - Finish lesson on 12.3
        i. Number students 1-4. Assign 1's to block A in the text (pg. 263), 2's to B, etc. Allow students to review what occurs in their respective step of translation and make a drawing of what is happening. Have each group reconvene and present to the class what happens in each step. (Jigsaw Strategy).
        ii. As a class, now discuss translation. Students should have a pretty thorough understanding of this topic.
        iii. Continue with remaining slides (20-28) until finished.
        *slide 25 has a link to a video of translation
    - DNA Scavenger Hunt
        i. Explain directions to students, and let them practice on the example problem at the top.
        ii. Have the students to choose a partner to work with for this activity. (groups of two)

iii. The students will work their way through the clues until they have finished.
iv. Students should complete the three questions on the last page of the packet and turn them in.

5. Closure:
   - Homework: students should work on their genetics projects.
   - Review material learned today, ask students: What does RNA look like? How are DNA and RNA different? What is the base pairing rule in DNA? In RNA? How many types of RNA are there? What are they? What is translation? Where does it occur? What is transcription?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Thurs. November 20, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 9: Mutations

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This lesson discusses mutations and what can possibly go wrong if molecular processes get out of control. It is necessary for the students to understand that these molecular processes must be closely regulated to avoid mutations.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Yesterday we discussed transcription and translation, but today we will talk about what will happen if these processes get out of control and an error is made in copying the genes.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Today's activity will help students to understand more about the causes of genetic diseases, which will help them in their presentations. The Brain Pop activity will help them see what mutations are, and the monstrous mutations activity will allow them to experience having a mutation themselves.

Students Will Know …

Students will know what a mutation is.

Students Will Be Able to Do … (objectives)

1. Students will be able to complete the vocabulary test with 95% accuracy. (DOK 1).
2. After watching the brain pop video, students will be able to complete the quiz with 80% accuracy. (DOK 2)
3. Students will be able to assimilate mutations in the monstrous mutations activity and answer the questions with 100% accuracy. (DOK 3).
4. Students will be able to hypothesize what is a gene mutation and what is a chromosomal mutation with 80% accuracy. (DOK 3).

Connections

Essential Questions:

What causes cancer?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Program of Studies:

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Chapter 12 Vocabulary Test	1	None
2	Formative	Brain Pop Quiz over Genetic Mutations	2	None
3	Formative	Monstrous Mutations Activity	3	Use high-low pairing to accommodate all students
4	Formative	12.4 Review WS	2	Some students may need additional assistance.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint, Smart Board, textbooks.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express, SmartBoard, Animated Biological Concepts DVD.

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Vocabulary Quiz.
2. Hook: Show the students two pictures, one of a normal human cell, and one of a cell with cancer. Ask them what they think the differences are. Ask students to raise their hands if anybody they know has ever had cancer. Then ask HOT question: What do you think causes cancer? (Allow time for student responses).
3. Bridge: Tell the students that today we will take DNA, Genes, and RNA one step further, by talking about what kinds of events happen in them that causes things such as cancer. Ask the students if any of them know what a mutation is? Tell them that mutations are what cause cancer, and they are what we will be talking today. Show students figure 12.2 of a typical human gene. Tell them that this is a normal gene, but when a mutation occurs, this gene becomes very deformed.
4. Activities:
    - Go to www.brainpop.com/science/cellularlifeandgenetics/geneticmutations
        i. Have students watch the short video clip then take the genetic mutations quiz.
    - Begin lesson 12.4 over Mutations

    **Students should complete their note taking guides during the lesson (New American Lecture Strategy).

        i. Distinguish between gene mutations, frameshift mutations, and chromosomal mutations.
        ii. View mutations video clips linked from slides 4,12, and 14.
        iii. Describe deletion, duplication, translocation, and inversion.
        iv. Define polyploidy.
    - Monstrous Mutations Activity
        i. Explain the directions to the students (listed on worksheet).
        ii. Divide students into eight groups and assign each group with a characteristic produced by a mutation. Have the students to inflict that mutation on each member of their group.
        iii. Each group will gather, store, retrieve, and process the food while being timed by the teacher.
        iv. Record times on board (based on mutation) for all to see.
        v. Conduct brief discussion over mutations.
        vi. Have students to answer questions on worksheet and turn them in.
5. Closure:
    - Assign 12.4 Review WS for homework.
    - Review material learned today, ask students: What are mutations? What did you learn from the game today? Provide examples of different types of mutations and ask students if they would be classified as a chromosomal, frameshift, or gene mutation. As students what is a translocation? What does the word polyploidy mean?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Fri. November 21, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 10: Review and DNA Extraction

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  Today's lesson is fun because it get allows students to have a hands-on approach to some of the things we have learned by extracting DNA from strawberries.

- Describe the students' prior knowledge or the focus of the previous lesson.

  The information covered in the past three days is very important for truly understanding and succeeding in today's lab. In the past we have learned about DNA and its structure and function, but today we are going to extract DNA and be able to view it with the naked eye.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Students will be able to view DNA with the naked eye, though it will seem very different from what we have learned about because the structures aren't as visible as they appear in the textbook. As with any lab, students may need extra assistance today as they extract DNA. High-low pairing should also be utilized for the Jeopardy review game.

Students Will Know …

Students will know the process by which DNA is extracted.

Students Will Be Able to Do … (objectives)

1. Students will be able to identify and define multiple types of mutations and compare and contrast between them with 80% accuracy.
2. Students will be able to extract DNA with 100% accuracy. (DOK 4).

Connections

Essential Questions:

Where is DNA found?
How do you remove DNA?
Can you see DNA with the naked eye?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).
Students identify, analyze, and use patterns such as cycles and trends to understand past

and present events and predict possible future events. (2.2).
Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4).

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).
Students will graphically represent (e.g., pedigrees punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).
Students will describe the structure of DNA and explain its role in protein synthesis, cell replication and reproduction. (SC-H-UD-S-6).
Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3)

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

SC-HS-3.4.3

Students will:

- Describe cell regulation (enzyme function, diffusion, osmosis, homeostasis)
- Predict consequences of internal/external environment change on cell function/regulation. (DOK 2)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Review WS 12.4 over Mutations	3	Lower ability level students can work in groups
2	Formative	DNA Extraction Activity/Worksheet	4	Use high-low pairing for lab activity.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
  Media projector, large ziplock bags, strawberries, cheesecloths, funnels, 100 mL beakers, test tubes, wooden coffee stirrers, a DNA extraction buffer, and ethanol

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.
  PowerPoint.

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework. Complete Review WS 12.4 over genetic mutations.
2. Hook: Ask HOT questions: When CSI investigators remove DNA from a crime scene, what do they do with it? How do you go about extracting DNA? Can you see DNA with the naked eye? (Allow time for student thinking and response).
3. Bridge: You can see DNA with the naked eye, and we are going to look at it today, although will appear much different than the pictures you have seen in your textbook. To answer the question how do you extract DNA? Well you can do it with a couple of common household items, just like we will be doing today! Remember today to keep in mind the actual structure of DNA and its function. You will learn to appreciate how something so tiny can make up so much of who we are.
4. Activities:
   - Begin DNA extraction activity.
     *Students are to complete worksheet as they move through the activity.
   - After the extraction activity is complete, begin the review game (Jeopardy Style) until the end of class. (Teams-Games-Tournaments strategy).
     *The winning team will earn extra credit points on tomorrow's test.
5. Closure:
   - Remind students about test tomorrow and provide them with the chapter 12 study guide.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Mon. November 24, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA, and The Human Genome

Lesson Number and Title: 11: Testing Your Knowledge

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.
  Today the students will be tested over what they have learned about DNA and RNA over the last four days. They will be tested over the function and structure of DNA and RNA, transcription, translation, replication, and mutations.

- Describe the students' prior knowledge or the focus of the previous lesson.
  Students should possess all of the knowledge that is required to be successful on today's exam and open response item.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).
  Some students might have difficulty with the exam, and if they ask for assistance, try to provide them with helpful hints or remind them of what we discussed that can help them answer the questions. Students performing poorly on the exam may also be granted permission to correct their tests for partial credit. In addition to this, some students may earn extra credit from yesterday's review game, or from the extra credit question on the test.

Students Will Know …

Students will know that the information passed from parents to offspring is coded in DNA molecules.
Students will know that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids.
Students will know the structure of RNA and its role in transcription and translation.
Students will know what a mutation is and the different types of mutations.
Students will know the process by which DNA is extracted.

Students Will Be Able to Do … (objectives)

1. Students will be able to compare and contrast properties of DNA and RNA; hypothesize between different gene mutations and create their own mutation; describe what happens in transcription, translation, and replication; explain the structure and function of DNA and RNA; and describe how DNA is extracted. They will be able to do this with 80% accuracy. (DOK 4).

Connections

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Students will describe the structure of DNA and explain its role in protein synthesis, cell replication and reproduction. (SC-H-UD-S-6).

Students will describe the processes by which cells maintain their internal environments within acceptable limits. (SC-H-UD-S-8).

Core Content:

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

SC-HS-3.4.1

Students will explain the role of DNA in protein synthesis. Cells store and use information to guide their functions. The genetic information stored in DNA directs the synthesis of the thousands of proteins that each cell requires. Errors that may occur during this process may result in mutations that may be harmful to the organism. (DOK 3)

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Summative	Chapter 12 Test and Open Response	4	Students can correct test for partial credit.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer Lab

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  PowerPoint

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Take just a few minutes to look over the material for the test, and allow students time to ask any last minute questions.
2. No Hook and Bridge since it is test day.
3. Activities:
    - Allow about 10 minutes for students to ask last-minute questions regarding test material.
    - Give students the test and wish them luck.
    - When students turn in their test, hand them the open response item.
    - Remind students periodically about how much time they have remaining.
    - Tests and open responses must be completed within the class period.
    - When all of the students have completed the test and open response, if time permits, take them to the computer lab to resume their heritable disease project research.
4. Closure:
    - Remind students that in order to be prepared for tomorrow, they may want to look at section 14.1.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Mon. November 25, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA and The Human Genome

Lesson Number and Title: 12: Human Heredity

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  This lesson allows students to see how something in their body that seems so simple (blood) is very complex in the way that it is coded for genetically. In the lab, the students will also get to see how actual clinicians type the blood of their patients, and put their blood typing skills to the test in the online game. They will continue to learn about disorders that occur in the body and the problems that can be caused by one small change in the DNA sequence.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today's lesson builds on students past knowledge of mutations, inheritance patterns, and punnett squares. They need a working understanding of these topics to be successful with today's material

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Some students may have trouble grasping the blood typing concept at first, but with enough repetition, they should be able to understand it. If the student needs assistance, they should come to the teacher with further inquiries. The online games allows for multiple attempts, and students should continue this activity until they understand the blood-typing concept.

Students Will Know …

Students will understand blood typing and pedigrees.

Students Will Be Able to Do … (objectives)

1. Students will be able construct and analyze pedigrees and be able to type blood with 85% accuracy. (DOK 3).
2. Students will be able to answer questions about human heredity and complete charts on sex chromosomes with 80% accuracy. (DOK 2).

Connections

Essential Questions:

How is sex determined?

How do geneticists know whether an individual will have a certain trait?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from one generation to another (heredity). (SC-H-UD-S-3). Students will graphically represent (e.g., pedigrees punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3).

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Blood Typing Activity Worksheet	3	Some students may need help with this activity and the questions that follow.
2	Formative	14.1 Review WS over Human Heredity	2	Page numbers are provided as a reference.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.
  Computer, media projector, PowerPoint, Interactive Whiteboards, and WARD's blood typing kit.

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.
  Prentice Hall: Presentation Express, http://www.newtonsapple.tv/video.php?id=1032 and http://nobelprize.org/educational_games/medicine/landsteiner/index.html

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Vocabulary section 14.1 and 14.2.
2. Hook: Ask HOT questions: Does anybody know how your sex is determined? How does a geneticist know whether an individual will have a certain trait? How do you know what kind of blood you have? (Allow students to ponder these questions and provide responses for them, one at a time).
3. Bridge: Tell the students that today we are going to learn about sex determination, utilizing our knowledge of DNA and punnett squares.
4. Activities:
   - Lesson over 14.1 via PowerPoint
     **students should fill out their note taking guide during the lesson (New American Lecture Strategy).
     i. Discuss human chromosomes, defining sex chromosomes and autosomes.
     ii. Explain pedigree charts and do the problem solving activity as a class on page 343.
       - Use the Interactive Whiteboards to draw pedigrees and have students analyze them.
     iii. After slide 6, show Blood Typing Video. http://www.newtonsapple.tv/video.php?id=1032 and discuss blood group and blood group genes.
       - Use the Interactive Whiteboard to allow students to create and work punnett squares dealing with blood types, and predict the probabilities that an offspring will be of a certain blood type.
     iv. Describe genetic disorders including autosomal disorders of the dominant, recessive, and codominant alleles.
   - Blood Typing Activity
     i. Students will work in groups of 2-3 for the lab. Follow directions in kit.
   - Go to the computer lab and allow students to play the blood typing game at this link: http://nobelprize.org/educational_games/medicine/landsteiner/index.html.
     i. After students have finished their games, they can work on finalizing their presentations if time allows.

5. Closure:
    - Assign 14.1 Review Worksheet and tell students to look over 14.2 and 14.3 for tomorrow.
    - Review material learned today, ask students: What are the three blood phenotypes? What types of blood can individuals with each of these blood types receive? What is a pedigree? What are sex chromosomes? Autosomes? What are some autosomal disorders caused by recessive alleles? Caused by dominant alleles? Caused by codominant alleles? What is cystic fibrosis? Sickle cell disease? What causes these?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Tues. November 26, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA and The Human Genome

Lesson Number and Title: 13: Human Chromosomes and Molecular Genetics

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  Today concludes the lessons on genetics by discussing more genetic disorders and the realm of genetics in understanding human DNA and treating genetic disorders.

- Describe the students' prior knowledge or the focus of the previous lesson.

  This lesson takes yesterday's discussion of sex chromosomes one step further by discussing sex-linked genes and sex-linked disorders such as colorblindness and hemophilia. It also goes digs deeper into the understanding of both chromosomes and mutations in the discussion of chromosomal disorders. Finally, this lesson relies on understanding from the DNA extraction lab and the lesson on gene mapping to promote a further discussion in human DNA analysis and the human genome project.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  Some of the concepts presented today are abstract and some students may need extra assistance. Utilize group work as much as possible to promote team learning. In addition, the note taking guide should benefit lower ability level students.

Students Will Know …

Students will know what sex-linked and chromosomal disorders are.
They will also know the implications for Human DNA analysis, the Human Genome Project, and gene therapy.

Students Will Be Able to Do … (objectives)

1. Students will be determine possible blood types when given a plausible genetic scenario. They will do this with 80% accuracy. (DOK 3).

Connections

Essential Questions:

Are men or women more likely to inherit genetic diseases?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).
Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).
Students use the concept of scale and scientific models to explain the organization and

functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from One generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3).

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Formative	Blood Types and Punnett Squares Worksheet	3	Allow advanced students to make design their own pedigrees and determine the probability of characteristics.
2	Formative	Human Genome Graphic Organizer	2	Some students may need help with this.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint, Interactive Whiteboard

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Prentice Hall: Presentation Express

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students turn in last night's homework (14.1 Review WS) and begin on the Blood Types and Punnett Squares worksheet.
2. Hook: Show the students two pictures, one of a man, and one of a woman, perhaps individuals they know. Ask HOT question: Which of these two individuals are more likely to inherit a genetic disease? (Allow time for student thinking and encourage student response).
3. Bridge: Tell the students that depending on the disease, sometimes males are more likely to inherit it, but sometimes it is females. Today we are going to take our discussions of chromosomes and mutations one step further to look at sex linked genes. We will also explore other chromosomal disorders and end our discussion with DNA analysis, where you can apply what you learned in the DNA extraction lab.
4. Activities:
    - Lesson over 14.2 and 14.3 via PowerPoint
      **students should fill out their note taking guide during the lesson (New American Lecture Strategy).
        i. Discuss sex-linked genes and disorders, including colorblindness and hemophilia
            - Allow students to use the interactive whiteboard to work examples of punnett squares dealing with colorblindness.
        ii. Review chromosomal disorders and nondisjunction
            - Show video clip on nondisjunction, linked in slide 9
            - Have students to draw their own representation of nondisjunction in the margin of their notes. Allow some students to explain their representations.
        iii. Discuss sex-chromosome disorders such as down syndrome
        iv. Explain the promise in human DNA analysis, including the premise of the human genome project, and the possibilities for gene therapy.
    - Have students complete the Human Genome Graphic Organizer (Compare and Contrast Strategy).
    - Use the time that remains for students to finalize their projects that will be presented over the next two days.
5. Closure:
    - Homework: give the students the reading over "Should Genetics Be Used to Improve Humans?" Describe to students the community circle activity we will be doing in the first half of the class tomorrow. Tell them that in order to be prepared for discussion they might want to think about the implications of the things mentioned in this article.
    - Review material learned today, ask students: How are sex-linked disorders different from sex-chromosome disorders? What happens as a result of nondisjunction? How can human DNA be analyzed? Is it possible to treat genetic disorders? Ask students how they think the genes are "replaced" in gene therapy?

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Wed. November 27, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA and The Human Genome

Lesson Number and Title: 14: Morals and Ethics in Genetics/Genetic Diseases

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  The goal of this lesson is to promote scientific literacy by allowing the students to take the things they learn, and decide how these real-life decisions assimilate into their belief system. Today's lesson will challenge the students because it will allow them to examine their views and beliefs upon hearing other dissenting opinions. Students will also learn about various different genetic disorders and be able to apply this knowledge to the things they have learned in class.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today's lesson builds on everything the student has learned thus far in the unit. It will also show how they have developed in their beliefs from the things they have learned over the last three weeks.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  It is important during this lesson that a positive classroom environment be maintained in order to promote discussion and make the students feel at ease. It is also important to give every student the opportunity to express their opinions and beliefs. In regards to the class presentations, students may be evaluated at the level which the teacher knows they are capable of achieving (ie: teacher will grade honors students harder than other individuals).

Students Will Know …

Students will know that in science there are a lot of controversial issues and that everyone has their own opinion on how matters should be handled. They will also come to understand that each scenario has to be viewed individually, because all cases are different. Students will also learn about different genetic diseases that affect the population around them.

Students Will Be Able to Do … (objectives)

1. Students will be able to present information to the class on a genetic disease they have chosen and done research on. They will do this scoring 3 out of 4 on a rubric. (DOK 3).

Connections

Essential Questions:

Under what circumstances should doctors be allowed to change the genes of patients?
Should genetic engineering be used to improve the human species?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from One generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees, punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3).

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Summative	Genetic Diseases Presentations	3	Students will be graded at a rigor equivalent to their ability level.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Students should inform the teacher of any materials they may need for their presentations.

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Allow students this time to set up for the presentations that will be started during the last half of the class.
2. Hook: Ask HOT questions: Under what circumstances should doctors be allowed to change the genes of patients? Should genetic engineering be used to improve the human species?
3. Activities:
    - Have students form a circle with their desks in the middle of their classrooms, and ask the HOT questions listed above: what circumstances should doctors be allowed to change the genes of patients? Allow this question to prompt discussion among students. When the discussion for that question is exhausted, ask: Should genetic engineering be used to improve the human species? The teacher should moderate the discussion and guide it in an appropriate way, promoting scientific inquiry and higher order thinking. Allow discussion to last for about 45 minutes. (Community Circle Strategy).
    - Class Presentations
        i. The presenter should provide a handout to all students of the high points of their presentation.
        ii. Students should ask questions of their peers who are presenting and be attentive during the presentations.
4. Closure:
    - Encourage students to take some time today to reflect on the discussion from the beginning of class.
    - The remaining students will present their presentations tomorrow.
    - At the end of class tomorrow will be a short quiz over section 14.2 and 14.3.

Task A-2
Lesson Plan Format

Name: Kelly Austin Date: Thurs. November 28, 2008 Age/Grade Level: 9th grade; Ages: 13-16

# of Students: 29 # of IEP Students: 0 # of GSSP Students 4 # of LEP Students: 0

Subject: Biology Major Content: Genetics Lesson Length: 90 minutes

Unit Title: Genetics, DNA, RNA and The Human Genome

Lesson Number and Title: 15: Reflective Writing and Genetic Diseases Presentations

Context

- Explain how this lesson relates to the unit of study or your broad goals for teaching about the topic.

  The goal of this lesson is to promote scientific literacy by allowing the students to contemplate the discourse from yesterday's activity and reflect on how they feel about ethical issues such as the ones discussed. Students will also learn about various different genetic disorders and be able to apply this knowledge to the things they have learned in class.

- Describe the students' prior knowledge or the focus of the previous lesson.

  Today's lesson builds on everything the student has learned thus far in the unit. It will also show how they have developed in their beliefs from the things they have learned over the last three weeks.

- Describe generally any critical student characteristics or attributes that will affect student learning (other than what you described in the Teaching and Learning Context).

  In regards to the class presentations, students may be evaluated at the level which the teacher knows they are capable of achieving (ie: teacher will grade honors students harder than other individuals).

Students Will Know …

Students will know that in science there are a lot of controversial issues and that everyone has their own opinion on how matters should be handled. They will also come to understand that each scenario has to be viewed individually, because all cases are different.
Students will also learn about different genetic diseases that affect the population around them.

Students Will Be Able to Do … (objectives)

1. Students will be able reflect on their feelings regarding yesterday's discussions. They will do this scoring a 3 out of 4 on a rubric. (DOK 3).
2. Students will be able to present information to the class on a genetic disease they have chosen and done research on. They will do this scoring 3 out of 4 on a rubric. (DOK 3).
3. Students will be able to complete the quiz over sections 14.2 and 14.3 with 85% accuracy. (DOK 2).

Connections

Essential Questions:

How did yesterday's discussion on ethics and genetics make you feel?

What were some of the things others said that you agreed with or disagreed with?

Academic Expectations:

Students understand scientific ways of thinking and working and use those methods to solve real-life problems. (2.1).

Students identify, analyze, and use patterns such as cycles and trends to understand past and present events and predict possible future events. (2.2).

Students use the concept of scale and scientific models to explain the organization and functioning of living and nonliving things and predict other characteristics. (2.4)

Program of Studies:

Students will investigate the role of genes/chromosomes in the passing of information from One generation to another (heredity). (SC-H-UD-S-3).

Students will graphically represent (e.g., pedigrees, punnet squares) and predict the outcomes of a variety of genetic combinations. (SC-H-UD-S-4).

Core Content:

SC-HS-3.4.5

Students will

- Explain the relationship between sexual reproduction (meiosis) and the transmission of genetic information.
- Draw conclusions/make predictions based on hereditary evidence/data (pedigrees, punnet squares).

Multicellular organisms, including humans, form from cells that contain two copies of each chromosome. This explains many features of heredity. Transmission of genetic information through sexual reproduction to offspring occurs when male and female gametes, that contain only one representative from each chromosome pair, unite. (DOK 3).

SC-HS-3.4.6 (Supporting Content)

Students will understand that in all organisms and viruses, the instructions for specifying the characteristics are carried in nucleic acids. The chemical and structural properties of nucleic acids determine how the genetic information that underlies heredity is both encoded in genes and replicated.

Assessment Plan

In tabular format, organize how each objective will be assessed. Include copies of assessment instruments and rubrics (if applicable to the lesson plan).

Objective/Assessment Plan Organizer

Objective Number	Type of Assessment	Description of Assessment	Depth of Knowledge Level	Adaptations and/or Accommodations
1	Summative	Scientific Reflective Journal	3	Some students may need guidance on things to write.
2	Summative	Genetic Diseases Presentations	3	Students will be graded at a rigor equivalent to their ability level
3	Summative	Section 14.2 and 14.3 Quiz	2	Students may choose not to use Clickers if they need more time.

Resources, media and technology

- List the specific materials and equipment needed for the lesson. Attach copies of printed materials to be used with the students.

  Computer, media projector, PowerPoint, Clickers

- If appropriate, list technology resources for the lesson including hardware, software, and Internet URLs, and be sure to cite the sources used to develop this lesson.

  Clicker software

Procedures

Describe the strategies and activities you will use to involve students and accomplish your objectives including how you will trigger prior knowledge and how you will adapt strategies to meet individual student needs and the diversity in your classroom.

1. Bell work: Have students to take out a sheet of paper and answer the HOT questions: How did yesterday's discussion on ethics and genetics make you feel? What were some of the things others said that you agreed with or disagreed with? Encourage students to be open and write any thoughts or feelings they may have. (Reflective Scientific Journal Strategy).
2. No Hook or Bridge since today is presentation day.
3. Activities:
   - Allow time for students to get set up for their presentations.
   - The majority of the class period should be used for presentations.
     i. The presenter should provide a handout to all students of the high points of their presentation.
     ii. Students should ask questions of their peers who are presenting and be attentive during the presentations.
   - During the last twenty minutes of class give the students a short quiz over 14.2 and 14.3 using Clickers.
4. Closure:
   - If time allows, review the answers to the quiz questions, aloud.